| Program Name | : Electronics Engineering Programme Group / Diploma in Automation & Robotics |
|---|---|
| Program Code | : DE/EJ/ET/EN/EX/EQ/IE/IS/IC/AO |
| Semester | : Sixth |
| Course Title | : Emerging Trends in Electronics |
| Course Code | : 22636 |

## 1.　RATIONALE

Every technological area is developing at an exponential rate. New applications are coming up and it is mandatory for all technologists to be well versed in these developments to survive and provide satisfactory and quality services to the society and industry. This course aims to prepare the diploma graduates to be conversant with such emerging trends. The main areas in which such developments encompassed are Electronic system manufacturing process, Smart systems, Digital factory and Telecom network. The course gives an introduction of these areas and helps the students to apply emerging trends.

## 2.　COMPETENCY

Aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- **Use the trending practices in Electronics fields.**

## 3.　COURSE OUTCOMES (COs)

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

a) Suggest the relevant computing systems/processor for specific type of application.
b) Suggest the relevant techniques in electronic system manufacturing process .
c) Suggest different telecom network for given application.
d) Suggest the relevant IoT technologies for Digital Factory.
e) Suggest the different electronic systems for smart world.

## 4.　TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Paper Hrs. | Theory | | | | | | Practical | | | | | |
| L | T | P | | | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | - | - | 3 | 90 Min | 70*# | 28 | 30* | 00 | 100 | 40 | -- | -- | -- | -- | -- | -- |

*(\*): Under the theory PA, Out of 30 marks, 10 marks are for micro-project assessment to facilitate integration of COs and the remaining 20 marks is the average of 2 tests to be taken during the semester for the assessment of the cognitive domain UOs required for the attainment of the Cos(\*#): On Line ESE*

*Legends: L-Lecture; T – Tutorial/Teacher Guided Theory Practice; P -Practical; C – Credit,*
*ESE –End Semester Examination; PA - Progressive Assessment #-External Assessment*

## 5. COURSE MAP (with sample COs, UOs, ADOs and topics)

This course map illustrates an overview of the flow and linkages of the topics at various levels of outcomes (details in subsequent sections) to be attained by the student by the end of the course, in all domains of learning in terms of the industry/employer identified competency depicted at the center of this map.
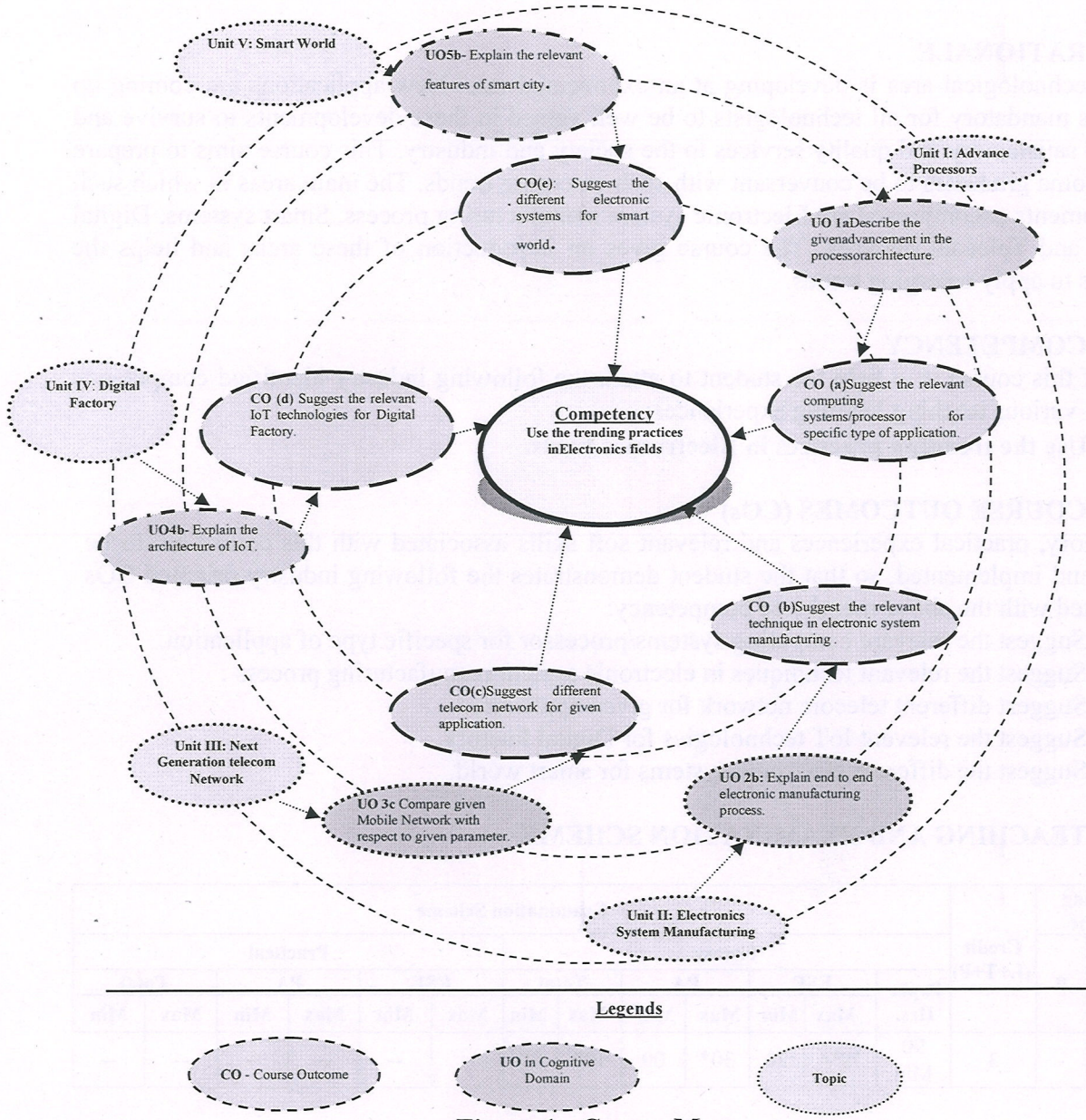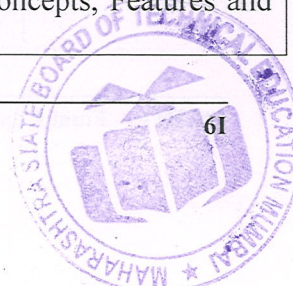


**Figure 1 - Course Map**

## 6. SUGGESTED PRACTICALS/ EXERCISES: Not Applicable
## 7. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED: Not Applicable

## 8. UNDERPINNING THEORY COMPONENTS

The following topics are to be taught and assessed in order to develop the sample UOs given below for achieving the COs to attain the identified competency. More UOs could be added.

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| **Unit– I Advance Processors** | 1a. Describe the given advancement in the processor architecture.<br>1b. Describe the given feature of the ARM7 processors.<br>1c. Describe the given features of Arduino board.<br>1d. Describe the given functions in Arduino IDE.<br>1e. Enlist features of GPU. | 1.1 Advances in processor architecture: Introduction, Processor Selection Criteria.<br>1.2 ARM: Introduction, Features of ARM7 and ARM7TDMI, advantages, applications.<br>1.3 Arduino: Introduction, Compatible R2/R3 Uno boardFeatures. Atmega 328: Introduction, pin description.<br>1.4 Arduino IDE: Features, Sketch: C,C++ functions setup(), loop(), pinMode(), digitalWrite(), digital Read() and delay()<br>1.5 Arduino Interfacing: LED, Relay and DC motor.<br>1.6 Graphical Processing Unit (GPU): Introduction, Features, Basic architecture of GPU, Architectural difference between GPU and CPU, GPU applications. |
| **Unit – II Electronic System Manufacturing Processes** | 2a. Enlist the advantages of SMD.<br>2b. Explain end to end electronic system manufacturing process.<br>2c. Suggest specifications to select typical machines for electronic system manufacturing.<br>2d. Enlist environmental standards for Electronic Manufacturing process. | 2.1 Surface Mount Devices: Introduction, need, advantages, applications.<br>2.2 Modern Electronic Assembly and Manufacturing process: Various machines used in End to End manufacturing process with their features and functions. Pick-n-Place machine and Automatic Component Insertion machine. Reflow soldering method.<br>2.3 Environmental standards for electronic manufacturing such as: EPEAT and RoHS Standards.<br>2.4 Battery [Li-ion, nuclear]:Concepts and Applications including E vehicles. |
| **Unit– III Next Generation Telecom Network** | 3a. Explain the function of given Network components.<br>3b. Describe the Spectrum in Telecom sector.<br>3c. Compare given Mobile Network with respect to given parameter.<br>3d. Explain the Multi-Protocol Label Switching in NGN core.<br>3e. Explain the given | 3.1 NGN architecture: Features, Functional block diagram, Network components: Media Gateway, Media Gateway Controller, and Application Server.<br>3.2 NGN Wireless Technology: Telecom network Spectrum: Types [licensed and unlicensed], Mobile Network Evolution (3G to 5G), Comparative features,<br>3.3 NGN Core: Features, Multi-Protocol Label Switching (MPLS): Concepts, Features and Advantages |

| Unit | Unit Outcomes (UOs) (in cognitive domain) | Topics and Sub-topics |
|---|---|---|
| | component used in FTTH. 3f. Describe the features of Optical Transmission Technology. | 3.4 Fiber to the Home (FTTH): Features, Architecture and Components: Optical Line Termination (OLT), Optical Network Unit (ONU) 3.5 Next generation transmission system: Optical Transport Network variants: Synchronous Transfer Module STM1, STM4, STM16, STM64 and STM256Features: bit rates and capacity, OTN Standards |
| Unit– IV Digital Factory | 4a. Explain the principle of IoT used in given application. 4b. Explain the architecture of IoT. 4c. Explain the importance of IoT in given application. 4d. Explain the importance of Industrial revolution I4.0. 4e. Suggest the suitable type of ML for given AI application. | 4.1 Internet of Things IoT: Introduction, Functions of Cyber Physical system components 4.2 Architectures: IoT Sensor to cloud data routes: 4.3 Applications of IoT in Industries: Automotive, Discrete Manufacturing, Telecom and Agro- industries 4.4 I4.0/IIoT/ Smart Manufacturing: Introduction/ Evolution from I1.0 to I4.0, applications and benefits of I4.0, Compare I3.0 with I4.0, Architecture of I4.0 4.5 Artificial Intelligence/Machine Learning [AI/ML]: Definitions of AI, Applications and Advantages of AI, Definition and Types of ML such as Supervised, Unsupervised and Reinforcement. Relationship between DL, ML and AI. Agents in AI: Single Agent and Multi-Agent. |
| Unit– V Smart World | 5a. Explain the working principle of given electronic system in smart home. 5b. Explain the relevant features of smart city. 5c. Explain the mechanism of city surveillance in smart city. 5d. Explain the given Network component functions. | 5.1 Evolution of smart home. X10 Protocol for Home automation 5.2 Basic requirements and components for Smart Home: Video Monitoring, Security and Alarm, Door control, Smart lighting and Smart metering 5.3 Basic requirements for Smart City: Smart Transportation, Smart Healthcare, Smart physical safety/Security (IP based CCTV, Fire and Gas detection, Fire extinguishers) and Smart education. 5.4 IoT/M2M Network architecture: Conceptual diagram 5.5 Domains for operation: Application domain, Network domain, M2M device domain. |
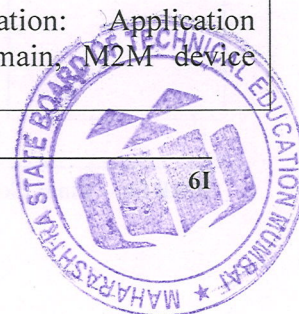
*Note: To attain the COs and competency, above listed UOs need to be undertaken to achieve the 'Application Level' and above of Bloom's 'Cognitive Domain Taxonomy'.*

## 9. SUGGESTED SPECIFICATION TABLE FOR QUESTIONPAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|---|---|---|---|---|---|---|
| | | | R Level | U Level | A Level | Total Marks |
| I | Advance Processors | 10 | 02 | 06 | 08 | 16 |
| II | Electronic System Manufacturing Process | 08 | 02 | 04 | 04 | 10 |
| III | Next Generation Telecom Network | 12 | 04 | 04 | 08 | 16 |
| IV | Digital Factory | 10 | 04 | 06 | 06 | 16 |
| V | Smart world | 08 | 02 | 04 | 06 | 12 |
| | **Total** | **48** | **14** | **24** | **32** | **70** |

*Legends: R=Remember, U=Understand, A=Apply and above (Bloom's Revised taxonomy)*
**Note**: *This specification table provides general guidelines to assist student for their learning and to teachers to teach and assess students with respect to attainment of UOs. The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.*

## 10. SUGGESTED STUDENT ACTIVITIES

Other than the classroom and laboratory learning, following are the suggested student-related *co-curricular* activities which can be undertaken to accelerate the attainment of the various outcomes in this course: Students should conduct following activities in group and prepare reports of about 5 pages (one activity by each group), also collect/record physical evidences for their (student's) portfolio which will be useful for their placement interviews:

- a. Prepare a report on proposed features of Smart city.
- b. Prepare a power point presentation on IoT/IIoT applications.
- c. Prepare report on visit to nearby telecom exchange/industry.
- d. Perform Group discussion on E vehicles/UMV.
- e. Prepare a comparative chart of recent processors.
- f. Prepare a report on AI used inday-to-day applications.

## 11. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are suggested strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- a. Massive open online courses (*MOOCs*) may be used to teach various topics/sub topics.
- b. *'L' in item No. 4* does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- c. About *15-20% of the topics/sub-topics* which is relatively simpler or descriptive in nature is to be given to the students for *self-directed learning* and assess the development of the COs through classroom presentations (see implementation guideline for details).
- d. With respect to item No.10, teachers need to ensure to create opportunities and provisions for *co-curricular activities*.
- e. Guide student(s) in undertaking micro-projects.
- f. Show video demonstration on safety precautions.
- g. Demonstrate the actions and care to be taken.
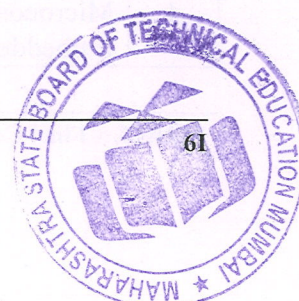
    h. Arrange a visit/use relevant e-resources tounderstand Electronic system manufacturing process.

    i. Arrange expert lecture of industry person.

## 12. SUGGESTED MICRO-PROJECTS

*Only one micro-project* is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the year. In the first two years, the micro-project is group-based. In the third year the number of students in the group should *not exceed three.*

    The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each micro-project should encompass two or more COs which are in fact, an integration of PrOs, UOs and ADOs as applicable. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than *16 (sixteen) student engagement hours* during the course. The student ought to submit micro-project by the end of the semester to develop the industry oriented COs.

    A suggestive list of micro-projects is given here. Similar micro-projects could be added by the concerned faculty:

    a. Prepare a report on existing automation in an industry and suggest improvements.

    b. Prepare a report on Smart City.

    c. Build Arduino based project for smart home.

    d. Build Arduino based project for smart city.

    e. Prepare a report on Smart city surveillance systems.

    f. Prepare report on electronic systems in Disaster Management.

    g. Present a power point presentation on upcoming 5G technology.

    h. Prepare a report on automatic electronic components assembly machines.

    i. Conduct a survey and prepare a report on various EDA tools.

    j. Prepare anapplication report on AR VR Technologies.

    k. Prepare a report on Artificial Intelligence.

    l. Prepare a report on Machine Learning.

    m. Prepare report on electronic home security systems.

    n. Prepare report on fire and gas detection and deluge systems.

    o. Prepare report on ATM security systems.

## 13. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---|---|---|---|
| 1 | Sustainable Smart Cities in India: Challenges and Future Perspectives | PoonamSharma, Swati Rajput, | Spinger; ISBN 978-3-319-47145-7 |
| 2 | The ABC of Fiber Optics Communication | Sudhir Warier | Artech House Boston London ISBN 13: 978-1-63081-414-4 |
| 3 | IoT Fundamentals: Networking Technologies Protocols and use cases for IoT | David Hanes, Gonzalo Salguein | Cisco Press. ISBN 13: 978-1-58714-456-1 |
| 4 | The AVR Microcontroller and Embedded Systems using | MuhammadAli Mazidi | MicroDigitalEd.com ISBN-13:078-0997925968 |

| Sr. No. | Title of Book | Author | Publication |
|---|---|---|---|
| | Assembly and C. | | |
| 5 | ARM Assembly Language Programming and Architecture | Muhammad Ali Mazidi, Sarmad Naimi | MicroDigitalEd.com ISBN-13: 978-0997925906 |
| 6 | Artificial Intelligence | Saroj Kaushik | CENCAGE Learning ISBN-13:978-81-315-1099-5 ISBN-10:81-315-315-1099-9 |

## 14. SUGGESTED SOFTWARE/LEARNING WEBSITES:

| Sr No | Theory topic /sub topic | Web site |
|---|---|---|
| 1 | Unit– IAdvance Processors (Advances in processor architecture) | https://slideplayer.com/slide/8290583/ |
| 2 | Unit– IAdvance Processors (Arduino) | http://www.hobbytronics.co.uk/arduino-uno-r3 |
| 3 | Unit– I Advance Processors (Arduino) | https://www.arduino.cc/en/Guide/HomePage |
| 4 | Unit I– Advance Processors(ARM) | http://www.microdigitaled.com |
| 5 | Unit I– Advance Processors (ARM) | https://en.wikipedia.org/wiki/ARM7 |
| 6 | Unit II- Electronic Product Environmental Assessment Tool (EPEAT) | https://www.techopedia.com/definition/2107/electronic-product-environmental-assessment-tool-epeat#what-does-electronic-product-environmental-assessment-tool-epeat-mean |
| 7 | Unit II- Restriction of Hazardous Substances. RoHS | https://www.rohsguide.com/rohs-faq.htm |
| 8 | Unit– IIINext Generation telecom Network | TRAI official website: www.trai.gov.in |
| 9 | Unit– III Next Generation telecom Network | https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-Y.2012-200609-S!!PDF-E&type=items |
| 10 | Unit– IVDigital Factory (IoT) | https://en.wikipedia.org/wiki/Internet_of_things |
| 11 | Unit– IVDigital Factory | http://dot.gov.in/sites/default/files/National%20Telecom%20M2M%20Roadmap.pdf |
| 12 | Unit– IVDigital Factory | http://www.tec.gov.in/technical-reports/ |
| 13 | Unit– IVDigital Factory(I4.0/IIoT) | http://i40today.com/ |
| 14 | Unit– VSmart World | http://tec.gov.in/pdf/M2M/Design%20Planning%20Smart%20Cities%20with%20IoT%20ICT.pdf |