# VIGNAN'S
Foundation for Science, Technology & Research
(Deemed to be University)
-Estd. u/s 3 of UGC Act 1956

## Department of Electronics and Communication Engineering.

### Minutes of Board of Studies Meeting

17-07-2021

Minutes of Board of studies (BoS) meeting of B. Tech Electronics and communication engineering program held at Center of Excellence (CoE) Laboratory, Department of Electronics and communication engineering. VFSTR, Vadlamudi. All the members joined through zoom link https://us02web.zoom.us/j/8128112759?pwd=NVdueHk3WHRIQ083U2tIbnNZVTQ4QT09.

Chairman Board of Studies (BoS) (HoD, ECE) invited all the external and internal members of BoS in Online Zoom meeting.

**Agenda of the meeting.**

1. To discuss and finalize the structure and detailed syllabus fir B.Tech Electronics and Communication Engineering (ECE) applicable from 2021-22 admitted batch.

The following external and internal members are attended for the meeting in online.

*External BoS members.*

1) **Rama Krishna Dasari,** CEO, Efftronics System Private Limited, Vijayawada.

2) **Dr. Narasimha Sarma N V S,** Director, IIIT Trichy, Trichy.

3) **Prof. S. Salivahanan,** Vice Chancellor , Vel Tech Rangarajan Dr.Sagunthala R&D Institute of Science and Technology, Chennai.

4) **Mr. S. Uma Mahesh,** Director, Indrion Technologies, Bangalore.

5) **Dr. G. Mallikarjuna Rao,** Scientist-F, DRDO-RCI, Hyderabad.

6) **Mr. P. Hari Babu,** Scientist, CDAC, Bangalore.

*Internal BoS members.*

1) **Dr. T. Pitchaiah, Professor, HoD and BoS Chairman.**

2) **Dr. SK. Jakeer Hussain, Professor and Deputy HoD,**

3) **Dr. B. Seetha Ramanjaneyulu,** Professor.

4) **Dr. N. Usha Rani,** Professor.

5) **Dr. M.S.S. Rukmini,** Professor.

6) **Dr. M. Sarada,** Professor.

7) **Dr. G. Ramana Murthy,** Professor.

8) **Dr. Y. Ravi Sekhar,** Professor.

9) **Dr. K. Annapurna,** Associate Professor.

10) **Dr. Pachiyanan,** Associate Professor.

11) **Mr. G.S.R Satyanarayana,** Assistant Professor.

12) **Mr. P. Krishna Chaitanya,** Assistant Professor, BoS Coordinator.

The meeting started at 9.30 AM on 17/7/2021 (online mode)

**Discussion on Course Structure**

**Dr. Narasimha Sarma N V S,** Director, IIIT Trichy,

1. Fundamental concepts are essential. After 10 years, current IT Technologies may be outdated. Therefore impart the required basic skills to upgrade students with the future technologies.
2. In EMTL course, first two units should be related to transmission lines and in the following units, electromagnetics should be covered.
3. Course structure is moving with only two mathematical courses with Signals and Systems and probability theory and stochastic process. Care should be taken while discussing these courses.
4. Fundamental courses covered for all elective pools.

**Er. Rama Krishna Dasari,** CEO, Efftronics System Private Limited.

1. Any basic course covering data types?
    a. Chairman BoS (HoD, ECE) clarified the query raised by External BoS member, the following courses covers the data types.
2. Introduction to C programming, Programming for Problem solving and unit one in Digital Electronics.
3. All External BoS members suggested Electrical Technology course is missing in the curriculum and all members suggested the same.

4. Chairman BoS Explained clearly about intra, inter and societal related Projects.
5. Reduce emphasis on outdated controllers from curriculum like 8051 controllers (instead of two units reduce the 8051 contents to one unit and put more emphasis on ARM controllers).
6. The concepts of SPI, IIC and Ethernet should be covered in DCCN.
7. Rather than software, hard ware realization is also important.
8. Programming languages should be oriented towards applications.
9. In digital electronics remove PLA and PAL concepts.
10. Employability skills should be more focused towards work culture in industry rather than how to acquire job.
11. Reliability and failure analysis is required to build systems and to identify faults.

**Mr. S. Uma Mahesh,** Director, Indrion Technologies,

1. All coding courses should be offered as 2 lecture hours and 2 practical hours
2. Good move of removing engineering chemistry to add an additional course
3. Basic sensors and Instrumentation should be in core and advanced sensors should be in Elective
4. Before selecting the elective, clear objectives of each and every elective pool should be shared to the students, then only student can select the elective pool without any hesitation

**Dr. G. Mallikarjuna Rao,** Scientist-F, DRDO-RCI

1. The course should be titled Radar engineering instead of Radar system and should be moved to core. If it cannot be moved to core, at least basics of radar as one unit should be covered in RF and MW course.
2. Course on how broadcasting is to be done and its overall structure in one or more communication systems like TV/ Radio/ Mobile/ IoT/ Satellite etc is to be placed
3. In Radar engineering, counter measurement concepts are to be added.

**Prof. S. Salivahanan,** Vice Chancellor, Vel Tech Rangarajan Dr.Sagunthala

R&D Institute of Science and Technology

1. Instead of Engineering Chemistry, include a course related to basic electrical technology.
2. If possible, introduce two more elective pools on Cyber security and Data science.
3. Network synthesis is missing. If possible add one unit in Network theory.
4. The course Web technologies should be moved to IT elective pool.

**Mr. P. Hari Babu,** Scientist, CDAC, Bangalore.

1. In the course titled Computer architecture and Microprocessors, the way computer works and other basics of computers are required.
2. The course Sensors and Instrumentation should be covered before IoT course.
3. Operating Systems course is very much essential for ECE students.
4. In CMC course, 3GPP release and standard concepts should be included.

## Discussion on elective courses

1. The title of Embedded & IoT should be changed to Embedded Systems and IoT suggested by Er. Rama krishna sir and Mr. Hari babu.
2. In the elective pool, the courses should enable the devices to sense, communicate, analyze and ACT.
3. Er. Rama Krishna also suggested to split the Embedded systems and IoT
4. Some of the elective courses need practical hours in VLSI and AI and ML pool
5. Dr. Salivahanan suggested to provide a chance to students by enabling them, selecting the courses from any of the elective pool
6. Sensors and actuators course should be in IoT pool
7. In the elective pool "Embedded systems and IoT" IoT platforms like Power-BI and with other tools available in current market should be discussed.
8. The student can opt the courses from any of the elective stream and they should be permitted. It is entirely based on his/her discretion and only faculty has to counsel.

## The Outcomes of BoS meeting are as follows:

1. Propose and approve course structure for all 4- years of B. Tech Programme in Electronics and Communication Engineering (ECE).
2. The 4 years of B.Tech programme is approved with effect from the academic year 2021-22. The proposed structure and syllabus is applicable for 2021 admitted batch onwards.
3. The curriculum follows the choice based credit system (CBCS).
4. Approved Course Structure is shown in Appendix I.
5. The Curriculum is encompassing the courses that enable employability or entrepreneurship or skill development Appendix II.
6. In all the courses of the revised curriculum (R19) substantial changes are made in the content. The percentage of revision from R19 to R21 is 43%. The list of new courses is provided in Appendix III.
7. Stakeholder's feedback is analyzed in CDMC and placed before the BoS which is given utmost priority while designing the curriculum and their suggestions are implemented.

Chairman BoS

Dr. T. Pitchaiah

**B.Tech.**

**ECE**

**I YEAR**

# R-21 Course Structure

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

## I Year I Semester

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Engineering Mathematics - I | 3 | 1 | - | 4 |
| | Engineering Physics | 2 | - | 2 | 3 |
| | Electrical Technology | 2 | - | 2 | 3 |
| | Network Theory | 3 | 1 | - | 4 |
| | Constitution of India | 1 | - | - | 1 |
| | Engineering Graphics & Design | - | - | 2 | 1 |
| | Introduction to C Programming | 3 | - | 2 | 4 |
| | Physical Fitness, Sports & Games - I | - | - | 2 | 1 |
| | Total | 14 | 2 | 10 | 21 |

## I Year II Semester

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Engineering Mathematics - II | 3 | 1 | - | 4 |
| | Programming for Problem Solving | 3 | - | 2 | 4 |
| | Electronics Devices and Circuits | 3 | - | 2 | 4 |
| | Digital Electronics | 3 | - | 2 | 4 |
| | English Proficiency and Communication Skills | - | - | 2 | 1 |
| | Technical English Communication | 2 | - | 2 | 3 |
| | Environmental Studies | 2 | - | - | 1 |
| | Workshop | 1 | - | 2 | 2 |
| | Physical Fitness, Sports & Games - II | - | - | 2 | 1 |
| | Total | 17 | 1 | 14 | 24 |

L : Lecture Hours/week ; T : Tutorial Hours/week ;
P : Practical Hours/week ; C : Credits of the Course.`

# R-21 CURRICULUM

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

## II Year I Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Data Structures | 2 | - | 2 | 3 |
| | Signal and Systems | 3 | - | 2 | 4 |
| | Analog Circuits | 3 | - | 2 | 4 |
| | Computer Architecture and Microprocessors | 3 | - | 2 | 4 |
| | Control Systems | 3 | - | - | 3 |
| | PCB Lab | - | - | 2 | 1 |
| | Life Skills - I | - | - | 2 | - |
| | Technical Seminar - I | - | - | 2 | 1 |
| | Intra-Disciplinary Projects - I | - | - | 3 | 1 |
| | Physical Fitness, Sports & Games - III | - | - | 2 | 1 |
| | **Total** | **14** | **-** | **19** | **22** |

## II Year II Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Communication Systems | 3 | - | 2 | 4 |
| | Electromagnetic Waves and Transmission Lines | 3 | 1 | - | 4 |
| | Probability Theory and Stochastic Processes | 3 | - | - | 3 |
| | VLSI Design | 3 | - | 2 | 4 |
| | Life Skills - II | - | - | 2 | 1 |
| | Technical Seminar - II | - | - | 2 | 1 |
| | Intra-Disciplinary Projects - II | - | - | 2 | 1 |
| | Open Elective -I | 2 | - | 2 | 3 |
| | Open Elective -II | 2 | - | 2 | 3 |
| | **Total** | **16** | **1** | **14** | **24** |

**B.Tech.**

# ECE

**III YEAR**

# R-21 CURRICULUM

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

## III Year I Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Data Communications and Computer Networks | 3 | - | - | 3 |
| | Antennas and Wave Propagation | 3 | - | - | 3 |
| | Microcontrollers | 3 | - | 2 | 4 |
| | Sensors and Instrumentation | 2 | - | 2 | 3 |
| | Human Values, Professional Ethics & Gender Equity | 2 | - | - | 2 |
| | Soft Skills Laboratory | - | - | 2 | 1 |
| | Employability Skills - I | - | - | 2 | - |
| | Inter-Departmental Projects - I | - | - | 4 | 2 |
| | Open Elective -III | 2 | - | 2 | 3 |
| | Department Elective - I | 3 | - | - | 3 |
| | Total | 18 | - | 14 | 24 |

## III Year II Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | RF and Microwave Engineering | 3 | - | 2 | 4 |
| | Digital Signal Processing | 3 | - | 2 | 4 |
| | Internet of Things | 2 | - | 2 | 3 |
| | Professional Communication Laboratory | - | - | 2 | 1 |
| | Competitive Programming | - | - | 4 | 2 |
| | Open Elective -IV | - | - | 2 | 1 |
| | Open Elective -V | - | - | - | 1 |
| | Employability Skills - II | - | - | 2 | 1 |
| | Inter-Departmental Projects - II | - | - | 4 | 2 |
| | Department Elective - II | 3 | - | - | 3 |
| | Open Elective (NPTEL/Swayam) | 3 | - | - | 3 |
| | Total | 14 | - | 22 | 25 |

# R-21 CURRICULUM

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

## IV Year I Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Principles of Management and Organizational Behavior | 3 | - | - | 3 |
| | Cellular and Mobile Communications | 3 | - | - | 3 |
| | Societal - Centric and Industry Related Projects | - | - | 6 | 3 |
| | Department Elective – III | 3 | - | - | 3 |
| | Department Elective – IV (NPTEL/Swayam) | 3 | - | - | 3 |
| | Department Elective - V (NPTEL/Swayam) | 3 | - | - | 3 |
| | Total | 15 | - | 6 | 18 |

## IV Year II Semester

| | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Internship / Project Work | - | - | 24 | 12 |
| | Total | - | - | 24 | 12 |

L : Lecture Hours/week ; T : Tutorial Hours/week ;
P : Practical Hours/week ; C : Credits of the Course.

# R-21 CURRICULUM

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

# DEPARTMENT ELECTIVE STREAMS AND COURSES

## STREAM - 1: COMMUNICATION SYSTEMS AND SIGNAL PROCESSING

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Digital TV and Broadcasting | 3 | - | - | 3 |
| | Information Theory and Coding | 3 | - | - | 3 |
| | Optical Communication | 2 | - | 2 | 3 |
| | Satellite Communications | 3 | - | - | 3 |
| | Radar Engineering | 3 | - | - | 3 |
| | Software Defined Radio | 3 | - | - | 3 |

## STREAM - 2: VLSI

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | FPGA based system Design | 2 | - | 2 | 3 |
| | Testing of VLSI Circuits | 3 | - | - | 3 |
| | Hardware verification Techniques | 3 | - | - | 3 |
| | Verification using System Verilog & UVM | 2 | - | 2 | 3 |
| | Python for Software/Hardware co-design | 2 | - | 2 | 3 |
| | System on chip Design | 3 | - | - | 3 |
| | PERL, TCL and TK programming | 2 | - | 2 | 3 |
| | C based VLSI Design | 3 | - | - | 3 |

# DEPARTMENT ELECTIVE STREAMS AND COURSES

## STREAM - 3: EMBEDDED AND IOT

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Introduction to Embedded Systems | 3 | - | - | 3 |
| | Wireless Sensor Networks | 3 | - | - | 3 |
| | Embedded system design using FPGA | 2 | - | 2 | 3 |
| | Sensors and Actuators | 2 | - | 2 | 3 |
| | Multicore architectures and programming | 3 | - | - | 3 |
| | Embedded Linux | 3 | - | - | 3 |
| | Android OS and Application development | 2 | - | 2 | 3 |
| | Linux Device Drivers | 2 | - | 2 | 3 |
| | Smart & Virtual Instrumentation | 2 | - | 2 | 3 |
| | Introduction to Industry 4.0 and Industrial Internet of Things | 3 | - | - | 3 |

## STREAM - 4: ARTIFICIAL INTELIGENCE (AI) AND MACHINE LEARINING (ML)

| Course Code | Course Title | L | T | P | C |
|---|---|---|---|---|---|
| | Digital Image and Video Processing | 2 | - | 2 | 3 |
| | Introduction to Artificial Intelligence | 3 | - | - | 3 |
| | Machine Learning | 2 | - | 2 | 3 |
| | Deep Learning | 2 | - | 2 | 3 |
| | Human Machine Interaction | 3 | - | - | 3 |
| | Biometric | 3 | - | - | 3 |

## R-21 CURRICULUM

(Applicable for students admitted into First Year from academic year 2021-22 onwards)

# DEPARTMENT ELECTIVE STREAMS AND COURSES

**STREAM - 5:** INFORMATION TECHNOLOGY (IT)

| | | | | |
|---|---|---|---|---|
| Database management systems | 3 | - | - | 3 |
| Web Technologies | 2 | - | 2 | 3 |
| Discrete Mathematical Structures | 3 | - | - | 3 |
| Design and Analysis of Algorithms | 3 | - | 2 | 4 |
| Unix and Shell Programming | 3 | - | - | 3 |
| Operating Systems | 3 | - | - | 3 |
| Advanced Data Structures | 3 | - | 2 | 4 |

The courses that are highlighted denote implementation of 'Choice based Credit System (CBCS)'

Chairman BoS

Dr. T. Pitchaiah

# APPENDIX - II

List of courses that enable employability or entrepreneurship or skill development in the R-21 B.Tech – Electronics & Communication Engineering

| S. No | Year/ Semester | Course Name | Employability/Entrepreneurship/ Skill development |
|-------|----------------|-------------|---------------------------------------------------|
| 1 | Semester I/ First Year | Engineering Mathematics - I | Skill Development |
| 2 | Semester I/ First Year | Engineering Physics | Skill Development |
| 3 | Semester I/ First Year | Electrical Technology | Skill Development |
| 4 | Semester I/ First Year | Network Theory | Skill Development |
| 5 | Semester I/ First Year | Constitution of India | Skill Development |
| 6 | Semester I/ First Year | Engineering Graphics & Design | Skill Development |
| 7 | Semester I/ First Year | Introduction to C Programming | Employability |
| 8 | Semester I/ First Year | Physical Fitness, Sports & Games - I | Skill Development |
| 9 | Semester II/ First Year | Engineering Mathematics - II | Skill Development |
| 10 | Semester II/ First Year | Programming for Problem Solving | Employability |
| 11 | Semester II/ First Year | Electronics Devices and Circuits | Skill Development |
| 12 | Semester II/ First Year | Digital Electronics | Employability |
| 13 | Semester II/ First Year | English Proficiency and Communication Skills | Skill Development |
| 14 | Semester II/ First Year | Technical English Communication | Employability |
| 15 | Semester II/ First Year | Environmental Studies | Skill Development |
| 16 | Semester II/ First Year | Workshop | Skill Development |

| 17 | Semester II/ First Year | Physical Fitness, Sports & Games - II | Skill Development |
|---|---|---|---|
| 18 | Semester I/ Second Year | Data Structures | Employability |
| 19 | Semester I/ Second Year | Signal and Systems | Skill Development |
| 20 | Semester I/ Second Year | Analog Circuits | Skill Development |
| 21 | Semester I/ Second Year | Computer Architecture and Microprocessors | Employability |
| 22 | Semester I/ Second Year | Control Systems | Skill Development |
| 23 | Semester I/ Second Year | PCB Lab | Employability |
| 24 | Semester I/ Second Year | Life Skills - I | Skill Development |
| 25 | Semester I/ Second Year | Technical Seminar - I | Skill Development |
| 26 | Semester I/ Second Year | Intra-Disciplinary Projects - I | Employability |
| 27 | Semester I/ Second Year | Physical Fitness, Sports & Games - III | Skill Development |
| 28 | Semester II/ Second Year | Communication Systems | Employability |
| 29 | Semester II/ Second Year | Electromagnetic Waves and Transmission Lines | Skill Development |
| 30 | Semester II/ Second Year | Probability Theory and Stochastic Processes | Skill Development |
| 31 | Semester II/ Second Year | VLSI Design | Employability |
| 32 | Semester II/ Second Year | Life Skills - II | Skill Development |
| 33 | Semester II/ Second Year | Technical Seminar - II | Skill Development |
| 34 | Semester II/ Second Year | Intra-Disciplinary Projects - II | Employability |
| 35 | Semester I/ Third Year | Data Communications and Computer Networks | Employability |
| 36 | Semester I/ Third Year | Antennas and Wave Propagation | Skill Development |
| 37 | Semester I/ Third Year | Microcontrollers | Employability |
| 38 | Semester I/ Third Year | Sensors and Instrumentation | Employability |

| 39 | Semester I/ Third Year | Human Values, Professional Ethics & Gender Equity | Skill Development |
|----|------------------------|---------------------------------------------------|------------------|
| 40 | Semester I/ Third Year | Soft Skills Laboratory | Employability |
| 41 | Semester I/ Third Year | Employability Skills - I | Employability |
| 42 | Semester I/ Third Year | Inter-Departmental Projects - I | Employability |
| 43 | Semester I/ Third Year | Digital TV and Broadcasting | Skill Development |
| 44 | Semester I/ Third Year | Information Theory and Coding | Skill Development |
| 45 | Semester I/ Third Year | Testing of VLSI Circuits | Employability |
| 46 | Semester I/ Third Year | Hardware verification Techniques | Employability |
| 47 | Semester I/ Third Year | Introduction to Embedded Systems | Employability |
| 48 | Semester I/ Third Year | Wireless Sensor Networks | Employability |
| 49 | Semester I/ Third Year | Introduction to Artificial Intelligence | Employability |
| 50 | Semester I/ Third Year | Discrete Mathematical Structures | Skill Development |
| 51 | Semester I/ Third Year | Database management systems | Employability |
| 52 | Semester II/ Third Year | RF and Microwave Engineering | Skill Development |
| 53 | Semester II/ Third Year | Digital Signal Processing | Skill Development |
| 54 | Semester II/ Third Year | Internet of Things | Employability |
| 55 | Semester II/ Third Year | Professional Communication Laboratory | Employability |
| 56 | Semester II/ Third Year | Employability Skills - II | Employability |
| 57 | Semester II/ Third Year | Inter-Departmental Projects - II | Employability |
| 58 | Semester II/ Third Year | Optical Communication | Employability |
| 59 | Semester II/ Third Year | Hardware verification Techniques | Employability |
| 60 | Semester II/ Third Year | Verification using System Verilog & UVM | Employability |

| 61 | Semester II/ Third Year | Embedded system design using FPGA | Employability |
|----|------------------------|-----------------------------------|---------------|
| 62 | Semester II/ Third Year | Sensors and Actuators | Employability |
| 63 | Semester II/ Third Year | Digital Image and Video Processing | Employability |
| 64 | Semester II/ Third Year | Web Technologies | Employability |
| 65 | Semester II/ Third Year | Design and Analysis of Algorithms | Employability |
| 66 | Semester I/ Fourth Year | Principles of Management and Organizational Behavior | Entrepreneurship |
| 67 | Semester I/ Fourth Year | Cellular and Mobile Communications | Employability |
| 68 | Semester I/ Fourth Year | Societal - Centric and Industry Related Projects | Employability |
| 69 | Semester I/ Fourth Year | Satellite Communications | Skill Development |
| 70 | Semester I/ Fourth Year | Radar Systems | Skill Development |
| 71 | Semester I/ Fourth Year | Software Defined Radio | Employability |
| 72 | Semester I/ Fourth Year | Python for Software/Hardware co-design | Employability |
| 73 | Semester I/ Fourth Year | System on chip Design | Employability |
| 74 | Semester I/ Fourth Year | PERL,TCL and TK programming | Employability |
| 75 | Semester I/ Fourth Year | C based VLSI Design | Employability |
| 76 | Semester I/ Fourth Year | Multicore architectures and programming | Employability |
| 77 | Semester I/ Fourth Year | Embedded Linux | Employability |
| 78 | Semester I/ Fourth Year | Android OS and Application development | Employability |
| 79 | Semester I/ Fourth Year | Linux Device Drivers | Employability |
| 80 | Semester I/ Fourth Year | Smart & Virtual Instrumentation | Employability |
| 81 | Semester I/ Fourth Year | Introduction to Industry 4.0 and Industrial Internet of Things | Employability |
| 82 | Semester I/ Fourth Year | Machine Learning | Employability |

| 83 | Semester I/ Fourth Year | Deep Learning | Employability |
|----|-------------------------|---------------|--------------|
| 84 | Semester I/ Fourth Year | Human Machine Interaction | Employability |
| 85 | Semester I/ Fourth Year | Biometric | Employability |
| 86 | Semester I/ Fourth Year | Unix and Shell Programming | Employability |
| 87 | Semester I/ Fourth Year | Operating Systems | Employability |
| 88 | Semester I/ Fourth Year | Advanced Data Structures | Employability |
| 89 | Semester II/ Fourth Year | Internship / Project Work | Employability |

Chairman BoS

Dr. T. Pitchaiah

**VIGNAN'S**
Foundation for Science, Technology & Research
(Deemed to be University)
Estd. u/s 3 of UGC Act 1956

## Department of Electronics and Communication Engineering.

### APPENDIX-III

### List of New Courses in R-21

| S. No | Title of the New Course | Course Category |
|-------|------------------------|-----------------|
| 1 | Engineering Mathematics-II | Basic Science |
| 2 | Electrical technology | Basic Engineering |
| 3 | Electronic Devices and Circuits. | Professional Core |
| 4 | Digital System Design | Professional Core |
| 5 | Data Structures | Basic Engineering |
| 6 | Signal and Systems | Professional Core |
| 7 | Analog Circuits | Professional Core |
| 8 | Computer Architecture and Microprocessors | Professional Core |
| 9 | Communication Systems | Professional Core |
| 10 | Probability Theory and Stochastic Processes | Professional Core |
| 11 | VLSI Design | Professional Core |
| 12 | Data Communications and Computer Networks | Professional Core |
| 13 | Antennas and Wave Propagation | Professional Core |
| 14 | Microcontrollers | Professional Core |
| 15 | Sensors and Instrumentation | Professional Core |
| 16 | Digital Signal Processing | Professional Core |
| 17 | Cellular and Mobile communications | Professional Core |
| 18 | Digital TV and Broadcasting | Professional Elective |
| 19 | FPGA based system Design | Professional Elective |
| 20 | Testing of VLSI Circuits | Professional Elective |
| 21 | Hardware verification Techniques | Professional Elective |
| 22 | Verification using System Verilog & UVM | Professional Elective |
| 23 | Python for Software/Hardware co-design | Professional Elective |
| 24 | System on chip Design | Professional Elective |
| 25 | PERL,TCL and TK programming | Professional Elective |
| 26 | C based VLSI Design | Professional Elective |
| 27 | Introduction to Embedded Systems | Professional Elective |
| 28 | Embedded system design using FPGA | Professional Elective |
| 29 | Sensors and Actuators | Professional Elective |
| 30 | Multicore architectures and programming | Professional Elective |
| 31 | Embedded Linux | Professional Elective |

| 32 | Android OS and Application development | Professional Elective |
|----|----------------------------------------|-----------------------|
| 33 | Linux Device Drivers | Professional Elective |
| 34 | Smart & Virtual Instrumentation | Professional Elective |
| 35 | Introduction to Industry 4.0 and Industrial Internet of Things | Professional Elective |
| 36 | Digital Image and Video Processing | Professional Elective |
| 37 | Introduction to Artificial Intelligence | Professional Elective |
| 38 | Machine Learning | Professional Elective |
| 39 | Deep Learning | Professional Elective |
| 40 | Human Machine Interaction | Professional Elective |
| 41 | Biometric | Professional Elective |
| 42 | Database management systems | Professional Elective |
| 43 | Web Technologies | Professional Elective |
| 44 | Discrete Mathematical Structures | Professional Elective |
| 45 | Design and Analysis of Algorithms | Professional Elective |
| 46 | Unix and Shell Programming | Professional Elective |
| 47 | Operating Systems | Professional Elective |
| 48 | Advanced Data Structures | Professional Elective |

Chairman BoS

Dr. T. Pitchaiah