

## **COURSE HANDOUT**

|                               |                            |
|-------------------------------|----------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE  |
| <b>ACADEMIC YEAR</b>          | : 2016-17                  |
| <b>COURSE NAME &amp; CODE</b> | : Speech Processing – T137 |
| <b>L-T-P STRUCTURE</b>        | : 3-1-0                    |
| <b>COURSE CREDITS</b>         | : 3                        |
| <b>COURSE INSTRUCTOR</b>      | : Mrs. B.Rajeswari         |
| <b>COURSE COORDINATOR</b>     | : Mrs. B.Rajeswari         |

**COURSE OBJECTIVE:** This course provides the awareness about different speech organs and their role in speech production. Also provides the knowledge on time domain methods such as short time energy, average magnitude, short time average zero crossing rate for discrimination of speech vs. silence and parameter estimation in a speech signal. This course also provides the understanding about various linear predictive coding analysis techniques for speech processing. This course discusses about the speech enhancement techniques and also different speech recognition systems.

**COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO | Statement<br>At the end of the course,<br>student will be able to        | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>3 |
|----|--------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| 1  | Describe human speech generation system.                                 |         |         |         |         |         |         |         |         |         |          |          |          |          |          |          |
| 2  | Apply different time domain models for the processing of speech signals. |         |         |         |         |         |         |         |         |         |          |          |          |          |          |          |
| 3  | Familiar with Linear predictive coding techniques.                       |         |         |         |         |         |         |         |         |         |          |          |          |          |          |          |
| 4  | Learn various speech enhancement techniques.                             |         |         |         |         |         |         |         |         |         |          |          |          |          |          |          |
| 5  | Analyze different pattern and digit recognition systems.                 |         |         |         |         |         |         |         |         |         |          |          |          |          |          |          |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put '-'  
**1-** Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

**BOS APPROVED TEXT BOOKS:**

- 1 Digital processing of speech signals - L.R Rabiner and S.W.Schafer. Pearson Education.

**BOS APPROVED REFERENCE BOOKS:**

- 1 Speech Communications: Human & Machine - Douglas O'Shaughnessy,  
2<sup>nd</sup> ed., IEEE Press.

**COURSE DELIVERY PLAN (LESSON PLAN): Section-B****UNIT-I : Fundamentals of Digital Speech Processing**

| S.No.                                      | Topics to be covered                                 | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|--------------------------------------------|------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 1.                                         | Introduction to Subject                              | 1                       | 15.12.16                     |                           | TLM1                      |                 |
| 2.                                         | Course Outcomes                                      | 1                       | 16.12.16                     |                           | TLM1                      |                 |
| 3.                                         | Introduction to UNIT-I                               | 1                       | 19.12.16                     |                           | TLM1                      |                 |
| 4.                                         | Introduction to Speech Processing                    | 1                       | 20.12.16                     |                           | TLM1                      |                 |
| 5.                                         | Fundamentals of Speech Signal and processing         | 1                       | 21.12.16                     |                           | TLM1,2                    |                 |
| 6.                                         | Anatomy of Speech Organs                             | 1                       | 22.12.16                     |                           | TLM1,2                    |                 |
| 7.                                         | Physiology of Speech Organs                          | 2                       | 23.12.16<br>26.12.16         |                           | TLM1,2                    |                 |
| 8.                                         | Lungs,Thorax,Larynx                                  | 2                       | 27.12.16<br>28.12.16         |                           | TLM1,2                    |                 |
| 9.                                         | Tutorial--1                                          | 1                       | 29.12.16                     |                           | TLM3                      |                 |
| 10.                                        | Vocal folds, Vocal tract                             | 2                       | 30.12.16<br>31.12.16         |                           | TLM1,2                    |                 |
| 11.                                        | Introduction to speech production                    | 1                       | 02.01.17                     |                           | TLM1,2                    |                 |
| 12.                                        | The process of speech production                     | 1                       | 03.01.17                     |                           | TLM1,2                    |                 |
| 13.                                        | Introduction to acoustic theory of speech production | 2                       | 04.01.17<br>05.01.17         |                           | TLM1,2                    |                 |
| 14.                                        | Acoustics of Excitation source and vocal tract       | 1                       | 06.01.17                     |                           | TLM1,2                    |                 |
| 15.                                        | Effect of losses in vocal tract                      | 1                       | 16.01.17                     |                           | TLM1,2                    |                 |
| 16.                                        | Introduction to modeling of speech signals           | 1                       | 17.01.17                     |                           | TLM1,2                    |                 |
| 17.                                        | Digital models for speech signals                    | 1                       | 18.01.17                     |                           | TLM1,2                    |                 |
| 18.                                        | Tutorial--2                                          | 1                       | 19.1.17                      |                           | TLM3                      |                 |
| No. of classes required to complete UNIT-I |                                                      | 22                      | No. of classes taken:        |                           |                           |                 |

**UNIT-II : Time Domain Models for Speech Processing**

| S.No. | Topics to be covered                                       | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 19.   | Introduction to time domain models for speech processing . | 1                       | 20.1.17                      |                           | TLM1,2                    |                 |
| 20.   | Window considerations                                      | 1                       | 23.1.17                      |                           | TLM1,2                    |                 |
| 21.   | Short time energy and average magnitude                    | 1                       | 24.1.17                      |                           | TLM1,2                    |                 |
| 22.   | Short time average zero crossing rate                      | 1                       | 25.1.17                      |                           | TLM1,2                    |                 |
| 23.   | Speech vs silence discrimination using energy              | 1                       | 27.1.17                      |                           | TLM1,2                    |                 |
| 24.   | Speech vs silence discrimination using zero crossing       | 1                       | 30.1.17                      |                           | TLM1,2                    |                 |
| 25.   | The short-time autocorrelation function                    | 2                       | 31.1.17                      |                           | TLM1,2                    |                 |

|                                             |                                          |    |                       |  |        |  |
|---------------------------------------------|------------------------------------------|----|-----------------------|--|--------|--|
| 26.                                         | Autocorrelation function                 | 1  | 1.2.17                |  | TLM1,2 |  |
| 27.                                         | Short time magnitude difference function | 1  | 2.2.17                |  | TLM1,2 |  |
| 28.                                         | Comparison of the time domain models     | 1  | 3.2.17                |  | TLM1,2 |  |
| 29.                                         | Tutorial--3                              | 1  | 7.2.17                |  | TLM3   |  |
| No. of classes required to complete UNIT-II |                                          | 12 | No. of classes taken: |  |        |  |

### UNIT-III : Linear Predictive Coding(LPC) Analysis

| S.No.                                        | Topics to be covered                                    | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|----------------------------------------------|---------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 30.                                          | Introduction to LPC                                     | 1                       | 8.2.17                       |                           | TLM1,2                    |                 |
| 31.                                          | Basic principles                                        | 1                       | 13.2.17                      |                           | TLM1,2                    |                 |
| 32.                                          | Autocorrelation method                                  | 1                       | 14.2.17<br>15.2.17           |                           | TLM1,2                    |                 |
| 33.                                          | Covariance method                                       | 1                       | 16.2.17                      |                           | TLM1,2                    |                 |
| 34.                                          | Solutions of LPC equation: Cholesky sol. for covariance | 2                       | 17.2.17<br>20.2.17           |                           | TLM1,2                    |                 |
| 35.                                          | Tutorial--4                                             | 1                       | 21.2.17                      |                           | TLM3                      |                 |
| 36.                                          | Durbin's solution for autocorrelation                   | 1                       | 22.2.17                      |                           | TLM1,2                    |                 |
| 37.                                          | Comparison between methods of solution of LPC equations | 2                       | 23.2.17<br>27.2.17           |                           | TLM1,2                    |                 |
| 38.                                          | Introduction to speech parameters                       | 1                       | 28.2.17                      |                           | TLM1,2                    |                 |
| 39.                                          | Pitch detection using LPC parameters                    | 1                       | 1.3.17                       |                           | TLM1,2                    |                 |
| 40.                                          | Formant analysis using LPC parameters                   | 1                       | 2.3.17                       |                           | TLM1,2                    |                 |
| 41.                                          | LPC Vocoder                                             | 1                       | 3.3.17                       |                           | TLM1,2                    |                 |
| 42.                                          | Voiced –Excited Vocoders                                | 1                       | 6.3.17                       |                           | TLM1,2                    |                 |
| 43.                                          | Tutorial--5                                             | 1                       | 7.3.17                       |                           | TLM3                      |                 |
| No. of classes required to complete UNIT-III |                                                         | 16                      | No. of classes taken:        |                           |                           |                 |

### UNIT-IV : Speech Enhancement

| S.No. | Topics to be covered               | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 44.   | Introduction to UNIT-IV            | 1                       | 8.3.17                       |                           | TLM1,2                    |                 |
| 45.   | Nature of Interfering sounds       | 2                       | 9.3.17<br>10.3.17            |                           | TLM1,2                    |                 |
| 46.   | Introduction to Speech Enhancement | 1                       | 13.3.17                      |                           | TLM1,2                    |                 |
| 47.   | Speech Enhancement techniques      | 2                       | 14.3.17<br>15.3.17           |                           | TLM1,2                    |                 |
| 48.   | Single microphone approach         | 1                       | 16.3.17                      |                           | TLM1,2                    |                 |
| 49.   | Multi microphone approach          | 1                       | 17.3.17                      |                           | TLM1,2                    |                 |
| 50.   | Spectral subtraction               | 1                       | 20.3.17                      |                           | TLM1,2                    |                 |
| 51.   | Enhancement by re-synthesis        | 1                       | 21.3.17                      |                           | TLM1,2                    |                 |
| 52.   | Comb filter                        | 2                       | 22.3.17<br>23.3.17           |                           | TLM1,2                    |                 |
| 53.   | Wiener filter                      | 2                       | 24.3.17<br>27.3.17           |                           | TLM1,2                    |                 |

|                                             |             |    |                       |  |      |  |
|---------------------------------------------|-------------|----|-----------------------|--|------|--|
| 54.                                         | Tutorial--6 | 1  | 29.3.17               |  | TLM3 |  |
| No. of classes required to complete UNIT-IV |             | 15 | No. of classes taken: |  |      |  |

#### UNIT-V : Automatic speech recognition

| S.No.                                      | Topics to be covered                         | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
|--------------------------------------------|----------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| 55.                                        | Introduction automatic speech recognition    | 2                             | 30.3.17<br>31.3.17                 |                                 | TLM1,2                          |                       |
| 56.                                        | Basic pattern recognition approaches         | 1                             | 3.4.17                             |                                 | TLM1,2                          |                       |
| 57.                                        | Parametric representation of speech          | 1                             | 4.4.17                             |                                 | TLM1,2                          |                       |
| 58.                                        | Evaluating the similarity of speech patterns | 2                             | 6.4.17<br>7.4.17                   |                                 | TLM1,2                          |                       |
| 59.                                        | Isolated digit recognition system            | 1                             | 10.4.17                            |                                 | TLM1,2                          |                       |
| 60.                                        | Continuous digit recognition system          | 1                             | 11.4.17                            |                                 | TLM1,2                          |                       |
| 61.                                        | Tutorial--7                                  | 1                             | 12.4.17                            |                                 | TLM3                            |                       |
| No. of classes required to complete UNIT-V |                                              | 09                            | No. of classes taken:              |                                 |                                 |                       |

#### Contents beyond the Syllabus

| S.No. | Topics to be covered         | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 62.   | Speaker Verification system  | 1                       | 13.4.17                      |                           | TLM1,2                    |                 |
| 63.   | Pitch and formant estimation | 1                       | 14.4.17                      |                           | TLM1,2                    |                 |

#### Teaching Learning Methods

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

#### ACADEMIC CALENDAR:

| Description                | From       | To         | Weeks  |
|----------------------------|------------|------------|--------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3½ W   |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W     |
| I Phase of Instructions-II | 16-01-2017 | 8-02-2017  | 3½ W   |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9W     |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days |
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1W     |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1W     |

#### EVALUATION PROCESS:

| <b>Evaluation Task</b>                                                             | <b>COs</b>       | <b>Marks</b>  |
|------------------------------------------------------------------------------------|------------------|---------------|
| Assignment/Quiz – 1                                                                | 1                | A1=5          |
| Assignment/Quiz – 2                                                                | 2                | A2=5          |
| I-Mid Examination                                                                  | 1,2              | B1=20         |
| Assignment/Quiz – 3                                                                | 3                | A3=5          |
| Assignment/Quiz – 4                                                                | 4                | A4=5          |
| Assignment/Quiz – 5                                                                | 5                | A5=5          |
| II-Mid Examination                                                                 | 3,4,5            | B2=20         |
| Evaluation of Assignment/Quiz Marks: $A=(A1+A2+A3+A4+A5)/5$                        | 1,2,3,4,5        | A=5           |
| Evaluation of Mid Marks: $B=75\% \text{ of Max}(B1,B2)+25\% \text{ of Min}(B1,B2)$ | 1,2,3,4,5        | B=20          |
| <b>Cumulative Internal Examination : A+B</b>                                       | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                   | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                          | <b>1,2,3,4,5</b> | <b>100</b>    |

Mrs..B.Rajeswari  
Course Instructor

Mrs..B.Rajeswari  
Course Coordinator

Mr.T.Anil Raju  
Module Coordinator

Dr.E,V.Krishna Rao  
Research Coordinator

Prof.B.Ramesh Reddy  
BOS Chairman&HOD

## **COURSE HANDOUT**

|                               |                                            |
|-------------------------------|--------------------------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE                  |
| <b>ACADEMIC YEAR</b>          | : 2016-17                                  |
| <b>COURSE NAME &amp; CODE</b> | : Cellular and Mobile Communications T-134 |
| <b>L-T-P STRUCTURE</b>        | : 4-1-0                                    |
| <b>COURSE CREDITS</b>         | : 4                                        |
| <b>COURSE INSTRUCTOR</b>      | : Mr Ch. V Naga Bhaskar, Asst Professor    |
| <b>COURSE COORDINATOR</b>     | : Dr. A Narendra Babu, Professor           |

**COURSE OBJECTIVE :** In this course , students are able to understand the fundamental concepts of mobile cellular systems and specifics of current and proposed cellular systems.

### **COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO       | Statement<br>At the end of the course,<br>student will be able to                       | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>3 |
|----------|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| <b>1</b> | Summarize the basic concepts related to different cellular systems and their operation. | 3       | 2       | 1       | -       | 3       | 3       | 1       | -       | -       | -        | -        | 3        | 3        | 2        | -        |
| <b>2</b> | Analyze radio propagation losses at different cell site and mobile antennas.            | 3       | 2       | 3       | 3       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | 1        |
| <b>3</b> | Design and differentiate the co-channel and adjacent channel interferences.             | 3       | -       | 3       | 2       | 3       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |
| <b>4</b> | Gain the knowledge on various handoffs and different channel assignments.               | 2       | -       | 3       | -       | 3       | 2       | -       | -       | -       | -        | -        | -        | 3        | -        | -        |
| <b>5</b> | Understand the different digital cellular systems and multiple access techniques.       | 2       | 2       | 3       | -       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put **'-'**  
**1-** Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

### **BOS APPROVED TEXT BOOKS:**

- 1 W.C.Y.Lee, Wireless and Cellular Telecommunications, Tata McGraw Hill, 3<sup>rd</sup> edition, 2006
- 2 G. Sasbushana Rao, Mobile Cellular Communications, Pearson Education India, 2012

### **BOS APPROVED REFERENCE BOOKS:**

- 1 Theodore. S. Rapoport, Wireless Communications, Pearson education, 2<sup>nd</sup> Edn., 2002
- 2 V. Jeyasri Arokiamary, Mobile Communications, Technical Publications.

**COURSE DELIVERY PLAN (LESSON PLAN): Section-A****UNIT-I : INTRODUCTION TO CELLULAR SYSTEMS**

| UNIT-IV INTRODUCTION TO CELLULAR SYSTEMS   |                                                                      |                               |                                    |                                 |                                 |                       |
|--------------------------------------------|----------------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                      | Topics to be covered                                                 | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 1.                                         | Introduction                                                         | 1                             | 15.12.16                           |                                 |                                 |                       |
| 2.                                         | Continuation to introduction                                         | 1                             | 16.12.16                           |                                 |                                 |                       |
| 3.                                         | Basic Cellular system                                                | 1                             | 19.12.16                           |                                 |                                 |                       |
| 4.                                         | Concept of Analog and Digital Cellular systems                       | 1                             | 20.12.16                           |                                 |                                 |                       |
| 5.                                         | Performance criteria.                                                | 1                             | 21.12.16                           |                                 |                                 |                       |
| 6.                                         | uniqueness of mobile radio environment                               | 1                             | 22.12.16                           |                                 |                                 |                       |
| 7.                                         | operation of cellular systems                                        | 1                             | 23.12.16                           |                                 |                                 |                       |
| 8.                                         | Hexagonal shaped cells                                               | 1                             | 26.12.16                           |                                 |                                 |                       |
| 9.                                         | Concept of frequency Reuse channels                                  | 1                             | 27.12.16                           |                                 |                                 |                       |
| 10.                                        | Co-channel Interference Reduction Factor and Problems                | 2                             | 28.12.16<br>29.12.16               |                                 |                                 |                       |
| 11.                                        | <b>Tutorial-1</b>                                                    | 1                             | 30.12.16                           |                                 |                                 |                       |
| 12.                                        | desired C/I from a normal case in an Omni directional Antenna system | 1                             | 02.1.17                            |                                 |                                 |                       |
| 13.                                        | Consideration of the Components of a Cellular system                 | 1                             | 03.1.17                            |                                 |                                 |                       |
| 14.                                        | Cell splitting.                                                      | 1                             | 04.1.17                            |                                 |                                 |                       |
| 15.                                        | <b>Tutorial-2</b>                                                    | 1                             | 05.1.17                            |                                 |                                 |                       |
| No. of classes required to complete UNIT-I |                                                                      | 16                            | No. of classes taken:              |                                 |                                 |                       |

**UNIT-II : MOBILE RADIO PROPAGATION**

| S.No. | Topics to be covered                                             | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
|-------|------------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| 16.   | Introduction, Basics of Mobile Radio Propagation                 | 1                             | 06.1.16                            |                                 |                                 |                       |
| 17.   | Free space propagation                                           | 1                             | 16.1.17                            |                                 |                                 |                       |
| 18.   | Link budget design                                               | 1                             | 17.1.17                            |                                 |                                 |                       |
| 19.   | Propagation models                                               | 1                             | 18.1.17                            |                                 |                                 |                       |
| 20.   | <b>Tutorial-3</b>                                                | 1                             | 19.1.17                            |                                 |                                 |                       |
| 21.   | Small scale multipath propagation,                               | 1                             | 20.1.17                            |                                 |                                 |                       |
| 22.   | Types of small-scale fading                                      | 1                             | 23.1.17                            |                                 |                                 |                       |
| 23.   | Statistical models for multipath propagation                     | 1                             | 24.1.17                            |                                 |                                 |                       |
| 24.   | CELL SITE ANTENNAS AND MOBILE ANTENNAS: Cell site Antenna height | 1                             | 25.1.17                            |                                 |                                 |                       |
| 25.   | Omni directional antennas                                        | 1                             | 27.1.17                            |                                 |                                 |                       |
| 26.   | directional antennas for interference reduction                  | 1                             | 30.1.17                            |                                 |                                 |                       |
| 27.   | space diversity antennas ,umbrella pattern antennas              | 1                             | 31.1.17                            |                                 |                                 |                       |
| 28.   | <b>Tutorial-4</b>                                                | 1                             | 01.2.17                            |                                 |                                 |                       |
| 29.   | Minimum separation of cell site                                  | 1                             | 02.2.17                            |                                 |                                 |                       |

|                                             |                             |    |                       |  |  |  |
|---------------------------------------------|-----------------------------|----|-----------------------|--|--|--|
|                                             | receiving antennas,         |    |                       |  |  |  |
| 30.                                         | Mobile high gain antennas.  | 1  | 03.2.17               |  |  |  |
| 31.                                         | Sum and difference patterns | 1  | 06.2.17               |  |  |  |
| 32.                                         | <b>Tutorial-5</b>           | 1  | 07.2.17               |  |  |  |
| No. of classes required to complete UNIT-II |                             | 17 | No. of classes taken: |  |  |  |

### UNIT-III : INTERFERENCE

| S.No.                                        | Topics to be covered                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|----------------------------------------------|---------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 33.                                          | Introduction to Co-Channel Interference     | 1                       | 08.2.17                      |                           |                           |                 |
| 34.                                          | real time Co-Channel interference           | 1                       | 13.2.17                      |                           |                           |                 |
| 35.                                          | Co-Channel interference measurement         | 1                       | 14.2.17                      |                           |                           |                 |
| 36.                                          | Design of Omni directional Antenna system   | 1                       | 15.2.17                      |                           |                           |                 |
| 37.                                          | <b>Tutorial-6</b>                           | 1                       | 16.2.17                      |                           |                           |                 |
| 38.                                          | Design of directional Antenna system        | 1                       | 17.2.17                      |                           |                           |                 |
| 39.                                          | Antenna parameters and their effects,       | 1                       | 20.2.17                      |                           |                           |                 |
| 40.                                          | diversity receiver,                         | 1                       | 21.2.17                      |                           |                           |                 |
| 41.                                          | non-co-channel interference-different types | 1                       | 22.2.17                      |                           |                           |                 |
| 42.                                          | <b>Tutorial-7</b>                           | 1                       | 23.2.17                      |                           |                           |                 |
| No. of classes required to complete UNIT-III |                                             | 10                      | No. of classes taken:        |                           |                           |                 |

### UNIT-IV : HANDOFFS AND DROPPED CALLS

| S.No.                                       | Topics to be covered                                                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---------------------------------------------|-----------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 43.                                         | Types of handoff, handoff invitation                                        | 1                       | 27.2.17                      |                           |                           |                 |
| 44.                                         | delaying handoff, forced handoff                                            | 1                       | 28.2.17                      |                           |                           |                 |
| 45.                                         | mobile assigned handoff, Intersystem handoff                                | 1                       | 01.3.17                      |                           |                           |                 |
| 46.                                         | dropped call rates and their evaluation                                     | 1                       | 02.3.17                      |                           |                           |                 |
| 47.                                         | <b>Tutorial-8</b>                                                           | 1                       | 03.3.17                      |                           |                           |                 |
| 48.                                         | <b>FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT</b> : Numbering and grouping | 1                       | 06.3.17                      |                           |                           |                 |
| 49.                                         | setup access and paging channels                                            | 1                       | 07.3.17                      |                           |                           |                 |
| 50.                                         | channel assignments to cell sites and mobile units                          | 1                       | 08.3.17                      |                           |                           |                 |
| 51.                                         | channel sharing and borrowing                                               | 1                       | 09.3.17                      |                           |                           |                 |
| 52.                                         | <b>Tutorial-9</b>                                                           | 1                       | 10.3.17                      |                           |                           |                 |
| 53.                                         | sectorization, overlaid cells                                               | 1                       | 13.3.17                      |                           |                           |                 |
| 54.                                         | non fixed channel assignment                                                | 1                       | 14.3.17                      |                           |                           |                 |
| 55.                                         | cell splitting                                                              | 1                       | 15.3.17                      |                           |                           |                 |
| 56.                                         | <b>Tutorial-10</b>                                                          | 1                       | 16.3.17                      |                           |                           |                 |
| No. of classes required to complete UNIT-IV |                                                                             | 14                      | No. of classes taken:        |                           |                           |                 |

### UNIT-V : DIGITAL CELLULAR SYSTEMS AND MULTIPLE ACCESS TECHNIQUES

| UNIT V : DIGITAL CELLULAR SYSTEMS AND MULTIPLE ACCESS TECHNIQUES |                                    |                               |                                    |                                 |                                 |                       |
|------------------------------------------------------------------|------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                                            | Topics to be covered               | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 57.                                                              | Introduction                       | 1                             | 17.3.17                            |                                 |                                 |                       |
| 58.                                                              | Global System for Mobile           | 1                             | 20.3.17                            |                                 |                                 |                       |
| 59.                                                              | Global System for Mobile           | 1                             | 21.3.17                            |                                 |                                 |                       |
| 60.                                                              | Time Division Multiple Access      | 3                             | 22.3.17<br>23.3.17<br>24.3.17      |                                 |                                 |                       |
| 61.                                                              | <b>Tutorial-11</b>                 | 1                             | 27.3.17                            |                                 |                                 |                       |
| 62.                                                              | Frequency Division Multiple Access | 2                             | 29.3.17<br>30.3.17                 |                                 |                                 |                       |
| 63.                                                              | Code Division Multiple Access      | 2                             | 31.3.17<br>03.4.17                 |                                 |                                 |                       |
| 64.                                                              | <b>Tutorial-12</b>                 | 1                             | 04.4.17                            |                                 |                                 |                       |
| No. of classes required to complete UNIT-V                       |                                    | 12                            | No. of classes taken:              |                                 |                                 |                       |

### Contents beyond the Syllabus

| S.No. | Topics to be covered                                           | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|----------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 65.   | <b>3G Systems</b> -Universal Mobile Telecommunications System; | 1                       | 06.4.17                      |                           |                           |                 |
| 66.   | Wideband CDMA; CDMA 2000.                                      | 1                       | 07.4.17                      |                           |                           |                 |

### Teaching Learning Methods

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

### ACADEMIC CALENDAR:

| Description                | From       | To         | Weeks  |
|----------------------------|------------|------------|--------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3½W    |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W     |
| I Phase of Instructions-II | 16-01-2017 | 08-02-2017 | 3½W    |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9 W    |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days |
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1 W    |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1 W    |

**EVALUATION PROCESS:**

| <b>Evaluation Task</b>                                                               | <b>COs</b>       | <b>Marks</b>  |
|--------------------------------------------------------------------------------------|------------------|---------------|
| I-Mid Examination                                                                    | 1,2              | A1=20         |
| II-Mid Examination                                                                   | 3,4,5            | A2=20         |
| Attendance                                                                           |                  | B=5           |
| Evaluation of Mid Marks: $A=75\%$ of $\text{Max}(A1,A2)+25\%$ of $\text{Min}(A1,A2)$ | 1,2,3,4,5        | A=20          |
| <b>Cumulative Internal Examination : A+B</b>                                         | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                     | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                            | <b>1,2,3,4,5</b> | <b>100</b>    |

Ch.V Naga Bhaskar

**Course Instructor**

Dr.A Narendra Babu

**Course Coordinator**

Mr.G.L.N Murthy

**Module Coordinator**

Dr.J Babu

**Research Coordinator**

Prof.B.Ramesh Reddy

**BOS Chairman&HOD**

## **COURSE HANDOUT**

|                               |                                            |
|-------------------------------|--------------------------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE                  |
| <b>ACADEMIC YEAR</b>          | : 2016-17                                  |
| <b>COURSE NAME &amp; CODE</b> | : Cellular and Mobile Communications T-134 |
| <b>L-T-P STRUCTURE</b>        | : 4-1-0                                    |
| <b>COURSE CREDITS</b>         | : 4                                        |
| <b>COURSE INSTRUCTOR</b>      | : Dr. A Narendra Babu, Professor           |
| <b>COURSE COORDINATOR</b>     | : Dr. A Narendra Babu, Professor           |

**COURSE OBJECTIVE :** In this course , students are able to understand the fundamental concepts of mobile cellular systems and specifics of current and proposed cellular systems.

### **COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO       | Statement<br>At the end of the course,<br>student will be able to                       | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>3 |
|----------|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| <b>1</b> | Summarize the basic concepts related to different cellular systems and their operation. | 3       | 2       | 1       | -       | 3       | 3       | 1       | -       | -       | -        | -        | 3        | 3        | 2        | -        |
| <b>2</b> | Analyze radio propagation losses at different cell site and mobile antennas.            | 3       | 2       | 3       | 3       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | 1        |
| <b>3</b> | Design and differentiate the co-channel and adjacent channel interferences.             | 3       | -       | 3       | 2       | 3       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |
| <b>4</b> | Gain the knowledge on various handoffs and different channel assignments.               | 2       | -       | 3       | -       | 3       | 2       | -       | -       | -       | -        | -        | -        | 3        | -        | -        |
| <b>5</b> | Understand the different digital cellular systems and multiple access techniques.       | 2       | 2       | 3       | -       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put **'-'**  
**1-** Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

### **BOS APPROVED TEXT BOOKS:**

- 1 W.C.Y.Lee, Wireless and Cellular Telecommunications, Tata McGraw Hill,3<sup>rd</sup> edition,2006
- 2 G. Sasbushana Rao,Mobile Cellular Communications, PearsonEducation India,2012

### **BOS APPROVED REFERENCE BOOKS:**

- 1 Theodore. S. Rapport, Wireless Communications, Pearson education, 2<sup>nd</sup> Edn.,2002
- 2 V. Jeyasri Arokiamary,Mobile Communications, Technical Publications.

**COURSE DELIVERY PLAN (LESSON PLAN): Section-B****UNIT-I : INTRODUCTION TO CELLULAR SYSTEMS**

| UNIT-I INTRODUCTION TO CELLULAR SYSTEMS    |                                                                      |                               |                                    |                                 |                                 |                       |
|--------------------------------------------|----------------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                      | Topics to be covered                                                 | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 1.                                         | Introduction                                                         | 1                             | 15.12.16                           |                                 |                                 |                       |
| 2.                                         | Continuation to introduction                                         | 1                             | 16.12.16                           |                                 |                                 |                       |
| 3.                                         | Basic Cellular system                                                | 1                             | 19.12.16                           |                                 |                                 |                       |
| 4.                                         | Concept of Analog and Digital Cellular systems                       | 1                             | 20.12.16                           |                                 |                                 |                       |
| 5.                                         | Performance criteria.                                                | 1                             | 21.12.16                           |                                 |                                 |                       |
| 6.                                         | uniqueness of mobile radio environment                               | 1                             | 22.12.16                           |                                 |                                 |                       |
| 7.                                         | operation of cellular systems                                        | 1                             | 23.12.16                           |                                 |                                 |                       |
| 8.                                         | Hexagonal shaped cells                                               | 1                             | 26.12.16                           |                                 |                                 |                       |
| 9.                                         | Concept of frequency Reuse channels                                  | 1                             | 27.12.16                           |                                 |                                 |                       |
| 10.                                        | Co-channel Interference Reduction Factor and Problems                | 2                             | 28.12.16<br>29.12.16               |                                 |                                 |                       |
| 11.                                        | <b>Tutorial-1</b>                                                    | 1                             | 30.12.16                           |                                 |                                 |                       |
| 12.                                        | desired C/I from a normal case in an Omni directional Antenna system | 1                             | 02.1.17                            |                                 |                                 |                       |
| 13.                                        | Consideration of the Components of a Cellular system                 | 1                             | 03.1.17                            |                                 |                                 |                       |
| 14.                                        | Cell splitting.                                                      | 1                             | 04.1.17                            |                                 |                                 |                       |
| 15.                                        | <b>Tutorial-2</b>                                                    | 1                             | 05.1.17                            |                                 |                                 |                       |
| No. of classes required to complete UNIT-I |                                                                      | 16                            | No. of classes taken:              |                                 |                                 |                       |

**UNIT-II : MOBILE RADIO PROPAGATION**

| S.No. | Topics to be covered                                             | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
|-------|------------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| 16.   | Introduction, Basics of Mobile Radio Propagation                 | 1                             | 06.1.16                            |                                 |                                 |                       |
| 17.   | Free space propagation                                           | 1                             | 16.1.17                            |                                 |                                 |                       |
| 18.   | Link budget design                                               | 1                             | 17.1.17                            |                                 |                                 |                       |
| 19.   | Propagation models                                               | 1                             | 18.1.17                            |                                 |                                 |                       |
| 20.   | <b>Tutorial-3</b>                                                | 1                             | 19.1.17                            |                                 |                                 |                       |
| 21.   | Small scale multipath propagation,                               | 1                             | 20.1.17                            |                                 |                                 |                       |
| 22.   | Types of small-scale fading                                      | 1                             | 23.1.17                            |                                 |                                 |                       |
| 23.   | Statistical models for multipath propagation                     | 1                             | 24.1.17                            |                                 |                                 |                       |
| 24.   | CELL SITE ANTENNAS AND MOBILE ANTENNAS: Cell site Antenna height | 1                             | 25.1.17                            |                                 |                                 |                       |
| 25.   | Omni directional antennas                                        | 1                             | 27.1.17                            |                                 |                                 |                       |
| 26.   | directional antennas for interference reduction                  | 1                             | 30.1.17                            |                                 |                                 |                       |
| 27.   | space diversity antennas ,umbrella pattern antennas              | 1                             | 31.1.17                            |                                 |                                 |                       |
| 28.   | <b>Tutorial-4</b>                                                | 1                             | 01.2.17                            |                                 |                                 |                       |
| 29.   | Minimum separation of cell site                                  | 1                             | 02.2.17                            |                                 |                                 |                       |

|                                             |                             |    |                       |  |  |  |
|---------------------------------------------|-----------------------------|----|-----------------------|--|--|--|
|                                             | receiving antennas,         |    |                       |  |  |  |
| 30.                                         | Mobile high gain antennas.  | 1  | 03.2.17               |  |  |  |
| 31.                                         | Sum and difference patterns | 1  | 06.2.17               |  |  |  |
| 32.                                         | <b>Tutorial-5</b>           | 1  | 07.2.17               |  |  |  |
| No. of classes required to complete UNIT-II |                             | 17 | No. of classes taken: |  |  |  |

### UNIT-III : INTERFERENCE

| S.No.                                        | Topics to be covered                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|----------------------------------------------|---------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 33.                                          | Introduction to Co-Channel Interference     | 1                       | 08.2.17                      |                           |                           |                 |
| 34.                                          | real time Co-Channel interference           | 1                       | 09.2.17                      |                           |                           |                 |
| 35.                                          | Co-Channel interference measurement         | 1                       | 10.2.17                      |                           |                           |                 |
| 36.                                          | Design of Omni directional Antenna system   | 1                       | 13.2.17                      |                           |                           |                 |
| 37.                                          | <b>Tutorial-6</b>                           | 1                       | 14.2.17                      |                           |                           |                 |
| 38.                                          | Design of directional Antenna system        | 1                       | 15.2.17                      |                           |                           |                 |
| 39.                                          | Antenna parameters and their effects,       | 1                       | 16.2.17                      |                           |                           |                 |
| 40.                                          | diversity receiver,                         | 1                       | 17.2.17                      |                           |                           |                 |
| 41.                                          | non-co-channel interference-different types | 1                       | 20.2.17                      |                           |                           |                 |
| 42.                                          | <b>Tutorial-7</b>                           | 1                       | 21.2.17                      |                           |                           |                 |
| No. of classes required to complete UNIT-III |                                             | 10                      | No. of classes taken:        |                           |                           |                 |

### UNIT-IV : HANDOFFS AND DROPPED CALLS

| S.No.                                       | Topics to be covered                                                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---------------------------------------------|-----------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 43.                                         | Types of handoff, handoff invitation                                        | 1                       | 22.2.17                      |                           |                           |                 |
| 44.                                         | delaying handoff, forced handoff                                            | 1                       | 23.2.17                      |                           |                           |                 |
| 45.                                         | mobile assigned handoff, Intersystem handoff                                | 1                       | 27.3.17                      |                           |                           |                 |
| 46.                                         | dropped call rates and their evaluation                                     | 1                       | 28.3.17                      |                           |                           |                 |
| 47.                                         | <b>Tutorial-8</b>                                                           | 1                       | 01.3.17                      |                           |                           |                 |
| 48.                                         | <b>FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT</b> : Numbering and grouping | 1                       | 02.3.17                      |                           |                           |                 |
| 49.                                         | setup access and paging channels                                            | 1                       | 03.3.17                      |                           |                           |                 |
| 50.                                         | channel assignments to cell sites and mobile units                          | 1                       | 06.3.17                      |                           |                           |                 |
| 51.                                         | channel sharing and borrowing                                               | 1                       | 07.3.17                      |                           |                           |                 |
| 52.                                         | <b>Tutorial-9</b>                                                           | 1                       | 08.3.17                      |                           |                           |                 |
| 53.                                         | sectorization, overlaid cells                                               | 1                       | 09.3.17                      |                           |                           |                 |
| 54.                                         | non fixed channel assignment                                                | 1                       | 10.3.17                      |                           |                           |                 |
| 55.                                         | cell splitting                                                              | 1                       | 13.3.17                      |                           |                           |                 |
| 56.                                         | <b>Tutorial-10</b>                                                          | 1                       | 14.3.17                      |                           |                           |                 |
| No. of classes required to complete UNIT-IV |                                                                             | 14                      | No. of classes taken:        |                           |                           |                 |

### UNIT-V : DIGITAL CELLULAR SYSTEMS AND MULTIPLE ACCESS TECHNIQUES

| UNIT-V: DIGITAL CELLULAR SYSTEMS AND MULTIPLE ACCESS TECHNIQUES |                                    |                               |                                    |                                 |                                 |                       |
|-----------------------------------------------------------------|------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                                           | Topics to be covered               | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 57.                                                             | Introduction                       | 1                             | 15.3.17                            |                                 |                                 |                       |
| 58.                                                             | Global System for Mobile           | 1                             | 16.3.17                            |                                 |                                 |                       |
| 59.                                                             | Global System for Mobile           | 1                             | 17.3.17                            |                                 |                                 |                       |
| 60.                                                             | Time Division Multiple Access      | 3                             | 20.3.17<br>21.3.17<br>22.3.17      |                                 |                                 |                       |
| 61.                                                             | <b>Tutorial-11</b>                 | 1                             | 23.3.17                            |                                 |                                 |                       |
| 62.                                                             | Frequency Division Multiple Access | 2                             | 24.3.17<br>27.3.17                 |                                 |                                 |                       |
| 63.                                                             | Code Division Multiple Access      | 2                             | 29.3.17<br>30.3.17                 |                                 |                                 |                       |
| 64.                                                             | <b>Tutorial-12</b>                 | 1                             | 31.3.17                            |                                 |                                 |                       |
| No. of classes required to complete UNIT-V                      |                                    | 12                            | No. of classes taken:              |                                 |                                 |                       |

### Contents beyond the Syllabus

| S.No. | Topics to be covered                                           | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|----------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 65.   | <b>3G Systems</b> -Universal Mobile Telecommunications System; | 1                       | 03.4.17                      |                           |                           |                 |
| 66.   | Wideband CDMA; CDMA 2000.                                      | 1                       | 04.4.17                      |                           |                           |                 |

### Teaching Learning Methods

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

### ACADEMIC CALENDAR:

| Description                | From       | To         | Weeks  |
|----------------------------|------------|------------|--------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3½W    |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W     |
| I Phase of Instructions-II | 16-01-2017 | 08-02-2017 | 3½W    |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9 W    |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days |
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1 W    |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1 W    |

**EVALUATION PROCESS:**

| <b>Evaluation Task</b>                                                               | <b>COs</b>       | <b>Marks</b>  |
|--------------------------------------------------------------------------------------|------------------|---------------|
| I-Mid Examination                                                                    | 1,2              | A1=20         |
| II-Mid Examination                                                                   | 3,4,5            | A2=20         |
| Attendance                                                                           |                  | B=5           |
| Evaluation of Mid Marks: $A=75\%$ of $\text{Max}(A1,A2)+25\%$ of $\text{Min}(A1,A2)$ | 1,2,3,4,5        | A=20          |
| <b>Cumulative Internal Examination : A+B</b>                                         | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                     | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                            | <b>1,2,3,4,5</b> | <b>100</b>    |

Ch.V Naga Bhaskar

**Course Instructor**

Dr.A Narendra Babu

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Dr.J Babu

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Prof.B.Ramesh Reddy

**BOS Chairman&HOD**

## **COURSE HANDOUT**

|                               |                                            |
|-------------------------------|--------------------------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE                  |
| <b>ACADEMIC YEAR</b>          | : 2016-17                                  |
| <b>COURSE NAME &amp; CODE</b> | : Cellular and Mobile Communications T-134 |
| <b>L-T-P STRUCTURE</b>        | : 4-1-0                                    |
| <b>COURSE CREDITS</b>         | : 4                                        |
| <b>COURSE INSTRUCTOR</b>      | : V.V.Rama Krishna, Assoc Professor        |
| <b>COURSE COORDINATOR</b>     | : Dr. A Narendra Babu, Professor           |

**COURSE OBJECTIVE :** In this course , students are able to understand the fundamental concepts of mobile cellular systems and specifics of current and proposed cellular systems.

### **COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO       | Statement<br>At the end of the course,<br>student will be able to                       | PO<br>1 | PO<br>2 | PO<br>3 | PO<br>4 | PO<br>5 | PO<br>6 | PO<br>7 | PO<br>8 | PO<br>9 | PO<br>10 | PO<br>11 | PO<br>12 | PSO<br>1 | PSO<br>2 | PSO<br>3 |
|----------|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|----------|----------|----------|----------|----------|----------|
| <b>1</b> | Summarize the basic concepts related to different cellular systems and their operation. | 3       | 2       | 1       | -       | 3       | 3       | 1       | -       | -       | -        | -        | 3        | 3        | 2        | -        |
| <b>2</b> | Analyze radio propagation losses at different cell site and mobile antennas.            | 3       | 2       | 3       | 3       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | 1        |
| <b>3</b> | Design and differentiate the co-channel and adjacent channel interferences.             | 3       | -       | 3       | 2       | 3       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |
| <b>4</b> | Gain the knowledge on various handoffs and different channel assignments.               | 2       | -       | 3       | -       | 3       | 2       | -       | -       | -       | -        | -        | -        | 3        | -        | -        |
| <b>5</b> | Understand the different digital cellular systems and multiple access techniques.       | 2       | 2       | 3       | -       | -       | -       | -       | -       | -       | -        | -        | 3        | 3        | -        | -        |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put **'-'**  
**1-** Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

### **BOS APPROVED TEXT BOOKS:**

- 1 W.C.Y.Lee, Wireless and Cellular Telecommunications, Tata McGraw Hill, 3<sup>rd</sup> edition, 2006
- 2 G. Sasbushana Rao, Mobile Cellular Communications, Pearson Education India, 2012

### **BOS APPROVED REFERENCE BOOKS:**

- 1 Theodore. S. Rapoport, Wireless Communications, Pearson education, 2<sup>nd</sup> Edn., 2002
- 2 V. Jeyasri Arokiamary, Mobile Communications, Technical Publications.

**COURSE DELIVERY PLAN (LESSON PLAN): Section-C****UNIT-I : INTRODUCTION TO CELLULAR SYSTEMS**

| UNIT-I-INTRODUCTION TO CELLULAR SYSTEMS    |                                                                      |                               |                                    |                                 |                                 |                       |
|--------------------------------------------|----------------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                      | Topics to be covered                                                 | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 1.                                         | Introduction                                                         | 1                             | 15-12-16                           |                                 |                                 |                       |
| 2.                                         | Continuation to introduction                                         | 1                             | 15-12-16                           |                                 |                                 |                       |
| 3.                                         | Basic Cellular system                                                | 1                             | 16-12-16                           |                                 |                                 |                       |
| 4.                                         | Concept of Analog and Digital Cellular systems                       | 1                             | 19-12-16                           |                                 |                                 |                       |
| 5.                                         | Performance criteria.                                                | 1                             | 19-12-16                           |                                 |                                 |                       |
| 6.                                         | uniqueness of mobile radio environment                               | 1                             | 20-12-16                           |                                 |                                 |                       |
| 7.                                         | operation of cellular systems                                        | 1                             | 21-12-16                           |                                 |                                 |                       |
| 8.                                         | Hexagonal shaped cells                                               | 1                             | 21-12-16                           |                                 |                                 |                       |
| 9.                                         | Concept of frequency Reuse channels                                  | 1                             | 22-12-16                           |                                 |                                 |                       |
| 10.                                        | Co-channel Interference Reduction Factor and Problems                | 2                             | 22-12-16                           |                                 |                                 |                       |
| 11.                                        | <b>Tutorial-1</b>                                                    | 1                             | 23-12-16                           |                                 |                                 |                       |
| 12.                                        | desired C/I from a normal case in an Omni directional Antenna system | 1                             | 26-12-16                           |                                 |                                 |                       |
| 13.                                        | Consideration of the Components of a Cellular system                 | 1                             | 26-12-16                           |                                 |                                 |                       |
| 14.                                        | Cell splitting.                                                      | 1                             | 27-12-16                           |                                 |                                 |                       |
| 15.                                        | <b>Tutorial-2</b>                                                    | 1                             | 28-12-16                           |                                 |                                 |                       |
| No. of classes required to complete UNIT-I |                                                                      | 16                            | No. of classes taken:              |                                 |                                 |                       |

**UNIT-II : MOBILE RADIO PROPAGATION**

| S.No. | Topics to be covered                                             | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 16.   | Introduction, Basics of Mobile Radio Propagation                 | 1                       | 29-12-16                     |                           |                           |                 |
| 17.   | Free space propagation                                           | 1                       | 30-12-16                     |                           |                           |                 |
| 18.   | Link budget design                                               | 1                       | 02-01-17                     |                           |                           |                 |
| 19.   | Propagation models                                               | 1                       | 02-01-17                     |                           |                           |                 |
| 20.   | <b>Tutorial-3</b>                                                | 1                       | 03-01-17                     |                           |                           |                 |
| 21.   | Small scale multipath propagation,                               | 1                       | 04-01-17                     |                           |                           |                 |
| 22.   | Types of small-scale fading                                      | 1                       | 04-01-17                     |                           |                           |                 |
| 23.   | Statistical models for multipath propagation                     | 1                       | 05-01-17                     |                           |                           |                 |
| 24.   | CELL SITE ANTENNAS AND MOBILE ANTENNAS: Cell site Antenna height | 1                       | 05-01-17                     |                           |                           |                 |
| 25.   | Omni directional antennas                                        | 1                       | 06-01-17                     |                           |                           |                 |
| 26.   | directional antennas for interference reduction                  | 1                       | 16-01-17                     |                           |                           |                 |
| 27.   | space diversity antennas ,umbrella pattern antennas              | 1                       | 16-01-17                     |                           |                           |                 |
| 28.   | <b>Tutorial-4</b>                                                | 1                       | 17-01-17                     |                           |                           |                 |
| 29.   | Minimum separation of cell site                                  | 1                       | 18-01-17                     |                           |                           |                 |

|                                             |                             |    |                       |  |  |  |
|---------------------------------------------|-----------------------------|----|-----------------------|--|--|--|
|                                             | receiving antennas,         |    |                       |  |  |  |
| 30.                                         | Mobile high gain antennas.  | 1  | 18-01-17              |  |  |  |
| 31.                                         | Sum and difference patterns | 1  | 19-01-17              |  |  |  |
| 32.                                         | <b>Tutorial-5</b>           | 1  | 19-01-17              |  |  |  |
| No. of classes required to complete UNIT-II |                             | 17 | No. of classes taken: |  |  |  |

### UNIT-III : INTERFERENCE

| S.No.                                        | Topics to be covered                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|----------------------------------------------|---------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 33.                                          | Introduction to Co-Channel Interference     | 1                       | 23-01-17                     |                           |                           |                 |
| 34.                                          | real time Co-Channel interference           | 1                       | 23-01-17                     |                           |                           |                 |
| 35.                                          | Co-Channel interference measurement         | 1                       | 24-01-17                     |                           |                           |                 |
| 36.                                          | Design of Omni directional Antenna system   | 1                       | 25-01-17                     |                           |                           |                 |
| 37.                                          | <b>Tutorial-6</b>                           | 1                       | 25-01-17                     |                           |                           |                 |
| 38.                                          | Design of directional Antenna system        | 1                       | 27-01-17                     |                           |                           |                 |
| 39.                                          | Antenna parameters and their effects,       | 1                       | 01-02-17                     |                           |                           |                 |
| 40.                                          | diversity receiver,                         | 1                       | 01-02-17                     |                           |                           |                 |
| 41.                                          | non-co-channel interference-different types | 1                       | 02-02-17                     |                           |                           |                 |
| 42.                                          | <b>Tutorial-7</b>                           | 1                       | 02-02-17                     |                           |                           |                 |
| No. of classes required to complete UNIT-III |                                             | 10                      | No. of classes taken:        |                           |                           |                 |

### UNIT-IV : HANDOFFS AND DROPPED CALLS

| S.No.                                       | Topics to be covered                                                        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---------------------------------------------|-----------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 43.                                         | Types of handoff, handoff invitation                                        | 1                       | 06-02-16                     |                           |                           |                 |
| 44.                                         | delaying handoff, forced handoff                                            | 1                       | 06-02-16                     |                           |                           |                 |
| 45.                                         | mobile assigned handoff, Intersystem handoff                                | 1                       | 07-02-16                     |                           |                           |                 |
| 46.                                         | dropped call rates and their evaluation                                     | 1                       | 08-02-16                     |                           |                           |                 |
| 47.                                         | <b>Tutorial-8</b>                                                           | 1                       | 08-02-16                     |                           |                           |                 |
| 48.                                         | <b>FREQUENCY MANAGEMENT AND CHANNEL ASSIGNMENT</b> : Numbering and grouping | 1                       | 13-02-16                     |                           |                           |                 |
| 49.                                         | setup access and paging channels                                            | 1                       | 13-02-16                     |                           |                           |                 |
| 50.                                         | channel assignments to cell sites and mobile units                          | 1                       | 14-02-16                     |                           |                           |                 |
| 51.                                         | channel sharing and borrowing                                               | 1                       | 15-02-16                     |                           |                           |                 |
| 52.                                         | <b>Tutorial-9</b>                                                           | 1                       | 15-02-16                     |                           |                           |                 |
| 53.                                         | sectorization, overlaid cells                                               | 1                       | 16-02-16                     |                           |                           |                 |
| 54.                                         | non fixed channel assignment                                                | 1                       | 16-02-16                     |                           |                           |                 |
| 55.                                         | cell splitting                                                              | 1                       | 17-02-16                     |                           |                           |                 |
| 56.                                         | <b>Tutorial-10</b>                                                          | 1                       | 20-02-16                     |                           |                           |                 |
| No. of classes required to complete UNIT-IV |                                                                             | 14                      | No. of classes taken:        |                           |                           |                 |

**UNIT-V : DIGITAL CELLULAR SYSTEMS AND MULTIPLE ACCESS TECHNIQUES**

| S.No.                                      | Topics to be covered               | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
|--------------------------------------------|------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| 57.                                        | Introduction                       | 1                             | 20-02-16                           |                                 |                                 |                       |
| 58.                                        | Global System for Mobile           | 1                             | 21-02-16                           |                                 |                                 |                       |
| 59.                                        | Global System for Mobile           | 1                             | 22-02-16                           |                                 |                                 |                       |
| 60.                                        | Time Division Multiple Access      | 3                             | 22-02-16                           |                                 |                                 |                       |
| 61.                                        | <b>Tutorial-11</b>                 | 1                             | 23-02-16                           |                                 |                                 |                       |
| 62.                                        | Frequency Division Multiple Access | 2                             | 23-02-16                           |                                 |                                 |                       |
| 63.                                        | Code Division Multiple Access      | 2                             | 24-02-16                           |                                 |                                 |                       |
| 64.                                        | <b>Tutorial-12</b>                 | 1                             | 27-02-16                           |                                 |                                 |                       |
| No. of classes required to complete UNIT-V |                                    | 12                            | No. of classes taken:              |                                 |                                 |                       |

**Contents beyond the Syllabus**

| S.No. | Topics to be covered                                           | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|----------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 65.   | <b>3G Systems</b> -Universal Mobile Telecommunications System; | 1                       | 06.4.17                      |                           |                           |                 |
| 66.   | Wideband CDMA; CDMA 2000.                                      | 1                       | 07.4.17                      |                           |                           |                 |

**Teaching Learning Methods**

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

**ACADEMIC CALENDAR:**

| Description                | From       | To         | Weeks  |
|----------------------------|------------|------------|--------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3½W    |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W     |
| I Phase of Instructions-II | 16-01-2017 | 08-02-2017 | 3½W    |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9 W    |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days |
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1 W    |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1 W    |

**EVALUATION PROCESS:**

| <b>Evaluation Task</b>                                                               | <b>COs</b>       | <b>Marks</b>  |
|--------------------------------------------------------------------------------------|------------------|---------------|
| I-Mid Examination                                                                    | 1,2              | A1=20         |
| II-Mid Examination                                                                   | 3,4,5            | A2=20         |
| Attendance                                                                           |                  | B=5           |
| Evaluation of Mid Marks: $A=75\%$ of $\text{Max}(A1,A2)+25\%$ of $\text{Min}(A1,A2)$ | 1,2,3,4,5        | A=20          |
| <b>Cumulative Internal Examination : A+B</b>                                         | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                     | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                            | <b>1,2,3,4,5</b> | <b>100</b>    |

V.V.Rama Krishna  
Course Instructor

Dr.A Narendra Babu  
Course Coordinator

Mr.G.L.N Murthy  
Module Coordinator

Dr.J Babu  
Research Coordinator

Prof.B.Ramesh Reddy  
BOS Chairman&HOD

## **COURSE HANDOUT**

|                               |                                         |
|-------------------------------|-----------------------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE               |
| <b>ACADEMIC YEAR</b>          | : 2016-17                               |
| <b>COURSE NAME &amp; CODE</b> | : Digital Design Through Verilog – T160 |
| <b>L-T-P STRUCTURE</b>        | : 4-1-0                                 |
| <b>COURSE CREDITS</b>         | : 3                                     |
| <b>COURSE INSTRUCTOR</b>      | : Mr. Y. Amar Babu, Assoc. Professor    |
| <b>COURSE COORDINATOR</b>     | : Mr. Y. Amar Babu, Assoc. Professor    |

**COURSE OBJECTIVE :** This course provides the knowledge on digital design using various modeling styles of Verilog HDL, verification of digital design using Verilog constructs, FSM modeling using Verilog HDL, architecture of Xilinx FPGA, CPLDs, Altera CPLDs MAX 7000 series, FLEX 10k series and Implementation of digital design on FPGAs/CPLDs.

### **COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO       | Statement<br>At the end of the course,<br>student will be able to                      | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|----------|----------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| <b>1</b> | Analyze Verilog module, test bench structures and Language constructs                  |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| <b>2</b> | Design digital system using Gate level and behavioral modeling                         |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| <b>3</b> | Design digital system using Dataflow and switch level modeling                         |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| <b>4</b> | Write synthesizable Verilog modules using tasks, functions UDPs and simulation modules |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |
| <b>5</b> | Implement Digital System on FPGA/CPLD Architectures                                    |      |      |      |      |      |      |      |      |      |       |       |       |       |       |       |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put '-'  
**1**- Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

### **BOS APPROVED TEXT BOOKS:**

- 1 T.R. Padmanabhan and B. Bala Tripura Sundari, Design through Verilog HDL, WSE,2004, IEEE Press.

### **BOS APPROVED REFERENCE BOOKS:**

- 1 Stephen. Brown and Zvonko Vranesic, Fundamentals of Logic Design with Verilog
- 2 Charles H Roth, Digital Systems Design using VHDL, Jr Thomson Publications

**COURSE DELIVERY PLAN (LESSON PLAN): Section-A****UNIT-I : INTRODUCTION TO VERILOG**

| UNIT- I INTRODUCTION TO VERILOG            |                                                                |                               |                                    |                                 |                                 |                       |
|--------------------------------------------|----------------------------------------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| S.No.                                      | Topics to be covered                                           | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
| 1.                                         | Verilog as HDL, Levels of Design Description                   | 1                             | 15-12-16                           |                                 | TLM1,2                          |                       |
| 2.                                         | Concurrency, Simulation and Synthesis, Functional Verification | 1                             | 15-12-16                           |                                 | TLM1,2                          |                       |
| 3.                                         | System Tasks, Programming Language Interface (PLI), Module     | 1                             | 19-12-16                           |                                 | TLM1,2                          |                       |
| 4.                                         | Simulation and Synthesis Tools                                 | 1                             | 19-12-16                           |                                 | TLM1,2                          |                       |
| 5.                                         | Test Benches                                                   | 1                             | 20-12-16                           |                                 | TLM1,2                          |                       |
| 6.                                         | <b>Tutorial-1</b>                                              | 1                             | 20-12-16                           |                                 | TLM3                            |                       |
| 7.                                         | LANGUAGE CONSTRUCTS AND CONVENTIONS                            | 1                             | 21-12-16                           |                                 | TLM1,2                          |                       |
| 8.                                         | Introduction, Keywords, Identifiers, Strings                   | 1                             | 21-12-16                           |                                 | TLM1,2                          |                       |
| 9.                                         | White Space Characters, Comments, Numbers                      | 1                             | 22-12-16                           |                                 | TLM1,2                          |                       |
| 10.                                        | Scalars and Vectors, Logic Values, Strengths                   | 1                             | 22-12-16                           |                                 | TLM1,2                          |                       |
| 11.                                        | Data Types                                                     | 1                             | 26-12-16                           |                                 | TLM1,2                          |                       |
| 12.                                        | Parameters, Memory                                             | 1                             | 26-12-16                           |                                 | TLM1,2                          |                       |
| 13.                                        | Operators, System Tasks                                        | 1                             | 27-12-16                           |                                 | TLM1,2                          |                       |
| 14.                                        | <b>Tutorial-2</b>                                              | 1                             | 27-12-16                           |                                 | TLM3                            |                       |
| No. of classes required to complete UNIT-I |                                                                | 14                            | No. of classes taken:              |                                 |                                 |                       |

**UNIT-II : GATE LEVEL AND BEHAVIORAL MODELING**

| S.No. | Topics to be covered                                                                            | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|-------------------------------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 15.   | Introduction, AND Gate Primitive, Module Structure                                              | 1                       | 28-12-16                     |                           | TLM1,2                    |                 |
| 16.   | Other Gate Primitives, Illustrative Examples, Tri-State Gates, Array of Instances of Primitives | 1                       | 28-12-16                     |                           | TLM1,2                    |                 |
| 17.   | Design of Flip flops with Gate Primitives                                                       | 1                       | 29-12-16                     |                           | TLM1,2                    |                 |

|                                             |                                                                                                                  |    |                       |  |        |  |
|---------------------------------------------|------------------------------------------------------------------------------------------------------------------|----|-----------------------|--|--------|--|
| 18.                                         | Delays, Strengths and Contention Resolution                                                                      | 1  | 29-12-16              |  | TLM1,2 |  |
| 19.                                         | Net Types, Design of Basic Circuits                                                                              | 1  | 02-01-17              |  | TLM1,2 |  |
| 20.                                         | <b>Tutorial-3</b>                                                                                                | 1  | 02-01-17              |  | TLM3   |  |
| 21.                                         | Introduction, Operations and Assignments, Functional Bifurcation ,<br><i>Initial Construct, Always Construct</i> | 1  | 03-01-17              |  | TLM1,2 |  |
| 22.                                         | Multiple Always ,Examples Assignments with Delays, <i>Wait</i> construct                                         | 1  | 03-01-17              |  | TLM1,2 |  |
| 23.                                         | Blocks, Designs at Behavioral Level                                                                              | 1  | 04-01-17              |  | TLM1,2 |  |
| 24.                                         | Blocking and Non-blocking Assignments                                                                            | 1  | 04-01-17              |  | TLM1,2 |  |
| 25.                                         | <b>Tutorial-4</b>                                                                                                | 1  | 05-01-17              |  | TLM3   |  |
| 26.                                         | The <i>case</i> statement, Simulation Flow <i>if</i> and <i>if-else</i> constructs                               | 1  | 05-01-17              |  | TLM1,2 |  |
| 27.                                         | <i>assign-deassign</i> construct, <i>repeat</i> construct                                                        | 1  | 06-01-17              |  | TLM1,2 |  |
| 28.                                         | <i>for</i> loop, the <i>disable</i> construct, <i>While</i> loop,                                                | 1  | 06-01-17              |  | TLM1,2 |  |
| 29.                                         | <i>forever</i> loop, parallel blocks,                                                                            | 1  | 09-01-17              |  | TLM1,2 |  |
| 30.                                         | <i>force- release</i> construct, Event                                                                           | 1  | 09-01-17              |  | TLM1,2 |  |
| 31.                                         | <b>Tutorial-5</b>                                                                                                | 1  | 09-01-17              |  | TLM3   |  |
| No. of classes required to complete UNIT-II |                                                                                                                  | 17 | No. of classes taken: |  |        |  |

### UNIT-III : DATA FLOW AND SWITCH LEVEL MODELING

| S.No. | Topics to be covered                                                              | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|-----------------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 32.   | Introduction, Continuous Assignment Structures, Delays and Continuous Assignments | 1                       | 17-01-17                     |                           | TLM1,2                    |                 |
| 33.   | Assignment to Vectors                                                             | 1                       | 17-01-17                     |                           | TLM1,2                    |                 |
| 34.   | Operators                                                                         | 1                       | 18-01-17                     |                           | TLM1,2                    |                 |
| 35.   | <b>Tutorial-6</b>                                                                 | 1                       | 18-01-17                     |                           | TLM3                      |                 |
| 36.   | Introduction, Basic Transistor Switches,                                          | 1                       | 19-01-17                     |                           | TLM1,2                    |                 |

|                                              |                                                 |    |                       |  |        |  |
|----------------------------------------------|-------------------------------------------------|----|-----------------------|--|--------|--|
| 37.                                          | CMOS Switch, Bi-directional Gates               | 1  | 19-01-17              |  | TLM1,2 |  |
| 38.                                          | Time Delays with Switch Primitives              | 1  | 23-01-17              |  | TLM1,2 |  |
| 39.                                          | Instantiations with Strengths and Delays        | 1  | 23-01-17              |  | TLM1,2 |  |
| 40.                                          | Strength Contention with Trireg Nets, Exercises | 1  | 24-01-17              |  | TLM1,2 |  |
| 41.                                          | <b>Tutorial-7</b>                               | 1  | 24-01-17              |  | TLM3   |  |
| No. of classes required to complete UNIT-III |                                                 | 10 | No. of classes taken: |  |        |  |

#### UNIT-IV : SYSTEM TASK, FUNCTIONS, UDPS

| S.No.                                       | Topics to be covered                                                      | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---------------------------------------------|---------------------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 42.                                         | Introduction, Parameters, Path Delays, Module Parameters                  | 1                       | 25-01-17                     |                           | TLM1,2                    |                 |
| 43.                                         | System Tasks and Functions                                                | 1                       | 25-01-17                     |                           | TLM1,2                    |                 |
| 44.                                         | File-Based Tasks and Functions                                            | 1                       | 30-01-17                     |                           | TLM1,2                    |                 |
| 45.                                         | Compiler Directives, Hierarchical Access, General Observations, Exercises | 1                       | 30-01-17                     |                           | TLM1,2                    |                 |
| 46.                                         | <b>Tutorial-8</b>                                                         | 1                       | 31-01-17                     |                           | TLM3                      |                 |
| 47.                                         | Introduction, Function                                                    | 1                       | 31-01-17                     |                           | TLM1,2                    |                 |
| 48.                                         | Tasks                                                                     | 1                       | 01-02-17                     |                           | TLM1,2                    |                 |
| 49.                                         | User- Defined Primitives (UDP)                                            | 1                       | 01-02-17                     |                           | TLM1,2                    |                 |
| 50.                                         | <b>Tutorial-9</b>                                                         | 1                       | 02-02-17                     |                           | TLM3                      |                 |
| 51.                                         | FSM Design (Moore and Mealy Machines)                                     | 1                       | 02-02-17                     |                           | TLM1,2                    |                 |
| 52.                                         | FSM Design (Moore and Mealy Machines)                                     | 1                       | 06-02-17                     |                           | TLM1,2                    |                 |
| 53.                                         | FSM Design (Moore and Mealy Machines)                                     | 1                       | 06-02-17                     |                           | TLM1,2                    |                 |
| 54.                                         | <b>Tutorial-10</b>                                                        |                         | 07-02-17                     |                           | TLM3                      |                 |
| No. of classes required to complete UNIT-IV |                                                                           | 13                      | No. of classes taken:        |                           |                           |                 |

#### UNIT-V : DIGITAL DESIGN

| S.No. | Topics to be covered                          | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|-----------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 55.   | State Machine Charts, Derivation of SM Charts | 1                       | 07-02-17                     |                           | TLM1,2                    |                 |
| 56.   | State Machine Charts                          | 1                       | 08-02-17                     |                           | TLM1,2                    |                 |

|                                            |                                                               |    |                       |  |        |  |
|--------------------------------------------|---------------------------------------------------------------|----|-----------------------|--|--------|--|
| 57.                                        | Realization of SM Charts                                      | 1  | 08-02-17              |  | TLM1,2 |  |
| 58.                                        | Realization of SM Charts                                      | 1  | 09-02-17              |  | TLM1,2 |  |
| 59.                                        | Implementation of the Dice Game                               | 1  | 09-02-17              |  | TLM1,2 |  |
| 60.                                        | <b>Tutorial-11</b>                                            | 1  | 13-02-17              |  | TLM3   |  |
| 61.                                        | Alternative realizations for SM Charts using Microprogramming | 1  | 13-02-17              |  | TLM1,2 |  |
| 62.                                        | Microprogramming                                              | 1  | 14-02-17              |  | TLM1,2 |  |
| 63.                                        | Linked State Machines                                         | 1  | 14-02-17              |  | TLM1,2 |  |
| 64.                                        | Xilinx 3000 Series FPGAs                                      | 1  | 15-02-17              |  | TLM1,2 |  |
| 65.                                        | Designing with FPGAs                                          | 1  | 15-02-17              |  | TLM1,2 |  |
| 66.                                        | Using a One-Hot State Assignment                              | 1  | 16-02-17              |  | TLM1,2 |  |
| 67.                                        | Altera Complex Programmable Logic Devices (CPLDs)             | 1  | 16-02-17              |  | TLM1,2 |  |
| 68.                                        | Altera FLEX 10K Series CPLDs                                  | 1  | 20-02-17              |  | TLM1,2 |  |
| 69.                                        | <b>Tutorial-12</b>                                            | 1  | 20-02-17              |  | TLM3   |  |
| No. of classes required to complete UNIT-V |                                                               | 15 | No. of classes taken: |  |        |  |

#### Contents beyond the Syllabus

| S.No. | Topics to be covered        | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|-----------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 70.   | Advanced FPGA Architectures | 1                       | 21-02-17                     |                           | TLM2                      |                 |
| 71.   | ASIC Design                 | 1                       | 21-02-17                     |                           | TLM2                      |                 |

#### Teaching Learning Methods

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

#### ACADEMIC CALENDAR:

| Description                | From       | To         | Weeks             |
|----------------------------|------------|------------|-------------------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3 $\frac{1}{2}$ W |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W                |
| I Phase of Instructions-II | 16-01-2017 | 08-02-2017 | 3 $\frac{1}{2}$ W |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days            |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9W                |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days            |

|                            |            |            |    |
|----------------------------|------------|------------|----|
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1W |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1W |

### EVALUATION PROCESS:

| <b>Evaluation Task</b>                                                             | <b>COs</b>       | <b>Marks</b>  |
|------------------------------------------------------------------------------------|------------------|---------------|
| Attendance A                                                                       |                  | 05            |
| I-Mid Examination                                                                  | 1,2              | B1=20         |
| II-Mid Examination                                                                 | 3,4,5            | B2=20         |
| Evaluation of Mid Marks: $B=75\% \text{ of Max}(B1,B2)+25\% \text{ of Min}(B1,B2)$ | 1,2,3,4,5        | B=20          |
| <b>Cumulative Internal Examination : Attendance+B</b>                              | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                   | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                          | <b>1,2,3,4,5</b> | <b>100</b>    |

Mr. Y. Amar Babu  
Course Instructor

Mr. Y. Amar Babu  
Course Coordinator

Mr.Y. Amar Babu  
Module Coordinator

Dr.M. Suman  
Research Coordinator

Prof.B.Ramesh Reddy  
BOS Chairman&HOD

## **COURSE HANDOUT**

|                               |                                     |
|-------------------------------|-------------------------------------|
| <b>PROGRAM</b>                | : B.Tech., VIII-Sem., ECE-C         |
| <b>ACADEMIC YEAR</b>          | : 2016-17                           |
| <b>COURSE NAME &amp; CODE</b> | : Wireless Sensor Networks - T 342  |
| <b>L-T-P STRUCTURE</b>        | : 4-1-0                             |
| <b>COURSE CREDITS</b>         | : 3                                 |
| <b>COURSE INSTRUCTOR</b>      | : P.Venkat Rao, Assistant Professor |
| <b>COURSE COORDINATOR</b>     | : Dr.G.Srinivasa Rao, Professor     |

**COURSE OBJECTIVE:** This course provides the knowledge on applications, architectures and protocols of wireless sensor networks. The course also gives the overview regarding the software platforms and tools required for wireless sensor networks.

### **COURSE ARTICULATION MATRIX(Correlation between COs&POs,PSOs):**

| CO | Statement<br>At the end of the course,<br>student will be able to                                | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO 10 | PO 11 | PO 12 | PSO 1 | PSO 2 | PSO 3 |
|----|--------------------------------------------------------------------------------------------------|------|------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|
| 1  | Understand different applications of wireless sensor networks.                                   | 3    | -    | 1    | -    | 2    | 2    | 3    | -    | -    | -     | -     | -     | 1     | 3     | 2     |
| 2  | Understand how individual sensor nodes can be connected into a wireless sensor network.          | 2    | 3    | -    | -    | 1    | 1    | 1    | -    | -    | 1     | 3     | -     | 2     | 3     | -     |
| 3  | Analyze different communication protocols of wireless sensor networks in real time applications. | 3    | 3    | 2    | -    | -    | -    | -    | -    | -    | -     | 1     | -     | -     | 3     | 3     |
| 4  | Learn about the establishment of wireless sensor networks.                                       | 2    | 2    | 3    | -    | 3    | -    | -    | -    | -    | -     | -     | -     | 3     | 3     | 1     |
| 5  | Apply the knowledge of platforms and tools for the operation of wireless sensor networks.        | 2    | -    | 2    | -    | 3    | -    | 1    | -    | -    | -     | -     | -     | 2     | 3     | -     |

**Note:** Enter Correlation Levels **1** or **2** or **3**. If there is no correlation, put **'-'**  
**1-** Slight(Low), **2** - Moderate(Medium), **3** - Substantial (High).

### **BOS APPROVED TEXT BOOKS:**

- 1 Holger Karl & Andreas Willig, " Protocols And Architectures for Wireless Sensor Networks" , John Wiley, 2005.

### **BOS APPROVED REFERENCE BOOKS:**

- 1 Feng Zhao & Leonidas J. Guibas, "Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007.
- 2 Kazem Sohraby, Daniel Minoli, & Taieb Znati, "Wireless Sensor Networks- Technology, Protocols, And Applications", John Wiley, 2007.

## **COURSE DELIVERY PLAN (LESSON PLAN): Section-C**

### **UNIT-I : Overview of wireless sensor networks**

| UNIT-I : Overview of wireless sensor networks |                                                              |                         |                              |                           |                           |                 |
|-----------------------------------------------|--------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| S.No.                                         | Topics to be covered                                         | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
| 1.                                            | Introduction to Wireless sensor networks                     | 1                       | 15.12.16                     |                           |                           |                 |
| 2.                                            | Course Outcomes and overview of WSN and traditional networks | 1                       | 16.12.16                     |                           |                           |                 |
| 3.                                            | Introduction to UNIT-I                                       | 1                       | 19.12.16                     |                           |                           |                 |
| 4.                                            | Defining wireless sensor network and its architecture        | 1                       | 20.12.16                     |                           |                           |                 |
| 5.                                            | Basic components of sensor node-examples                     | 1                       | 21.12.16                     |                           |                           |                 |
| 6.                                            | Applications of wireless sensor networks                     | 2                       | 22.12.16<br>23.12.16         |                           |                           |                 |
| 7.                                            | TUTORIAL-1                                                   | 1                       | 26.12.16                     |                           |                           |                 |
| 8.                                            | Types of applications of WSN                                 | 1                       | 27.12.16                     |                           |                           |                 |
| 9.                                            | Classification of wireless sensor networks                   | 1                       | 28.12.16                     |                           |                           |                 |
| 10.                                           | Challenges of wireless sensor networks                       | 1                       | 29.12.16                     |                           |                           |                 |
| 11.                                           | Characteristics requirements of WSN                          | 1                       | 30.12.16                     |                           |                           |                 |
| 12.                                           | Requires mechanisms to meet the requirements                 | 1                       | 02.01.17                     |                           |                           |                 |
| 13.                                           | MANETs Vs WSNs                                               | 1                       | 03.01.17                     |                           |                           |                 |
| 14.                                           | Enabling technologies for Wireless sensor networks           | 1                       | 04.01.17                     |                           |                           |                 |
| 15.                                           | TUTORIAL-2                                                   | 1                       | 05.01.17                     |                           |                           |                 |
| No. of classes required to complete UNIT-I    |                                                              | 16                      | No. of classes taken:        |                           |                           |                 |

### **UNIT-II : Architectures of wireless sensor networks**

| S.No. | Topics to be covered                       | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|--------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 16.   | Introduction to UNIT-II                    | 1                       | 06.01.17                     |                           |                           |                 |
| 17.   | Block diagram of single node architecture  | 1                       | 16.01.17                     |                           |                           |                 |
| 18.   | Hardware components of sensor node         | 1                       | 17.01.17                     |                           |                           |                 |
| 19.   | Energy consumption of sensor nodes         | 2                       | 18.01.17<br>19.01.17         |                           |                           |                 |
| 20.   | TUTORIAL-3                                 | 1                       | 20.01.17                     |                           |                           |                 |
| 21.   | Transceiver structure and characteristics  | 1                       | 23.01.17                     |                           |                           |                 |
| 22.   | Operational states of sensor nodes         | 2                       | 24.01.17<br>25.01.17         |                           |                           |                 |
| 23.   | Operating system and execution environment | 1                       | 27.01.17                     |                           |                           |                 |
| 24.   | Network architecture                       | 2                       | 30.01.17<br>31.01.16         |                           |                           |                 |
| 25.   | Sensor network scenarios                   | 1                       | 01.02.17                     |                           |                           |                 |
| 26.   | Optimization goals and figure of merit     | 1                       | 02.02.17                     |                           |                           |                 |

|                                             |                  |    |                       |  |  |  |
|---------------------------------------------|------------------|----|-----------------------|--|--|--|
| 27.                                         | Gateway concepts | 1  | 03.02.17              |  |  |  |
| 28.                                         | TUTORIAL-4       | 1  | 06.02.17              |  |  |  |
| No. of classes required to complete UNIT-II |                  | 16 | No. of classes taken: |  |  |  |

### UNIT-III : Networking Sensors

| UNIT-III: Networking Sensors                 |                                   |                         |                              |                           |                           |                 |
|----------------------------------------------|-----------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| S.No.                                        | Topics to be covered              | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
| 29.                                          | Introduction to UNIT-III          | 1                       | 07.02.17                     |                           |                           |                 |
| 30.                                          | Physical layer                    | 1                       | 08.02.17                     |                           |                           |                 |
| 31.                                          | Transceiver design considerations | 1                       | 13.02.17                     |                           |                           |                 |
| 32.                                          | MAC protocol for WSN              | 1                       | 14.02.17                     |                           |                           |                 |
| 33.                                          | TUTORIAL-5                        | 1                       | 15.02.17                     |                           |                           |                 |
| 34.                                          | Low duty cycle protocol           | 1                       | 16.02.17                     |                           |                           |                 |
| 35.                                          | S-MAC protocol                    | 1                       | 17.02.17                     |                           |                           |                 |
| 36.                                          | Wakeup radio concepts             | 1                       | 20.02.17                     |                           |                           |                 |
| 37.                                          | Mediation device protocol         | 1                       | 21.02.17                     |                           |                           |                 |
| 38.                                          | Address and name managements      | 1                       | 22.02.17                     |                           |                           |                 |
| 39.                                          | Assignment of MAC address         | 1                       | 23.02.17                     |                           |                           |                 |
| 40.                                          | TUTORIAL-6                        | 1                       | 27.02.17                     |                           |                           |                 |
| 41.                                          | Routing protocols                 | 2                       | 28.03.17<br>01.03.17         |                           |                           |                 |
| 42.                                          | Energy efficient routing          | 1                       | 02.03.17                     |                           |                           |                 |
| 43.                                          | Geographic routing                | 1                       | 03.03.17                     |                           |                           |                 |
| 44.                                          | TUTORIAL-7                        | 1                       | 06.03.17                     |                           |                           |                 |
| No. of classes required to complete UNIT-III |                                   | 17                      | No. of classes taken:        |                           |                           |                 |

### UNIT-IV : Infrastructure establishment

| S.No.                                       | Topics to be covered                      | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|---------------------------------------------|-------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 45.                                         | Introduction to UNIT-IV                   | 1                       | 07.03.17                     |                           |                           |                 |
| 46.                                         | Possible options for topology control     | 1                       | 08.03.17                     |                           |                           |                 |
| 47.                                         | Flat networks with power control          | 1                       | 09.03.17                     |                           |                           |                 |
| 48.                                         | LMST algorithm                            | 1                       | 10.03.17                     |                           |                           |                 |
| 49.                                         | Hierarchical networks with dominated sets | 1                       | 13.03.17                     |                           |                           |                 |
| 50.                                         | Clustering                                | 1                       | 14.03.17                     |                           |                           |                 |
| 51.                                         | TUTORIAL-8                                | 1                       | 15.03.17                     |                           |                           |                 |
| 52.                                         | Time synchronization                      | 2                       | 16.03.17<br>20.3.17          |                           |                           |                 |
| 53.                                         | TUTORIAL-9                                | 1                       | 21.03.17                     |                           |                           |                 |
| 54.                                         | Localization and positioning              | 1                       | 22.03.17                     |                           |                           |                 |
| 55.                                         | Sensor node tasking and control           | 1                       | 23.03.17                     |                           |                           |                 |
| 56.                                         | TUTORIAL-10                               | 1                       | 24.03.17                     |                           |                           |                 |
| No. of classes required to complete UNIT-IV |                                           | 13                      | No. of classes taken:        |                           |                           |                 |

### UNIT-V : Sensor Network Platforms and Tools

| S.No.                                      | Topics to be covered          | No. of<br>Classes<br>Required | Tentative<br>Date of<br>Completion | Actual<br>Date of<br>Completion | Teaching<br>Learning<br>Methods | HOD<br>Sign<br>Weekly |
|--------------------------------------------|-------------------------------|-------------------------------|------------------------------------|---------------------------------|---------------------------------|-----------------------|
| 57.                                        | Introduction to UNIT-V        | 1                             | 27.03.17                           |                                 |                                 |                       |
| 58.                                        | Operating systems for WSN     | 1                             | 29.03.17                           |                                 |                                 |                       |
| 59.                                        | Different Examples            | 1                             | 30.03.17                           |                                 |                                 |                       |
| 60.                                        | Sensor Node Hardware          | 1                             | 31.03.17                           |                                 |                                 |                       |
| 61.                                        | Berkeley Motes                | 1                             | 03.04.17                           |                                 |                                 |                       |
| 62.                                        | Programming challenges        | 1                             | 04.04.17                           |                                 |                                 |                       |
| 63.                                        | TUTORIAL-11                   | 1                             | 06.04.17                           |                                 |                                 |                       |
| 64.                                        | TUTORIAL-12                   | 1                             | 07.04.17                           |                                 |                                 |                       |
| 65.                                        | Node level Software platforms | 1                             | 10.04.17                           |                                 |                                 |                       |
| 66.                                        | Node level simulators         | 1                             | 11.04.17                           |                                 |                                 |                       |
| 67.                                        | State centric programming     | 1                             | 12.04.17                           |                                 |                                 |                       |
| No. of classes required to complete UNIT-V |                               | 11                            | No. of classes taken:              |                                 |                                 |                       |

#### Contents beyond the Syllabus

| S.No. | Topics to be covered                                         | No. of Classes Required | Tentative Date of Completion | Actual Date of Completion | Teaching Learning Methods | HOD Sign Weekly |
|-------|--------------------------------------------------------------|-------------------------|------------------------------|---------------------------|---------------------------|-----------------|
| 68.   | Concepts on Practical deployment of wireless sensor networks | 1                       | 13.04.16                     |                           |                           |                 |
| 69.   | Software concepts- Tiny OS, NS                               | 1                       | 14.04.16                     |                           |                           |                 |
| 70.   | UWB in WSNs                                                  | 1                       | 15.04.16                     |                           |                           |                 |

#### Teaching Learning Methods

|             |                |             |                    |             |                |
|-------------|----------------|-------------|--------------------|-------------|----------------|
| <b>TLM1</b> | Chalk and Talk | <b>TLM4</b> | Problem Solving    | <b>TLM7</b> | Seminars or GD |
| <b>TLM2</b> | PPT            | <b>TLM5</b> | Programming        | <b>TLM8</b> | Lab Demo       |
| <b>TLM3</b> | Tutorial       | <b>TLM6</b> | Assignment or Quiz | <b>TLM9</b> | Case Study     |

#### ACADEMIC CALENDAR:

| Description                | From       | To         | Weeks  |
|----------------------------|------------|------------|--------|
| I Phase of Instructions-1  | 15-12-2016 | 07-01-2017 | 3½W    |
| Sankranthi Holidays        | 09-01-2017 | 14-01-2017 | 1W     |
| I Phase of Instructions-II | 16-01-2017 | 08-02-2017 | 3½W    |
| I Mid Examinations         | 09-02-2017 | 11-02-2017 | 3 days |
| II Phase of Instructions   | 13-02-2017 | 15-04-2017 | 9W     |
| II Mid Examinations        | 17-04-2017 | 19-04-2017 | 3 days |
| Preparation and Practicals | 20-04-2017 | 24-04-2017 | 1W     |
| Semester End Examinations  | 25-04-2017 | 29-04-2017 | 1W     |

**EVALUATION PROCESS:**

| <b>Evaluation Task</b>                                                             | <b>COs</b>       | <b>Marks</b>  |
|------------------------------------------------------------------------------------|------------------|---------------|
| I-Mid Examination                                                                  | 1,2              | A1=20         |
| II-Mid Examination                                                                 | 3,4,5            | A2=20         |
| Attendance Marks: B                                                                | 1,2,3,4,5        | B=5           |
| Evaluation of Mid Marks: $B=75\% \text{ of Max}(A1,A2)+25\% \text{ of Min}(A1,A2)$ | 1,2,3,4,5        | A=20          |
| <b>Cumulative Internal Examination : A+B</b>                                       | <b>1,2,3,4,5</b> | <b>A+B=25</b> |
| <b>Semester End Examinations</b>                                                   | <b>1,2,3,4,5</b> | <b>C=75</b>   |
| <b>Total Marks: A+B+C</b>                                                          | <b>1,2,3,4,5</b> | <b>100</b>    |

Mr.P.Venkat Rao  
Course Instructor

Dr.G.Srinivasa Rao  
Course Coordinator

Mr.G.L.N.Murthy  
Module Coordinator

Dr.J.Babu Babu  
Research Coordinator

Prof.B.Ramesh Reddy  
BOS Chairman&HOD



**LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING** (Autonomous)

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NAAC Accredited with "A" grade, Accredited by NBA

New Delhi & Certified by ISO 9001:2008

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**COURSE** : B.Tech., (VIII-Sem.,)- Sections A  
**A.Y** : 2016-17  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

### **Contents of the Course File (Bottom to Top)**

1. Attendance Registers
2. Syllabus Copy
3. Previous Semester (Old) Question Papers
4. Course Educational Objectives/Course Outcomes
5. Lesson Plan
6. UNIT I: Descriptive Questions, Quiz Questions, Tutorials
7. UNIT II: Descriptive Questions, Quiz Questions, Tutorials
8. I-MID Examination Question Paper with Scheme of Valuation
9. Assessment and Evaluation of Attainment of Course Outcomes with Graphs(Units-I&II)
10. UNIT III: Descriptive Questions, Quiz Questions, Tutorials
11. UNIT IV: Descriptive Questions, Quiz Questions, Tutorials
12. UNIT V: Descriptive Questions, Quiz Questions, Tutorials
13. II-MID Examination Question Paper with Scheme of Valuation
14. Final Mid marks – Evaluation sheet
15. Assessment and Evaluation of Attainment of Course Outcomes with Graphs(Units-III,IV&V)

Note: Conduct minimum of 12 tutorials per course ( 2 tutorials per unit)



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## LESSON PLAN

**ACADEMIC YEAR** : 2016-17  
**COURSE** : B.Tech., (VIII-Sem.,)- Section B  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

| S.No.                                                       | Tentative Date | Topics to be covered                              | No. of Classes | Actual Date | Content Delivery Method |
|-------------------------------------------------------------|----------------|---------------------------------------------------|----------------|-------------|-------------------------|
| <b>UNIT-I : Embedded System Introduction</b>                |                |                                                   |                |             |                         |
| 64.                                                         | 20-06-16       | Embedded systems overview                         | 1              |             |                         |
| 65.                                                         | 22-06-16       | Design challenge                                  | 1              |             |                         |
| 66.                                                         | 23-06-16       | Processor technology                              | 1              |             |                         |
| 67.                                                         | 24-06-16       | IC technology                                     | 1              |             |                         |
| 68.                                                         | 25-06-16       | <b>Tutorials -1</b>                               | 1              |             |                         |
| 69.                                                         | 27-07-16       | Design Technology                                 | 1              |             |                         |
| 70.                                                         | 29-07-16       | Trade-offs                                        | 1              |             |                         |
| 71.                                                         | 30-07-16       | Single purpose processors                         | 1              |             |                         |
| 72.                                                         | 01-07-16       | RT-level combinational logic                      | 1              |             |                         |
| 73.                                                         | 02-07-16       | <b>Tutorials -2</b>                               | 1              |             |                         |
| 74.                                                         | 04-07-16       | Sequential logic (RT level)                       | 1              |             |                         |
| 75.                                                         | 07-07-16       | Custom single purpose processor design (RT-level) | 1              |             |                         |
| 76.                                                         | 08-07-16       | Optimizing custom single purpose processors       | 1              |             |                         |
| <b>Total Classes(UNIT-I)</b>                                |                |                                                   | 13             | --          | --                      |
| <b>UNIT-II : Sate Machine and Concurrent Process Models</b> |                |                                                   |                |             |                         |
| 77.                                                         | 09-07-16       | State Machine and Concurrent Process Models       | 1              |             |                         |
| 78.                                                         | 11-07-16       | <b>Tutorials -3</b>                               | 1              |             |                         |
| 79.                                                         | 13-07-16       | models Vs languages                               | 1              |             |                         |
| 80.                                                         | 14-07-16       | finite state machines with data path model (FSMD) | 1              |             |                         |
| 81.                                                         | 15-07-16       | using state machines                              | 1              |             |                         |
| 82.                                                         | 16-07-16       | program state machine model (PSM)                 | 1              |             |                         |
| 83.                                                         | 18-07-16       | <b>Tutorials -4</b>                               | 1              |             |                         |
| 84.                                                         | 20-07-16       | concurrent process model , concurrent processes   | 1              |             |                         |
| 85.                                                         | 21-07-16       | communication among processes                     | 1              |             |                         |
| 86.                                                         | 22-07-16       | synchronization among processes                   | 1              |             |                         |
| 87.                                                         | 23-07-16       | Implementation                                    |                |             |                         |
| 88.                                                         | 25-07-16       | Data flow model, real-time systems                | 1              |             |                         |

|                                                                              |          |                                                                                               |    |    |    |
|------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----|----|----|
| <b>Total Classes(UNIT-II)</b>                                                |          |                                                                                               | 12 |    | -- |
| <b>UNIT-III : Embedded/RTOS Concepts</b>                                     |          |                                                                                               |    |    |    |
| 89.                                                                          | 27-08-16 | Embedded/RTOS Concepts: Architecture of the Kernel                                            | 1  |    |    |
| 90.                                                                          | 28-07-16 | Tasks and Task scheduler                                                                      | 1  |    |    |
| 91.                                                                          | 29-07-16 | Interrupt service routines                                                                    | 1  |    |    |
| 92.                                                                          | 30-07-16 | <b>Tutorials -5</b>                                                                           | 1  |    |    |
| 93.                                                                          | 01-07-16 | Semaphores, Mutex                                                                             | 1  |    |    |
| 94.                                                                          | 03-08-16 | Mailboxes , Message Queues                                                                    | 1  |    |    |
| 95.                                                                          | 04-08-16 | Event Registers, Pipes                                                                        | 1  |    |    |
| 96.                                                                          | 05-08-16 | Signals, Timers                                                                               | 1  |    |    |
| 97.                                                                          | 06-08-16 | <b>Tutorials -6</b>                                                                           | 1  |    |    |
| 98.                                                                          | 08-08-16 | Memory Management, Priority inversion problem                                                 | 1  |    |    |
| 99.                                                                          | 10-09-16 | Embedded operating systems Embedded Linux                                                     | 1  |    |    |
| 100.                                                                         | 11-08-16 | Real-time operating systems, RT Linux                                                         | 1  |    |    |
| 101.                                                                         | 13-08-16 | Handheld operating systems, Windows CE                                                        | 1  |    |    |
| <b>Total Classes(UNIT-III)</b>                                               |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-IV : Hardware-Software Co-Design In an Embedded System</b>           |          |                                                                                               |    |    |    |
| 102.                                                                         | 17-08-16 | <b>Tutorials -7</b>                                                                           | 1  |    |    |
| 103.                                                                         | 18-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 104.                                                                         | 19-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 105.                                                                         | 20-08-16 | Embedded System Design and Co-Design Issues                                                   | 1  |    |    |
| 106.                                                                         | 22-08-16 | Embedded System Development Process Goal                                                      | 1  |    |    |
| 107.                                                                         | 29-08-16 | <b>Tutorials -8</b>                                                                           | 1  |    |    |
| 108.                                                                         | 31-09-16 | Action Plan                                                                                   | 1  |    |    |
| 109.                                                                         | 01-09-16 | Complete Specifications and system Requirements                                               | 1  |    |    |
| 110.                                                                         | 02-09-16 | Conceptual Design                                                                             | 1  |    |    |
| 111.                                                                         | 03-09-16 | Software and Hardware Layout Design                                                           | 1  |    |    |
| 112.                                                                         | 07-09-16 | <b>Tutorials -9</b>                                                                           | 1  |    |    |
| 113.                                                                         | 08-09-16 | Detailed Design                                                                               | 1  |    |    |
| 114.                                                                         | 09-09-16 | Implementation Tools and Testing                                                              | 1  |    |    |
| <b>Total Classes(UNIT-IV)</b>                                                |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-V : Design Cycle in the Development Phase for an Embedded System</b> |          |                                                                                               |    |    |    |
| 115.                                                                         | 10-09-16 | Design Cycle in the Development Phase                                                         | 1  |    |    |
| 116.                                                                         | 14-09-16 | <b>Tutorials -10</b>                                                                          | 1  |    |    |
| 117.                                                                         | 15-10-16 | Uses of Target System, Emulator and ICE                                                       | 1  |    |    |
| 118.                                                                         | 16-10-16 | Use of Device Programmer for Downloading                                                      | 1  |    |    |
| 119.                                                                         | 17-10-16 | Use of Software Tools for Development of an Embedded System: Code generation tools, Simulator | 1  |    |    |
| 120.                                                                         | 19-10-16 | Exemplary Prototype Development, Testing and Debugger Tools for Embedded Systems              | 1  |    |    |
| 121.                                                                         | 21-10-16 | <b>Tutorials -11</b>                                                                          | 1  |    |    |
| 122.                                                                         | 22-10-16 | IDE, Memory and Processor Sensitive Programs and Device Drivers, DLLs                         | 1  |    |    |
| 123.                                                                         | 23-10-16 | Hardware Tests                                                                                | 1  |    |    |
| 124.                                                                         | 24-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 125.                                                                         | 26-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 126.                                                                         | 28-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |

|                                                                  |          |                                  |    |    |    |
|------------------------------------------------------------------|----------|----------------------------------|----|----|----|
| 127.                                                             | 29-10-16 | Issues in Embedded System Design | 1  |    |    |
| 128.                                                             | 30-10-16 | <b>Tutorials -12</b>             | 1  |    |    |
| <b>Total Classes(UNIT-V)</b>                                     |          |                                  | 14 | -- | -- |
| <b>TOPICS BEYOND THE SYLLABUS</b>                                |          |                                  |    |    |    |
| 129.                                                             | 01-10-16 | Over view of Unit I              | 1  |    |    |
| 130.                                                             | 02-10-16 | Over view of Unit II             | 1  |    |    |
| 131.                                                             | 05-10-16 | Over view of Unit III            | 1  |    |    |
| 132.                                                             | 06-10-16 | Over view of Unit IV             | 1  |    |    |
| 133.                                                             | 07-10-16 | Over view of Unit V              | 1  |    |    |
| <b>Total Classes(TOPICS BEYOND THE SYLLABUS)</b>                 |          |                                  | 5  | -- | -- |
| <b>Total Number of Classes Required to complete the Syllabus</b> |          |                                  | 71 | -- | -- |
| <b>Total Number of Classes Taken</b>                             |          |                                  |    | -- | -- |

| <b>DELIVERY METHODS</b> |                                           |            |                                           |
|-------------------------|-------------------------------------------|------------|-------------------------------------------|
| <b>DM1</b>              | Lecture interspersed with discussions /BB | <b>DM4</b> | Assignment/Test                           |
| <b>DM2</b>              | Tutorial                                  | <b>DM5</b> | Demonstration ( laboratory, field visit ) |
| <b>DM3</b>              | Lecture with a quiz                       | <b>DM6</b> | Presentations/PPT                         |

|                  |                        |                           |            |
|------------------|------------------------|---------------------------|------------|
| <b>Signature</b> |                        |                           |            |
| <b>Name</b>      |                        |                           |            |
|                  | <b>Subject Teacher</b> | <b>Course Coordinator</b> | <b>HOD</b> |



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New Delhi & Certified by ISO 9001:2008

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

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## LESSON PLAN

**ACADEMIC YEAR** : 2015-16  
**COURSE** : B.Tech., (VIII-Sem.,)- Section A  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

| S.No.                                                        | Tentative Date | Topics to be covered                              | No. of Classes | Actual Date | Content Delivery Method |
|--------------------------------------------------------------|----------------|---------------------------------------------------|----------------|-------------|-------------------------|
| <b>UNIT-I : Embedded System Introduction</b>                 |                |                                                   |                |             |                         |
| 1.                                                           | 22-06-16       | Embedded systems overview                         | 1              |             |                         |
| 2.                                                           | 23-06-16       | Design challenge                                  | 1              |             |                         |
| 3.                                                           | 25-06-16       | Processor technology                              | 1              |             |                         |
| 4.                                                           | 26-06-16       | IC technology                                     | 1              |             |                         |
| 5.                                                           | 27-06-16       | <b>Tutorials -1</b>                               | 1              |             |                         |
| 6.                                                           | 09-07-16       | Design Technology                                 | 1              |             |                         |
| 7.                                                           | 13-07-16       | Trade-offs                                        | 1              |             |                         |
| 8.                                                           | 14-07-16       | Single purpose processors                         | 1              |             |                         |
| 9.                                                           | 16-07-16       | RT-level combinational logic                      | 1              |             |                         |
| 10.                                                          | 17-07-16       | <b>Tutorials -2</b>                               | 1              |             |                         |
| 11.                                                          | 20-07-16       | Sequential logic (RT level)                       | 1              |             |                         |
| 12.                                                          | 21-07-16       | Custom single purpose processor design (RT-level) | 1              |             |                         |
| 13.                                                          | 23-07-16       | Optimizing custom single purpose processors       | 1              |             |                         |
| <b>Total Classes(UNIT-I)</b>                                 |                |                                                   | 13             | --          | --                      |
| <b>UNIT-II : State Machine and Concurrent Process Models</b> |                |                                                   |                |             |                         |
| 14.                                                          | 24-07-16       | State Machine and Concurrent Process Models       | 1              |             |                         |
| 15.                                                          | 25-07-16       | <b>Tutorials -3</b>                               | 1              |             |                         |

|                                                                    |          |                                                    |    |    |    |
|--------------------------------------------------------------------|----------|----------------------------------------------------|----|----|----|
| 16.                                                                | 27-07-16 | models Vs languages                                | 1  |    |    |
| 17.                                                                | 28-07-16 | finite state machines with data path model (FSMD)  | 1  |    |    |
| 18.                                                                | 30-07-16 | using state machines                               | 1  |    |    |
| 19.                                                                | 31-07-16 | program state machine model (PSM)                  | 1  |    |    |
| 20.                                                                | 01-08-16 | <b>Tutorials -4</b>                                | 1  |    |    |
| 21.                                                                | 03-08-16 | concurrent process model , concurrent processes    | 1  |    |    |
| 22.                                                                | 04-08-16 | communication among processes                      | 1  |    |    |
| 23.                                                                | 06-08-16 | synchronization among processes                    | 1  |    |    |
| 24.                                                                | 07-08-16 | Implementation                                     |    |    |    |
| 25.                                                                | 10-08-16 | Data flow model, real-time systems                 | 1  |    |    |
| <b>Total Classes(UNIT-II)</b>                                      |          |                                                    | 12 |    | -- |
| <b>UNIT-III : Embedded/RTOS Concepts</b>                           |          |                                                    |    |    |    |
| 26.                                                                | 11-08-16 | Embedded/RTOS Concepts: Architecture of the Kernel | 1  |    |    |
| 27.                                                                | 13-08-16 | Tasks and Task scheduler                           | 1  |    |    |
| 28.                                                                | 14-08-16 | Interrupt service routines                         | 1  |    |    |
| 29.                                                                | 24-08-16 | <b>Tutorials -5</b>                                | 1  |    |    |
| 30.                                                                | 25-08-16 | Semaphores, Mutex                                  | 1  |    |    |
| 31.                                                                | 27-08-16 | Mailboxes , Message Queues                         | 1  |    |    |
| 32.                                                                | 28-08-16 | Event Registers, Pipes                             | 1  |    |    |
| 33.                                                                | 31-08-16 | Signals, Timers                                    | 1  |    |    |
| 34.                                                                | 1-09-16  | <b>Tutorials -6</b>                                | 1  |    |    |
| 35.                                                                | 3-09-16  | Memory Management, Priority inversion problem      | 1  |    |    |
| 36.                                                                | 4-09-16  | Embedded operating systems Embedded Linux          | 1  |    |    |
| 37.                                                                | 7-09-16  | Real-time operating systems, RT Linux              | 1  |    |    |
| 38.                                                                | 8-09-16  | Handheld operating systems, Windows CE             | 1  |    |    |
| <b>Total Classes(UNIT-III)</b>                                     |          |                                                    | 13 | -- | -- |
| <b>UNIT-IV : Hardware-Software Co-Design In an Embedded System</b> |          |                                                    |    |    |    |
| 39.                                                                | 11-09-16 | <b>Tutorials -7</b>                                | 1  |    |    |
| 40.                                                                | 14-09-16 | Embedded System Project Management                 | 1  |    |    |
| 41.                                                                | 15-09-16 | Embedded System Project Management                 | 1  |    |    |
| 42.                                                                | 18-09-16 | Embedded System Design and Co-Design Issues        | 1  |    |    |
| 43.                                                                | 19-09-16 | Embedded System Development Process Goal           | 1  |    |    |
| 44.                                                                | 21-09-16 | <b>Tutorials -8</b>                                | 1  |    |    |
| 45.                                                                | 22-09-16 | Action Plan                                        | 1  |    |    |
| 46.                                                                | 25-09-16 | Complete Specifications and system Requirements    | 1  |    |    |
| 47.                                                                | 26-09-16 | Conceptual Design                                  | 1  |    |    |
| 48.                                                                | 28-09-16 | Software and Hardware Layout Design                | 1  |    |    |

|                                                                              |          |                                                                                               |    |    |    |
|------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----|----|----|
| 49.                                                                          | 29-09-16 | <b>Tutorials -9</b>                                                                           | 1  |    |    |
| 50.                                                                          | 01-10-16 | Detailed Design                                                                               | 1  |    |    |
| 51.                                                                          | 3-10-16  | Implementation Tools and Testing                                                              | 1  |    |    |
| <b>Total Classes(UNIT-IV)</b>                                                |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-V : Design Cycle in the Development Phase for an Embedded System</b> |          |                                                                                               |    |    |    |
| 52.                                                                          | 5-10-16  | Design Cycle in the Development Phase                                                         | 1  |    |    |
| 53.                                                                          | 6-10-16  | <b>Tutorials -10</b>                                                                          | 1  |    |    |
| 54.                                                                          | 8-10-16  | Uses of Target System, Emulator and ICE                                                       | 1  |    |    |
| 55.                                                                          | 9-10-16  | Use of Device Programmer for Downloading                                                      | 1  |    |    |
| 56.                                                                          | 12-10-16 | Use of Software Tools for Development of an Embedded System: Code generation tools, Simulator | 1  |    |    |
| 57.                                                                          | 13-10-16 | Exemplary Prototype Development, Testing and Debugger Tools for Embedded Systems              | 1  |    |    |
| 58.                                                                          | 15-10-16 | <b>Tutorials -11</b>                                                                          | 1  |    |    |
| 59.                                                                          | 16-10-16 | IDE, Memory and Processor Sensitive Programs and Device Drivers, DLLs                         | 1  |    |    |
| 60.                                                                          | 17-10-16 | Hardware Tests                                                                                | 1  |    |    |
| 61.                                                                          | 26-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 62.                                                                          | 27-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 63.                                                                          | 29-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 64.                                                                          | 30-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 65.                                                                          | 31-10-16 | <b>Tutorials -12</b>                                                                          | 1  |    |    |
| <b>Total Classes(UNIT-V)</b>                                                 |          |                                                                                               | 14 | -- | -- |
| <b>TOPICS BEYOND THE SYLLABUS</b>                                            |          |                                                                                               |    |    |    |
| 66.                                                                          | 31-10-16 | Over view                                                                                     | 1  |    |    |
| <b>Total Classes(TOPICS BEYOND THE SYLLABUS)</b>                             |          |                                                                                               | 5  | -- | -- |
| <b>Total Number of Classes Required to complete the Syllabus</b>             |          |                                                                                               | 71 | -- | -- |
| <b>Total Number of Classes Taken</b>                                         |          |                                                                                               |    | -- | -- |

| <b>DELIVERY METHODS</b> |                                           |            |                                           |
|-------------------------|-------------------------------------------|------------|-------------------------------------------|
| <b>DM1</b>              | Lecture interspersed with discussions /BB | <b>DM4</b> | Assignment/Test                           |
| <b>DM2</b>              | Tutorial                                  | <b>DM5</b> | Demonstration ( laboratory, field visit ) |
| <b>DM3</b>              | Lecture with a quiz                       | <b>DM6</b> | Presentations/PPT                         |

|                  |                        |                           |            |
|------------------|------------------------|---------------------------|------------|
| <b>Signature</b> |                        |                           |            |
| <b>Name</b>      |                        |                           |            |
|                  | <b>Subject Teacher</b> | <b>Course Coordinator</b> | <b>HOD</b> |



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**COURSE** : B.Tech., (VIII-Sem.,)- Sections A  
**A.Y** : 2016-17  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

### **Contents of the Course File (Bottom to Top)**

16. Attendance Registers
17. Syllabus Copy
18. Previous Semester (Old) Question Papers
19. Course Educational Objectives/Course Outcomes
20. Lesson Plan
21. UNIT I: Descriptive Questions, Quiz Questions, Tutorials
22. UNIT II: Descriptive Questions, Quiz Questions, Tutorials
23. I-MID Examination Question Paper with Scheme of Valuation
24. Assessment and Evaluation of Attainment of Course Outcomes with Graphs(Units-I&II)
25. UNIT III: Descriptive Questions, Quiz Questions, Tutorials
26. UNIT IV: Descriptive Questions, Quiz Questions, Tutorials
27. UNIT V: Descriptive Questions, Quiz Questions, Tutorials
28. II-MID Examination Question Paper with Scheme of Valuation
29. Final Mid marks – Evaluation sheet
30. Assessment and Evaluation of Attainment of Course Outcomes with Graphs(Units-III,IV&V)

Note: Conduct minimum of 12 tutorials per course ( 2 tutorials per unit)



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## LESSON PLAN

**ACADEMIC YEAR** : 2016-17  
**COURSE** : B.Tech., (VIII-Sem.,)- Section B  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

| S.No.                                                       | Tentative Date | Topics to be covered                              | No. of Classes | Actual Date | Content Delivery Method |
|-------------------------------------------------------------|----------------|---------------------------------------------------|----------------|-------------|-------------------------|
| <b>UNIT-I : Embedded System Introduction</b>                |                |                                                   |                |             |                         |
| 134.                                                        | 20-06-16       | Embedded systems overview                         | 1              |             |                         |
| 135.                                                        | 22-06-16       | Design challenge                                  | 1              |             |                         |
| 136.                                                        | 23-06-16       | Processor technology                              | 1              |             |                         |
| 137.                                                        | 24-06-16       | IC technology                                     | 1              |             |                         |
| 138.                                                        | 25-06-16       | <b>Tutorials -1</b>                               | 1              |             |                         |
| 139.                                                        | 27-07-16       | Design Technology                                 | 1              |             |                         |
| 140.                                                        | 29-07-16       | Trade-offs                                        | 1              |             |                         |
| 141.                                                        | 30-07-16       | Single purpose processors                         | 1              |             |                         |
| 142.                                                        | 01-07-16       | RT-level combinational logic                      | 1              |             |                         |
| 143.                                                        | 02-07-16       | <b>Tutorials -2</b>                               | 1              |             |                         |
| 144.                                                        | 04-07-16       | Sequential logic (RT level)                       | 1              |             |                         |
| 145.                                                        | 07-07-16       | Custom single purpose processor design (RT-level) | 1              |             |                         |
| 146.                                                        | 08-07-16       | Optimizing custom single purpose processors       | 1              |             |                         |
| <b>Total Classes(UNIT-I)</b>                                |                |                                                   | 13             | --          | --                      |
| <b>UNIT-II : Sate Machine and Concurrent Process Models</b> |                |                                                   |                |             |                         |
| 147.                                                        | 09-07-16       | State Machine and Concurrent Process Models       | 1              |             |                         |
| 148.                                                        | 11-07-16       | <b>Tutorials -3</b>                               | 1              |             |                         |
| 149.                                                        | 13-07-16       | models Vs languages                               | 1              |             |                         |
| 150.                                                        | 14-07-16       | finite state machines with data path model (FSMD) | 1              |             |                         |
| 151.                                                        | 15-07-16       | using state machines                              | 1              |             |                         |
| 152.                                                        | 16-07-16       | program state machine model (PSM)                 | 1              |             |                         |
| 153.                                                        | 18-07-16       | <b>Tutorials -4</b>                               | 1              |             |                         |
| 154.                                                        | 20-07-16       | concurrent process model , concurrent processes   | 1              |             |                         |
| 155.                                                        | 21-07-16       | communication among processes                     | 1              |             |                         |
| 156.                                                        | 22-07-16       | synchronization among processes                   | 1              |             |                         |
| 157.                                                        | 23-07-16       | Implementation                                    |                |             |                         |
| 158.                                                        | 25-07-16       | Data flow model, real-time systems                | 1              |             |                         |

|                                                                              |          |                                                                                               |    |    |    |
|------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----|----|----|
| <b>Total Classes(UNIT-II)</b>                                                |          |                                                                                               | 12 |    | -- |
| <b>UNIT-III : Embedded/RTOS Concepts</b>                                     |          |                                                                                               |    |    |    |
| 159.                                                                         | 27-08-16 | Embedded/RTOS Concepts: Architecture of the Kernel                                            | 1  |    |    |
| 160.                                                                         | 28-07-16 | Tasks and Task scheduler                                                                      | 1  |    |    |
| 161.                                                                         | 29-07-16 | Interrupt service routines                                                                    | 1  |    |    |
| 162.                                                                         | 30-07-16 | <b>Tutorials -5</b>                                                                           | 1  |    |    |
| 163.                                                                         | 01-07-16 | Semaphores, Mutex                                                                             | 1  |    |    |
| 164.                                                                         | 03-08-16 | Mailboxes , Message Queues                                                                    | 1  |    |    |
| 165.                                                                         | 04-08-16 | Event Registers, Pipes                                                                        | 1  |    |    |
| 166.                                                                         | 05-08-16 | Signals, Timers                                                                               | 1  |    |    |
| 167.                                                                         | 06-08-16 | <b>Tutorials -6</b>                                                                           | 1  |    |    |
| 168.                                                                         | 08-08-16 | Memory Management, Priority inversion problem                                                 | 1  |    |    |
| 169.                                                                         | 10-09-16 | Embedded operating systems Embedded Linux                                                     | 1  |    |    |
| 170.                                                                         | 11-08-16 | Real-time operating systems, RT Linux                                                         | 1  |    |    |
| 171.                                                                         | 13-08-16 | Handheld operating systems, Windows CE                                                        | 1  |    |    |
| <b>Total Classes(UNIT-III)</b>                                               |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-IV : Hardware-Software Co-Design In an Embedded System</b>           |          |                                                                                               |    |    |    |
| 172.                                                                         | 17-08-16 | <b>Tutorials -7</b>                                                                           | 1  |    |    |
| 173.                                                                         | 18-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 174.                                                                         | 19-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 175.                                                                         | 20-08-16 | Embedded System Design and Co-Design Issues                                                   | 1  |    |    |
| 176.                                                                         | 22-08-16 | Embedded System Development Process Goal                                                      | 1  |    |    |
| 177.                                                                         | 29-08-16 | <b>Tutorials -8</b>                                                                           | 1  |    |    |
| 178.                                                                         | 31-09-16 | Action Plan                                                                                   | 1  |    |    |
| 179.                                                                         | 01-09-16 | Complete Specifications and system Requirements                                               | 1  |    |    |
| 180.                                                                         | 02-09-16 | Conceptual Design                                                                             | 1  |    |    |
| 181.                                                                         | 03-09-16 | Software and Hardware Layout Design                                                           | 1  |    |    |
| 182.                                                                         | 07-09-16 | <b>Tutorials -9</b>                                                                           | 1  |    |    |
| 183.                                                                         | 08-09-16 | Detailed Design                                                                               | 1  |    |    |
| 184.                                                                         | 09-09-16 | Implementation Tools and Testing                                                              | 1  |    |    |
| <b>Total Classes(UNIT-IV)</b>                                                |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-V : Design Cycle in the Development Phase for an Embedded System</b> |          |                                                                                               |    |    |    |
| 185.                                                                         | 10-09-16 | Design Cycle in the Development Phase                                                         | 1  |    |    |
| 186.                                                                         | 14-09-16 | <b>Tutorials -10</b>                                                                          | 1  |    |    |
| 187.                                                                         | 15-10-16 | Uses of Target System, Emulator and ICE                                                       | 1  |    |    |
| 188.                                                                         | 16-10-16 | Use of Device Programmer for Downloading                                                      | 1  |    |    |
| 189.                                                                         | 17-10-16 | Use of Software Tools for Development of an Embedded System: Code generation tools, Simulator | 1  |    |    |
| 190.                                                                         | 19-10-16 | Exemplary Prototype Development, Testing and Debugger Tools for Embedded Systems              | 1  |    |    |
| 191.                                                                         | 21-10-16 | <b>Tutorials -11</b>                                                                          | 1  |    |    |
| 192.                                                                         | 22-10-16 | IDE, Memory and Processor Sensitive Programs and Device Drivers, DLLs                         | 1  |    |    |
| 193.                                                                         | 23-10-16 | Hardware Tests                                                                                | 1  |    |    |
| 194.                                                                         | 24-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 195.                                                                         | 26-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 196.                                                                         | 28-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |

|                                                                  |          |                                  |    |    |    |
|------------------------------------------------------------------|----------|----------------------------------|----|----|----|
| 197.                                                             | 29-10-16 | Issues in Embedded System Design | 1  |    |    |
| 198.                                                             | 30-10-16 | <b>Tutorials -12</b>             | 1  |    |    |
| <b>Total Classes(UNIT-V)</b>                                     |          |                                  | 14 | -- | -- |
| <b>TOPICS BEYOND THE SYLLABUS</b>                                |          |                                  |    |    |    |
| 199.                                                             | 01-10-16 | Over view of Unit I              | 1  |    |    |
| 200.                                                             | 02-10-16 | Over view of Unit II             | 1  |    |    |
| 201.                                                             | 05-10-16 | Over view of Unit III            | 1  |    |    |
| 202.                                                             | 06-10-16 | Over view of Unit IV             | 1  |    |    |
| 203.                                                             | 07-10-16 | Over view of Unit V              | 1  |    |    |
| <b>Total Classes(TOPICS BEYOND THE SYLLABUS)</b>                 |          |                                  | 5  | -- | -- |
| <b>Total Number of Classes Required to complete the Syllabus</b> |          |                                  | 71 | -- | -- |
| <b>Total Number of Classes Taken</b>                             |          |                                  |    | -- | -- |

| <b>DELIVERY METHODS</b> |                                           |            |                                           |
|-------------------------|-------------------------------------------|------------|-------------------------------------------|
| <b>DM1</b>              | Lecture interspersed with discussions /BB | <b>DM4</b> | Assignment/Test                           |
| <b>DM2</b>              | Tutorial                                  | <b>DM5</b> | Demonstration ( laboratory, field visit ) |
| <b>DM3</b>              | Lecture with a quiz                       | <b>DM6</b> | Presentations/PPT                         |

|                  |                        |                           |            |
|------------------|------------------------|---------------------------|------------|
| <b>Signature</b> |                        |                           |            |
| <b>Name</b>      |                        |                           |            |
|                  | <b>Subject Teacher</b> | <b>Course Coordinator</b> | <b>HOD</b> |



**LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING** (Autonomous)

L.B.REDDY NAGAR, MYLAVARAM-521 230.A.P. INDIA

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NAAC Accredited with "A" grade, Accredited by NBA

New Delhi & Certified by ISO 9001:2008

**DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

<http://www.lbrce.ac.in>, [ecedep4@gmail.com](mailto:ecedep4@gmail.com) Phone: 08659-222933, Fax: 08659-222931

## LESSON PLAN

**ACADEMIC YEAR** : 2015-16  
**COURSE** : B.Tech., (VIII-Sem.,)- Section A  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

| S.No.                                                        | Tentative Date | Topics to be covered                              | No. of Classes | Actual Date | Content Delivery Method |
|--------------------------------------------------------------|----------------|---------------------------------------------------|----------------|-------------|-------------------------|
| <b>UNIT-I : Embedded System Introduction</b>                 |                |                                                   |                |             |                         |
| 67.                                                          | 22-06-16       | Embedded systems overview                         | 1              |             |                         |
| 68.                                                          | 23-06-16       | Design challenge                                  | 1              |             |                         |
| 69.                                                          | 25-06-16       | Processor technology                              | 1              |             |                         |
| 70.                                                          | 26-06-16       | IC technology                                     | 1              |             |                         |
| 71.                                                          | 27-06-16       | <b>Tutorials -1</b>                               | 1              |             |                         |
| 72.                                                          | 09-07-16       | Design Technology                                 | 1              |             |                         |
| 73.                                                          | 13-07-16       | Trade-offs                                        | 1              |             |                         |
| 74.                                                          | 14-07-16       | Single purpose processors                         | 1              |             |                         |
| 75.                                                          | 16-07-16       | RT-level combinational logic                      | 1              |             |                         |
| 76.                                                          | 17-07-16       | <b>Tutorials -2</b>                               | 1              |             |                         |
| 77.                                                          | 20-07-16       | Sequential logic (RT level)                       | 1              |             |                         |
| 78.                                                          | 21-07-16       | Custom single purpose processor design (RT-level) | 1              |             |                         |
| 79.                                                          | 23-07-16       | Optimizing custom single purpose processors       | 1              |             |                         |
| <b>Total Classes(UNIT-I)</b>                                 |                |                                                   | 13             | --          | --                      |
| <b>UNIT-II : State Machine and Concurrent Process Models</b> |                |                                                   |                |             |                         |
| 80.                                                          | 24-07-16       | State Machine and Concurrent Process Models       | 1              |             |                         |
| 81.                                                          | 25-07-16       | <b>Tutorials -3</b>                               | 1              |             |                         |

|                                                                    |          |                                                    |    |    |    |
|--------------------------------------------------------------------|----------|----------------------------------------------------|----|----|----|
| 82.                                                                | 27-07-16 | models Vs languages                                | 1  |    |    |
| 83.                                                                | 28-07-16 | finite state machines with data path model (FSMD)  | 1  |    |    |
| 84.                                                                | 30-07-16 | using state machines                               | 1  |    |    |
| 85.                                                                | 31-07-16 | program state machine model (PSM)                  | 1  |    |    |
| 86.                                                                | 01-08-16 | <b>Tutorials -4</b>                                | 1  |    |    |
| 87.                                                                | 03-08-16 | concurrent process model , concurrent processes    | 1  |    |    |
| 88.                                                                | 04-08-16 | communication among processes                      | 1  |    |    |
| 89.                                                                | 06-08-16 | synchronization among processes                    | 1  |    |    |
| 90.                                                                | 07-08-16 | Implementation                                     |    |    |    |
| 91.                                                                | 10-08-16 | Data flow model, real-time systems                 | 1  |    |    |
| <b>Total Classes(UNIT-II)</b>                                      |          |                                                    | 12 |    | -- |
| <b>UNIT-III : Embedded/RTOS Concepts</b>                           |          |                                                    |    |    |    |
| 92.                                                                | 11-08-16 | Embedded/RTOS Concepts: Architecture of the Kernel | 1  |    |    |
| 93.                                                                | 13-08-16 | Tasks and Task scheduler                           | 1  |    |    |
| 94.                                                                | 14-08-16 | Interrupt service routines                         | 1  |    |    |
| 95.                                                                | 24-08-16 | <b>Tutorials -5</b>                                | 1  |    |    |
| 96.                                                                | 25-08-16 | Semaphores, Mutex                                  | 1  |    |    |
| 97.                                                                | 27-08-16 | Mailboxes , Message Queues                         | 1  |    |    |
| 98.                                                                | 28-08-16 | Event Registers, Pipes                             | 1  |    |    |
| 99.                                                                | 31-08-16 | Signals, Timers                                    | 1  |    |    |
| 100.                                                               | 1-09-16  | <b>Tutorials -6</b>                                | 1  |    |    |
| 101.                                                               | 3-09-16  | Memory Management, Priority inversion problem      | 1  |    |    |
| 102.                                                               | 4-09-16  | Embedded operating systems Embedded Linux          | 1  |    |    |
| 103.                                                               | 7-09-16  | Real-time operating systems, RT Linux              | 1  |    |    |
| 104.                                                               | 8-09-16  | Handheld operating systems, Windows CE             | 1  |    |    |
| <b>Total Classes(UNIT-III)</b>                                     |          |                                                    | 13 | -- | -- |
| <b>UNIT-IV : Hardware-Software Co-Design In an Embedded System</b> |          |                                                    |    |    |    |
| 105.                                                               | 11-09-16 | <b>Tutorials -7</b>                                | 1  |    |    |
| 106.                                                               | 14-09-16 | Embedded System Project Management                 | 1  |    |    |
| 107.                                                               | 15-09-16 | Embedded System Project Management                 | 1  |    |    |
| 108.                                                               | 18-09-16 | Embedded System Design and Co-Design Issues        | 1  |    |    |
| 109.                                                               | 19-09-16 | Embedded System Development Process Goal           | 1  |    |    |
| 110.                                                               | 21-09-16 | <b>Tutorials -8</b>                                | 1  |    |    |
| 111.                                                               | 22-09-16 | Action Plan                                        | 1  |    |    |
| 112.                                                               | 25-09-16 | Complete Specifications and system Requirements    | 1  |    |    |
| 113.                                                               | 26-09-16 | Conceptual Design                                  | 1  |    |    |
| 114.                                                               | 28-09-16 | Software and Hardware Layout Design                | 1  |    |    |

|                                                                              |          |                                                                                               |    |    |    |
|------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----|----|----|
| 115.                                                                         | 29-09-16 | <b>Tutorials -9</b>                                                                           | 1  |    |    |
| 116.                                                                         | 01-10-16 | Detailed Design                                                                               | 1  |    |    |
| 117.                                                                         | 3-10-16  | Implementation Tools and Testing                                                              | 1  |    |    |
| <b>Total Classes(UNIT-IV)</b>                                                |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-V : Design Cycle in the Development Phase for an Embedded System</b> |          |                                                                                               |    |    |    |
| 118.                                                                         | 5-10-16  | Design Cycle in the Development Phase                                                         | 1  |    |    |
| 119.                                                                         | 6-10-16  | <b>Tutorials -10</b>                                                                          | 1  |    |    |
| 120.                                                                         | 8-10-16  | Uses of Target System, Emulator and ICE                                                       | 1  |    |    |
| 121.                                                                         | 9-10-16  | Use of Device Programmer for Downloading                                                      | 1  |    |    |
| 122.                                                                         | 12-10-16 | Use of Software Tools for Development of an Embedded System: Code generation tools, Simulator | 1  |    |    |
| 123.                                                                         | 13-10-16 | Exemplary Prototype Development, Testing and Debugger Tools for Embedded Systems              | 1  |    |    |
| 124.                                                                         | 15-10-16 | <b>Tutorials -11</b>                                                                          | 1  |    |    |
| 125.                                                                         | 16-10-16 | IDE, Memory and Processor Sensitive Programs and Device Drivers, DLLs                         | 1  |    |    |
| 126.                                                                         | 17-10-16 | Hardware Tests                                                                                | 1  |    |    |
| 127.                                                                         | 26-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 128.                                                                         | 27-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 129.                                                                         | 29-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 130.                                                                         | 30-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 131.                                                                         | 31-10-16 | <b>Tutorials -12</b>                                                                          | 1  |    |    |
| <b>Total Classes(UNIT-V)</b>                                                 |          |                                                                                               | 14 | -- | -- |
| <b>TOPICS BEYOND THE SYLLABUS</b>                                            |          |                                                                                               |    |    |    |
| 132.                                                                         | 31-10-16 | Over view                                                                                     | 1  |    |    |
| <b>Total Classes(TOPICS BEYOND THE SYLLABUS)</b>                             |          |                                                                                               | 5  | -- | -- |
| <b>Total Number of Classes Required to complete the Syllabus</b>             |          |                                                                                               | 71 | -- | -- |
| <b>Total Number of Classes Taken</b>                                         |          |                                                                                               |    | -- | -- |

| <b>DELIVERY METHODS</b> |                                           |            |                                           |
|-------------------------|-------------------------------------------|------------|-------------------------------------------|
| <b>DM1</b>              | Lecture interspersed with discussions /BB | <b>DM4</b> | Assignment/Test                           |
| <b>DM2</b>              | Tutorial                                  | <b>DM5</b> | Demonstration ( laboratory, field visit ) |
| <b>DM3</b>              | Lecture with a quiz                       | <b>DM6</b> | Presentations/PPT                         |

|                  |                        |                           |            |
|------------------|------------------------|---------------------------|------------|
| <b>Signature</b> |                        |                           |            |
| <b>Name</b>      |                        |                           |            |
|                  | <b>Subject Teacher</b> | <b>Course Coordinator</b> | <b>HOD</b> |



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### **DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING**

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**ACADEMIC YEAR** : 2015-16  
**COURSE** : B.Tech., (VII-Sem.,)- Section A & B  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T190)  
**FACULTY** : Y.AMAR BABU

### **COURSE OUTCOMES**

At the end of this course student will be able to

- CO1 Choose different design methodologies to implement given specifications
- CO2 Design of control unit and Data path unit for given Embedded System
- CO3 Select best Operating System for Typical Embedded System Design
- CO4 Hardware Software Co-design In Embedded system Design
- CO5 Design complete embedded system with RTOS



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## LESSON PLAN

**ACADEMIC YEAR** : 2016-17  
**COURSE** : B.Tech., (VIII-Sem.,)- Section B  
**BRANCH** : Electronics and Communication Engineering  
**SUBJECT** : Embedded Systems Design (Code: T 190)  
**FACULTY** : Y. AMAR BABU

| S.No.                                                       | Tentative Date | Topics to be covered                              | No. of Classes | Actual Date | Content Delivery Method |
|-------------------------------------------------------------|----------------|---------------------------------------------------|----------------|-------------|-------------------------|
| <b>UNIT-I : Embedded System Introduction</b>                |                |                                                   |                |             |                         |
| 204.                                                        | 20-06-16       | Embedded systems overview                         | 1              |             |                         |
| 205.                                                        | 22-06-16       | Design challenge                                  | 1              |             |                         |
| 206.                                                        | 23-06-16       | Processor technology                              | 1              |             |                         |
| 207.                                                        | 24-06-16       | IC technology                                     | 1              |             |                         |
| 208.                                                        | 25-06-16       | <b>Tutorials -1</b>                               | 1              |             |                         |
| 209.                                                        | 27-07-16       | Design Technology                                 | 1              |             |                         |
| 210.                                                        | 29-07-16       | Trade-offs                                        | 1              |             |                         |
| 211.                                                        | 30-07-16       | Single purpose processors                         | 1              |             |                         |
| 212.                                                        | 01-07-16       | RT-level combinational logic                      | 1              |             |                         |
| 213.                                                        | 02-07-16       | <b>Tutorials -2</b>                               | 1              |             |                         |
| 214.                                                        | 04-07-16       | Sequential logic (RT level)                       | 1              |             |                         |
| 215.                                                        | 07-07-16       | Custom single purpose processor design (RT-level) | 1              |             |                         |
| 216.                                                        | 08-07-16       | Optimizing custom single purpose processors       | 1              |             |                         |
| <b>Total Classes(UNIT-I)</b>                                |                |                                                   | 13             | --          | --                      |
| <b>UNIT-II : Sate Machine and Concurrent Process Models</b> |                |                                                   |                |             |                         |
| 217.                                                        | 09-07-16       | State Machine and Concurrent Process Models       | 1              |             |                         |
| 218.                                                        | 11-07-16       | <b>Tutorials -3</b>                               | 1              |             |                         |
| 219.                                                        | 13-07-16       | models Vs languages                               | 1              |             |                         |
| 220.                                                        | 14-07-16       | finite state machines with data path model (FSMD) | 1              |             |                         |
| 221.                                                        | 15-07-16       | using state machines                              | 1              |             |                         |
| 222.                                                        | 16-07-16       | program state machine model (PSM)                 | 1              |             |                         |
| 223.                                                        | 18-07-16       | <b>Tutorials -4</b>                               | 1              |             |                         |
| 224.                                                        | 20-07-16       | concurrent process model , concurrent processes   | 1              |             |                         |
| 225.                                                        | 21-07-16       | communication among processes                     | 1              |             |                         |
| 226.                                                        | 22-07-16       | synchronization among processes                   | 1              |             |                         |
| 227.                                                        | 23-07-16       | Implementation                                    |                |             |                         |
| 228.                                                        | 25-07-16       | Data flow model, real-time systems                | 1              |             |                         |
| <b>Total Classes(UNIT-II)</b>                               |                |                                                   | 12             |             | --                      |
| <b>UNIT-III : Embedded/RTOS Concepts</b>                    |                |                                                   |                |             |                         |

|                                                                              |          |                                                                                               |    |    |    |
|------------------------------------------------------------------------------|----------|-----------------------------------------------------------------------------------------------|----|----|----|
| 229.                                                                         | 27-08-16 | Embedded/RTOS Concepts: Architecture of the Kernel                                            | 1  |    |    |
| 230.                                                                         | 28-07-16 | Tasks and Task scheduler                                                                      | 1  |    |    |
| 231.                                                                         | 29-07-16 | Interrupt service routines                                                                    | 1  |    |    |
| 232.                                                                         | 30-07-16 | <b>Tutorials -5</b>                                                                           | 1  |    |    |
| 233.                                                                         | 01-07-16 | Semaphores, Mutex                                                                             | 1  |    |    |
| 234.                                                                         | 03-08-16 | Mailboxes , Message Queues                                                                    | 1  |    |    |
| 235.                                                                         | 04-08-16 | Event Registers, Pipes                                                                        | 1  |    |    |
| 236.                                                                         | 05-08-16 | Signals, Timers                                                                               | 1  |    |    |
| 237.                                                                         | 06-08-16 | <b>Tutorials -6</b>                                                                           | 1  |    |    |
| 238.                                                                         | 08-08-16 | Memory Management, Priority inversion problem                                                 | 1  |    |    |
| 239.                                                                         | 10-09-16 | Embedded operating systems Embedded Linux                                                     | 1  |    |    |
| 240.                                                                         | 11-08-16 | Real-time operating systems, RT Linux                                                         | 1  |    |    |
| 241.                                                                         | 13-08-16 | Handheld operating systems, Windows CE                                                        | 1  |    |    |
| <b>Total Classes(UNIT-III)</b>                                               |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-IV : Hardware-Software Co-Design In an Embedded System</b>           |          |                                                                                               |    |    |    |
| 242.                                                                         | 17-08-16 | <b>Tutorials -7</b>                                                                           | 1  |    |    |
| 243.                                                                         | 18-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 244.                                                                         | 19-08-16 | Embedded System Project Management                                                            | 1  |    |    |
| 245.                                                                         | 20-08-16 | Embedded System Design and Co-Design Issues                                                   | 1  |    |    |
| 246.                                                                         | 22-08-16 | Embedded System Development Process Goal                                                      | 1  |    |    |
| 247.                                                                         | 29-08-16 | <b>Tutorials -8</b>                                                                           | 1  |    |    |
| 248.                                                                         | 31-09-16 | Action Plan                                                                                   | 1  |    |    |
| 249.                                                                         | 01-09-16 | Complete Specifications and system Requirements                                               | 1  |    |    |
| 250.                                                                         | 02-09-16 | Conceptual Design                                                                             | 1  |    |    |
| 251.                                                                         | 03-09-16 | Software and Hardware Layout Design                                                           | 1  |    |    |
| 252.                                                                         | 07-09-16 | <b>Tutorials -9</b>                                                                           | 1  |    |    |
| 253.                                                                         | 08-09-16 | Detailed Design                                                                               | 1  |    |    |
| 254.                                                                         | 09-09-16 | Implementation Tools and Testing                                                              | 1  |    |    |
| <b>Total Classes(UNIT-IV)</b>                                                |          |                                                                                               | 13 | -- | -- |
| <b>UNIT-V : Design Cycle in the Development Phase for an Embedded System</b> |          |                                                                                               |    |    |    |
| 255.                                                                         | 10-09-16 | Design Cycle in the Development Phase                                                         | 1  |    |    |
| 256.                                                                         | 14-09-16 | <b>Tutorials -10</b>                                                                          | 1  |    |    |
| 257.                                                                         | 15-10-16 | Uses of Target System, Emulator and ICE                                                       | 1  |    |    |
| 258.                                                                         | 16-10-16 | Use of Device Programmer for Downloading                                                      | 1  |    |    |
| 259.                                                                         | 17-10-16 | Use of Software Tools for Development of an Embedded System: Code generation tools, Simulator | 1  |    |    |
| 260.                                                                         | 19-10-16 | Exemplary Prototype Development, Testing and Debugger Tools for Embedded Systems              | 1  |    |    |
| 261.                                                                         | 21-10-16 | <b>Tutorials -11</b>                                                                          | 1  |    |    |
| 262.                                                                         | 22-10-16 | IDE, Memory and Processor Sensitive Programs and Device Drivers, DLLs                         | 1  |    |    |
| 263.                                                                         | 23-10-16 | Hardware Tests                                                                                | 1  |    |    |
| 264.                                                                         | 24-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 265.                                                                         | 26-10-16 | Use of Scopes and Logic Analysis for System                                                   | 1  |    |    |
| 266.                                                                         | 28-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 267.                                                                         | 29-10-16 | Issues in Embedded System Design                                                              | 1  |    |    |
| 268.                                                                         | 30-10-16 | <b>Tutorials -12</b>                                                                          | 1  |    |    |
| <b>Total Classes(UNIT-V)</b>                                                 |          |                                                                                               | 14 | -- | -- |

| <b>TOPICS BEYOND THE SYLLABUS</b>                                |          |                       |    |    |    |
|------------------------------------------------------------------|----------|-----------------------|----|----|----|
| 269.                                                             | 01-10-16 | Over view of Unit I   | 1  |    |    |
| 270.                                                             | 02-10-16 | Over view of Unit II  | 1  |    |    |
| 271.                                                             | 05-10-16 | Over view of Unit III | 1  |    |    |
| 272.                                                             | 06-10-16 | Over view of Unit IV  | 1  |    |    |
| 273.                                                             | 07-10-16 | Over view of Unit V   | 1  |    |    |
| <b>Total Classes(TOPICS BEYOND THE SYLLABUS)</b>                 |          |                       | 5  | -- | -- |
| <b>Total Number of Classes Required to complete the Syllabus</b> |          |                       | 71 | -- | -- |
| <b>Total Number of Classes Taken</b>                             |          |                       |    | -- | -- |

| <b>DELIVERY METHODS</b> |                                           |            |                                           |
|-------------------------|-------------------------------------------|------------|-------------------------------------------|
| <b>DM1</b>              | Lecture interspersed with discussions /BB | <b>DM4</b> | Assignment/Test                           |
| <b>DM2</b>              | Tutorial                                  | <b>DM5</b> | Demonstration ( laboratory, field visit ) |
| <b>DM3</b>              | Lecture with a quiz                       | <b>DM6</b> | Presentations/PPT                         |

|                  |                        |                           |            |
|------------------|------------------------|---------------------------|------------|
| <b>Signature</b> |                        |                           |            |
| <b>Name</b>      |                        |                           |            |
|                  | <b>Subject Teacher</b> | <b>Course Coordinator</b> | <b>HOD</b> |