CMR Engineering College
Kandlakoya(V), Medchal Road, Hyderabad

## Department of Electronics & Communication Engineering

## COURSE FILE

**Sub: EMBEDDED SYSTEM DESIGN        A.Y.2022-2023        Year: III-II ECE**

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**DEAN-ADMINISTRATION**              **HOD**                          **PRINCIPAL**

1. **Vision of the Department:**

   To promote excellence in technical education and scientific research in electronics and communication engineering for the benefits of society.

   **Mission of the Department:**

   1. To impart quality technical education with state of art facilities and inculcating lifelong learning skills, professional ethics and team work skills among the students.
   2. To provide fundamental and core knowledge along with adaptable technical skills leading to core competence.
   3. To promote for higher learning by stimulating research activities in technology for the benefit of society.

2. **List of PEOs and POs**

**PEOs:**
   1. Excel in professional career & higher education in Electronics & Communication Engineering and allied fields through rigorous quality education.
   2. Exhibit professionalism, ethical attitude, communication skills, team work in their profession and adapt to current trends by engaging in lifelong learning.
   3. Solve real life problems relating to Electronics & Communications Engineering for the benefits of society.

**PSO:**
   1. Ability to apply concepts of Electronics & Communication Engineering to associated research areas of electronics, communication, signal processing, VLSI, Embedded systems
   2. Ability to design, analyze and simulate a variety of Electronics & Communication functional elements using hardware and software tools along with analytic skills

## Programme Outcomes (POs)

| | |
|---|---|
| **1** | **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems |
| **2** | **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| **3** | **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| **4** | **Conduct investigations of complex problems:** Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| **5** | **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations. |
| **6** | **The engineer and society:** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice. |
| **7** | **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development. |
| **8** | **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| **9** | **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| **10** | **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions. |
| **11** | **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| **12** | **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change. |

**3.** Mapping of Course Objectives, Course Outcomes with PEOS and POs

**Course Name: EMBEDDED SYSTEM DESIGN          Year of Study: 2022–23**

| CO1 | Students will be able to **Understand** the concept of Embedded systems and functionalities |
|---|---|
| CO2 | Students will be able to **Learn** about different types processors, sensors, memories and communication protocols. |
| CO3 | Students will be able to **Design** an embedded system with basic functionalities and also study about embedded firmware. |
| CO4 | Students will be able to **Visualize** the role of Real Time Operating Systems in Embedded systems. |
| CO5 | Students will be able to **Evaluate** the correlation between task synchronization and latency issues. |

**Mapping of COs with POs and PSOs**

**Course Outcome (CO)-Program Outcome (PO) Matrix:**
**Course Name: EMBEDDED SYSTEM DESIGN          Year of Study: 2022-23**

| Course Outcomes (CO's) | Program Outcomes (PO's) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| CO1 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO3 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CO4 | 3 | 3 | 3 | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| CO5 | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

**Course Outcome (CO)-Program Specific Outcome (PSO) Matrix:**

| Course Outcomes (CO's) | Program Specific Outcomes (PSO's) | |
|:---:|:---:|:---:|
| | PSO1 | PSO2 |
| CO1 | 3 | 3 |
| CO2 | 2 | 2 |
| CO3 | 2 | 2 |
| CO4 | 3 | 2 |
| CO5 | 3 | 2 |

4. **Syllabus Copy and Suggested/Reference Books**

**UNIT 1**

**Introduction to embedded systems**: definition of embedded system, embedded systems Vs general computing systems, history of embedded systems, classification, major application areas, purpose of embedded systems, characteristics and quality attributes of embedded systems.

**UNIT 2**

**Typical embedded system:** core of the embedded system: general purpose and domain specific processors, ASICs, PLDs, commercial-off the shelf components (CTOS), memory: ROM, RAM, memory according to the type of interface, memory shadowing, memory selection for embedded systems, sensors and actuators, communication interface: onboard and external communication interface.

**UNIT 3**

**Embedded firmware:** reset circuits, brown-out protection circuits, oscillator unit, real time clock, watchdog timer, embedded firmware design approaches and development languages.

**UNIT 4**

**RTOS based embedded system design:** operating system basics, types of operating systems, tasks, process and threads, multiprocessing and multi tasking, task scheduling.

**UNIT 5**

**Task communication:** shared memory, message passing, remote procedure call and sockets, task synchronization , task communication, synchronization issues, task synchronization techniques, device drivers, how to choose an RTOS

**References (Text books/websites/Journals)**

**TEXT BOOKS:**

1.Introduction To Embedded Systems – shibu k.v

2. Computer as Components – principles of embedded computing system design, Wayne wolf, Elsevier (2$^{nd}$ edition)

**REFERENCE BOOKS**
   1. Embedded Systems Building BlocksLabrosse, via CMP Publishers

   2. embedded systems, Raj Kamal, TMH

   3. Microcontroller Ajay V Deshmukh, TMH

   **5.** Individual Time Table

## Faculty Name: K. Subramanya Chari

| Day & Time | I<br>09.10 – 10.10 | II<br>10.10 – 11.00 | III<br>11.00 – 11.50 | IV<br>11.50 – 12.40 | 12.40 - 01.20 | V<br>01.20 – 02.20 | VI<br>02.20 – 03.10 | VII<br>03.10 – 04.00 |
|---|---|---|---|---|---|---|---|---|
| MON | D | | | | | C | | |
| TUE | | | | C | | | D | |
| WED | | D | C | | LUNCH | | | D |
| THU | C | | | | | | | |
| FRI | | | C | | | D | | |
| SAT | | | | | | | | |

**6.** Detailed Lecture Plan (Including Teaching methods)

| S.NO | TOPIC TO BE COVERED | Suggested Books (Eg: T1,T2,R5) | NO. OF LECTURES REQUIRED |
|---|---|---|---|
| **UNIT-I**<br>**Classes required - 11** | | |
| 1 | Introduction: Definition of embedded system, | T1,R1,R2 | 1 |
| 2 | embedded systems Vs general computing systems | T1,R1,R2,R3 | 1 |
| 3 | History of embedded systems | T1,R1,R2,R3 | 1 |
| 4 | Classification of embedded systems, | T1,R1,R2,R3 | 2 |
| 5 | Major application areas | T1,R1,R2,R3,R4 | 1 |
| 6 | Purpose of embedded systems | T1,R1,R2,R3 | 2 |
| 7 | Characteristics of embedded systems | T1,R1,R2,R3 | 1 |
| 8 | Quality attributes of embedded system | T1 | 2 |
| **UNIT-II**<br>**Classes required - 10** | | |
| 9 | Typical embedded system: core of the embedded system | T1,R1,R2 | 1 |
| 10 | General purpose and domain specific processors | T1,R1 | 1 |
| 11 | ASICs, PLDs | T1,R1 | 1 |
| 12 | Commercial-off the shelf components (CTOS) | T1 | 1 |
| 13 | Memory: ROM, RAM | T1,R1,R2 | 1 |
| 14 | Memory according to the type of | T1,R2 | 1 |

| | | | |
|---|---|---|---|
| | interface | | |
| 15 | Memory shadowing, memory selection for embedded systems | **T1** | **1** |
| 16 | Sensors and actuators, | **T1,R1, R2,R3,R4** | **1** |
| 17 | Communication interface: onboard communication and external interface. | **T1** | **2** |
| | **UNIT-III**<br>**Classes required - 10** | | |
| 18 | **Embedded firmware:** reset circuits | **T1** | **1** |
| 19 | Brown-out protection circuits, oscillator unit | **T1** | **1** |
| 20 | Real time clock , watchdog timer | **T1** | **2** |
| 21 | Embedded firmware design approaches | **T1,R1,R4** | **3** |
| 22 | Embedded development languages. | **T1,R3,R4** | **3** |
| | **UNIT-IV**<br>**Classes required - 10** | | |
| 23 | **RTOS based embedded system design:** operating system basics | **T1,R2,R4** | **3** |
| 24 | Types of operating systems, tasks | **T1,R2,R4** | **2** |
| 25 | Process and threads, multiprocessing | **T1,R2,R4** | **2** |
| 26 | Multitasking, task scheduling. | **T1,R2,R4** | **3** |
| | **UNIT-V**<br>**Classes required - 10** | | |
| 27 | **Task communication:** shared | **T1,R2,R3,R4** | **2** |

| | memory, | | |
|---|---|---|---|
| 28 | Message passing | **T1,R4** | **1** |
| 29 | Remote procedure | **T1,R4** | **1** |
| 30 | call and sockets | **T1,R4** | **1** |
| 31 | Task synchronization | **T1,R4** | **1** |
| 32 | Task communication | **T1,R4** | **1** |
| 33 | Synchronization issues | **T1,R4** | **1** |
| 34 | Task synchronization techniques, | **T1,R4** | **1** |
| 35 | device drivers, how to choose an RTOS | **T1,R4** | **1** |
| **Total No. Classes required**<br>**51** | | | |

**Total No of Classes   55**

## 7. Session execution log

| S.No | Syllabus | Completed date | Remarks |
|---|---|---|---|
| 1 | I-UNIT | 06-01-2023 | |
| 2 | I1-UNIT | 01-02-2023 | |
| 3 | I11-UNIT | 24-02-2023 | |
| 4 | IV-UNIT | 20-03-2023 | |
| 5 | V-UNIT | 23-04-2023 | |

**8.** Assignment & Innovative Assignment Questions

## Unit I

Q1. Define embedded system? Compare embedded computing system with general computing system?

Q2. Describe classification of embedded systems?

Q3. List major application areas of embedded systems?

Q4. Explain the various possible purposes of using and embedded system?

Q5. Explain the characteristics of an embedded system?

Q6. Explain the component of typical embedded system in detail?

## Unit II

Q7. What is the difference between microprocessor and microcontroller? Explain the role of microprocessor and controller in embedded system design?

Q8. What is the difference between RISC and CISC processor? Give an example for each.

Q9. What are the different types of memories used in embedded system design? Explain the role of each?

Q10.what are sensor and actuators? Explain its role in embedded system design? Illustrate with an example.

Q11.write a short note on

1. I2C
2. SPI
3. USB
4. BLUETOOTH / WIFI

Q.12. Write short note on:

i. DSP

ii. PLD

iii.ASIC

iv. COTS

## Unit III

1. Explain the reset circuit and brown out protection circuits?

**2.** Explain watchdog timer and write its significance?.

**3.** Discuss embedded firmware

**4.** Explain embedded programming language?

## UNIT-IV

1,Describe operating system basics?

2.Explain Types of operating systems, tasks?

3. Explain process and threads, multiprocessing?

4.Define Multitasking, task scheduling.

## UNIT V

**1.** Explain shared memory, message passing ?

**2.** Demonstrate Remote procedure call and sockets, task synchronization?

3. Discuss Task communication, synchronization issues

4. demonstrate device drivers, how to choose an RTOS

**INNOVATIVE Assignment On Embedded System Design**

## Assignment I

**Issue Date:**

**Submit Date:**

## Set 1

Q1) Is it possible to design an embedded system without an OS and actuators? If possible how, If not why? (Basic Knowledge)

Q2) What are the operations carried by the controller in the below figure? (Model Based)
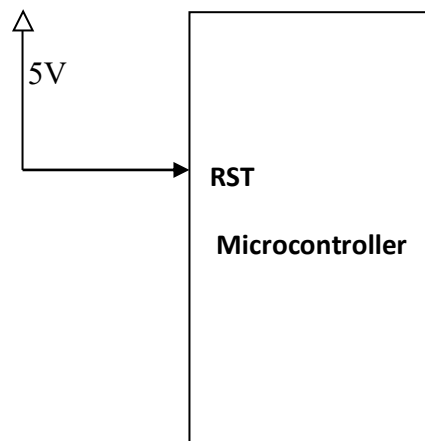


Q3) Design a basic embedded system model which can collect data from sensors and display. (Project based)

Q4) What if an external interrupt occurs during a high priority internal interrupt is under operation? (Case Study)

# SET 2

Q1) Explain how the characteristics like power and size effect the performance of an Embedded System. (Basic Knowledge)

Q2) Describe with a circuit diagram how a SRAM (memory cell) module can be designed by using transistors. (Technological)

Q3) Is it possible to perform information exchange between the modules mentioned in the below figure? (Problem solving)
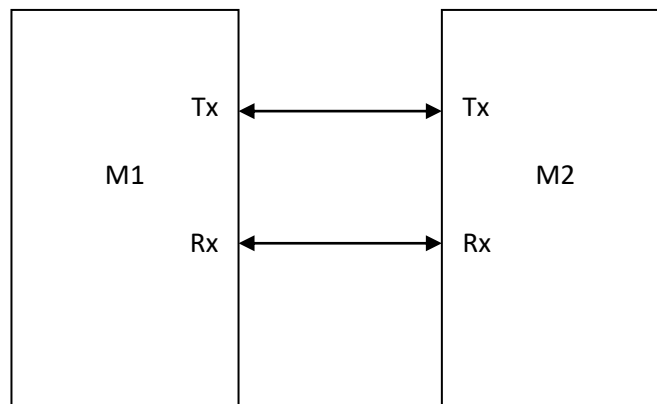


Q4) What is the importance of oscillator and timer in design of an embedded systems? What difference can be seen in the design if 11.0592 MHz oscillator is replaced with a 16 MHz oscillator? (Case Study)
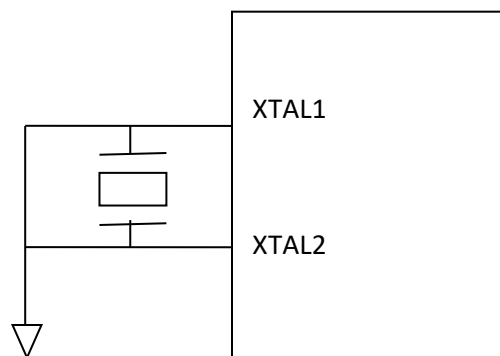
## Embedded Systems design

# Assignment II

## Set 3

Q1) How to interface external memory block to the controller? (Basic Knowledge)

Q2) What are the necessary requirements needed in the below figure along with specifications? (Model Based)



Q3) For a given embedded system if the output voltage generated by the controller in not adequate to run actuators what are the driving circuits designed,

If the output is 3.3V and 150mA and requirements are 5V and 500mA, with the help of a circuit diagram? (Problem solving)

Q4) Design an embedded system which receives data from PC or base station continuously and post the data wirelessly to remote area? (Project based)
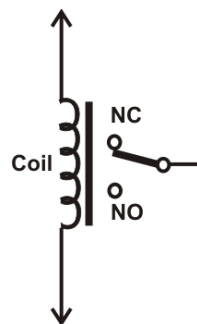
## Set 4

Q1) How to achieve synchronization in task communication in a monolithic kernel system? (Case Study)

Q2) For the below figure explain the steps how to generate BCD code to display the digits 2, 4, 6, 8 and 0 in common cathode mode? (Basic Knowledge)
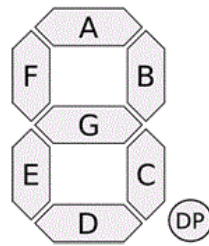


Q3) Design an embedded system which can control the household appliances with 5V Dc using Relay switch. (Project based)



Q4) Describe the operation of ZIGBEE (XBEE) communication model with the help of a referral paper for its function in an embedded system. Discuss how it is different form WLAN, PAN, BT 2.0. (Research)

9. Sample Assignment Scripts

   (Attached )

10. Unit-Wise Lecture Notes

    (Attached )


11. Mid Exam Question Papers


# Set A

**Answer any TWO of the following questions.**                    **2X5=10**

1. Explain the characteristics of Embedded Systems?(CO1)

2. Write the differences between General Purpose and domain specific Processors?(CO2)

3. What is On-Chip Memory? Explain different types of On-Chip Memory?(CO1)

4. Explain the below:(CO1)

   (A) Reset circuit.

   (B) Oscillator unit.

# SET-B

**Answer any TWO of the following questions.**                    **2X5=10**

1. Distinguish between ECS and GCS?(CO3)

2. Explain the components of typical embedded system in details (CO2)

3. Explain the I/O subsystem with one sensor and one actuator?(CO1)

4. Explain the below: (CO2)

   (A) Real Time Clock

   (B) Brown-out protection circuit.

# SET-C

**Answer any TWO of the following questions.**                    **2X5=10**

1. What are the operational quality attributes of ESD?(CO1)

2. Explain the purpose of Embedded System with example?(CO2)

3. Explain about I2C communication interface bus ?(CO2)

4. Explain the below:(CO2)

   (A) Watchdog Timer.

   (B) Wi-Fi.

## EMBEDDED SYSTEM DESIGN MID II QP

### SET 1

1. Define Process and Threads? With the help of flow diagram explain process states and state transition?( **CO2)**
2. Explain The Different Embedded Firmware Design Approaches In Detail?**(CO3)**
3. Discuss The Concept Of Remote Procedure Call For **IPC** With Neat Sketch? **(CO4)**
4. What Is Device Driver? Explain Its Role In The OS Context? **(CO5)**

### SET 2

1. Explain The Operating System Architecture? **(CO3)**
2. What Is Interprocess Communication (**IPC**)? Give An Overview Of Different **IPC** Mechanism Adapted By Various Operating Systems? **(C04)**
3. Discuss The Concept Of Remote Procedure Call For **IPC** With Neat Sketch? **(CO4)**
4. Define Process and Threads? With the help of flow diagram explain process states and state transition? **(CO2)**

### SET 3

1. Explain Task, Task State, &Threads? **(CO4)**
2. Discuss The Concept Of Remote Procedure Call For **IPC** With Neat Sketch? **(CO4)**
3. Define Process and Threads? With the help of flow diagram explain process states and state transition? **CO2)**
4. Explain high level language to machine level language conversion process? Mention advantages of high level language conversion process? **(CO3)**

## 12. Scheme of Evaluation

# CMR ENGINEERING COLLEGE

| S.NO | Q.NO | THEORY | MARKS | TOTAL |
|------|------|--------|-------|-------|
| 1 | 1 | list of classifications | 1.5 | 05 |
|   |   | Explanation with examples | 3.5 | |
| 2 | 2 | List out of characteristics | 1.5 | 05 |
|   |   | explanation | 3.5 | |
| 3 | 3 | Types of memories | 1 | 05 |
|   |   | Role of memories in embedded system | 4 | |
| 4 | 4 | Definition of sensor and actuator | 2 | 05 |
|   |   | Illustration and examples | 3 | |

**DESCRIPTIVE TEST -  SET C   MID 1**

| S.NO | Q.NO | THEORY | MARKS | TOTAL |
|------|------|--------|-------|-------|
| 1 | 1 | list of classifications | 1.5 | 05 |
|   |   | Explanation with examples | 3.5 | |
| 2 | 2 | List out of characteristics | 1.5 | 05 |
|   |   | explanation | 3.5 | |

| 3 | 3 | Types of memories | 1 | 05 |
|---|---|---|---|---|
| | | Role of memories in embedded system | 4 | |
| 4 | 4 | Definition of sensor and actuator | 2 | 05 |
| | | Illustration and examples | 3 | |

**13.** Sample Mid Answer Script

**14.** Material Collected from Internet/Websites(links)


WEBSITES AND USEFUL LINKS

1. www.mit.edu
2. www.soe.stanford.edu
3. www.grad.gatech.edu
4. www.gsas.harward.edu
5. www.eng.ufl.edu
6. www.iitk.ac.in
7. www.iitd.ernet.in
8. www.iitb.ac.in
9. www.iitm.ac.in
10. www.iitr.ac.in
11. www.iitg.ernet.in
12. www.bits-pilani.ac.in
13. www.bitmesra.ac.in
14. www.psgtech.edu
15. www.iisc.ernet.in
16. www.ieee.org

**Useful URLs**

https://www.youtube.com/watch?v=y9RAhEfLfJs

*nptel.iitg.ernet.in › ... › Embedded Systems(Video)*

*online**videolecture**.com/?course_id=490*

*nptel.ac.in/courses/108102045/*

www.nptel**videos**.in/2012/11/**embedded-systems**.html

*users.ece.utexas.edu/valvano/Volume1/E-Book/**VideoLinks**.htm*

*https://chess.eecs.berkeley.edu/eecs149/*

**15.** ICT Materials

**16.** University Previous Question Papers

Code No: 117CZ

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
B. Tech IV Year I Semester Examinations, March - 2017
**EMBEDDED SYSTEMS DESIGN**
(Electronics and Communication Engineering)

Time: 3 Hours                                                                 Max. Marks: 75

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each
question carries 10 marks and may have a, b, c as sub questions.

## Part- A (25 Marks)

| | | |
|---|---|---|
| 1.a) | Define Embedded System. | [2] |
| b) | List out the differences between an embedded system and a general purpose computer. | [3] |
| c) | Explain the concept of Memory Shadowing. | [2] |
| d) | Write a short note on COTS. | [3] |
| e) | What is the use of reset circuit in an embedded system? | [2] |
| f) | Briefly explain Brown-out protection circuit. | [3] |
| g) | What is the use of RTOS in Embedded System Design? | [2] |
| h) | Discuss briefly about Task Scheduling. | [3] |
| i) | What are the considerations to choose an RTOS? | [2] |
| j) | Discuss the issues in Task Synchronization briefly. | [3] |

## Part-B (50 Marks)

2.    Explain in detail the classification of embedded system.            [10]
**OR**
3.a)  Describe the characteristics of an embedded system in detail.
  b)  Explain the quality attribute portability and reliability in embedded system design
      context.                                                            [5+5]

4.a)  What are the different types of memories used in embedded system design? Explain each
      with examples.
  b)  Explain the role of sensors in embedded system design.             [5+5]
**OR**
5.    Explain the different communication interfaces with respect to embedded systems. [10]

6.a)  Describe the purpose of a Real Time Clock in an embedded system, explain in detail.
  b)  Explain the function of Watchdog timer in an embedded system.       [5+5]
**OR**
7.    What is the need of an embedded firmware? Briefly explain the embedded
      firmware development languages.                                     [10]

8. What is a process? With a neat representation explain the process states and state transition. [10]

**OR**

9. Explain the different thread binding models for user and kernel level threads. [10]

10.a) Explain message passing technique for inter process communication in detail.
   b) Explain the concept of Shared memory in task communication. [5+5]

**OR**

11. What is a device driver? Explain the role of device driver in an embedded OS. [10]

Code No: 117CZ

<div align="right">R13</div>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
B. Tech IV Year I Semester Examinations, November/December - 2017
**EMBEDDED SYSTEM DESIGN**
(Common to ECE, ETM)

Time: 3 Hours                                                                 Max. Marks: 75

Note: This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A. Part B consists of 5 Units. Answer any one full question from each unit. Each question carries 10 marks and may have a, b, c as sub questions.

## PART- A

(25 Marks)

1.a) List the characteristics of an embedded system.                                     [2]
  b) What is the difference between a system and an embedded system?          [3]
  c) What is actuator?                                                                            [2]
  d) What are the considerations for processor selection?                            [3]
  e) Explain the role of reset circuit in an embedded system.                        [2]
  f) What is the difference between real time clock and watchdog time.           [3]
  g) When do you use cooperative scheduling?                                          [2]
  h) What is the function of timer in RTOS?                                             [3]
  i) What is Remote Procedure Call and explain its working?                       [2]
  j) What is meant by concurrency of task execution in real time system?       [3]

## PART-B

(50 Marks)

2.a) Explain the major application areas of embedded systems.
  b) What are the components of Embedded System Hardware?                    [5+5]
                                          **OR**
3.   Discuss the purpose of embedded systems. List the design metrics used to compare them.
                                                                                                   [10]

4.   With a neat diagram, explain the architecture of a general purpose processor.    [10]
                                          **OR**
5.a) Write the difference between general purpose processors and domain specific processors.
  b) Discuss the aspects of memory allocation and mapping in embedded domain.    [5+5]

6.a) What are the design criteria of external brown-out protection circuit.
  b) How to design and implement firmware for embedded systems?             [5+5]
                                          **OR**
7.   Explain with one example, how to change the bus frequency of the processor.    [10]

8.a) How do we initiate round robin time series scheduling?
  b) How lower priority task executes in a preemptive scheduler?                [5+5]

**OR**

9. Write the basic design principles when using an RTOS to design of sample RTOS.[10]

10. Explain in detail the following device drivers
    a) Serial port device driver
    b) Device drivers for internal programmable timing devices.                [5+5]

**OR**

11.a) Explain the inter task communication offered by RTOS.
   b) Explain message-passing communication system in detail.                [5+5]

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Code No: 117CZ

**R13**

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD**
**B. Tech IV Year I Semester Examinations, November/December - 2016**
**EMBEDDED SYSTEM DESIGN**
**(Electronics and Communication Engineering)**

Time: 3 Hours                                                                 Max. Marks: 75

**Note:** This question paper contains two parts A and B.
Part A is compulsory which carries 25 marks. Answer all questions in Part A.
Part B consists of 5 Units. Answer any one full question from each unit. Each
question carries 10 marks and may have a, b, c as sub questions.

## PART- A

**(25 Marks)**

| | | |
|---|---|---|
| 1.a) | Define "Time-to-market". | [2] |
| b) | What is the quality attribute "Portability" in the embedded system design context. | [3] |
| c) | What is the role of ASIC in Embedded System design? | [2] |
| d) | What is Actuator? | [3] |
| e) | What is the role of Reset Circuit in embedded system? | [2] |
| f) | What are the merits and drawbacks of 'recursion'? | [3] |
| g) | What is an Operating system? What are its primary functions? | [2] |
| h) | What is task control block (TCB)? | [3] |
| i) | Define Coffman conditions. | [2] |
| j) | How multiple threads of a process co-operate? | [3] |

## PART-B

**(50 Marks)**

2.   Define an embedded system? Explain the characteristics of Embedded Systems.   [10]

**OR**

3.   Explain the various purposes of embedded systems in detail with illustrative examples.
     [10]

4.a) Explain the different factors that needs to be considered in the selection of memory for
     embedded systems.

   b) Explain the difference between $I^2C$ and SPI communication interface.   [5+5]

**OR**

5.   Explain the different communication buses used in automotive application.   [10]

6. Explain the different sections of a memory segment allocated to an application by the memory manager. [10]

**OR**

7. Explain the difference between 'pointer to constant data' and 'constant pointer to data' in Embedded C programming. Explain the syntax for declaring both. [10]

8.a) Explain starvation in the process scheduling context. Explain how starvation can be effectively tackled.

b) What is the difference between a General Purpose kernal and Real-Time kernel? Give an example for both. [5+5]

**OR**

9. Explain the different multitasking models in the operating system context. [10]

10. Explain in detail, the different task communication synchronization issues encountered in Inter Process communication. [10]

**OR**

11. Explain the architecture of device driver, with neat sketch and give the applications of device drivers. [10]

---ooOoo---

**Attached**

**17. Websites/URLs/ e- Resources**

WEBSITES AND USEFUL LINKS

1. www.mit.edu
2. www.soe.stanford.edu
3. www.grad.gatech.edu
4. www.gsas.harward.edu
5. www.eng.ufl.edu
6. www.iitk.ac.in
7. www.iitd.ernet.in
8. www.iitb.ac.in
9. www.iitm.ac.in
10. www.iitr.ac.in
11. www.iitg.ernet.in
12. www.bits-pilani.ac.in
13. www.bitmesra.ac.in
14. www.psgtech.edu
15. www.iisc.ernet.in

16. [www.ieee.org](www.ieee.org)

**Useful URLs**

https://www.youtube.com/watch?v=y9RAhEfLfJs

*nptel.iitg.ernet.in › ... › Embedded Systems(Video)*

*online**videolecture**.com/?course_id=490*

*nptel.ac.in/courses/108102045/*

www.nptel**videos**.in/2012/11/**embedded**-**systems**.html

*users.ece.utexas.edu/valvano/Volume1/E-Book/**VideoLinks**.htm*

*https://chess.eecs.berkeley.edu/eecs149/*

## EXPERT DETAILS

### International

1. Peyton z. Peebles, jr., is Professor Emeritus of Electrical and Computer Engineering at the University of Florida.
2. Anthanasios Papoulis was a member of the faculty of the Polytechnic Institute of New York University

### National

1. Mrs.Chitralekha Mahanta, Ph. D.Professor,
   EEE Department, IIT Guwahati, Guwahati
   Phone: +91 361 2582507 (O), Fax : +91-361-2582542
   email: chitra@iitg.ernet.in
2. Mr.Gupta, Sanjeev, Ph.D.(Communication Engineering),
   Dhirubhai Ambani Institute of Information and Communication,Gandhinagar,Gujrat.
   email:sanjeev_gupta@daiict.ac.in
   Office : (+91) 079-3051-0594
1. Bansal R.K,Ph.D,ECE dept,IIT kanpur
   phone: +91-512-2597075, Fax: +91-512-2590063
   Email: rkb@iitk.ac.in

### Regional

1. Dr.S. ANURADHA, Assistant Professor, ECE Department, NIT, Warangal
E-Mail :anu_praise2004@yahoo.co.in
Phone No. :08702462446

2.SRI.SRIDHAR KV, Assoc Professor, ECE Department, NIT, Warangal
E-Mail : sridhar@nitw.ac.in