

**III B.Tech. II Semester**

**Examinations, April/May -2005  
ROBOTICS AND EMBEDDED SYSTEMS  
(Instrumentation & Control Engineering)**

**Time: 3 hours**

**Max Marks: 80**

**Answer any FIVE Questions  
All Questions carry equal marks**

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1. Discuss in detail four types of robot like devices.
2. (a) Compare the relative merits and demerits of Hydraulic, Pneumatic and electric type actuators?  
(b) Explain the principle of operation of a D.C servo meter?
3. (a) Explain the various types gripper actuating mechanisms?  
(b) Explain working of mechanical gripper with neat sketches?
4. (a) What are the characteristics of embedded computing applications? Explain briefly.  
(b) Explain the basic instruction format of ARM instructions and the format of CPSR.
5. (a) Explain the basic programming model of SHARC processor.  
(b) Write SHARC assembly code to implement the following 'C' conditional statements.  
if (x - y < 3)  
{ a = b+c;  
x = 0;  
}  
else  
{ y = 0;  
d = e-f + g;  
}
6. (a) Explain the major random-access memories together with their timing diagrams for reading operations.  
(b) Explain the functionality of DMA controller with a block diagram.
7. (a) Describe software pipelining in SHARC.  
(b) Explain the concept of code compression.
8. Describe briefly various scheduling algorithms and multitasking methods.

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1. Give the detailed classification of robots by co-ordinate system.
2. (a) What are the characteristics of a stepper motor? Why designers often select stepper motor D.C servomotor?  
(b) What is the principle of stepper motor operations?
3. (a) Explain how tools are used as end effectors in robots. With examples?  
(b) What are the considerations to be taken in gripper selection and design?
4. (a) Explain various addressing modes of an ARM processor.  
(b) What is the difference between fixed-point and floating-point ALU operations in SHARC and list out all ALU operations.
5. (a) Explain about interrupt mechanism in ARM processor and the steps involved in responding to an interrupt.  
(b) Write an ARM assembly code to implement the following 'C' conditional statements.  
if (x - y < 3)  
{ a = b - c;  
x = 0;  
}  
else  
{ y = 0;  
d = e + f + g;  
}
6. (a) Explain the functionality of memory management unit (MMU).  
(b) Calculate the total execution time of given 'C' code  
for (i = 0, f = 0; i ≤ N; i++)  
f = f + c[i] \* x[i];
7. (a) What are the ways of improving CPU performance? Explain them. What are the difficulties involved in those methods.  
(b) Explain the major random-access memories together with their timing diagrams for reading operation.

Process	Time	Deadline
P <sub>1</sub>	1	3
P <sub>2</sub>	1	4
P <sub>3</sub>	2	6

8. (a) Compare standard data flow graph and CDFG with an example.  
(b) For the process given below, schedule the processes using an EDF policy.

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1. Give the classification of robots by control method.
2. Explain the working of Hydraulic actuators with an example?
3. (a) Explain the speed control in robot?  
(b) What are the steps to be taken to avoid obstacles?
4. (a) Explain the functional and non-functional requirements in the design of embedded systems.  
(b) Explain the basic instruction format of ARM instructions and the format of CPSR.
5. (a) List out various addressing modes in SHARC processor.  
(b) Write SHARC assembly code for the following loop:  

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for ( i = 0; i < 10; i + + )
  for ( j =0; j < 10; j + + )
    z[i] = a[i, j] * b[i]
```
6. (a) Calculate the total execution time of given 'C' code.  

```

for (i = 0; f = 0; i < N; i + + )
  f = f + c [i] * x [i];
```

(b) What are the ways of improving CPU performance? Explain. What are the difficulties involved in those methods.
7. (a) For the process given, schedule the process using an EDF policy.

Process	Time	Deadline
P <sub>1</sub>	1	3
P <sub>2</sub>	1	4
P <sub>3</sub>	2	6

- (b) Compare RMS and EDF scheduling policies.
8. Write short notes on:
  - (a) Co-operative multitasking

(b) Pre-emptive multitasking.

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1. What are the major components of robots? Discuss in detail?
2. Explain the working of Pneumatic actuators with an example?
3. Explain different methods of defining position in space?
4. (a) Explain the steps involved in embedded system design process.  
(b) i. How would the ARM status would be set after the given operations.  

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ii. Distinguish between Von Neuman and Harward architecture.
5. (a) Explain how functional calls are implemented in ARM processor.  
(b) Write SHARC assembly code for the following loop:  
for (i = 0; i < 20; i + + )  
z[i] = a[i] \* b[i].
6. (a) Explain the functionality of memory management unit (MMU).  
(b) Explain the mechanisms by which a CMOS CPU consumes power and explain the power-saving strategies used.
7. (a) Compare standard data flow graph and CDFG with an example.  
(b) For the processes given below, schedule the processes using an RMS policy.

Process	Time	Deadline
P <sub>1</sub>	1	3
P <sub>2</sub>	1	4
P <sub>3</sub>	1	12

8. (a) Draw the state diagram of process states and explain.  
(b) Illustrate with an example, shared memory concept of inter process communication system.

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