Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2018

Programme Name: B. Tech (Instrumentation and Control Engineering) **Semester : VII**
Course Name : Computer Control **Time : 03 hrs**
Course Code : ICEG-411 **Max. Marks : 100**
Nos. of page(s) : 03
Instructions: Assume any data in programming, if required.

SECTION A (4 x 5 = 20 Marks)

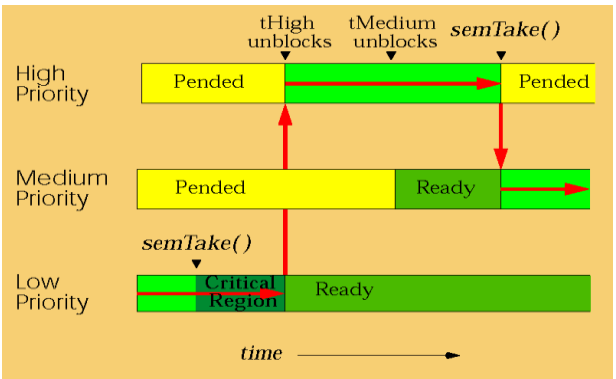
Attempt *all* the questions

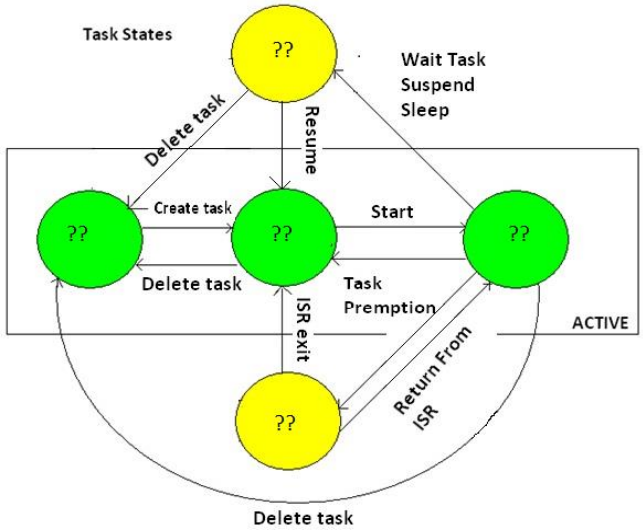
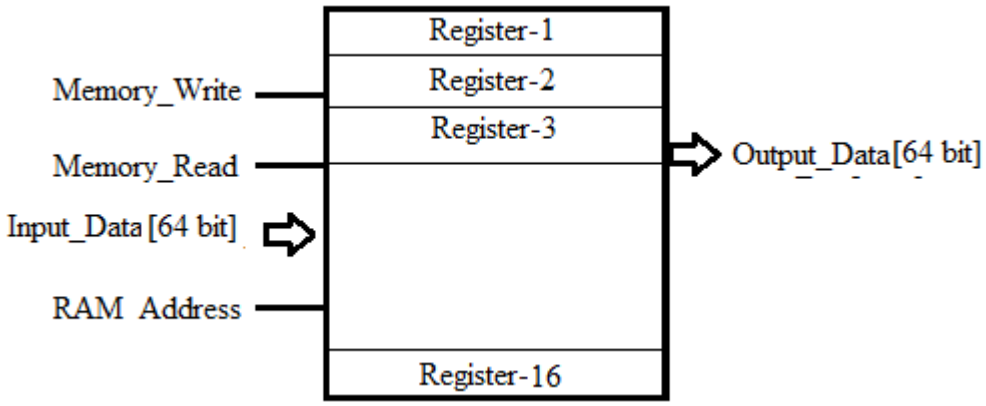
S. No.		Marks	CO
Q.1	How programs are classified for real time and non-real time tasks and to separate the activities carried by the computer control system.	**5**	**CO1**
Q.2	How the assembly language program is developed and debugged? Explain the format of assembly language programming and flow to debug the code.	**5**	**CO3**
Q.3	Detail the different LAN topologies and ISO standard layers for device to device communication with examples .	**5**	**CO2**
Q.4	Explain the foreground and background systems. Detail the role of different task states and their functionality with respect to RTS.	**5**	**CO4**

SECTION B (4 x 10 = 40 Marks)

Attempt *all* the questions

Q.5	**(a)** How direct digital control (DDC) is used in direct control with serval loop control handled within one computer. Can PID control algorithm be more accurate in comparison to DDC? Discuss the control technique to support your answer. **(b)** Explain concept of parallel processing and detail all possible computer architectures.	**5** **5**	**CO2**
Q.6	**(a)** Explain Hatley and Pirbhai model as requirement model with example. **(b)** You are the engineer in a plant which can produce ten different chemical products in batches which can be between 500 and 5000 Kg. What factors would you expect to consider in calculating the optimum batch size? What arguments you would put forward to justify the use of an online computer to calculate optimal batch size. Suggest the batch process control scheme for the same system	**5** **5**	**CO5**
Q.7	BCD to seven segment LED display decoder IC 7447 converts the 4 bit BCD code applied at its input into the patterns required to display the BCD numbers. Two seven segment display can be connected to a single 8 bit port. One 7447 IC can be connected to the four lower order bits and another 7447 can be connected to the four higher order bits of Port A. So six seven segment displays can be connected to a single 8255 that has three parallel I/O ports. This will results a complicated circuit. Suggest the technique to reduce the complexity of the circuit and develop the hex code to display the numbers 0	**10**	**CO3**

	to 9 on any one segment with the help of port A of 8255 and develop the Embedded 'C' code for the same		
Q.8	Explain the asynchronous data format and different modes of data transfer in serial communication. Discuss the Need of MAX 232 and DB 9 connector in serial communication.	**10**	**CO2**
SECTION-C (2 x 20 = 40 Marks) **Attempt *any two* the followings**			
Q.9	**(a)** A typical reactor vessel for sequence control is used fir chemical production by the reaction of two chemicals at specified. The chemicals are mixed together in a sealed vessel and the temperature of the reaction is controlled by feeding hot or cold water through the water jacket which surrounds the vessel. The water flow is controlled is adjusted with the values. The flow of material into and out of the vessel is regulated by other valves. The temperate of the contents of the vessel and the pressure in the vessel is also monitored. *Suggest the model and procedure of operation to support the same functionality and detail the block diagram for this chemical batch process, when all the operations are controlled by the computer and timings by software.* **(b)** A computer control hot air blower system is interfaced with digital computer for control purpose. The air flow can be controlled automatically and manual. Suggest the suitable interface diagram with the description of different units and temperature control.	**10** **10**	**CO1**
Q.10	**(a)** Compare the position and velocity algorithms for DDC. Tune the PID for the following transfer function and explain how it is applicable to control. $$G(s) = \frac{Ke^{-Ls}}{(1 + sTp)}$$ **(b)** Detail the different synchronization technique used for encapsulating the semaphore in real time control system. Suggest the example with each technique. Fig.1 list the case of one inbounded priority inversion problem. What technique of semaphore will be helpful to resolve the issue?  Fig.2 Task Execution	**10** **10**	**CO2**

Q.11	**(a)** Fig.2 shows the different task states. Complete the task state diagram and detail the operation to justify your answer.  Fig.2 Task States **(b)** Consider a memory system (16 x 64) which has 8 Registers as shown in fig.3. The input data CAF1H is written and read at different time intervals with 0.8 ms delay in all registers respectively. Suggest the algorithm for the complete RAM locations to store the data from input port and send to output port. Calculate the time required to perform the data storage in all registers. Also develop the code in Embedded 'C, or any other language. [10] [CO3]  Fig.3 RAM structure	**10** **10**	

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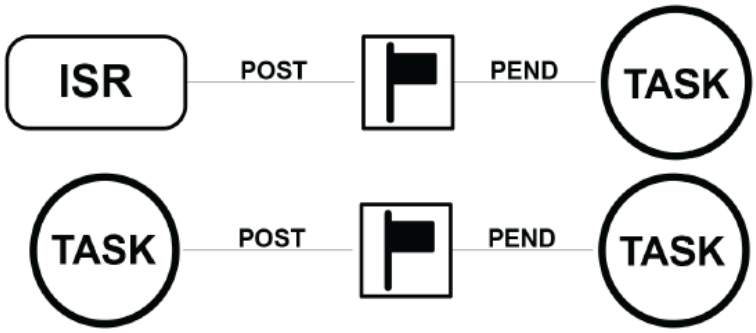
SECTION A (4 x 5 = 20 Marks)

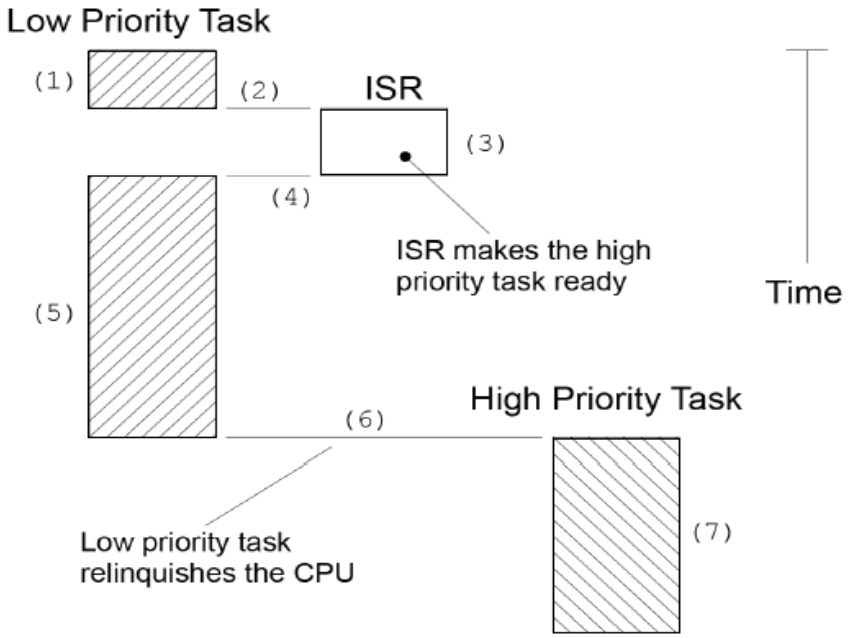
Attempt *all* the questions

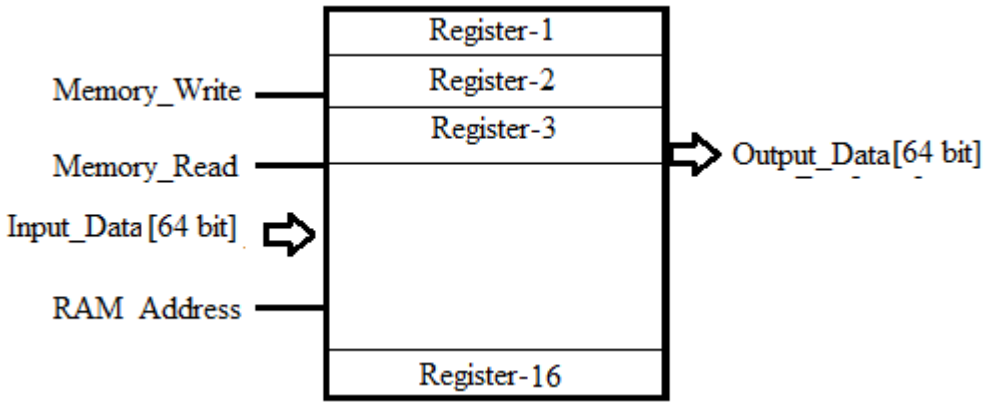
S. No.		Marks	CO
Q.1	Draw the simplified block diagram of sampled feedback control system in which c(nT), r(nt), e(nT), u(nT) are the sample values of control variable c(t), set point r(t), error input e(t) and manipulated variable u(t) at sample time nT for a plant	**5**	**CO1**
Q.2	How the computer control system programs are classified? Discuss the examples of each with respect to real time systems.	**5**	**CO1**
Q.3	Explain the foreground and background systems. Detail the role of different task states and their functionality with respect to RTS.	**5**	**CO4**
Q.4	Detail the different LAN topologies and ISO standard layers for device to device communication with examples .	**5**	**CO2**

SECTION B (4 x 10 = 40 Marks)

Attempt *all* the questions

Q.5	Outline the flow chat of abstract modeling approach of Ward and Mellor method. Show the relationship between models and diagram as the basic building in essential model and environmental model.	**10**	**CO5**
Q.6	List the advantages of DDC over analog control. Detail the loop control technique and its applications in PID.	**10**	**CO2**
Q.7	what are the different types of semaphore? Detail all with examples. What synchronization technique can be employed in fig.1 for synchronization task and ISR?  Fig.1 Task synchronization with ISR	**10**	**CO4**

Q.8	**(a)** Design a distributed and hierarchical system in which each unit is carrying out essentially similar tasks to all other units and in the event of failure or overloading of a particular unit all or some of the work can be transferred to other units. **(b)** Detail parallel processing and possible computer architectures for digital control.	**5** **5**	**CO1**
SECTION-C (2 x 20 = 40 Marks) **Attempt *any two* the followings**			
Q.9	Detail the scheduling associated with the real time operation listed in fig.2. What type of problems can be associated with the execution of the scheduled task. Also suggest the solution and description of scheduling method.  Fig.2 **(b)** Give the details and examples of different types of semaphore applicable for control system.	**10** **10**	**CO4**
Q.10	**(a)** Suggest the finite state machine for the following traffic light controller. Design the control algorithm, to control the traffic intensity from one way and develop the code for the same in Modula 2, Ada or embedded 'C'. **(b)** A large valve controlling the flow of steam is operated by a dc motor. The motor controller has two inputs: On/off control, 0V = off, 5V = on; and direction, 0 V = clockwise, 5 V = anticlockwise And two outputs Fully open = 0 V Fully closed = 5V Show how this valve could be interfaced to computer controlling the process, depict the diagram and develop the code to support the same functionality.	**10** **10**	**CO3**

Q.11	**(a)** A computer control hot air blower system is interfaced with digital computer for control purpose. The air flow can be controlled automatically and manual. Suggest the suitable model, interface diagram with the description of different units and temperature control**.** **(b)** Consider a memory system (16 x 64) which has 8 Registers as shown in fig.3. The input data CAF1H is written and read at different time intervals with 0.8 ms delay in all registers respectively. Suggest the algorithm for the complete RAM locations to store the data from input port and send to output port. Calculate the time required to perform the data storage in all registers. Also develop the code in Embedded 'C, or any other language.  Fig.3 RAM structure	**10** **10**	**CO5**