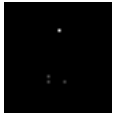
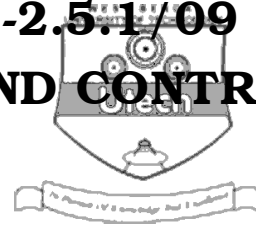


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**CS/M.Tech (CI)/SEM-2/CI-2.5.1/09**  
**INDUSTRIAL AUTOMATION AND CONTROL**  
**SEMESTER - 2**



Time : 3 Hours ]

[ Full Marks : 70

*The figures in the margin indicate full marks.*

*Candidates are required to give their answers in their own words as far as practicable.*

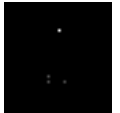
Answer Question No. 1 which is compulsory and any *four* from the rest.

5 ∞ 14 = 70

1. Answer in brief :

7 ∞ 2

- a) Explain the action of a capacitance based differential pressure transmitter (DPT).
- b) Find gain, band width and input impedance of a single Op-Amp buffer amplifier.
- c) Explain common mode rejection ratio ( CMRR ) in an instrumentation amplifier.
- d) List the different kinds of noise coupling that could happen in instrumentation.  
Which of these are deflected by using a shielded wire pair ?
- e) A synchro-pair acts as an angular position error detector in a carrier control system. The output of the control transformer is directly fed to the control winding of the two phase servomotor. How would the motor act to the error polarity ?
- f) Define relative stability of a system. Is it affected by presence of pure time delay ?
- g) Name the standard ports for serial and parallel interconnection in instrumentation.



2. Give in block diagrammatic form the ac carrier signal conditioning system. Briefly describe the function of each block.



Displacements with significant frequency component up to 500 Hz are measured by a linear variable differential transformer ( LVDT ) having 10 kHz ac excitation. What are the frequency bands present in the output of the LVDT ? What are the frequencies present in the demodulated output before the low pass filter ? Justify your answers.

5 + 5 + 4

3. Power system engineers use supervisory control and data acquisition ( SCADA ) systems for distribution automation purpose. Draw in block diagrammatic form the data acquisition ( DA ) system and give brief description of each block.

How would you add supervisory control, 'command and acknowledge' instructions, to the DA system ?

5 + 5 + 4

4. Explain the construction and principle of action of a either a variable reluctance ( VR ) or a permanent magnet ( PM ) type step motor.

What are half-stepping and micro-stepping in connection with running of a step motor ? Explain with diagrams.

4 + 4 + 3 + 3

5. Draw the circuit of an analog electronic P-I-D controller and find its transfer function. Identify the elements for setting the proportional band, reset and rate times.

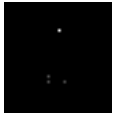
Deduce the incremental P-I-D control law for implementation on a digital processor.

4 + 4 + 2 + 4

6. Give the architecture of a programmable logic controller ( PLC ) with brief descriptions of the sub-systems. In what ways does the PLC differ from a micro-processor (  $\mu P$  ) or a personal computer ( PC ) ?

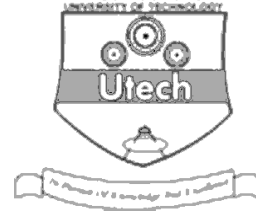
The relay ladder logic ( RLL ) is the most common method of programming a PLC. Expound on RLL and illustrate its use with an example.

4 + 4 + 2 + 4



7. Write an essay ( not more than 30 lines ) on 'Communication and Networking in Intelligent Automation ( CNIA )'.

14



8. Write short notes on any *two* of the following :

2 × 7

- a) Unbalanced Wheatstone bridge
- b) Nozzle-flapper type pneumatic amplifier
- c) Two phase ac servo motor
- d) Embedded system.

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END