DEC - 2008

DIGITAL DESIGN AND COMPUTER ORGANISATION

Branch : T.E. (E and TC/Electronics)

(2003 Course)

Time : 3 Hours Max. Marks : 100

Instructions: *1) In Section **I** : Attempt Q. 1 or Q. 2, Q. 3 or Q. 4, Q. 5 or Q. 6.*
*In Section **II** : Attempt Q. 7 or Q. 8, Q. 9 or Q. 10, Q. 11 or Q. 12.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Assume suitable data, **if necessary**.*

SECTION – I

1. a) What are the steps for the analysis of asynchronous sequential circuits ? **6**

   b) What does word 'finite' signify in the term finite state machine ? **2**

   c) Design and construct a Melay circuit which has single input and single output terminal. Output is 1 if the input is a sequence of alternate 1's and 0's. Assume that input is properly synchronised with the clock. **8**

   OR

2. a) What is a serial adder ? Explain its working with the help of a state diagram. **6**

   b) Enlist various encoding techniques used to represent state machine. **2**

   c) Draw and explain the ASM chart for binary multiplier. **8**

3. a) Explain different classes of data objects in VHDL with example for each. **8**

   b) Describe case statement in detail. Write a VHDL Code for 4 : 1 multiplexer using case statement. **8**

   OR

4. a) Why wait statement is normally used at the end of process and not at the beginning ?
   Explain following wait statements :
   (i) Wait on (ii) Wait for (iii) Wait until. **8**

   b) Write a VHDL Code for 4-bit up-down counter. **8**

P.T.O.

5. a) Using Booth's algorithm multiply the following :

   Multiplicand = + 15

   Multiplier = – 6. 8

   b) What are rules used to perform floating point multiplication and division ? 6

   c) What are the limitation of sign magnitude representation of a number ? 4

OR

6. a) Using restoring division algorithm solve the following :

   Dividend = 17

   Divisor = 03. 8

   b) Represent $(178.1875)_{10}$ in single and double precision floating point format. 6

   c) Define the following terms with respect to IEEE floating point numbers :

      i) Guard bits

      ii) Rounding. 4

SECTION – II

7. a) Explain the following addressing modes along with suitable examples :

      i) Register mode

      ii) Immediate mode

      iii) Autoincrement mode

      iv) Autodecrement mode. 8

   b) What are Subroutines ? Explain the role of stack in the execution of the program containing subroutines. 8

OR

8. a) Draw and explain the single bus organisation of the CPU. 6

   b) What are queues ? Give difference between stacks and queues. 6

   c) What are condition codes ? Explain the use of them. 4

9. a) What are the different methods of handling multiple I/O devices by CPU ? 8

   b) Explain the following :

      i) Programmed I/O.

      ii) Interrupt Driven I/O. 8

OR

10. a) Explain interface between keyboard and processor. Also explain the communication between them. 8

    b) Draw and explain the timing diagram for synchronous input data transfer. 8

11. a) What are the different types of memory found in a computer system ? Compare them based on speed, size and cost. 8

    b) Explain set-associative mapped cache with the help of diagram. 6

    c) Explain the functioning of CD-ROM. 4

OR

12. a) Explain the concept of virtual memory. How is virtual address translated to physical address ? 8

    b) Explain, What is RAID ? Differentiate between RAID 0, RAID 1 and RAID 2. 8

    c) Why DRAM is used in main memory of PC ? 2

ANALOG INTEGRATED CIRCUITS - DESIGN AND APPLICATIONS

Branch : T.E. (E & TC)

(2003 Course)

Time : 3 Hours Max. Marks :100

Instructions : *1) Answer **any three** questions from **each** Section.*
*2) Answers to the **two** Sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Black figures to the **right** indicate **full** marks.*
*5) Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator is **allowed**.*
*6) Assume suitable data, **if necessary**.*

SECTION – I

1. a) Explain the necessity of level shifting block in op-amp ? With neat diagram explain any two circuits for level shifting. 8

b) For Dual input balanced output differential amplifier the base voltages of differential pair transistor are $Vin_1 = -0.8V$ and $Vin_2 = +0.8$ V and spurious signal of amplitude 10 mV is added in phase with both inputs. Calculate V_0 and error caused by the common mode signal. 8

OR

2. a) Define the following terms for differential Amplifier.
   a) Differential signal
   b) Common-mode signal
   c) Differential gain and common mode gain
   d) CMRR. 8

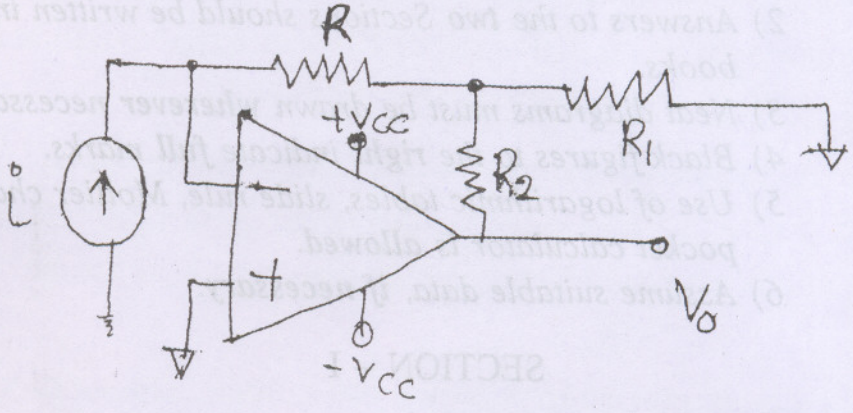
b) With the proper circuit diagram and logical procedure. Explain measurement of the following op-amp parameters
   1) input offset voltage
   2) Slew rate. 8

3. a) With the help of circuit diagram explain and derive the expression for output voltage of difference amplifier using single op-amp. **8**

   b) Justify with example shielding and grounding techniques to improve CMRR. **8**

OR

4. a) In the following figure specify suitable component values to achieve sensitivity of 0.1 V/nA. **8**



   b) Compare between Instrumentation amplifier and differential amplifier. **8**

5. a) Explain the necessity of Precision rectifier ? Draw and explain the full-wave Precision rectifier. **8**

   b) Design Inverting Schmitt Trigger for UTP = 4 V and LTP – 2V. Assume $V_{cc} = \pm 12V$. **6**

   c) What are the advantages of Schmitt trigger over comparator. **4**

OR

6. Write short note on : **18**

   a) Clipper and clamper using op-amp

   b) Sample and Hold circuit

   c) Window detector.

SECTION – II

7. a) Explain with neat diagram monostable multivibrator using IC 555. **8**

   b) Design a op-amp based square-wave generator for frequency 5 kHz and duty cycle 30%. Also show the circuit arrangement for fixed frequency and variable duty cycle. **8**

OR

8. a) Draw and explain RC Phase shift oscillator using op-amp. **8**

   b) Design RC phase shift oscillator to produce sinusoidal output at 1 kHz. Also determine whether we can get sustained oscillations. **8**

9. a) Derive the expression for the gain of first order Butterworth low pass filter. **8**

   b) Design a 1.5 kHz low pass second order Butterworth filter. Use sallen and key equal component model. Assume the damping factor to be $\sqrt{2}$. **8**

OR

10. a) Explain the design procedure of higher order filters with cascaded design. Also mention the advantages of cascading. **8**

    b) Derive the expression for phase angle in all pass filter. **8**

11. a) Explain how temperature dependent reverse saturation current gets eliminated by using logarithmic ratio amplifier. **8**

    b) Calculate the output frequency 'f_o', Lock range Δf_L and capture range Δf_C of PLL using IC 565. If

       1) Timing resistor = 10 kΩ
       2) Timing Capacitor = 0.01 μf
       3) Filter capacitor = 10 μf
       4) Internal filter resistor = 3.6 KΩ. **10**

OR

12. Write short note on :

    1) Phase angle detection using analog multiplier
    2) PLL as frequency synthesizer
    3) Analog and digital PLL. **18**

DIGITAL COMMUNICATION
(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions : *1) Answer **any three** questions from **each** section*
*2) Answer to the **two** sections should be written in **separate** books.*
*3) Neat diagrams must be drawn **wherever** necessary.*
*4) Figures to the **right** indicate **full** marks.*
*5) Assume suitable data, if **necessary**.*

SECTION – I

1. a) With help of mathematical expression explain stationary random processes, non-stationary random processes, and wide sense stationary processes and Ergodic processes. **8**

b) Consider a random processes X(t) given by $X(t) = A\cos(\omega t+\theta)$ where ω and θ are constants and A is a random variable. Determine whether X(t) is wide sense stationary processes. **4**

c) A wide sense stationary random processes X(t) is applied to input of an LTI system with impulse response $h(t) = 3e^{-2t}u(t)$. Find the mean value of output Y(t) of system if E[X(t)]=2. **4**

OR

2. a) Specify the Nyquist rate and the Nyquist interval for each of the following signals.

i) $g(t) = \text{sinc}(200t)$

ii) $g(t) = \text{sinc}^2(200t)$

iii) $g(t) = \text{sinc}(200t) + \text{sinc}^2(200t)$. **6**

b) Explain Aperture Effect by drawing the spectrum of sampling and sampled signals. Suggest a remedial measure to compensate for aperture effect. **4**

c) An continuous time signal g(t) of finite energy and infinite duration which is strictly band limited to W Hz is ideally sampled $g_\delta(t)$ i.e.

$$g_\delta(t) = \sum_{n=-\infty}^{\infty} g(nT_s)\ \delta(t - nT_s)$$

also

$$g_\delta(t) \rightleftharpoons f_s \sum_{m=-\infty}^{\infty} G(f - mf_s)$$

Determine the expression of $G_\delta(f)$ and G(f). Draw the spectrum of $G_\delta(f)$ and G(f) with and without Aliasing.

Reconstruct the signal g(t) and derive interpolation formula, comment on it. **6**

3. a) Consider a DM system designed to accommodate analog message signals limited to band-width $W = 5$ kHz. A sinusoidal test signal of amplitude $A = 1$ volt and frequency $f_m = 1\ kHz$ is applied to the system. The sampling rate of the system is 50 kHz.

i) Calculate the step size Δ required to minimize slope overload.

ii) Calculate the signal-to-(quantization) noise ratio of the system for the specified sinusoidal test signal. **9**

b) Explain the following terms with help of neat diagram.

1) Performance comparison of PCM and analog modulation.

2) Non uniform quantization. **9**

OR

4. a) A PCM system uses a uniform quantizer followed by a 7-bit binary encoder. The bit rate of the system is equal to 50×10^6 b/s.

   i) What is the maximum message bandwidth for which the system operates satisfactorily ?

   ii) Determine the output signal-to-(quantization) noise ratio when a full-load sinusoidal modulating wave of frequency 1 MHz is applied to the input. **6**

   b) Explain with the help of block diagram the CD audio playback system. How the error detection is taken care of ? **6**

   c) Derive the expression for quantization error and signal to quantization noise ratio for a non-sinusoidal PCM system. **6**

5. a) Consider the following sequence of 1^s and 0^s.

   i) An alternate sequence of 1^s and 0^s.

   ii) A long sequence of 1^s followed by a long sequence of 0^s.

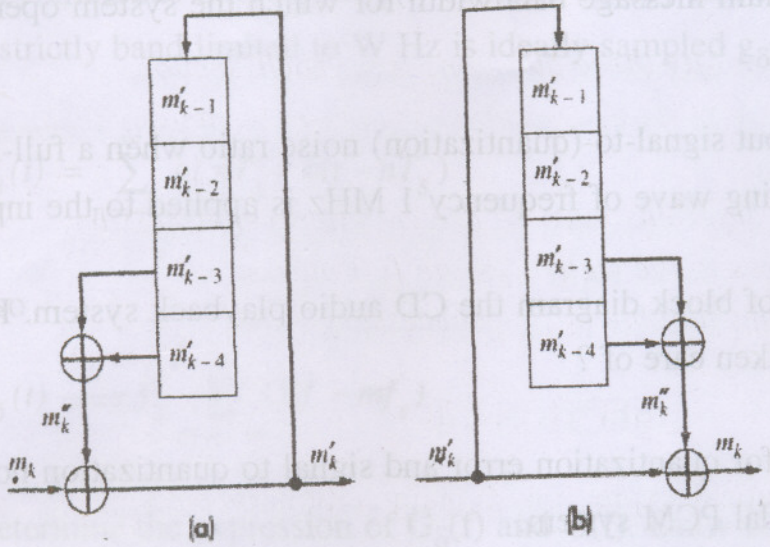
   iii) A single 0 and then a long sequence of 1^s.

   Sketch the waveform for each of these sequences using bipolar (AMI) signaling method of representation of 1 and 0, comment on its error detection capability also derive and draw its power spectral density. **10**

   b) What is a synchronizer ? Explain any one type of bit synchronizer. **6**

OR

6. a) Define Scrambling and its importance in digital communication.



For the (a) Scrambler and (b) Unscrambler, shown above determine the scrambled and unscrambled sequence assuming long string of 1^s of 14 bits and comment on the result. **10**

b) Write the functions performed by a multiplexer. What are three main categories of multiplexers ? **6**

SECTION – II

7. a) If the digital message input data rate is 8 kbps and average energy per bit is 0.01 unit, find

i) Bandwidth required for transmission of the message through BPSK, QPSk, 16-MPSK, orthogonal BPSK, MSK and 16-MFSK.

ii) Put these schemes in order of their susceptibility to noise after calculating minimum separation in signal space. **8**

b) Draw the block diagram and with the help of mathematical expression explain in detail the BPSK transmitter and receiver. Diagram the geometric representation and draw its power spectral density, along with its expression thereby comment on its Euclidian distance and bandwidth. **10**

OR

8. a) Diagram the signal space representation of the following :

Orthogonal BFSK, Non-Orthogonal BFSK, offset QPSK, Non-offset QPSK, 16-Ary PSK and 16 QAM. **6**

b) Compare QPSK and MSK. Explain phase continuity of MSK. **6**

c) Binary data is transmitted over an RF band pass channel with a usable bandwidth of 10 MHz at a rate of (4.8) (10^6) bits/sec using an ASK signaling method. The carrier amplitude at the receiver antenna is 1 mv and the noise power spectral density at the receiver input is 10^{-15} watt/Hz. Find the error probability of a coherent and non-coherent receiver.

Error function values : Q(3.10) = .00097, Q(3.15) = .00082, Q(5.00) = $2*10^{-7}$, Q(5.20)=10^{-7} **6**

9. a) Binary data is transmitted over a telephone link that has a usable bandwidth of 3000 Hz and a maximum achievable signal-to-noise power ratio of 6dB at its output.

i) Determine the maximum signaling rate and probability of error if a

ii) Coherent ASK scheme is used for transmitting binary data through this channel.

iii) If the data is maintained at 300 bits/sec, calculate the error probability. **8**

[Error function values : Q (3.40) = .00034, Q (3.45) = .00028, Q (6.30) = 10^{-10}]

b) Derive the expression for output of an optimum filter using Correlator. 8

OR

10. a) Show, that performance of a correlator and matched filter are Identical with the help of suitable output expressions.

b) A BPSK signal is received at the input of a coherent optimum receiver with amplitude 10mv and frequency 1 MHz, the signal is corrupted with white noise of PSD 10–9 watt/Hz if the data rate is 104 bits/sec, 8

i) Find error probability

ii) Find the error probability if the local oscillator has the phase shift of $\pi/6$ radian with input signal.

iii) Find the error probability if there is 10% mistiming in bit synchronization while sampling and

iv) Find the error probability when both (ii) and (iii) occur.

Complimentary error function :

x	erfc x	x	erfc x
1.19	$9.24*10^{-02}$	1.34	$5.81*10^{-02}$
1.20	$8.97*10^{-02}$	1.36	$5.44*10^{-02}$
1.26	$7.48*10^{-02}$	1.37	$5.27*10^{-02}$
1.27	$7.25*10^{-02}$	1.57	$2.64*10^{-02}$
1.29	$6.81*10^{-02}$	1.58	$255*10^{-02}$
1.30	$6.60*10^{-02}$	1.60	$2.37*10^{-02}$

11. a) Consider a fast hop spread spectrum system with binary FSK, two hops per symbol, and a PN sequence generator with outputs with the binary message of 011011011000. The message is transmitted using the following PN sequence :
{010,110,101,100,000,101,011,001,001,111,011,001,110,101,101,001,110, 001,011,111,100,000,110,110}, plot the output frequencies for the input message. **8**

b) What is PN sequence ? Draw a suitable PN sequence generator and prove the properties of PN sequence and sketch autocorrelation function of same. **8**

OR

12. a) In a DS/BPSK system, the feedback shift register used to generate the PN sequence has length m = 19. The system is required to have an average probability of symbol error due to externally generated interfering signals that does not exceed 10^{-5}. Calculate the following system parameters in decibels :

i) Processing gain

ii) Antijam margin. **8**

b) What is difference between multiplexing and multiple accesses technique ? What is multiple accesses technique ? Compare it with help of relevant diagram. **8**

MICROPROCESSOR, MICROCONTROLLER AND APPLICATIONS

Branch : T.E. (E&TC)

(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions: *1) Answer 3 questions from Section I and 3 questions from Section II.*

*2) Answers to the **two** sections should be written in **separate** books.*

*3) **Neat** diagrams must be drawn **wherever** necessary.*

*4) Black figures to the right indicate **full** marks.*

*5) **Use** of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is **allowed**.*

SECTION – I

1. a) Interface 8KB RAM using two 4KB RAM and 8KB EPROM using 4KB EPROM by suitable 3 : 8 decoder. EPROM address start from 0000H and RAM address start from 6000H. Show all control lines and address map. **10**

b) Draw and explain the internal block diagram of 8255. Draw the control word format and write the control word for following port configuration.

i) Port A as Output

ii) Port B as Input

iii) $PC_0 - PC_3$ as Input

iv) $PC_4 - PC_7$ as Output **8**

OR

2. a) Explain the logic analyzer with neat block diagram. What are its different display formats ? State the applications of logic analyzer. **10**

b) Explain following debugging tools (**any two**) :

i) Simulator

ii) In-circuit emulator

iii) Assembler. **8**

3. a) Explain an interrupts structure of 8051. 8

b) State and explain the serial modes of 8051. Show the calculation for setting baud rate 9600 in model of serial communication. 8

OR

4. a) Write an assembly language program to generate a square wave of frequency 5 KHz on pin P3.0 using auto reload mode of timero in 8051. 8

b) Draw an architecture of 8051. Explain PSW register of 8051. Compare microprocessor and microcontroller. 8

5. a) Explain the following instructions of 8051 :

i) XCH A, R_0

ii) SET B, P1.4

iii) CJNE A, #01H, Pinkey

iv) MOVX A, @R_1. 8

b) Write an assembly language program to move a block of 20 bytes of data from source to distination. The source block start from memory location 30H and distination block start from memory location 35H. 8

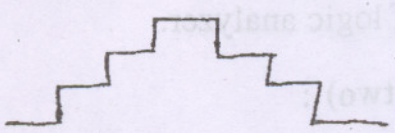
OR

6. a) Write an assembly language program of 8051 to unpack the BCD no. stored at 30H location. Store the MSB digit at memory location 41H and LSB digit at memory location 40H. Draw the flowchart for same. 8

b) Write an assembly language program of 8051 to add 8 byte. The numbers are stored in memory location starting from 80H onwards and store result at 60H and 61H. 8

SECTION – II

7. a) Draw an interfacing diagram to interface DAC with 8051. Write an ALP to generate following waveform (step). 8



b) Interface 4 × 4 matrix keyboard to 8051. Write a program to read key. 8

OR

8. a) Interface 2 line 16 character LCD display to 89C51. Using data pins only. Write a program to display "pincky" on line 1 from 5th position of LCD using bussy flag check. 8

   b) Interface stepper motor to 8051. Write an ALP to rotate the stepper motor in clockwise direction for 90°. Using full step mode. 8

9. a) What are features of I^2C bus ? Give the bus configuration of I^2C bus. Explain the signals used in I^2C bus. How data is transferred in I^2C bus ? 8

   b) List the features of MODBUS protocol. Compare I^2C and SPI protocol. 8

OR

10. a) Write short note on :
    i) RS 232C
    ii) SPI bus. 8

    b) Explain ASC II and RTU modes of MODBUS. Compare RS 485 and RS 232 standards. 8

11. a) Explain watchdog timer using in PIC microcontroller. 6

    b) List the feature of 89C51 RD2 microcontroller. 6

    c) Explain the status register of PIC 16CX17X microcontroller. 6

OR

12. a) Draw an explain in brief an architecture of AVR microcontroller. 6

    b) Write a short note on OTP microcontroller. 6

    c) Explain addressing mode of PIC microcontroller. 6

MECHATRONICS

Branch : T.E. (E and TC/Electronics)

(2003 Course)

Time: 3 Hours Max. Marks: 100

Instructions : 1) From Section I, answer Q.1 or Q.2, Q.3 or Q.4 and Q.5 or Q.6. From Section II, answer Q.7, or Q.8, Q.9 or Q.10 and Q.11 or Q.12.

*2) Answers to the **two** Sections should be written in **separate** books.*

*3) Neat diagrams must be drawn **wherever** necessary.*

*4) Black figures to the **right** indicate **full** marks.*

*5) **Use** of non-programmable calculator is **allowed**.*

*6) Assume suitable data, **if necessary**.*

SECTION – I

1. a) Explain the statement : "Mechatronics is the synergetic integration of Mechanical Engineering with Electronics and intelligent control algorithm in the design and manufacturing of process." **10**

b) Explain the significance of the following information given in the specification of Transducer :

i) A capacitive linearity displacement transducer Non-linearity and hysteresis : $\pm 0.01\%$ of the full scale.

ii) Thermocouple sensitivity : Nickel Chromium-Nickel Aluminium thermocouple : 0.039m V/°C when cold junction is at 0 °C.

iii) Load cell Repeatability : $\pm 0.01\%$ of the full scale. **6**

OR

2. a) State the steps involved in design of a Mechatronics system. Give the design of an 'Automation Printer' as an example of a Mechatronics system. **8**

b) Explain the following terms :

i) Precision ii) Threshold

iii) Sensitivity iv) Drift **4**

c) A spring balance is calibrated in environment at temperature 20°C and has the following load and deflection changes :

Load (Kg)	0	1	2	3	4
Deflection (mm)	0	20	40	60	80

When it is used in environment at 30°C it is having the following load and deflection changes :

Load (Kg)	0	1	2	3	4
Deflection (mm)	5	27	49	71	93

Determine :

i) Sensitivity at 20°C and 30°C

ii) Zero drift per degree change in temperature

iii) Sensitivity drift change in temperature. 4

3. a) Suggest a sensor that could be used as part of a system to control the thickness of rolled sheet by monitoring its thickness as it emerges from rollers. The sheet is in continuous motion and measurement need to be made quickly to enable corrective action to be taken immediately. The measurement system has to supply an electrical signal.

Explain the construction and working of the sensor suggested. 8

b) A parallel plate capacitance transducer uses plate's area of 500 mm^2 that are separated by a distance of 0.2 mm.

i) Calculate the value of capacitance when the dielectric is air having a permittivity of 8.85×10^{-12} F/m.

ii) A linear displacement reduces the gap length to 0.18 mm. Calculate the change in capacitance.

iii) Calculate the ration of per unit in capacitance to per unit change in displacement. 4

c) What is a Proximity Switch ? Explain different types of Proximity Switches. List few advantages of Proximity Switches over Eltromechanical Switches. 6

OR

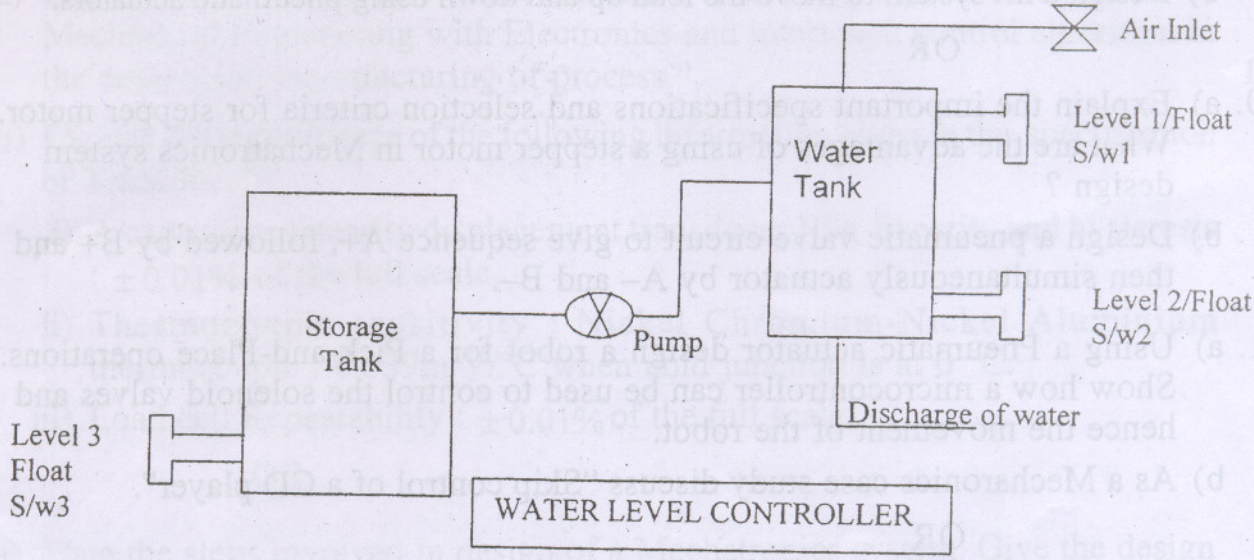
4. a) Suggest a sensor that could be used as a part of a control system to determine the difference in levels between the two containers. The output is to provide an electrical signal for the control system. Explain the construction and working of the sensor suggested. 8

b) Explain various elements used for pressure measurement. Compare their characteristics. 6

c) A platinum resistance temperature detector has a resistance of 100.00Ω at 0°C, 138.50Ω at 100°C and 175.83Ω at 200°C. What will be the non-linearity error in °C, if the detector is assumed to have a linear relationship between 0°C and 200°C ? 4

5. a) Design a complete measurement system involving the use of a thermocouple to determine the temperature of water in a boiler and give a visual indiction on a meter. The temperature will be in range 0°C to 100°C and is required to have an accuracy of ±1% of the full scale reading. Specify the materials to be used for the thermocouple and all other items necessary. In advocating your design you must consider the problem of cold junction and non-linearity. 8

b) Draw a ladder diagram for the diagram below. S/w1, S/w2, S/w3 are the level switches which controls the pump, so that the pump can start and stop automatically. 8



OR

6. a) Draw and explain the interfacing of 4*4 matrix keyboard to 8051 microcontroller. 6

b) State the different types of DAC and state their specifications. 4

c) Draw a ladder diagram for a timing circuit that will switch an output ON for 1 sec. then OFF for 20 sec., then ON for 1 sec. and then OFF for 20 sec. and so on. 6

SECTION – II

7. a) Explain Magnetic reordering technique. What is the drawback of this technique ? Which different encoding techniques are used to overcome the problems ? 8

   b) Write a short note on HART Protocol and state its advantages. 8

OR

8. a) Consider the requirement for a temperature measurement system for temperatures in the range of 0 °C to 1000 °C and which will give an 8-bit binary output with a change in 1 bit corresponding to a temperature change of 1 °C. The output is intended for inputting to a microcontroller as a part of a temperature control system. Design the system for the given specifications stated above which gives a binary output. 10

   b) Suggest a display unit that could be used to give :
   i) A permanent record of the output of thermocouple.
   ii) A display with enables the oil pressure in system to be observed.
   iii) A record to be kept of the digital output from a microprocessor. 6

9. a) Compare Hydraulic and Pneumatic systems. Give the design of a Hydraulic system. State the components and the different valves used in hydraulic systems. 12

   b) Design a lift system to move the load up and down using pneumatic actuators. 6

OR

10. a) Explain the important specifications and selection criteria for stepper motor. What are the advantages of using a stepper motor in Mechatronics system design ? 10

    b) Design a pneumatic valve circuit to give sequence A+, followed by B+ and then simultaneously actuator by A– and B–. 8

11. a) Using a Pneumatic actuator design a robot for a Pick-and-Place operations. Show how a microcontroller can be used to control the solenoid valves and hence the movement of the robot. 10

    b) As a Mecharonics case study discuss "Skip control of a CD player". 6

OR

12. a) Design a Mechatronics system for home appliances like Dishwasher. State the steps that might be present in sequential control of dishwasher. 8

    b) The system is designed to control the output water of a mixing valve fed by two reservoirs. Output temperature is measured by thermistor; voltage of thermistor signal conditioning circuit is utilized as analog input to data acquisition cards. The position of the valve is monitored by reading the voltage. The valve is controlled by 0.5 Volt output. Thermistor has 0-2.5 volts range. Design the system. 8