

Total No. of Questions : 6]

SEAT No. :

P5073

[Total No. of Pages : 2

**T.E./Insem.-621**  
**T.E. (E & TC) (Semester - I)**  
**DIGITAL COMMUNICATION**  
**(2015 Pattern)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Assume suitable data if necessary.*

**Q1) a)** Draw block diagram of PCM transmitter and explain its working. [6]

- b) A DM transmitter is designed to operate at 3 times Nyquist rate for a signal with 3 KHz bandwidth. Find the maximum amplitude of the 1KHz sinusoid to avoid slope overload if step size is 250 mV. [4]

OR

**Q2) a)** Draw block diagram of DM receiver and explain its working. [6]

- b) Find a signal  $g(t)$  which is band limited to 1Hz and its samples are  $g(0) = 1, g(\pm 0.5) = g(\pm 1) = g(\pm 1.5) = \dots = 0$ . [4]

**Q3) a)** Draw block diagram of T1 carrier system. [6]

- b) What absolute bandwidth is required to transmit an information rate of 8kbps using 64 level baseband signaling over a raised cosine channel with roll off factor of 40%. [4]

OR

**Q4) a)** What is scrambling? Why is its use? [4]

- b) Draw the line codes - Unipolar RZ, Polar NRZ, AMI, Manchester, Polar RZ and quaternary polar for the bit stream 10110100. [6]

**P.T.O.**

**Q5) a)** Define Random Process. Differentiate between random variable and random process. [6]

b) Find mean of a random process defined as  $x(t) = A \cos(2\pi f_c t + \phi)$  where  $\phi$  is a uniformly distributed over  $(0, 2\pi)$ . [4]

OR

**Q6) a)** What is Stationary Process? Explain. [6]

b) What is white noise? Explain. [4]



Total No. of Questions : 6]

SEAT No. :

P5074

[Total No. of Pages : 2

**T.E./Insem.-622**  
**T.E. (E & TC) (Semester - I)**  
**DIGITAL SIGNAL PROCESSING**  
**(2015 Pattern)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right indicate full marks.*
- 4) *All questions carry equal marks.*
- 5) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 6) *Assume suitable data if necessary.*

**Q1) a)** An analog signal is given by

$$x(t) = 3 \cos 100\pi t + 2 \sin 300\pi t - 4 \cos 100\pi t$$

- i) What is the Nyquist rate for this signal?
- ii) Write the equation of sampled signal.
- iii) If the signal is sampled at a rate of 200 sam/sec. What is the discrete time signal obtained after sampling.

[6]

b) Explain the basic elements of DSP system.

[4]

OR

**Q2) a)** Explain the concept of basis function and orthogonality. Check whether the functions given are orthogonal or not over a time interval [0, 1].

$$f(t) = 1; x(t) = \sqrt{3}(1 - 2t).$$

[6]

b) What are the advantages of digital signal processing over analog signal processing.

[4]

**P.T.O.**

**Q3) a)** Compute the DFT of following sequence

$$x(n) = \cos \frac{n\pi}{4} \quad n=0,1,2,3. \quad [4]$$

b) Given  $x(n)=[0 \ 1 \ 2 \ 3]$ , find  $x(k)$  using DIT FFT algorithm. [4]

c) How many computations are required to compute 16 point DFT using DFT & FFT algorithm. [2]

OR

**Q4) a)** Compute the circular convolution of following sequences [4]

$$x_1(n) = \{1 \ 1 \ 2 \ 2\} \quad x_2(n) = \{1 \ 2 \ 3 \ 4\} .$$

b) State and prove circular time shift property. [6]

**Q5) a)** State and prove the convolution property of Z-transform. [4]

b) Compute the Z-transform of following sequences [6]

i)  $x(n) = n u(n) .$

ii)  $x(n) = \left(\frac{1}{2}\right)^n u(n) + (3)^n u(-n-1) .$

OR

**Q6) a)** For [6]

$$X(z) = \frac{z}{3z^2 - 4z + 1}$$

Find  $x(n)$

if ROC is i)  $|z| > \frac{1}{3} .$

ii)  $|z| < 1 .$

iii)  $\frac{1}{3} < |z| < 1 .$

b) Explain the causality and stability of discrete time systems w.r.t. Z-transform. [4]



Total No. of Questions : 6]

SEAT No. :

P5075

[Total No. of Pages : 2

**T.E./Insem.-623**  
**T.E. (E & TC) (Semester - I)**  
**ELECTROMAGNETICS**  
**(2015 Pattern)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** A uniform line charge of  $4\mu\text{C}/\text{m}$  is located on the  $y$  axis. Find  $\vec{E}$  in Cartesian coordinates at  $P(3, 1, 2)$  if the charge extends from: **[6]**

- i)  $-\infty < y < \infty$ ,
- ii)  $-5 < y < 10$ .

b) Derive an expression for the potential difference  $V_{AB}$  between point  $A$  and  $B$ , in presence of an uniform line charge with charge density  $\rho_L$  lying on entire  $Z$ -axis ( $-\infty$  to  $\infty$ ). **[4]**

OR

**Q2) a)** Using Gauss's Law, derive an expression for electric field intensity ( $\vec{E}$ ) at point  $P$  in free space, due to infinite surface charge with charge density  $\rho_s$ , placed on entire  $Z = 0$  plane. Consider point  $P$  towards positive side of  $Z = 0$  plane. **[6]**

b) Four infinite uniform sheets of charge are located as follows  $20\text{pC}/\text{m}^2$  at  $y=7$ ,  $-8\text{pC}/\text{m}^2$  at  $y=3$ ,  $6\text{pC}/\text{m}^2$  at  $y=-1$  and  $-18\text{pC}/\text{m}^2$  at  $y=-4$ . Find  $\vec{E}$  at the point : **[4]**

- i)  $A(2, 6, -4)$ ,
- ii)  $B(0, 0, 0)$ ,
- iii)  $C(-1, -1.1, 5)$ .

**P.T.O.**

- Q3)** a) Derive electrostatic boundary conditions for the boundary between two perfect dielectric materials. [6]
- b) Let  $\epsilon_{r1} = 2.5$  for  $0 < y < 1$  mm,  $\epsilon_{r2} = 4$  for  $1 < y < 3$  mm, and  $\epsilon_{r3}$  for  $3 < y < 5$  mm. Conducting surfaces are present at  $y = 0$  and  $x = 5$ mm. Calculate the capacitance per square meter of surface area if : [4]
- $\epsilon_{r3}$  is that of air;
  - $\epsilon_{r3} = \epsilon_{r1}$ ;
  - $\epsilon_{r3} = \epsilon_{r2}$ ;
  - region 3 is silver.

OR

- Q4)** a) Derive an expression for energy stored in an electrostatic field in terms of  $\bar{D}$  &  $\bar{E}$ . [6]
- b) Two extensive homogeneous isotropic dielectrics meet on plane  $z = 0$ . For  $z > 0$ ,  $\epsilon_{r1} = 4$  and  $z < 0$ ,  $\epsilon_{r2} = 3$ . A uniform electric field  $\bar{E}_1 = 5\hat{a}_x - 2\hat{a}_y + 3\hat{a}_z$  kV / m exists for  $z \geq 0$ . [4]
- Find :
- $\bar{E}_2$  for  $z \leq 0$ ;
  - The angle which  $E_1$  makes with the interface;
  - The energy densitie (in  $J/m^3$ ) for  $z > 0$ .

- Q5)** a) i) Find  $\bar{H}$  in Cartesian components at P(2, 3, 4) if there is a current filament on the z axis carrying 8mA in the  $\bar{a}_z$  direction. [6]
- ii) Repeat if the filament is located at  $x = -1, y = 2$ . [6]
- b) Write Maxwell's equation in point form and integral form for static electric and steady magnetic fields. [4]

OR

- Q6)** a) Let  $\bar{H} = 15r\bar{a}_\phi$  mA / m .
- Determine current enclosed by the circular path  $r = 5, \theta = 25^\circ, 0 \leq \phi \leq 2\pi$  by using line integral side of Stokes theorem.
  - Determine current by surface integral side of Stokes theorem. [6]
- b) State and prove Ampere Circuital Law. [4]



Total No. of Questions : 6]

SEAT No. :

P5077

[Total No. of Pages : 2

**T.E./Insem.-625**  
**T.E. (E & TC)**  
**MECHATRONICS**  
**(2015 Pattern) (Semester - I)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Assume suitable data, if necessary.*

**Q1) a)** What is Conventional and Integrated approach in mechatronics design? **[5]**

b) Explain Audio CD Player control system as an example of Mechatronics systems. **[5]**

OR

**Q2) a)** Explain case study of Design of Coin Counter / Coin Separator as an example of mechatronics system. **[5]**

b) Sensitivity of a thermocouple is  $0.01 \text{ V/o}_c$ . Find output voltage if the temperature is  $200^\circ\text{C}$ . Also temperature for 3.5V output? **[5]**

**Q3) a)** What are the proximity sensors used in Industry? Explain photoelectric proximity sensors. **[5]**

b) Explain basic principle of working of ultrasonic transducer for flow measurement? What are its advantages and limitations? **[5]**

OR

**P.T.O.**

**Q4) a)** A resistance wire strain gauge with a GF of 2.0 is bonded to a steel structural member subjected to a stress of  $100 \text{ MN/m}^2$ . The modulus of elasticity of steel is  $200 \text{ GN/M}^2$ . Find the percentage change in the value of the gauge resistance, due to applied stress. Comment upon the results. **[5]**

b) Write a short note on Smart Sensors used in mechatronics applications? Explain it with schematic representation. **[5]**

**Q5) a)** Draw schematic of typical hydraulic system used in Mechatronics applications. **[4]**

b) Draw Schematic of hydraulic actuator systems. The hydraulic cylinder is of 1cm radius. Find the force exerted on the piston if the pressure is 200N. **[6]**

OR

**Q6) a)** Explain significance of hydraulic pumps in typical hydraulic systems. **[5]**

b) Draw schematic of filters and pressure regulator in hydraulic systems. **[5]**





Total No. of Questions : 6]

SEAT No. :

P5076

[Total No. of Pages : 2

**T.E./Insem.-624**  
**T.E. (E & TC) (Semester - I)**  
**MICROCONTROLLERS**  
**(2015 Pattern)**

*Time : 1 Hour]*

*[Max. Marks : 30*

*Instructions to the candidates:*

- 1) *Answer Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Figures to the right side indicate full marks.*
- 4) *Use of calculator is allowed.*
- 5) *Assume suitable data if necessary.*

**Q1) a)** Draw and explain the block diagram of 8051 in short. **[5]**

**b)** Explain following instructions with operation, addressing mode, no. of cycles and time required to execute the following instructions **[5]**

- i) DJNZ Rn, X,
- ii) MOVC A, @A+DPTR
- iii) DAA.

OR

**Q2) a)** Draw and explain in depth functional diagram of Timer/Counter. **[5]**

**b)** Write an ALP to transfer GOD continuously at the baud rate of 9600. **[5]**

**Q3) a)** Draw an interfacing diagram for 7-segment display connected to port 1 and write an ALP to display BCD counter. **[5]**

**b)** Draw and explain the block schematic of Logic analyzer. **[5]**

OR

**P.T.O.**

**Q4) a)** Draw an interfacing diagram of 4\*4 matrix keyboard and draw flowchart to detect key pressed. [5]

b) Draw an interfacing diagram for LCD and write an ALP to display GANESH on line 2 with default values. [5]

**Q5) a)** Draw an interfacing diagram of DAC and write an ALP to generate square of 2 KHz with delay using timer 1 in mode 0. [5]

b) Draw an interfacing diagram of Stepper motor and write an ALP to rotate it anticlockwise continuously. [5]

OR

**Q6) a)** Draw an interfacing diagram for Opto-isolator and write an ALP to flash lamp connected to it with delay of 10 msec. [5]

b) Draw a DAS to display the frequency of external signal on 7-segment display with LED indicator for highest value, Draw the flow chart. [5]

