KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 2nd Year 2nd Term Examination, 2018

Department of Electronics and Communication Engineering

ECE-2201

(Analog Communications)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Why is modulation necessary in communication systems? What will happen if modulation index is greater than one in amplitude modulation? (04+05)

   b) Prove that the sideband power in an AM wave is 1/3rd of the total power for 100% modulation. Calculate the sideband power in an AM wave for 50% modulation. (10+04)

   c) Draw an AM wave for 100% modulation of the modulating signal shown in figure 1(c). (05)

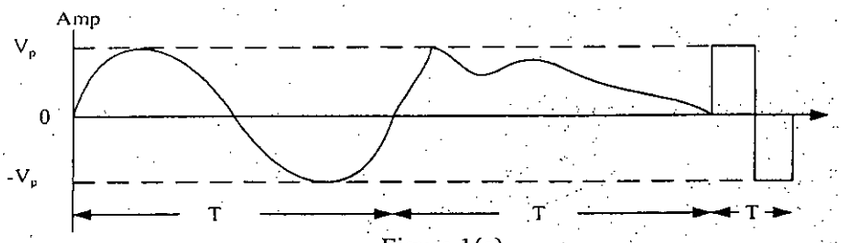

Figure 1(c).

   d) A 400W, 1MHz carrier is amplitude-modulated with a sinusoidal signal of 2500 Hz. The depth of modulation is 75%. Calculate the sideband frequencies, bandwidth, power in sidebands, and the total power in modulated wave. (07)

2. a) Draw the block diagram of a superhetrodyne radio receiver. What is the function of a local oscillator? How does a superhetrodyne radio receiver produce the intermediate frequency? (14)

   b) What is the main advantage of QAM? Explain the QAM transmitter and receiver with necessary block diagrams. (10)

   c) What is VSB? What are the advantages and disadvantages of VSB over SSB and DSB? Explain the VSB modulation using necessary diagrams. (11)

3. a) Prove that the bandwidth of FM wave is infinity. (08)

   b) What is meant by linear diode detection? Explain why the time constant RC of load circuit in linear diode detector cannot be kept too low or high. (15)

   c) Over an interval $|t| \le 1$, an angle modulated signal is given by $Q_{EM}(t) = 10\cos 13000t$. It is known that the carrier frequ $\omega_c = 10,000$. (12)

   (i) If this were a PM si with $k_p = 1000$, determine m(t) over the interval $|t| \le 1$.

   (ii) If this were a FM si with $k_f = 1000$, determine m(t) over the interval $|t| \le 1$.

4. a) Why Armstrong method is called indirect method? Explain the indirect method of Armstrong for FM. (09)

   b) What are the requirements for making stereophonic FM compatible with the monophonic FM? What are the function of Pre-emphasizer and De-emphasizer in FM stereophonic transmitter and receiver, respectively? (04+06)

   c) What are the requirements of commercial FM? (04)

   d) An angle modulated signal with carrier frequency $\omega_c = 2\pi \times 10^6$ is described by the equation $Q_{EM}(t) = 10\cos(\omega_c t + 0.1\sin 2000\pi t)$. (12)

   (i) Find the power of the modulated signal.

   (ii) Find the frequency deviation Δf and deviation ratio β.

   (iii) Estimate the bandwidth of $Q_{EM}(t)$.

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What are the sources of noise in typical communication systems? Explain flicker noise and shot noise using necessary diagrams. (10)

   b) Show that the noise figure of an amplifier is $F = 1 + \frac{N_{ao}}{N_{so}}$, where N_{ao} is the noise power at the output due solely to the amplifier, and N_{so} is the noise power at the output due solely to the source noise. (08)

   c) For the system configuration shown in figure 5(c), derive the *Noise Figure* if bandwidth, temperature, Boltzman constant and output power are denoted by δf ,T, K and P_{no}, respectively. (07)

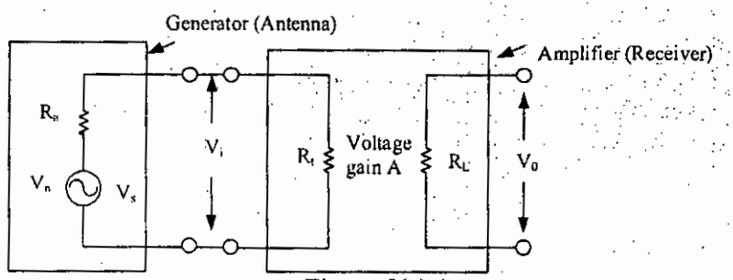

Figure 5(c).

   d) The front end of a radio receiver, having a bandwidth of 10 MHz and operating at a temperature of 27 ^{0}C, consists of an amplifier and mixer. The amplifier has a gain of 10, a 600 Ω input resistor, a 1600 Ω equivalent noise resistance and a 27 KΩ output resistor. For the mixer, these values are 25 KΩ, 81 KΩ, 10 KΩ and 1MΩ, respectively. (10)
   (i) Calculate the rms noise voltage.
   (ii) If it is driven by a generator whose output impedance is 50 Ω, calculate the noise figure of the radio receiver.

6. a) Explain the FDM technique. Why FDM is important for analog communication systems? (10)
   b) Deduce the Rayleigh energy theorem and from that obtain the ESD of any energy signal. (08)
   c) "The job of a limiter in FM demodulation is to suppress noise associated with amplitude variation"-Justify the statement. (08)
   d) Find output SNR of an FM Limiter-Discriminator demodulator when input signal strength is equal to 0.5 w, maximum frequency deviation 60 kHz, baseband signal cut-off frequency 15 kHz, received white Gaussian noise power spectral density 10^{-10} w/Hz and average power modulating signal 0.1 w. (09)

7. a) What is PSDF? Explain the PSDF of white signals. (06)
   b) What are differences between TDM and FDM? Draw the block diagram of digital hierarchy of T1 system, which is developed by Bell system. (11)
   c) Six independent message sources of bandwidth w, w, 2w, 2w, 3w and 3w Hz are to be transmitted on a TDM basis using a common communication channel. (i) Setup a scheme for accomplishing this multiplexing requirement, with each message signal sampled at its Nyquist rate, (ii) Determined the minimum transmission bandwidth of the channel. (10)
   d) Design an FDM system that can occupy 4 voice channels, each having 4 kHz of bandwidth. Show the configuration using frequency domain. Use (30 to50) kHz frequency space in the spectrum and also use guard bands of 1 kHz. (08)

8. a) Why are synchronizing pulses transmitted along with the picture signal? Draw the block diagram of a monochrome TV transmitter. (10)
   b) Justify the choice of rectangular frame with width to height ratio=4/3 for television transmission and reception. (07)
   c) What type of scanning is used in color TV system? Explain that the interlaced scanning reduces flicker and conserve bandwidth. (10)
   d) In the US NTSC system, the aspect ratio 4/3, the total number of line periods per frame is 525, and the number of suppressed lines is 40 per frame. Find the picture height and width in the number of pixels. Also find the number of pixel periods in a line period. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 2nd Year 2nd Term Examination, 2018

Department of Electronics and Communication Engineering

ECE-2205

(Electromagnetic Fields and Waves)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) What are the inadequacy of circuit-theory concepts and why we need electromagnetic field concept? Explain the physical significance of divergence in terms of electromagnetic field. (05+02)
   b) State Coulomb's law. Determine the electric field intensity due to a continuous distribution of charge with (i) surface charge density and (ii) line charge density. (10)
   c) Show that the electric field intensity inside a uniformly charged cloud is zero at it's centre and varies linearly upto the surface. (09)
   d) A negative point charge of magnitude ~~214C~~ 2 μC/214 μC/214 C is situated in air at origin and two positive point charges of 1μC each are at points y=±2 meters. Calculate the electric field strength and electric potential at a point 4 meters from the origin on the x axis. (09)

2. a) What is electrostatic energy? Derive an equation for electrostatic energy to assemble k charges one by one. (12)
   b) State the principle of ~~conversation~~ conservation of charge. Based on this principle, derive the continuity equation $\bar{\nabla}.\bar{J} = -\delta\rho_v/\delta t$, where the symbols have their usual meanings. Also, write down the physical significance of this equation. (10)
   c) A parallel plate capacitor consist of two plates with a separation d in between plates. The space between the conductors is filled with a dielectric of permittivity ε and the surface area of capacitor plates is A, determine the capacitance of this capacitor. (13)

3. a) Deduce Maxwell's equations from the four fundamental Governing equations of electrostatic and magnetostatic. (08)
   b) Write down the boundary equations for both electric field vectors and magnetic field vectors. Hence derive (i) boundary conditions between two lossless media and (ii) boundary conditions between a dielectric media and perfect conductor. (10)
   c) Starting from homogeneous wave equation, show that the scalar potential at a distance $\bar{R}$ from the surface at time t depends on the value of the charge density at an earlier time $\left(t - \bar{R}/u\right)$. (12)
   d) Write down the significance of Maxwell's equations. (05)

4. a) Define: (i) Critical frequency (ii) Maximum usable frequency (iii) Minimum usable frequency for radio wave propagation. (06)
   b) What are the different types of propagation of radio waves from the radiating antenna to the receiving antenna? Explain with their practical examples. (12)
   c) What is meant by virtual height in wave propagation? Why virtual height is used rather than actual height. (07)
   d) A high frequency radio link has to be established between two points at a distance of 250 km on earth's surface. Considering the ionospheric height to be 200 km and it's critical frequency 5 MHz, calculate the maximum usable frequency (MUF) for the given path. (10)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) State and explain Ampere's circuital law and Biot-Savart law. Also, compare the importances of these law's in determining magnetic flux density. (10)

   b) Write down the Lorentz's force equation. An infinite long, straight conductor with a circular cross section of radius b carries a steady current I. Determine magnetic flux density both inside and outside of the conductor. (02+11)

   c) Define following terms: (i) Magnetic field intensity (ii) Magnetization vector (iii) Magnetic dipole moment and (iv) Scalar magnetic potential. (12)

6. a) Find the magnetic flux density in figure 6(a) at a point P on the axis of a circular loop of radius 'b' that carries a direct current I. (10)

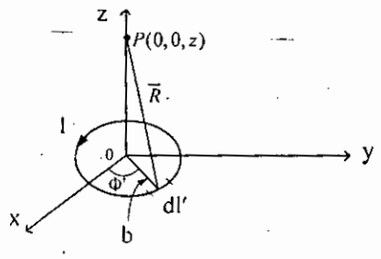

Figure 6(a)

   b) Show that the volume current density and surface current density are expressed as $\vec{J}_m = \vec{\nabla} \times \vec{M}\,(A/m^2)$ and $\vec{J}_{ms} = \vec{M} \times \vec{a}_n\,(A/m)$ respectively, where the symbols have their usual meanings in electromagnetics. (10)

   c) Demonstrate the analogous relation between the quantities in electrostatics and those in magnetostatics. Deduce the equation of energy stored in magnetic field. (04+06)

   d) In the figure 6(d) if $\mu_1 = 1$, $\mu_2 = 2.4$ and $\alpha_1 = 60^0$ then find α_2. (05)

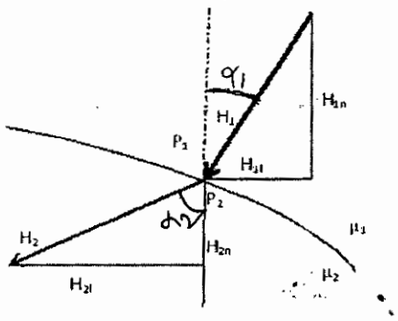

Figure 6(d)

7. a) Show that $\nabla^2 E - \frac{1}{C^2}\frac{\delta^2 E}{\delta t^2} = 0$ using Maxwell's equation. (08)

   b) "Superposition of two linearly polarized waves: one polarized in the x direction and the other in the y-direction and lagging 90^0 with different amplitude gives rise to elliptically polarized wave"-Justify the statement. (11)

   c) Write the form of Helmholtz's equation in long medias. (05)

   d) Investigate why there will be no dispersion when group velocity and phase velocity are equal. Prove that $\mu_g \mu_p = c^2$. (03+08)

8. a) The electric field intensity of a linearly polarized uniform plane wave propagating in the +z direction in seawater is $E_x = a_x 50\cos(10^5 \pi t)(v/m)$ at z=0. The constitutive parameter of seawater are $\varepsilon_r = 72$, $\mu_r = 1$ and $\sigma = 4(s/m)$. (a) Determine the attenuation constant, phase constant, intrinsic impedance, phase velocity, wavelength and skin depth (b) Find the distance at which amplitude of E is 1% of its value at z=0. (14)

   b) Define plasma frequency. Why standing wave is created when a plane electromagnetic wave incident normally on a plane conducting boundary. Explain it with necessary equation. (02+08)

   c) "Forces on current carrying conductor holds Newton's third law"-Identify whether the following statement is true or false and also explain the reason behind it with necessary equation. (11)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 2nd Year 2nd Term Examination, 2018

Department of Electronics and Communication Engineering

CSE 2209

(Data Structure and Algorithm)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in **Script A**)

1. a) Define linear data structure. Give some real life applications of it. (08)
   b) Consider a two dimensional array A[512] [512] and it is stored in row major order. (15)
      i) Find total number of element of this array.
      ii) Suppose base (A) =200, and W = 4 words per memory cell. Find location of A[29] [51].
   c) Apply Binary Search Algorithm for the following data elements to find item = 40: (12)
      22,11, 30, 55, 44, 40, 88, 60, 66
      [show the value of BEG, END, MID for each step]

2. a) Explain Postponed Decisions Problem with example. (08)
   b) What is Polish Notation? For which purpose it is needed? (05)
   c) Write an algorithm that can find the Fibonacci Sequence recursively. (10)
   d) Consider the following expression P:
      7*(27-15)/2+(18-9) (12)
      (i) Transform the expression into Postfix.
      (ii) Evaluate the Postfix expression.

3. a) Suppose you went to the Janata Bank to pay your Hall Dues. Which data structure they had followed to serve you. (06)
   b) Write down the algorithms to insert and delete item from Queue. (09)
   c) Consider following Queue of characters which is allowed in five memory cells. (20)

FRONT=2 REAR=3

	B	C		

Describe the Queue while the following operations take place successfully. Show the FRONT and REAR values for each operation.
(i) Insert D and then E.
(ii) Delete B and then C.
(iii) Insert F and then Delete D, E.
(iv) Delete F.

4. a) What is Garbage Collection? How does operating system manage it? (07)
   b) Write an algorithm to reverse a linked list. (10)
   c) Consider the following sorted Linked List: (18)

Address	1	2	3	4	5	6	7	8	9	10	11	12
Data	13	15		35	4	20		7		29	22	
Link	2	6	12	0	8	11	9	1	3	4	10	0

Apply the following operations so that list remains sorted. Show the table after each operation.
(i) Insert 2, 19, 40 into the list.
(ii) Delete 20, 35 from the list.

SECTION B

(Answer **ANY THREE** questions from this section in **Script B**)

5. a) Write comparisons between Complete Binary Tree and Extended Binary Tree. Draw Complete Binary Tree and Extended Binary Tree using list: 3, 17,5,4,3. (10)

b) In how many ways a binary tree can be represented in memory. Draw every representation of the following graph: (12)

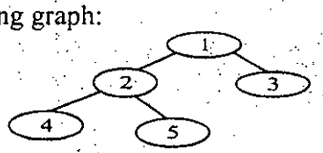

Fig. 5(b).

c) Suppose the following sequence lists the nodes of a binary tree T pre-order and in-order, respectively. (13)

Pre-order: G B Q A C K F P D E R H
In-order: Q B K C F A G P E D H R

Draw the diagrams of tree step by step.

6. a) "Searching in a Binary Search Tree is faster than Searching in a Linked List"-Justify the statement. (08)

b) What is heap? Differentiate between maxheap and minheap. (05)

c) Build a max heap step by step from the following list: 44,30,50, 22,60,55,77,55. (10)

d) Consider the following list: 14, 10, 17, 12, 10, 11, 20, 12, 18, 25, 20, 8, 22, 11, 23. Using the list show that for finding and deleting duplicate data from the list BST is faster than other algorithm. (12)

7. a) In how many ways can the graph be represented? Draw the sequential representation of the following graph: (08)

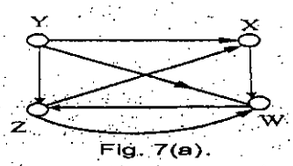

Fig. 7(a).

b) Find all pair shorted path using Warshall's algorithm for the following graph: (15)

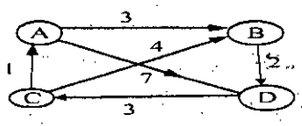

Fig. 7(b).

c) Apply BFS on the following graph: B is the source and I is the destination. (12)

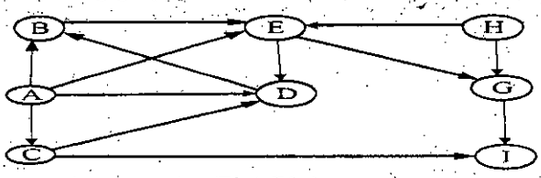

Fig. 7(c).

8. a) Apply Topological Sorting on the following graph: (12)

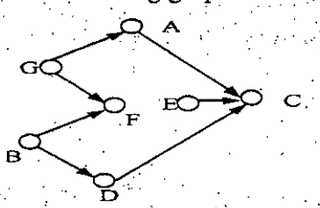

Fig. 8(a).

b) Apply Insertion Sort on the following data: 77,33,44,11,88,22,66,55. (10)

c) Apply Radix Sort on the following data: 348,143, 361, 423, 538, 128. (13)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 2nd Year 2nd Term Examination, 2018

Department of Electronics and Communication Engineering

EEE 2209

(Electrical Drives and Instrumentation)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in **Script A**)

1. a) "Rotary armature is the heart of the DC machines"-Justify the statement for DC generator and motor. Also write down the name of different parts of a DC machines with their functions. (11)
   b) Classify DC generator with their circuit diagram on the basis of field excitation. Also derive the EMF equation of a DC generator. (08)
   c) Why parallel operation of generator is necessary? How armature reaction could be reduced? Differentiate between generator and motor action. (08)
   d) A short-shunt compound generator delivers a load current of 25A at 25kw, and has armature, series-field and shunt-field resistance of 0.08Ω, 0.50Ω and 200Ω, respectively. Calculate the induced EMF and the armature current. Allow 0.5v per brush for contact drop. (08)

2. a) "Synchronous speed is achieved only for 3ψ supply"-Justify the statement. Write down the name of different parts of a synchronous generator with the advantages of stationary armature. (07)
   b) Describe the operating principle of induction motor. Write down some applications of induction motor. (10)
   c) Deduce the equation of EMF induced in transformer. What are the losses of transformer? (10)
   d) An 132-kvA distribution transformer has 550 turns on the primary and 110 turns on the secondary winding. The primary is connected to 11kv, 50Hz supply. Find the full-load primary and secondary currents, the RMS value of the secondary EMF and the average value of flux in the core. (08)

3. a) What are meant by equivalent resistance, reactance and impedance of a transformer? Draw the equivalent circuit of a transformer with referred to primary. (10)
   b) Classify universal motor? Write down some application of universal motor. (08)
   c) What are the different methods of speed control techniques of DC motor? Discuss flux control and armature control method. (09)
   d) What is slip? Draw the torque-slip curve of an induction motor. A 4-pole, 3ψ induction motor operates from a supply whose frequency is 50Hz. Calculate- (08)
      (i) The speed at which the magnetic field of the stator is rotating.
      (ii) The speed of the rotor when the slip is 0.03.
      (iii) The frequency of the motor currents when the slip is 0.04.
      (iv) The frequency of the rotor currents at stand still.

4. a) Why single-phase induction motor is not self-starting? What are the different methods by which we make the 1ψ-induction motor self-starting? Discuss them with neat sketch and vector diagram. (13)
   b) What is step angle? Classify stepper and servo motor? What are the main parts of a servo motor? (10)
   c) A transformer has a primary winding of 800 turns and a secondary winding of 200 turns. When the load current on the secondary is 80A at 0.8 power factor lagging, the primary current is 25A at 0.707 power factor lagging. Determine graphically or otherwise the no-load current of the transformer and its phase with respect to the voltage. (12)

SECTION B

(Answer **ANY THREE** questions from this section in **Script B**)

5. a) What is meant by measurements and instrumentation? Write down the applications of a measurement system. (10)

   b) Deduce the general equation of AC bridge network. How you could measure capacitance, inductance, and dissipation factor by using this principle. (10)

   c) Design and express the equation of a transducer which can convert thermal energy into electric potential. How many ways you can vary the design to obtain different voltages at the output. (10)

   d) How photovoltaic cell works? Explain with diagram. (05)

6. a) What is meant by transducer? Write down the advantages of electrical transducer. Also classify the resistive and reactive transducer. (10)

   b) Draw the block diagram of DC and AC signal conditioning system and write down the function of each block. Why signal conditioning is necessary? (12)

   c) What is piezo-electric crystal? Prove that the voltage sensitivity of a piezo-electric crystal is proportionally vary with electric field intensity while inversely vary with pressure. (13)

7. a) What is true value? A voltage has a true value of 1.50v. An analog indicating instrument with a scale range of 0-2.50v shows a voltage of 1.46v. What are the values of absolute error and correction? Express the error as a fraction of the true value and full scale deflection. (10)

   b) What is meant by PC based data acquisition system? Write down the block diagram of PC based data acquisition system with their functions. (10)

   c) Classify resistance. How transducer is used in communication systems? (10)

   d) A piezo-electric crystal having dimensions of 5mm x 5mm x 1.5mm and a voltage sensitivity of 0.055v-m/N is used for force measurement. Calculate the force if the voltage developed is 100v. (05)

8. a) Design a digital multimeter and explain how it works? Write down the function of spectrum analyzer. (10)

   b) How frequency is measured using Wien's Bridge and Lissajous pattern? (10)

   c) What is thermistor and thermocouples? Briefly explain with proper diagram. Also write down their advantages, disadvantages and applications. (10)

   d) Mention the differences between piezoelectric and photoelectric transducer. (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 2nd Year 2nd Term Examination, 2018

Department of Electronics and Communication Engineering

Math–2209

(Mathematics-IV)

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Necessary charts will be supplied.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) Describe and graph the locus represented by $|z-3|-|z+3|=4$ (08)

b) Is the function $f(z)=\dfrac{z^3+7}{(z^2-2z+2)(z-3)}$ analytic on the open disc $c:|z|<2$? Explain. (07)

c) Use the definition of limit $(\varepsilon-\delta)$ to show that $\lim\limits_{z\to i} f(z)=4+4i$ where $f(z)=\dfrac{3z^4-2z^3+8z^2-2z+5}{z-i}$. (10)

d) Expand $f(z)=\dfrac{z}{(z-1)(2-z)}$ in a Laurent Series valid for $0<|z-2|<1$ (10)

2. a) Verify whether the function $u(x,y)=2e^{-x}\cos y-2xy$ is harmonic and, if so, find the corresponding analytic function $f(z)$. Also hence find the harmonic conjugate of u. (14)

b) Evaluate $\int_C (\bar{z}-z^2)dz$, where C is the lower half of the circle $|z|=1$ in the positive sense. (08)

c) If $F(z_0)=\int_C \dfrac{2z^2-z-2}{z-z_0}dz$, where C is a positively oriented circle $|z|=4$, find $F'(-3i)$ using suitable theorem. What will be the value of F(5)? (13)

3. a) Expand $f(z)=\sin z$ in a Taylor series about $z=\pi/4$. (09)

b) Evaluate the following integrals using the method of contour integration: (26)

(i) $\int_0^{2\pi}\dfrac{\cos 3\theta}{5-4\cos\theta}d\theta$ (ii) $\int_0^{\infty}\dfrac{x^3\sin x}{(x^2+4)^2}dx$

4. a) Prove that $P_n(-x)=(-1)^n P_n(x)$ and hence show that $P_n(-1)=(-1)^n$. (08)

b) Express $f(x)=4x^3+6x^2+7x+2$ in terms of Legendre Polynomials. (10)

c) A string is stretched and fastened to two points l apart. The string is displaced, to give motion, in the form $u=a\sin\left(\dfrac{\pi x}{l}\right)$ from which it is released at time t=0. Show that the displacement of any point at a distance x from one end at time t is given by $u(x,t)=a\sin\left(\dfrac{\pi x}{l}\right)\cos\left(\dfrac{\pi ct}{l}\right)$. (17)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) Discuss the different types of frequency curves with examples. (12)

b) The frequency distribution of times between arriving teleport messages at the central processing unit of a time-sharing network is as follows: (13)

Table 5(b)

Time (millisecond)	Number of messages
0.0 -Under 5.0	152
5.0 -Under 10.0	84
10.0 -Under 15.0	56
15.0 -Under 20.0	31
20.0 -Under 25.0	14
25.0 -Under 30.0	6
30.0 -Under 35.0	2

(i) Plot the above as a histogram.
(ii) Construct a table showing the relative frequencies. Then find the cumulative relative frequencies for each class interval.
(iii) Plot the ogive using cumulative relative frequencies.

c) What is meant by Statistics? Why should the students need to study statistics? (10)

6. a) What is meant by central value and measures of central tendency? Mention the different types of measures of central tendency. (10)

b) Give the definition of the followings with examples: (i) The root mean square, (i) The median and (iii) The mode. (10)

c) An incomplete distribution of daily expenditure of some families is given below: (15)

Expenditure: 0-10 10-20 20-30 30-40 40-50
No. of families: 14 f_1 27 f_2 15.

If the median and mode for the distribution are Tk. 25 and Tk. 24 respectively, find the missing frequencies f_1 and f_2.

7. a) Let the continuous random variable X denotes the current measured in a thin copper wire in milliamperes. Assume that the range of X is [0, 20 mA], and the probability density function of X is $f(x)=0.05$ for $0 \le x \le 20$. Find the followings: (10)
(i) the probability that a current measurement is less than 10 millamperes.
(ii) The expected value of X.
(iii) The variance of X.

b) Mention the postulates of the probability. A person is looking for a new car. If the probabilities that she/he will buy a Chrysler, a Ford, or a Honda are 0.27, 0.25 and 0.08. What is the probability that she/he will buy one of the three? (10)

c) The mean grade on a final examination was 72 and the standard deviation was 9. The top 10% of the students are to receive A's. What is the minimum grade that a student must get in order to receive an A? (10)

d) If a bank receives on the average 20 bad checks per day, what is the probability that it will receive 6 bad checks on any given day? (05)

8. a) Solve the series, the equation $\frac{d^2y}{dx^2}+x(2x-1)\frac{dy}{dx}+y=0$. (15)

b) Derive the recurrence formula for $J_n(x)$: (08)
$xJ_{n+1}(x)-nJ_n(x)+xJ_n'(x)=0$.

c) The overall percentage of failures in a certain examination is 30. If 6 candidates appear in the examination, what is the probability that at least 5 candidates pass the examination? (12)