

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY  
B.Sc. Engineering 3rd Year 1st Term Examination, 2018  
Department of Electronics and Communication Engineering

ECE 3101  
(Industrial Electronics)

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 industrial electronics. Write down the normal operation of SCR. (06)  
b) "Thyristor is a latching device"-justify the statement. With the help of thyristor two-transistor model, explain how the regenerative action takes place. (14)  
c) What are the factors need to be considered in designing the thyristor gate control circuits? (08)  
d) For the SCR half wave controlled rectifier, show that the greater the firing angle, the smaller is the average current. (07)
2. a) Write short note on (i) GTO, (ii) DIAC and (iii) LASCR. (09)  
b) Draw a complete gate protection circuit for an SCR and write down the role of each component of that circuit. (07)  
c) What is PUT? Describe its operation with necessary waveforms. Also, write down the differences between PUT and UJT. (09)  
d) The SCR of figure 2(d) has gate trigger voltage  $V_T=0.7\text{V}$ , gate trigger current  $I_T=7\text{mA}$  and holding current  $I_H=6\text{mA}$ .  
(i) What is the output voltage when the SCR is off?  
(ii) What is the input voltage that triggers the SCR?  
(iii) If  $V_{cc}$  is decreased until the SCR opens, what is the value of  $V_{cc}$ ?

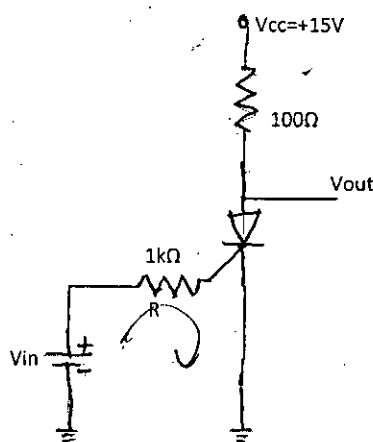


Figure 2(d)

3. a) Describe the principle of operation of step-down chopper with relevant circuits and waveforms for resistive load. (12)  
b) What are the advantages and disadvantages of a buck-boost regulation? (08)  
c) What is a switching-mode regulator? (05)

- d) A chopper is feeding an RL load as shown in fig 3(d) with  $V_s=220$  V,  $R=5\Omega$ ,  $L=7.5$  mH,  $f=1$  KHz,  $k=0.5$  and  $E=0$  V. Calculate  
 (i) The minimum instantaneous load current.  
 (ii) The maximum peak-to-peak load ripple current.

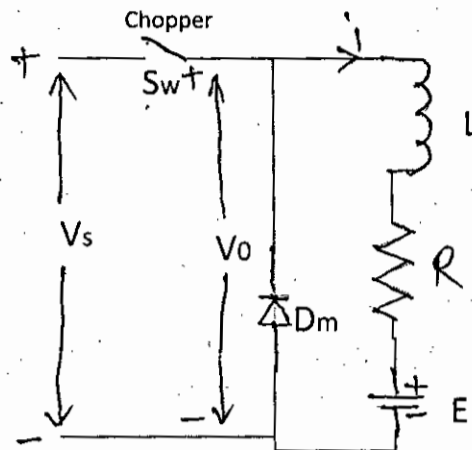


Figure 3(d)

4. a) How eddy current and skin effect are responsible for induction heating? (10)  
 b) What is an inverter? Write the applications of inverters. (07)  
 c) Draw the circuit diagram of three phase inverter formed by single-phase inverters. (09)  
 d) The single-phase half-bridge inverter in fig 4(d) has a resistive load of  $R=2.4\Omega$  and the dc input voltage is  $V_s=48$  V. Determine, (i) The output power, (ii) The average and peak currents of each transition. (09)

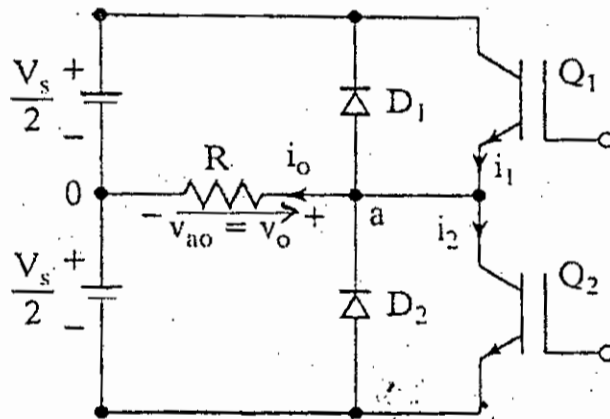


Figure 4(d)

## SECTION B

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

5. a) What are the merits and drawbacks of variable speed dc drives to ac drives? (08)  
 b) Draw the equivalent circuit of a series dc motor and derive expression for (i) armature voltage, (ii) developed torque, (iii) developed power and (iv) speed of the motor. (12)  
 c) Write down the function of free wheeling diode. (05)  
 d) A 15 kW, 200 V, 2000 rpm separately excited dc motor controls a load torque 50 N-m at 1500 rpm. The field circuit resistance is  $100\Omega$ , the armature circuit resistance is  $0.3\Omega$ . The voltage constant of the motor is 0.4 v/A rad-s. The field voltage is 200 V. Calculate the values of (i) Back emf; (ii) rated armature current of the motor; and (iii) required armature voltage. Neglect the effect of viscous friction and no-load losses. Assume the armature current to be continuous and ripple free. (10)
6. a) With the help of necessary diagrams, describe the principle of "Four Quadrants" operation of dc motor drives for variable speed applications. (11)

- b) Describe the principle of regenerative break control and derive the equation for minimum and maximum speed dc separately excited motors. (12)
- c) Describe the working principle of a single phase full converter drive for a separately excited dc motor and also draw the waveform of typical voltages and currents. (12)
- // a) Illustrate the equation of developed torque for an induction motor and using this equation find the relation between torque and slip. (17)
- b) Draw the necessary waveforms for speed control of a dc motor by a three phase semiconductor system for the firing angle,  $\alpha=90^\circ$ . (10)
- c) Classify synchronous motor drives. (08)
8. a) Draw the block diagram of vector control method of induction motor and explain its principle in brief. (15)
- b) Briefly explain static Kramer drive and static Scherbius drive. (10)
- c) A dc separately excited motor is powered by a dc chopper as shown in fig 8(d) from a 600 V dc source. The armature resistance  $R_a=0.05\Omega$ . The back emf constant of motor is  $K_v=1.527$  v/A-rad/s. The average armature current is  $I_a=250$ A. The field current is  $I_f=2.5$ A. The armature current is continuous and has negligible ripple. If the duty cycle of the chopper is 60%, determine (i) the input power from the source; (ii) the motor speed and (iii) the developed torque. (10)

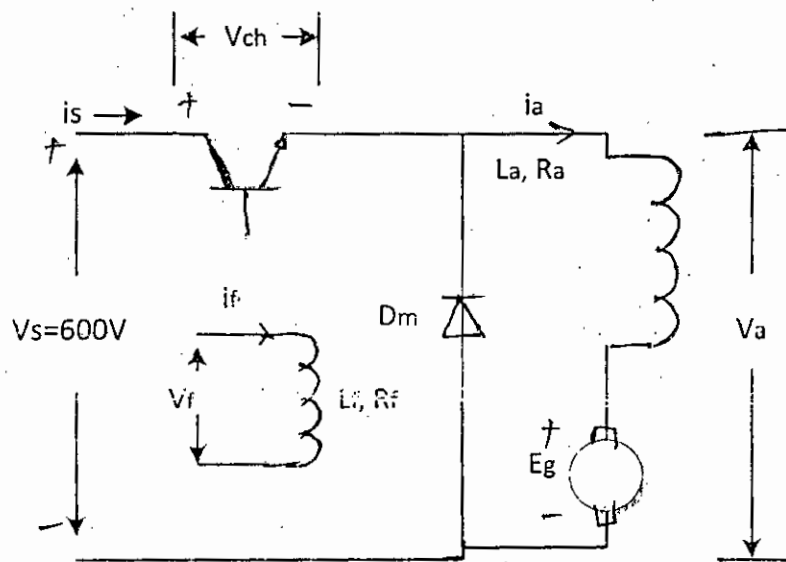


Figure 8(d)



# KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3<sup>rd</sup> year 1<sup>st</sup> Term Examination, 2018

Department of Electronics and Communication Engineering

ECE 3103

(Microprocessors & Microcomputers)

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) Table of MOD and R/M bit patterns for 8086 will be supplied if necessary

## SECTION A

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

1. a) Describe the purpose of using system tools of i) Assemblers, ii) Debuggers, and iii) Linkers. What is the advantage of using assembly language instead of writing a program directly in machine language? (09)
- b) Given the register contents in Fig. 1(b), illustrate the operation and results of each of the following instructions: (10)
  - i) MOV BX, 201AH
  - ii) MOV AL, [BX]
  - iii) SUB AL, CL
  - iv) JNC BX
  - v) MOV [BX], AL

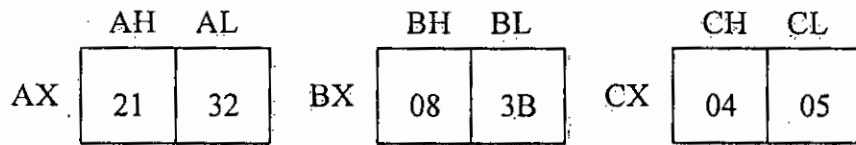


Fig. 1 (b): Register contents.

- c) Discuss the function of Intel 8086 microprocessor's i) Segment register, ii) Instruction pointer, and iii) Stack pointer. (12)
  - d) Describe the function of EQU, DB, DW, and DD directives. (04)
2. a) Discuss the various instruction groups for Intel 8086 microprocessor with appropriate examples. (10)
  - b) Write the 8086 instruction which will perform the following operations: (05)
    - i) Copy AL to BL, ii) Load 43H into CL, iii) Add 07H to DL, iv) Multiplying AL times BL, v) Copy AX to a memory location at offset 2454H in the data segment.
  - c) Construct the binary code for each of the following 8086 instructions. (12)
    - i) MOV DX, 4527H [BX], ii) MOV [BX] [SI], DX, iii) MOV CX, 43H [BX], iv) MOV CL, [BX].
  - d) Explain the master and slave mode operations of DMA with suitable chip and circuit diagrams. (08)
3. a) Discuss about the 8086 stack. Use a stack map to show the effect of each of the following instructions on the stack pointer (SP) and on the contents of the stack [see Fig. 3(a)]. What effect would it have on the execution of this program if the POPF instruction in the procedure was accidentally left out? (10)

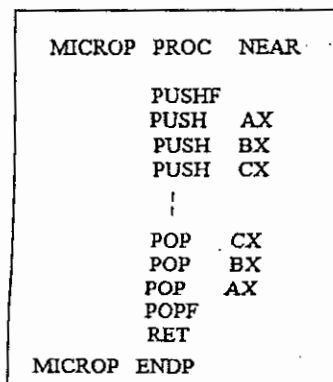


Fig. 3(a)

- b) Convert  $(-96.27)_{10}$  to IEEE single precision and double precision floating point formats. (10)
- c) What do you understand by interruption pointer and type of an interruption? Write down the priority table of Intel 8086 interrupts. Draw the interrupt vector table of Intel 8086. (15)
4. a) Classify interrupt in 8086 microprocessor. Discuss briefly about the Type 3 and Type 1 interrupt. (09)
- b) Why writing and using procedures is memory? Discuss the role of PUSH and POP instructions. (09)
- c) How does the 8086 processor respond to an interrupt request? Calculate the starting address of Interrupt services routing for type 33 interrupt in interrupt vector table. (07)
- d) Draw the interconnection of Intel 8086 microprocessor and the Intel 8087 math coprocessor. Mention the role of  $\overline{\text{TEST}}$ ,  $\overline{\text{LOCK}}$ , and  $\overline{\text{BHE}}/S7$  pins of the connection. (10)

### SECTION B

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

5. a) What is a microprocessor? What is the difference between a microprocessor and CPU? (08)
- b) What is interfacing? Describe the common methods of parallel data transferring. (12)
- c) Determine the control word for the following configuration of the ports of Intel 8255. (10)  
Port A: Output and Mode 1, Port B: Input and Mode 0  
Port  $C_L$  : Output and Port  $C_u$  : Input (05)
- d) Determine the control word to reset  $PC_2$ . (05)
6. a) Draw the functional block diagram of Intel 8254. And what are the modes of Intel 8254? (8+5)
- b) Briefly describe the software triggered strobe and hardware triggered strobe modes of 8254. (13)
- c) Briefly explain the following priority modes of Intel 8259. (09)  
i) Fully Nested Mode, ii) Automatic Rotation Mode, and iii) Specific Rotation Mode.
7. a) Why do we need to cascade interrupt controllers? Briefly explain the function of IRR, ISR and INR in 8259. (4+6)
- b) What is co-processor? Compare the basic features of Intel 80186, 80286, 80386 and Intel 80486. (3+12)
- c) What is hyper-threading technology? What new instructions appear in the Pentium III microprocessors that do not appear in the Pentium Pro counterpart? (10)
8. a) What are linker and loader? What are the functions of linker and loader? (4+6)
- b) Write the algorithm for an absolute loader. (08)
- c) Why the body of Macro has no level? Explain it with example code. (07)
- d) A microprocessor uses RAM chips of 1024x1 capacity. (10)  
i) How many chips are needed and how should their address lines be connected to provide a memory capacity of 1024 bytes?  
ii) How many chips are needed to provide a memory capacity of 16 Kbytes? Explain in words how the chips are to be connected to the address bus.

# KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3<sup>rd</sup> year 1<sup>st</sup> Term Examination, 2018

Department of Electronics and Communication Engineering

ECE 3105

(Microwave Engineering)

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) Smith Chart will be supplied if necessary

## SECTION A

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

1. a) Write down the basic principles of transmission line and draw its equivalent circuit. (6+4)  
b) "An infinite line is equivalent to a finite line terminated in its characteristic impedance"-Justify the statement. (10)  
c) Define low loss line and distortion less line. (06)  
d) What do you mean by characteristics impedance? Show that the characteristics impedance of the transmission line is given by  $Z_o = \frac{R + j\omega L}{r} = \sqrt{\frac{R + j\omega L}{G + j\omega C}}$ , where the symbols have their usual meanings. (09)
2. a) Derive an equation of input impedance. Hence extend your answer for the i) open circuit case, and ii) short circuit case. (14)  
b) A  $50\Omega$  line is connected to  $Z_L = 35 - j47.5\Omega$ . Using Smith Chart, find the position of the short circuited stub required to match the line. (14)  
c) What are the functions of Smith Chart? Why is short circuited stub preferred than an open circuited stub? (07)
3. a) Establish the relationship between transmission coefficient and reflection coefficient for any segment of a line terminated by an impedance  $Z_L$ . (08)  
b) Derive the expression of cut off frequency of TE<sub>n</sub> mode and also find the wave impedance of that mode for parallel plate waveguide. (15)  
c) What is TE, TM and TEM waves? "TEM mode does not exist in rectangular waveguide"-Justify the statement. (12)
4. a) Define propagating wave and classify them in a uniform waveguide. (08)  
b) What do you mean by dominant mode? Find the dominant mode for the parallel plate waveguide characterized by TM waves. (12)  
c) A TE<sub>10</sub> wave at 10 GHz propagates in a brass ( $\sigma_c = 1.57 \times 10^7 \text{ s/m}$ ) rectangular waveguide with inner dimensions  $a=1.5\text{cm}$  and  $b=0.6\text{cm}$ , which is filled with polyethylene ( $\epsilon_r = 2.25, \mu_r = 1, \text{ loss tangent} = 4 \times 10^{-4}$ ). Determine: i) the phase constant, ii) the guide wavelength, iii) the phase velocity, iv) the wave impedance, and v) the attenuation constant due to loss in the dielectric. (15)

## SECTION B

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

5.
  - a) Define crossed field type tube. Write down the fundamental differences between microwave tubes and conventional electronic vacuum tubes. (4+5)
  - b) How the bandwidth of Klystron tube can be improved? Explain with suitable diagram. (08)
  - c) Write down the assumptions for calculating the RF power of Reflex Klystron oscillator. (08)
  - d) Draw the circuit diagram of two cavity Klystron amplifier and its applegate diagram. (5+5)
6.
  - a) Classify the different types of TWTA and write down its application. (08)
  - b) Explain the features of slow wave structure. (07)
  - c) Describe the operation mechanism of TWTA with its suitable figure. (4+8)
  - d) A helix TWT operates at 4 GHz under a beam voltage 10 kv and beam current 500 mA. If the helix impedance is  $25 \Omega$  and the interaction length is 20 cm, find the output power gain in dB. (08)
7.
  - a) What is transponder? Draw the block diagram of a transponder. (2+5)
  - b) Write down the characteristics of avalanche transit time devices and classify them. (06)
  - c) Describe the electron trajectory of magnetron oscillator and find out the value of Hull cut-off magnetic voltage of magnetron oscillator. (13)
  - d) A pulsed cylindrical magnetron is operated with the following parameters: Anode voltage=25kv, Beam current=25A, Magnetic density=0.34 wb/m<sup>2</sup>, Radius of cathode cylinder=5cm, Radius of anode cylinder=10cm. Calculate: (i) the angular frequency, (ii) the cut-off voltage, and (iii) the cut-off magnetic density. (09)
8.
  - a) How does the EM radiation cause damage of biological substances? How can we protect ourselves from such radiation hazards? (10)
  - b) Write down five importance differences between tunnel diode and conventional p-n diode. (07)
  - c) Define fading and classify them. Describe the causes of attenuation for atmospheric multipath fading. (5+5)
  - d) Describe the mechanism of microwave heating system. (08)



KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY (KUET)  
B.Sc. Engineering 3<sup>rd</sup> Year 1<sup>st</sup> Term Examination, 2018  
Department of Electronics and Communication Engineering

Hum-3109  
(Government and Sociology)

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 is state and government? What are the functions of a modern welfare state? (15)  
b) Critically describe the scope of politics with example from your own context. (10)  
c) What are the relationship between politics and sociology? (10)
  
2. a) Describe the various forms of government. Which of them do you like best? Give reason. (20)  
b) What is meant by local self-government? Critically describe the functions of local self-government. (15)
  
3. a) What is meant by public opinion? Why public opinion is important for democratic government? (15)  
b) Describe the agencies which mould public opinion in modern times. (10)  
c) What are the hindrances in the way of good citizen? How can the citizenship be acquired and lost? (10)
  
4. a) What is feudalism? Describe the political importance of feudalism. (10)  
b) Discuss the organization, power and function of General Assembly. (20)  
c) What is VETO power? (05)

## SECTION B

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

5. a) Sociology is “the science of social institution”-explain the statement in the light of your own society. (10)
- b) Do you think that culture and civilization are the part of sociology? Discuss why? (15)
- c) Discuss contribution of Auguste Comte behind establishment of sociology as a specialized science. (10)
6. a) Do you think the study of sociology is important for the students of ECE? Give reason in favor of your answer. (15)
- b) What is sociological perspective? Discuss key sociological perspective with example from Bangladesh. (20)
7. a) What is meant by Society? Explain characteristics of evolutionary phases of society. (15)
- b) Why are human society stratified? (10)
- c) What is social structure? Critically discuss elements of social structure of Bangladesh. (10)
8. a) Define and explain ‘cultural lag’ in the light of South-Asian society. (10)
- b) What are the bases of human behavior? (10)
- c) What do you mean by culture? Explain elements of culture described by H. M. Johnson. (15)

# KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3<sup>rd</sup> Year 1<sup>st</sup> Term Examination, 2018

Department of Electronics and Communication Engineering

ECE 3109

(Numerical Analysis)

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 the study of numerical analysis important to engineering students? Also mention some limitations of numerical analysis. (08)  
b) Show that the fixed point method is linearly convergent. (10)  
c) Determine the roots of equations (13)

$$x^2 + xy = 6$$

$$x^2 - y^2 = 3$$

using the Newton-Raphson method. Assume the initial guesses  $x_0 = 1$  and  $y_0 = 1$ .

- d) What is meant by numerical instability? (04)
2. a) Write down the taxonomy of errors in numerical computing. How can the total error be minimized? (06+05)  
b) Explain the theoretical concept of Newton-Raphson method and hence mention its strength and weakness. (09)  
c) Given the following set of data points, obtain the table of divided differences. Use the table to estimate the value of  $f(1.5)$ . (15)

$i$	0	1	2	3	4
$x_i$	1	2	3	4	5
$f(x_i)$	0	7	26	63	124

3. a) What are the key steps for finding optimal solution based on the minimum sum of squared principle? Why optimal solution is essential for engineering applications? (06+06)  
b) What are the advantages of secant method? Show that the convergence of secant method is superlinear. (11)  
c) The temperature of a metal strip was measured at various time intervals during heating and the values are given in the table below: (12)

Time, $t$ (min)	1	2	3	4
Temp, $T$ ( $^{\circ}$ C)	70	83	100	124

If the relationship between the temperature  $T$  and time  $t$  is of the form  $T = be^{t/4} + a$ . Estimate the temperature at  $t=6$  min.

4. a) Why numerical integration is used in communication engineering? Show that Simpson's one-third rule is exact up to degree 3. (05+07)  
b) How can we improve the accuracy of numerical integration process? (08)  
c) The vertical distance in meters covered by a rocket from  $t=8$  to  $t=30$  seconds is given (15)  
by  $s = \int_8^{30} \left( 2000 \ln \left[ \frac{140000}{140000 - 2100t} \right] - 9.8t \right) dt$ , using Simpson 1/3 rule (with  $n_1=4$ ) and Simpson 3/8 rule (with  $n_2=3$ ) to find the approximate values of the integral.

## SECTION B

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

5. a) What are ill-conditioned systems? Discuss on the problems associated with the (09)

- solution of ill-conditioned systems and mention suitable approach for them.
- b) Write down the basic difference between Gauss elimination and Gauss-Jordan (10) methods. Also compare the computational requirements for them.
- c) An electrical system is shown in Fig 5(c). Determine the loop current using LU (16) decomposition method.

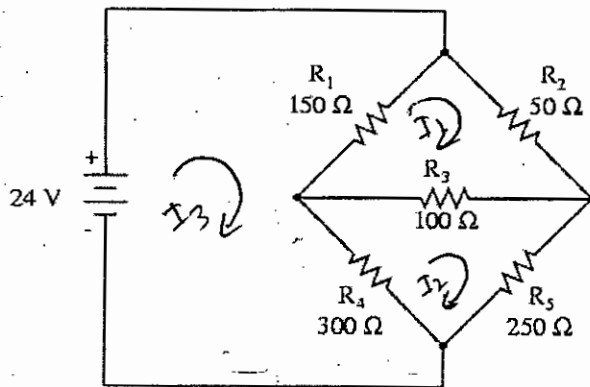


Figure 5(c)

6. a) Temperature distribution in an IC under specific boundary conditions can be (10)  

$$2T_1 - T_2 + 2T_3 = 6$$
simplified to linear system as:  $2T_1 - T_2 + T_3 = 3$  .  

$$T_1 + 3T_2 - T_3 = 4$$

Find the temperature  $T_1$ ,  $T_2$ , and  $T_3$  using Gauss-Seidel method.

- b) Explain the theoretical background of Heun's method using necessary diagrams and (10) hence estimate  $y(1.25)$  for the equation  $y'(x) = \frac{2y}{x}$  with  $y(1) = 2$  and  $h=0.25$ .
- c) Show that for a two equation system (10)

$$a_{11}x_1 + a_{12}x_2 = b_1$$

$$a_{21}x_1 + a_{22}x_2 = b_2$$

A sufficient condition for convergence of the iteration process is

$$\left| \frac{a_{12}a_{21}}{a_{11}a_{22}} \right| < 1.$$

- d) State the predictor correction formulae used in Adams-Bashforth-Moulton method. (05)

7. a) The distance travelled by a vehicle at various points in time are given as follows: (08)

Time (s)	0	2	4	6	8	10	12	14	16
Distance (km)	0	0.25	1	2.2	4	6.5	8.5	11	13

Estimate the velocity and acceleration at  $T=10s$ .

- b) A high-order differential equation can be solved by replacing it by a system of first-order equations. Discuss. (10)
- c) What are the applications of singular value decomposition (SVD) method in ECE? (13) Decompose the following matrix using SVD concept.

$$A = \begin{bmatrix} 1 & 2 & 1 \\ 2 & 3 & 2 \\ 1 & 2 & 1 \end{bmatrix}$$

- d) How does the SVD determine the singularity of a matrix? (04)

8. a) Briefly explain some real life problems which can be modeled by partial differential equations. (08)
- b) How does Poisson's equation differ from Laplace equation? Consider a steel plate of size  $20 \text{ cm} \times 20 \text{ cm}$  with two connected sides at  $100^\circ\text{C}$  and other two connected sides at  $0^\circ\text{C}$ . Find the relationship among the temperatures at interior points assuming grid size of  $5 \text{ cm} \times 5 \text{ cm}$ . (09)
- c) Why is crank-Nicholson method used for? Discuss the impact of size of incremental width  $\Delta T$  for the time variable  $t$  on the solution of wave equation. (07)
- d) What are the main advantages of finite element method (FEM)? Explain the key steps of FEM. (11)