

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd year 1st Term Examination, 2016
Department of Electronics & 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) What is power electronics? Why the study of industrial electronics is necessary for the students of ECE department? 08
b) Describe different ON and OFF methods for an SCR. Indicate which of them are used for general SCR. 12
c) What are the purposes of di/dt and dv/dt protection of an SCR. 10
d) Compare the operation of a triac and the anti-parallel connection of an SCR. 05
2. a) What are the different isolation circuits used to protect the Thyristors? Explain them briefly. 11
b) Explain the operation and mathematical model of a step up chopper. 12
c) Design the triggering circuit of the following figure. The parameters of PUT are, $V_s = 30$ V and $I_g = 1$ mA. The frequency of oscillation is $f = 60$ Hz. The pulse width is $t_g = 50$ μ s and the peak triggering voltage is $V_k = 10$ V. 12

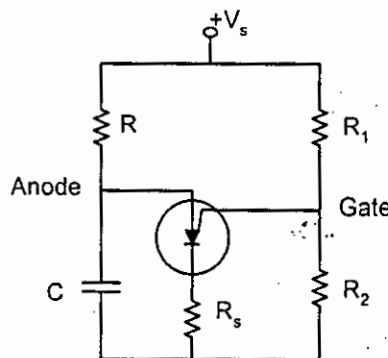


Fig. for Q 2(c)

3. a) How to make a 3- ϕ inverter with three 1- ϕ half-bridge inverters? Show with schematic diagram and circuit diagram. 10
b) Construct a 3- ϕ inverter with six transistors and six diodes where each transistor conducts 120° . Also find the expression for line voltages and phase voltages. 16
c) What are the different voltage control techniques of 1- ϕ inverters? Explain. 09
4. a) Explain the blocking and on-state operations of an IGBT. What is latch-up in IGBT? 10
b) How skin effect becomes responsible for the induction heating. 05
c) Distinguish the properties of dielectric and induction heating. 10
d) A slab of insulating material 0.025 m² in area, 0.01 m in thickness having relative permittivity of 5, and power factor of 0.05, is to be heated by dielectric heating. The power required at 30 MHz is 400 W. Determine the voltage required and the resulting current that will flow through the material. 10

SECTION B

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

5. a) What is meant by motor drives? Note down the applications of 1- ϕ and 3- ϕ ac drives. 10
b) Draw the waveshapes for speed control of dc motor drives for variable speed applications. 15
c) Derive equation of developed torque in case of salient pole motor. 10
6. a) Draw the equivalent circuit of single phase full converter drive with respective voltage-current waveform. Also prove that the rms output voltage of this drive is same as supply voltage. 14
b) Draw the necessary waveforms for speed control of a dc motor by a three phase semiconverter system for $\alpha = \pi/2$. 11
c) The speed of a 20 hp 300 V 900 rpm separately excited dc motor is controlled by a three phase full converter. The field circuit is also controlled by a three phase full converter. The ac input to the armature and field converter is three phase, Y-connected, 208 V, 60 Hz. The armature resistance is $R_a = 0.25 \Omega$, the field circuit resistance $R_f = 145 \Omega$ and the motor voltage constant is $k_v = 1.2 \text{ V/A-rad/s}$. the viscous friction and no load losses can be considered negligible. 10
i) If the free converter is operated at the maximum field current and the torque is $T_d = 116 \text{ N-m}$ at 900 rpm, determine the delay angle of the armature converter α_a .
ii) If the field circuit converter is set for the maximum field current, the torque $T_d = 116 \text{ N-m}$ and $\alpha_a = 0$, determine the speed of the motor.
7. a) Describe the principles of vector control of an induction motor with necessary block diagram. 10
b) Illustrate the equation of developed torque for an induction motor and using this equation find the relation between torque and slip. 17
c) Classify the synchronous motor drives. 08
8. a) Explain the principle of regenerative brake control of chopper fed dc drive and find the range of braking speed. 10
b) A 1- ϕ ac voltage controller has a resistive load of $R = 10 \Omega$ and the input voltage is $V_s = 120 \text{ V}$, 60 Hz. The delay angle of thyristors T_1 is $\alpha = \pi/2$. Determine (i) the rms value of output voltage V_0 , (ii) the input PF, and (iii) the average input current. 12
c) How can you control the voltage of rotor of an induction motor drive? Explain the procedures. 13

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd year 1st Term Examination, 2016
 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.

SECTION A

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

1. a) Describe the purpose of using system tools of editors, assemblers, linkers, locators, and debuggers in assembly language. 10
 b) How can four 64 Kbyte segments be positioned within 1 Mbyte address range? Explain in brief. 06
 c) Given the register contents in figure 1(c), illustrate the operation and results of each of the following instructions: 08
- i) ROR BX, CL
 - ii) DIV BL
 - iii) SUB AX, DX
 - iv) AND AL, CH

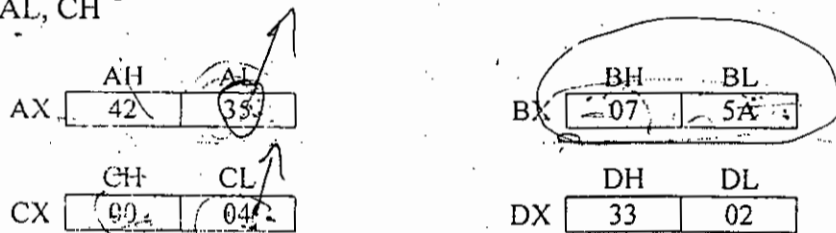


Fig. 1(c): Register contents.

- d) Suppose that $DS = 0200H$, $BX = 0300H$, $SI = 0100H$, and $DI = 0400H$. Determine the memory address accessed by each of the following instructions, assuming real mode operation. 11
- i) $MOV AL, [1234H]$
 - ii) $MOV [DI + 100H], AX$
 - iii) $MOV AX, [BX + SI + 100H]$

Also mention the corresponding addressing modes for each instruction.

2. a) Convert $(-152.75)_{10}$ to IEEE single precision and double precision floating point formats. 10
 b) Write a program in assembly language instructions to determine the resonant frequency of an LC circuit given by $f_r = \frac{1}{2\pi\sqrt{LC}}$. 07
 c) What are the corresponding math coprocessor instructions to calculate the following mathematical operations? 06
- i) $\tan \theta$
 - ii) $2^x - 1$
 - iii) $y \log_2(x+1)$
- d) What is the necessity of DMA? Explain the master and slave mode operations of DMA with suitable chip and circuit diagrams. 12
3. a) What is pipelining? What are the advantages of using the queue in Intel 8086 microprocessor? 09
 b) 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(b)]. What effect would it have on the execution of this program if the POPF instruction in the procedure was accidentally left out? 10

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MOV SP, 4000H
PUSH AX
CALL MULT0
POP AX

MULT0: PROC NEAR
PUSHF
PUSH BX

POP BX
POP F
RET

MULT0: ENDP

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Fig. 3(b)

- c) Discuss the function of segment register, instruction pointer, and stack pointer in Intel 8086? What physical address is represented by i) 4370:561EH and ii) 7A32:0028H? 08
- d) What do you understand by reentrant and recursive procedures? Discuss the role of CALL and RET instructions in writing and using procedures. 08
4. a) Write down the priorities of interrupts of Intel 8086. 05
- b) How does the 8086 processor respond to an interrupt request? Calculate the starting address of Interrupt Service Routine for type 33 interrupt in interrupt vector table. 06
- c) Define interrupt pointer and interrupt pointer table. Discuss briefly about type 0, 1, 2, 3, 4 interrupts. 10
- d) Mention the role of $\overline{\text{TEST}}$, $\overline{\text{LOCK}}$, and $\overline{\text{BHE/S}_7}$ pins of 8086 or 8087. 06
- e) How the execution of math instructions of Intel 80486 has been 3 times faster as compared to an 80386 microprocessor and 80387 co-processor combinations? Explain in brief. 08

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? 06
- b) What is Von Neumann architecture of a digital computer? 06
- c) What is virtual memory? Show that the virtual memory capacity of Intel 80486 is 64 TB. 08
- d) What is meant by tristate devices? Explain why tristate logic is critical for proper functioning of microcomputer. 07
- e) What are the differences between RAM and ROM? If the memory chip size is 2048×8 bits, how many chips are required to make up 16 Kbyte memory? 08
6. a) What are transputers? What are their important features? 07
- b) Draw the block diagram of Intel 8254 programmable interval timer. Briefly explain the different operating modes of Intel 8254. 12
- c) Briefly explain the following priority modes of Intel 8259.
i) Fully Nested Mode ii) Automatic Rotation Mode iii) Specific Rotation Mode 06
- d) Illustrate the bus timing diagram to execute the machine code MVIA, 32H where the hex code for MVIA is 3EH. The memory locations where the codes are stored are 2000H and 2001H. Calculate also the time required to execute the Opcode Fetch, the memory read cycles and the entire instruction cycle if the clock frequency is 2 MHz. 10
7. a) What do you mean by I/O mapped I/O and memory mapped I/O? Write down the advantages and disadvantages of them? 10
- b) The figure shows an interfacing circuit using the 8255 in model. Port A is designed as the input port for a keyboard with interrupt I/O, and port B is designed as the 25

output port for a printer with status check I/O.

- i) Find the port address by analyzing the decode logic.
- ii) Determine the control word to set up port A as input and port B as output in model.
- iii) Determine the BSR word to enable INTE_A (port A).
- iv) Determine the masking byte to verify $\overline{\text{OBF}}_B$ line in the status check I/O (port B).

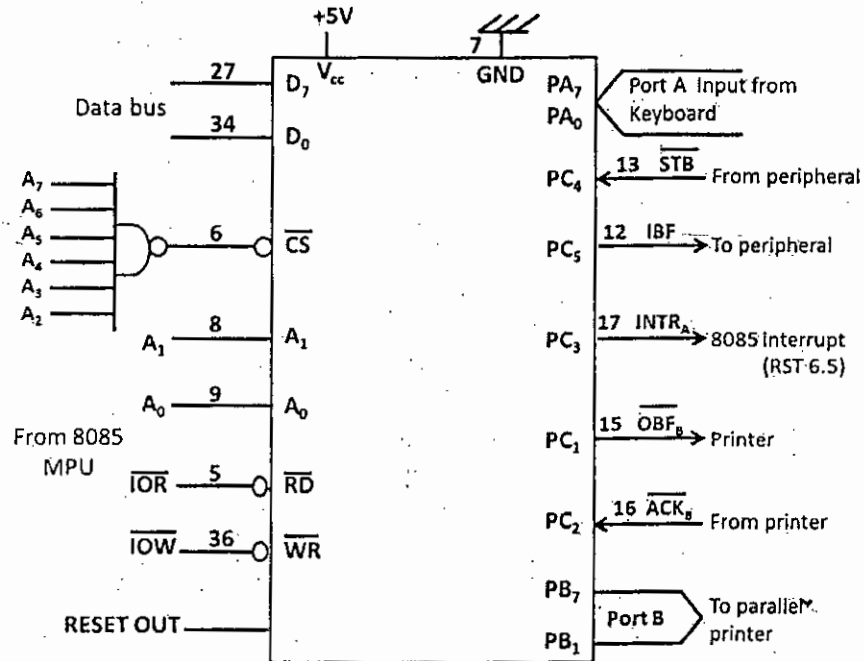


Fig. 7(b)

8. a) What are the differences between RISC and CISC processor? Is 8085 a CISC processor? Justify your answer. 09
- b) Write down the basic features of Intel 80186, 80286, 80386 and 80486. 12
- c) What is the system memory management mode of operation for the Pentium processor? What is the main difference between the 4K paging of earlier processors and the 4M paging of Pentium? 07
- d) What is hyperthreading technology? What new instructions appear in the Pentium III microprocessors that do not appear in the Pentium pro counterpart? 07

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 1st Term Examination, 2016
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) Define characteristic impedance. "An infinite line is equivalent to a finite line terminated in its characteristic impedance" – Justify the statement. (11)
b) What do you mean by (i) distortion less line and (ii) flat line? (06)
c) Derive the equation of input impedance, Hence extend your answer for the (i) open circuit case and (ii) short circuit case. (18)
2. a) What do you mean by standing wave ratio (SWR)? Establish the relation between SWR and reflection coefficient. (10)
b) Discuss the importance of Smith Chart. Explain r-circle and x-circle with their properties. (10)
c) A load impedance of $130 + j90 \Omega$ terminates a 50Ω transmission line that is 0.3λ long. Find the reflection coefficient, input impedance, SWR on the line and the return loss with the aid of Smith Chart. (15)
3. a) What is the necessary condition for single stub matching technique? Why is short circuited stub preferred to an open circuited stub? (10)
b) "Transverse fields of a TEM wave satisfy Laplace's equation and thus known as static field" – Justify the statement. (11)
c) Derive the expression of cut off frequency for TM_n mode and hence find, (i) lowest frequency for this TM mode and (ii) wave impedance of a TM mode. (14)
4. a) Derive the expressions for the transverse field components of TE_{mn} mode of a rectangular waveguide. Also find the followings from the above field components:
(i) cut off frequency $f_{c_{mn}}$
(ii) cut off frequency for the dominant mode
(iii) field expression for TE_{00} mode. (17)
b) Define cavity resonator and Q of a resonator. (06)
c) Consider a length of Teflon filled, copper k-band rectangular waveguide having dimensions $a = 1.07\text{cm}$ and $b = 0.43\text{cm}$. Find the cut off frequencies of the first five propagating modes. If the operating frequency is 15GHz, find the propagation constant for TE_{10} mode. Assume $\epsilon_r = 2.08$ for Teflon and $\tan\delta = 0.0004$. (12)

SECTION B

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

5. a) What do you mean by 'O' type tube and 'M' type tube? Classify the 'O' type tube. (07)
b) Why conventional vacuum tubes fail to operate above 1 GHz frequency? (07)
c) "Higher modes occur at lower repeller voltages and lower modes occur at higher repeller voltages for RK0" – Justify the statement. (07)

- d) What are the properties of velocity modulation of RK0? Find out the value of (i) beam coupling coefficient, (ii) depth of modulation and (iii) bunching parameter of RK0 from velocity modulation process. (14)
6. a) What is beam loading? (08)
 b) Describe the mechanism of operation of two-cavity Klystron amplifier with suitable diagrams. (15)
 c) A two-cavity Klystron amplifier has the following parameters: (12)
 Beam voltage $V_0 = 850\text{v}$, Beam current $I_0 = 30\text{mA}$, Frequency $f = 10\text{GHz}$, Gap spacing $d = 1\text{mm}$, Spacing between center of cavities, $L = 4\text{cm}$, Effective shunt impedance $R_{sh} = 40\text{K}\Omega$. Determine (i) DC electron velocity, (ii) Gap transit angle, and (iii) Beam coupling coefficient.
7. a) Explain the features of slow wave structure. (06)
 b) Discuss the amplification process in helix traveling wave tube. Also mention the applications of it. (09)
 c) Describe the equations of electron trajectory of magnetron oscillator. (11)
 d) An x-band pulsed cylindrical magnetron has the following parameters: (09)
 Anode voltage $V_0 = 26\text{Kv}$, Beam current $I_0 = 27\text{A}$, Magnetic flux density $B_0 = 0.336\text{wb/m}^2$, radius of cathode cylinder $a = 5\text{cm}$, radius of vane edge to center $b = 10\text{cm}$.
 Compute:
 (i) The cyclotron angular frequency,
 (ii) The cut off voltage for a fixed B_0 ,
 (iii) The cut off magnetic flux density for a fixed V_0 .
8. a) Classify microwave solid state devices with their potential applications. (07)
 b) What are meant by power divider and directional coupler? Write down the application of Gunn diode. (10)
 c) Specify the five fundamental differences among the read diodes IMPATT, TRAPATT and BARITT. (08)
 d) Discuss the effect of electromagnetic radiation hazards. What do you mean by SAR? (10)
 What is the acceptable limit of SAR recommended by the FCC?

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd year 1st Term Examination, 2016
Department of Electronics & 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 do you mean by politics? Is there any benefit in politics? Discuss. 10
b) What is state and government? Distinguish between the state and government. 15
c) What are the relationship between politics and sociology? 10
2. a) Explain the origin and the evolution of state according to the social contract theory. 10
b) What are the principles of dictatorship? What are its merits and demerits? 15
c) What is democracy? What are the basic characteristics of a democratic state? 10
3. a) Explain the importance of public opinion in a democratic state. 10
b) What is citizenship? What are the hindrances in the way of good citizen? How can the citizenship be acquired and lost? 15
c) State briefly the basic principles of Marxism. 10
4. a) What is Feudalism? What is the political importance of Feudalism? Explain the reasons to fall of Feudalism. 15
b) What are the objectives of the UNO? What are its organs? 10
c) "Fascism is not based on doctrines but reality." Explain the statement. 10

SECTION B

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

5. a) What is sociology? 05
b) What makes sociology distinctively modern enterprise? 10
c) What is society? Explain different types of societies with their evolutionary character. 20
6. a) What are the basic elements of social structure? 10
b) Why are human society stratified? 10
c) Explain the types of stratification structure. 15
7. a) Differentiate between ethnocentrism and cultural relativity. 10
b) Explain the bases of human behavior. 10
c) Differentiate between norms and values. Also explain them as elements of culture. 15
8. a) What is urbanization? 05
b) Explain different views to describe urbanism. 20
c) What is suburban? What are the problems of suburban living? 10

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 1st Term Examination, 2016

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) Write down the taxonomy of errors in numerical computing. How can the total error be minimized? (10)
- b) Show that Newton-Raphson method is said to have quadratic convergence. Also write down the pitfalls of Newton-Raphson method. (13)
- c) The velocity v of a falling parachutist is given by: (12)

$$v = \frac{gm}{c} (1 - e^{-(c/m)t})$$

Use False-position method to determine the drag coefficient c needed so that the parachutist of mass $m = 68.1\text{kg}$ has a velocity $v = 40\text{m/s}$ after time $t = 10\text{s}$ of free fall. *Note:* The acceleration of gravity g is 9.8m/s^2 . Use initial guesses of $x_1 = 12$ and $x_2 = 16$ and perform two iterations.

2. a) "The convergence of secant method is super-linear" – Justify the statement. (13)
- b) It is said that False-position method and secant method are similar. Then what is the basic difference between them? (05)
- c) Write down the advantages and disadvantages of Fixed point method. (05)
- d) The flux equation of an iron core electric circuit is given by (12)
 $f(\phi) = 10 - 2.1\phi - 0.01\phi^3 = 0$. Estimate the flux (ϕ) using Newton-Raphson method.

3. a) "A spline performs better than a higher-order polynomial" – Justify the statement. (08)
- b) Given the table of values: (13)

i	0	1	2	3
x_i	1	2	3	4
$f(x_i)$	0.5	0.3333	0.25	0.20

Estimate the value of $f(2.5)$ using cubic spline functions.

- c) How does the Newton interpolation formula overcome the limitations of Lagrange formula? Construct the Newton divided difference table and calculate $\sqrt{2.5}$ using the following data. (14)

x	1	2	3	4	5
\sqrt{x}	1	1.4142	1.7321	2	2.2361

4. a) What are the limitations of least square regression? Fit a second order polynomial to the data given below: (10)

x	2	4	6	8
y	1.4	2.0	2.4	2.6

- b) How does Romberg method improve the accuracy of integration? (05)

- c) Evaluate $\int_0^{\pi/2} \sqrt{\sin x} dx$ using (i) Simpson's 1/3 rule and (ii) Simpson's 3/8 rule. (12)

- d) Given the values for x and $f(x)$ in the following table, use the trapezoidal rule to estimate the integral from $x = 1.8$ to $x = 2.8$. (08)

x	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0
$f(x)$	4.953	6.050	7.389	9.025	11.023	13.464	16.445	20.086

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 solution of ill-conditioned systems and mention suitable solution approach for them. (07)
- b) What is pivoting? How does it improve the accuracy of solution of a system of linear equations? (06)
- c) The loop currents of an electrical network follows the following equations: (13)

$$3I_1 - 7I_2 - 2I_3 = -7$$

$$-3I_1 + 5I_2 + I_3 = 5$$

$$6I_1 - 4I_2 = 2$$

Determine the loop currents using LU decomposition method.

- d) Solve the following system of equation using Gauss-Seidel iterative method. (09)

$$4x_1 + x_2 - x_3 = 3$$

$$2x_1 + 7x_2 + x_3 = 19$$

$$x_1 - 3x_2 + 12x_3 = 31$$

6. a) Why is the polygon method called midpoint method? Illustrate graphically. (08)
- b) What is meant by over relaxation and under relaxation? Describe the importance of relaxation parameter in iterative solutions of system of equations. (12)
- c) Using the Milne-Simpson method, find $y(0.4)$ for the initial value problem: (15)

$$\frac{dy}{dx} = x^2 + y^2, \quad y(0) = 1$$

Calculate the required initial values by Runge-Kutta method using step size $h = 0.1$.

7. a) Briefly explain the basic concept of singular value decomposition method and mention some of its applications. (10)
- b) What is Eigen value problem? Determine the Eigen values of the following system using Fadeev-Leverrier method. (12)

$$(-1 - \lambda)x_1 = 0$$

$$x_1 + (-2 - \lambda)x_2 + 3x_3 = 0$$

$$2x_2 + (-3 - \lambda)x_3 = 0$$

- c) Solve numerically the wave equation, (13)

$$\frac{\partial^2 f}{\partial t^2} = 4 \frac{\partial^2 f}{\partial x^2}; \quad 0 \leq x \leq 5$$

With the boundary conditions, $f(0, t) = 0$ and $f(5, t) = 0$ and initial values $f(x, 0) = 100x^2(5 - x)$ and $f_t(x, 0) = 0$.

8. a) What are the importance of numerical solution of partial differential equations? Explain briefly using real life examples. (07)
- b) What is Crank-Nicholson method used for? Discuss on the impact of size of the incremental width Δt for the time variable t on the solution of wave equation. (07)
- c) Solve the heat equation $f_{xx} - 0.5f_t = 0$, considering the initial condition $f(x, 0) = x(5 - x)$ and boundary conditions $f(0, t) = 0$ and $f(5, t) = 0$. (10)
- d) What are the advantages of finite element method (FEM). Explain the procedural steps of FEM in brief. (11)