KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 1st Term Examination, 2019

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) What are the benefits of electronics in industrial applications? Mention some power semiconductor devices used in industrial electronics. (07)

   b) What are the factors need to be considered in designing the thyristor Gate control circuits? (08)

   c) For the SCR half-wave-controlled rectifier, show that the greater the firing angle, the smaller is the average current. (08)

   d) The SCR of **Figure 1(d)** has Gate trigger voltage $V_t = 0.7V$, Gate trigger current $I_t = 0.7mA$, and holding current $I_H = 6mA$. Calculate (i) the output voltage when SCR is off? (ii) the input voltage that triggers the SCR? (iii) V_{cc}, if V_{cc} is decreased until the SCR opens? (12)

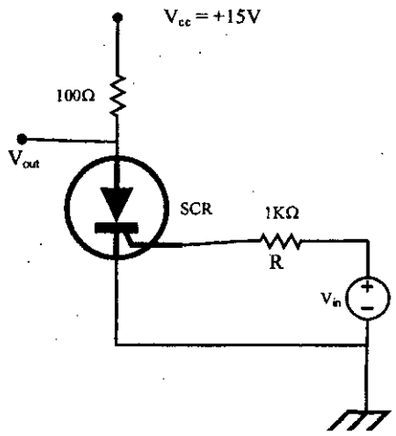

Fig. 1(d)

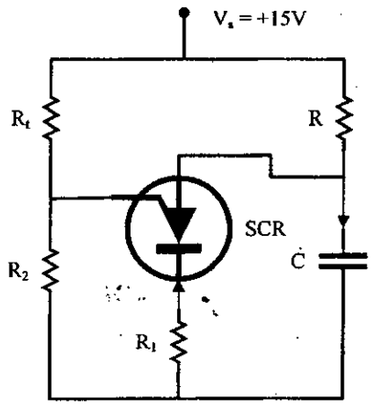

Fig. 2(c)

2. a) Describe the operation of PUT with necessary waveforms. Also, write down the differences between PUT and UJT. (12)

   b) Comparing with antiparallel connection of SCR, show the advantages and disadvantages of TRIAC and GTO. (09)

   c) Design the triggering circuit of **Figure 2(c)**. The parameters of PUT are, the peak triggering voltage $V_{tk} = 10V$, the pulse width $t_g = 50\mu s$, frequency oscillation f=60Hz and Gate current $I_G = 1mA$. (14)

3. a) What are the advantages and disadvantages of a buck-boast regulation? (08)

   b) Describe the principle operation of step-down chopper with relevant circuits and waveforms for resistive load. (12)

   c) What is dc-to dc converter? Why is it necessary? (05)

   d) A chopper is feeding an RL load as shown **in Figure 3(d)** with $V_s = 220V$, $R = 5\Omega$, $L = 7.5nH, f = 1kHz, k = 0.5$ *and* $E = 0V$. Calculate (i) the minimum instantaneous load current; (ii) the maximum peak-to-peak load ripple current. (10)

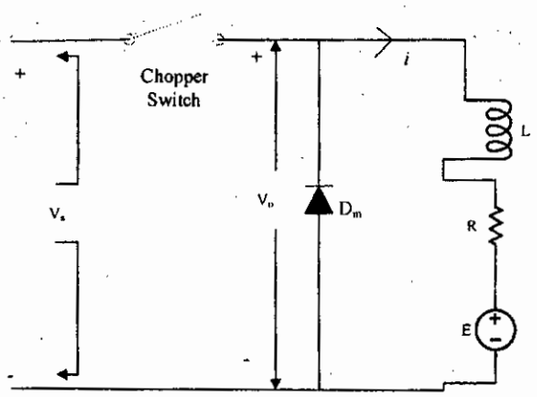

Fig. 3(d)

4. a) Derive the formula for the amount of heat induced in dielectric heating. From this equation, show which factors are responsible for dielectric loss. (15)

   b) Draw and explain the circuit diagram of three phase inverter formed by single phase inverters. (10)

   c) How eddy current and skin effect are responsible for the induction heating? (10)

SECTION B

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

5. a) Write down the functions of freewheeling diode. (06)

   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) What is meant by motor derives? Draw the waveshapes for speed control of DC motor derives for variable speed applications. (17)

6. a) What are the merits and drawbacks of variable speed dc drives to ac drives? (10)

   b) Draw the necessary waveforms for speed control of a dc motor by a $3-\phi$ full converter system for $\alpha = {}^{\pi}/_{3}$. (15)

   c) Explain the operation of single-phase semi-converter derives for dc motor and also draw the waveforms of typically voltages and currents. (10)

7. a) A 200-hp, 800V, 1500rpm dc series motor controls a load requiring a torque of $T_L = 200N - m$ at 1200rpm. The field current resistance $R_f = 0.06\Omega$, the armature circuit resistance $R_a = 0.04\Omega$, and the voltage constant $K_v = \frac{32mV}{A} rad/s$. The viscous friction and the no load losses are ripple free. Determine: (i) the back emf E_g; (ii) the required armature voltage v_a; (iii) rated armature current. (10)

   b) Draw the necessary waveforms for speed control of a dc motor by a three-phase semi converter system for the firing angle $\alpha = 90^{\circ}$. (10)

   c) What is salient-pole motors? What are the differences between cylindrical rotor motor and salient pole motor? (10)

   d) What is static Kramer drive? (05)

8. a) Explain the torque-speed characteristics of induction motors. (10)

   b) With the help of necessary diagrams, describe the principle of "Four Quadrants" operation of DC motor drives for variable speed applications. (10)

   c) Classify the synchronous motor drives. (08)

   d) Write down the uses of permanent magnet motor drives. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B. Sc. Engineering 3rd year 1st Term Examination, 2019

Department of Electronics and Communication Engineering

ECE-3103

(Microprocessor & 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) Use a stack map to show the effect of each of the following instructions of Fig. 1(a) on the stack pointer (SP) and on the contents of the stack. What effect would it have on the execution of this program if the POPF instruction in the procedure was accidentally left out? 10

```
        MOV  SP, 4000H
        PUSH AX
        CALL MULTO
        POP  AX

MULTO   PROC NEAR
        PUSHF
        PUSH BX
        PUSH CX
        .
        .
        POP CX
        POP BX
        POPF
        RET

MULTO   ENDP
```

Fig. 1(a): Program segment to show the effect on stack and stack pointer.

b) Suppose that DS = 0200 H, BX = 0300 H, SI = 0100 H, and DI = 0400 H. Determine the memory address accessed by each of the following instructions, assuming real mode operation: 10
i) MOV DX, [BX + DI] ii) MOV AL, [1234 H] iii) MOV AX, [BX]
iv) MOV [DI + 100 H], AX v) MOV AX, [BX + SI + 100 H]
Also mention the corresponding addressing modes for each instruction.

c) What is pipelining? What are the advantages of using the queue in Intel 8086 microprocessor? 06

d) Write down the differences between the following instructions: 09
i) AND and TEST, ii) JUMP and LOOP, iii) MOV and PUSH

2. a) What do you understand by interrupt pointer and type of an interrupt? Discuss briefly about five reserved interrupts of Intel 8086 microprocessor. 14

b) Construct the binary code for each of the following 8086 instructions: 12
i) MOV DX, 4527 H [BX], ii) MOV [BX] [SI], DX
iii) MOV CX, 43 H [BX], iv) MOV CL, [BX]

c) Discuss the function of segment register, instruction pointer, and stack pointer in Intel 8086. What physical address is represented by i) 4370 : 561E H and ii) 7A32 : 0028 H? 09

3. a) Discuss the role of i) CALL and RET, and ii) PUSH and POP in writing and using procedures. 10

b) What is ESCAPE instructions? Write down the meaning and corresponding operations of each of the following instruction: FSTSW, FLDLG2, FPTAN, FICOMP, FPREM, and FBSTP. 08

c) Convert $(-152.75)_{10}$ to IEEE single precision and double precision floating point formats. 10

d) Write a program in assembly language instructions to determine the resonant frequency of an LC circuit given by $f_r = 1/(2\pi\sqrt{LC})$. 07

4. a) Write the 8086 instruction which will perform the indicated operation. 06
   i) Copy AH to a memory location whose offset is in BX.
   ii) Multiply AL time BL.
   iii) Add 07 H to DL.

b) Classify interrupt in 8086 microprocessors. Discuss briefly about the Type 3 and Type 1 interrupt. 10

c) How many flags does the 8086 have? Discuss the role of each flag. 09

d) Explain the functions performed by BX, BP and CX in addition to the function of a general purpose register? What are the function of index registers SI and DI? 10

SECTION B

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

5. a) What is INTE? Explain the handshake signals for an input port in Mode 1. 08

b) What is interfacing? Describe the common methods of parallel data transferring. 12

c) Determine the control word for the following configuration of Intel 8255: 10
   Port A – output. Mode of port A – Mode 0
   Port B – input. Mode of port B – Mode 0
   Port C_{upper} – input
   Port C_{lower} – output

d) Determine the control word to set PC_2 of Intel 8255. 05

6. a) Explain the operating modes of 8255A programmable peripheral interface. Show the pin diagram of each operating mode. 12

b) Explain briefly the features and functionalities of different handshaking signals used in 8255A. 10

c) How do counter-latch command and read-back command work in Intel 8254? 06

d) What is RISC and CISC processor? Explain the features of them. 07

7. a) What are the modes available in Intel 8254? Briefly describe interrupt on terminal and rate generator modes of 8254. 14

b) What do you mean by the assembler directives? What are the limitations of high level language? 08

c) Compare the basic features of Intel 80186, 80286, 80386, and Intel 80486. 07

d) Why do we need cascading of interrupt controllers? 06

8. a) What is Pentium processor? What new instructions appear in the Pentium III microprocessors that do not appear in the Pentium pro counterpart? 10

b) What is virtual memory? Show that the virtual memory capacity of Intel 80486 is 64 TB. 08

c) What is hyper-threading technology? What are the functions of linker and loader? 09

d) Why the body of macro has no level? What are the advantages and disadvantages of an absolute loader? 08

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B. Sc. Engineering 3rd year 1st Term Examination, 2019

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) Deduce Telegraphist's equations and hence find the coupled time harmonic transmission line equations. 10

b) A transmission line has the following parameters: 06

$R = 2\ \Omega/\text{m}, G = 0.5\ \text{mS/m}, f = 1\ \text{GHz}, L = 8\ \text{nH/m}, C = 0.23\ \text{pF}.$

Calculate i) the characteristic impedance and ii) the propagation constant.

c) A lossless line has a characteristics impedance of 50 Ω and is terminated in a load resistance of 75 Ω. The line is energized by a generator which has an output impedance of 50 Ω and an open circuit voltage of 30 V (rms). The line is assumed to be 2.25 wavelengths long. Determine: i) the input impedance, ii) the magnitude of the instantaneous load voltage, and iii) the instantaneous power delivered to the load. 09

d) Prove that $Z_0 = \sqrt{Z_{io} Z_{is}}\ (\Omega)$ and $\gamma = \frac{1}{l}\tanh^{-1}\sqrt{\frac{Z_{is}}{Z_{io}}}\ (\text{m}^{-1})$, where the symbols have their usual meanings. 10

2. a) What is standing wave and how does it occur in a transmission line? 10

b) The terminating impedance Z_L is $100 + j100\ \Omega$, and the characteristic impedance Z_0 of the line and the stub is 50 Ω. The first stub is placed at 0.40 λ away from the load. The spacing between the two stubs is 3/8 λ. Determine the length of the short-circuited stubs when the match is achieved. Use smith chart for the solution. 15

c) A signal generator is to feed equal power through a lossless air transmission line with a characteristic impedance 50 Ω to two separate resistive loads, 64 Ω and 25 Ω. Quarter wave transformers are used to match the loads to the 50 Ω line, as shown in figure below. 10

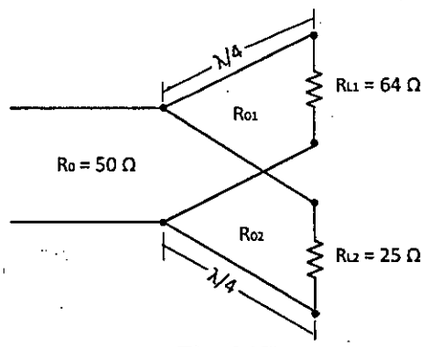

Fig. 2(C)

i) Determine the required characteristics impedances of the quarter wave line,
ii) Find the standing-wave ratio on the matching line sections.

3. a) Compare the relative advantages and disadvantages of the single-stub and the double-stub methods of impedance matching. 08

b) "Transverse fields of a TEM wave satisfy Laplace's equation and thus known as static field" – justify the statement. 12

c) Derive the expression of cut-off frequency of TM_n mode and hence find i) the lowest frequency of this TM mode and ii) the wave impedance of that mode for parallel plate waveguide. 15

4. a) Briefly explain the following terms: i) wave impedance, ii) evanescent mode, and iii) Q of a resonator. 09

b) Find the cut off frequency of the first two propagating modes TE_{11} ($P'_{11} = 1.841$) and TM_{01} ($P'_{01} = 2.405$) of Teflon filled circular waveguide with $a = 0.5$ cm. If the interior of the guide is gold plated, calculate the attenuation due to dielectric loss in dB for a 30 cm length operating at 14 GHz. Assume $\varepsilon_r = 2.08$ for Teflon and $\tan\delta = 0.0004$. 13

c) For a cavity resonator, show that $\frac{1}{Q_l} = \frac{1}{Q_0} + \frac{1}{Q_{ext}}$, where the symbols have their usual meanings. How the coupling coefficient influences Q_l, explain with necessary figure. 13

SECTION B

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

5. a) "Conventional vacuum tubes fail to operate above 1 GHz" – justify the statement. 08

b) "Higher modes occur at lower repeller voltages and lower modes occur at higher repeller voltages for reflex klystron oscillator"– explain the statement. 09

c) What is meant by beam loading of a tube? 05

d) Find out the value of i) beam coupling coefficient, ii) depth of modulation and iii) bunching parameter from the velocity modulation process of a reflex klystron oscillator. 13

6. a) Classify the different types of TWTA and write down its application. 08

b) Describe the electron trajectory of magnetron oscillator and find out the value of Hull-cut-off magnetic voltage of it. 6+9

c) A TWT operates under the following parameters: 12

Beam voltage $V_0 = 3$ kV,
Beam current $I_0 = 30$ mA,
Characteristics impedance of helix $Z_0 = 10\ \Omega$,
Circuit length $N = 50$,
Frequency $f = 10$ GHz,

Determine: i) the gain parameter, C ii) the output power gain, A_p in decibels and iii) first propagation constant.

7. a) What are the merits of microwave communications? Describe the terrestrial systems of microwave communications. 10

b) How does the EM radiation cause damage of biological substances? How can we protect ourselves from such radiation hazards? 10

c) A pulsed cylindrical magnetron is operated with the following parameters: 15

Anode voltage = 25 kV
Beam current = 25 A
Magnetic density = 0.34 Wb/m^2
Radius of cathode cylinder = 5 cm
Radius of anode cylinder = 10 cm

Calculate: i) angular frequency, ii) the cut-off voltage, and iii) the cut-off magnetic flux density.

8. a) What are the adverse effects of high-power microwave radiations? How can we protect ourselves from such radiations? 10

b) How can be applied the microwave in medical purposes? 08

c) Classify different types of microwave diode with their proper applications. 07

d) Draw the complete system of microwave oven. 10

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B. Sc. Engineering 3rd year 1st Term Examination, 2019
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 do you mean by politics? People do say that politics as a dirty game, is that true? Discuss. 10
   b) What is meant by state and government? Critically explain functions of a modern welfare state. 15
   c) Is UN a state? Discuss the constituent elements of state. 10

2. a) Explain the origin and evolution of state according to the social contract theory. 10
   b) What are the main features 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) What do you mean by political party? Discuss how political parties are essential for the successful working of democracy. 15
   b) What do you mean by public opinion? Describe the agencies which mould public opinion in modern times. 10
   c) Distinguish between parliamentary and presidential form of government. 10

4. a) What is feudalism? What is the political importance of feudalism? 10
   b) What do you mean by citizen? Discuss the qualities of an ideal citizen. 10
   c) What are the aims and objectives of UNO? Discuss the utility and future of UNO. 15

SECTION B

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

5. a) What is meant by sociology? Explain contribution of Auguste Comte and Karl Marx behind origin and development of sociology as a distinct science. 15
   b) "Sociology has a short past but long history" – explain contributing factors behind origin and development of sociology as a distinct discipline in the light of the given statement. 15
   c) Distinguish between social science and natural science. 05

6. a) What is industrial revolution? Explain socio-political and economic impact of industrial revolution in the light of your own society. 20
   b) What is society? Explain different types of society with their distinctive character. 15

7. a) "Association is the means of pursuing ends" – do you agree with this statement? Explain with example. 15
   b) What is social structure? Explain elements of social structure with relevant example. 15
   c) Discuss types of community. 05

8. a) What is culture? How can you differentiate civilization from culture? 10
   b) What is "cultural lag"? Explain the carriers of culture. 15
   c) What is crime and what are the types of crime? Explain. 10

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY

B.Sc. Engineering 3rd Year 1st Term Examination, 2019

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) What is study of "numerical analysis" important of engineering students? Also, mention the limitations of numerical methods. (10)

   b) Describe the common errors available in numerical computing. How can the total error be minimized? (10)

   c) The flux equation of an iron core electric circuit is given by $f(\Phi) = 10 - 2.1\Phi - 0.01\Phi^3$. Estimate Φ using False position method. (15)

2. a) Describe the theoretical concept of Newton-Raphson method and hence mention its weakness. Prove that the convergence rate of this method is quadrature. (16)

   b) What are the advantages of secant method? Evaluate square root of 5 using secant method. (11)

   c) Why are curve fitting technique important in engineering analysis? Distinguish between interpolation and regression considering curve fitting concept. (08)

3. a) The temperature of a metal strip was measured at various time integrals during heating and the values are given in the table below: (12)

time, t(min)	1	2	3	4
temp, T(°C)	70	83	100	124

If the relationship between the temperature T and time t is of the from

$$T = be^{t/4} + a$$

Estimate the temperature at $t = 6min$.

   b) The distances travelled by a vehicle at intervals of 2 minutes are given as follows: (12)

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

Evaluate the velocity and acceleration of the vehicle at $T = 5$,10 and 13 seconds.

   c) Find the Lagrange interpolation polynomial to fit the following data: (11)

x	0	1	2	3
$e^x - 1$	0	1.7183	6.3891	19.0855

4. a) What is Romberg integration? How does it improve the accuracy of numerical integration? (08)

   b) Use Simpson's 3/8 rule to evaluate: (i) $\int_1^2 (x^3 + 1)dx$; (ii) $\int_0^{\pi/2} \sqrt{\sin x}\, dx$ (12)

c) Compute Romberg estimate R_{22} for $\int_1^2 \left(\frac{1}{x^2}\right) dx$. (15)

SECTION B

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

5. a) What is system of equations? Compare the computational requirements if Gauss Elimination and Gauss Jordan method for solution of system of equations. (10)

b) The loop currents of an electrical network follow 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.

c) "Gauss-Seidal method is an improves version of Jacobi iteration method"-Explain and proof the statement using suitable examples. (12)

6. a) How does the relaxing parameter increase the convergence rate of Gauss-Seidel method? The temperature distribution in an IC under the specific boundary conditions is represented as: (13)

$$4T_1 + T_2 - T_3 = 3$$
$$2T_1 + 7T_2 + T_3 = 19$$
$$T_1 - 3T_2 + 12T_3 = 31$$

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

b) Why is the Polygon method called mid-point method? Illustrate graphically. (07)

c) Using Milne-Simpsons method, find $y(0.4)$ for different equation: (15)

$$\frac{dy}{dx} = -2y + x + 4;\ y(0) = 1$$

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

7. a) Define and classify partial differential equation (PDE). Also give some real-life examples that are modeled by PDEs. (08)

b) What is Poisson equation? Derive the finite difference from of Poisson equation considering 4 × 4 grids. (09)

c) Write down the procedural steps of Fadeev-Laveriar method to solve the Eigen value problem. (08)

d) 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)

8. a) What are the advantages of Finite Element Method (FEM)? Write down the procedural steps of FEM. (10)

b) What is Singular Value Decomposition (SVD) method? How does the SVD method determine the rank and singularity of a matrix? (08)

c) Write down the process of computing inverse of a singular matrix using SVD technique. (07)

d) Solve the wave equation $f_{tt}(x,t) = 16f_{tt}(x,t), 0 \le x < 5$ with the boundary condition $f(0,t) = 0$ and $f(5,t) = 0$ and initial conditions $f(x,0) = f(x) = x(5-x)$ and $f_t(x,0) = g(x) = 0$. (10)