# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

## 3rd year 2nd Semester B. Sc (Engg.) Final Examination 2021

Course Title: Microwave Engineering
Full Marks: 70

Course Code: ICT 3201
Time: 3 hour

Answer any **five** from the following questions

1. (a) What is microwave? Draw the block diagram of microwave system and briefly explain. 4
   (b) How does waveguide propagation differ from two wire transmission line or coaxial transmission? 3
   (c) Define: skin depth, intrinsic impedance and characteristic impedance, surface resistance, dominant mode, degenerate mode and TEM mode. 7

2. (a) What are the advantages of waveguides? 2
   (b) What is velocity modulation? Narrate the velocity modulation process of a two-cavity klystron amplifier. 6
   (c) Calculate resonant frequency of rectangular cavity filled with dielectric with $\varepsilon_r = 4$ and having dimensions a=5cm, b=4cm, and d=15cm. 6

3. (a) Define microwave cavities. Derive the equation of resonant frequency of a rectangular cavity resonator. 6
   (b) What is isolator? Briefly explain the working principle of isolator. 6
   (c) What are the applications of microwave solid state devices? 2

4. (a) Briefly explain the microwave characteristics of tunnel diode. 4
   (b) Write down the differences between microwave transistors and transferred electron devices (TEDs). 3
   (c) A reflex klystron operates under the following conditions: 7

   $V_0$ =600 V  L=1 mm  $R_{sh}$ =15KΩ  $\frac{e}{m} = 1.759 \times 10^{11}$  $f_r = 9$ GHz

   The tube is oscillating at $f_r$ at the peak of the n=2 mode or $1\frac{3}{4}$ mode. Assume that the transit time through the gap and beam loading can be neglected.
   (i) Find the value of the repeller voltage $V_r$.
   (ii) Find the direct current necessary to give a microwave gap voltage of 200V.
   What is the electronic efficiency under this condition?

5. (a) Why do we use multi-cavity klystron amplifier instead of two cavity klystron amplifier? 2
   (b) Explain the possibility of oscillations in a TWT amplifier. 6
   (c) A four-cavity klystron amplifier has the following parameters: 6

   $V_0$ =1000V  $R_0$ =40KΩ  $I_0$ =25mA  f=3GHz
   Gap spacing in either cavity: d=1mm
   Spacing between the two cavities: L=4cm
   Effective shunt impedance, excluding beam loading $R_{th}$ =30KΩ
   (i) Find the gap voltage to give maximum voltage $V_2$.
   (ii) Find the voltage gain, neglecting the beam loading in the output cavity.

6. (a) State the differences between co-planner strip lines, shielded strip lines and parallel strip lines. 3
   (b) Describe the working principle of IMPATT diode (read diode) 5
   (c) A lossless parallel strip line has a conducting strip width w. The substrate dielectric separating the two conducting strips has a relative dielectric constant $\epsilon_{rd}$ of 6 (beryllia or beryllium oxide BeO) and a thickness d of 4 mm. 6

   Calculate:
   a. The required width w of the conducting strip in order to have a characteristic impedance of 50 n
   b. The strip-line capacitance
   c. The strip-line inductance
   d. The phase velocity of the wave in the parallel strip line

7. (a) Explain the design procedure of a Yagi-Uda antenna array. 5
   (b) Show that average power radiated by an antenna is $P_{rad} = \frac{1}{2}\oiint Re(E \times H^*).ds$, 4
   Where symbols carry their usual meanings.
   (c) A half-wave dipole antenna is capable of radiating 1-KW and has a 2.15dB gain over an isotropic antenna. How much power must be delivered to the isotropic (omnidirectional) antenna, to match the field strength directional antenna? 5

8. (a) Define antenna. How does radiation occur in single wire antenna? 5
   (b) Define radiation pattern, isotropic antenna, side lobe, HPBW, antenna gain and radiation intensity. 5
   (c) What is microstrip? Explain why microstrip cannot support a pure TEM wave. 4

# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

## 3rd year 2nd Semester B. Sc (Engg.) Final Examination 2021

Course Title: Complier Design
Full Marks: 70

Course Code: ICT-3203
Time: 3 hour

Answer any **five** from the following questions

1. (a) What is Compiler? Design the analysis and synthesis model of compiler. 4
   (b) Discuss the various phases of compiler and trace the program segment a=b+c*50 for all phases. 6
   (c) Divide the following C++ program into appropriate lexemes. Which lexemes should get associated lexical values? What should those values be? 4

```
float limited Square (x) float x {
}
/* returns x-squared, but never more than 100 */
return (x<=-10 . 0 || x>=10 . 0) ?100 : x*x ;
```

2. (a) Design a lexical analyzer for recognizing the tokens such as identifiers and keywords. 5
   (b) Consider the context-free grammar 4

S->S S + | S S * | a

i) Show how the string aa+a* can be generated by this grammar.
ii) Construct a parse tree for this string.
iii) What language does this grammar generate? Justify your answer.

   (c) What language is generated by the following grammars? In each case justify your answer. 5

a) $S \rightarrow 0\,S\,1 \mid 0\,1$

b) $S \rightarrow +\,S\,S \mid -\,S\,S \mid a$

c) $S \rightarrow S\,(\,S\,)\,S \mid \epsilon$

d) $S \rightarrow a\,S\,b\,S \mid b\,S\,a\,S \mid \epsilon$

e) $S \rightarrow a \mid S+S \mid S\,S \mid S* \mid (\,S\,)$

3. (a) What is a regular expression? State the rules, which define regular expression? 4
   (b) Draw a transition diagram to represent relational operators and number. 5
   (c) Describe the languages denoted by the following regular expressions: 5
   i. a(a|b)*a
   ii. ((ε|a)b*)*
   iii. (a|b)*a(a|b)(a|b)
   iv. a*ba*ba*ba*
   v. (aa|bb)*((ab|ba)(aa|bb)*(ab|ba)(aa|bb)*)*

4. (a) What do you mean by parsing? Construct recursive-descent parsers, starting with the following grammars: 7

E –> T E'
E' –> + T E' | €
T –> F T'
T' –> * F T' | €
F –> ( E ) | id

   (b) Construct predictive parse tree or LL(1) parser for the following grammar and check whether the string 'id+id$' is accepted or note. 7

E –> E + T | T
T –> T * F | F
F –> (E) | id

5. (a) Define DAG? Draw DAG for the following expression: 6

(i) (a*b)+(c-d)*(a*b)+b (ii) a=(a*b+c)-(a*b+c)

(b) Construct syntax tree and postfix notation for the following expression: 4

(a+(b*c)^d-e/(f+g)

(c) Discuss the various peephole optimization techniques in detail. 4

6. (a) Is it possible to detect all the errors present in the source program in lexical analysis and syntax analysis phase? Explain with example. 5

(b) What is left recursion? Eliminate left recursion from the grammar: 5

$S \rightarrow Aa|b$

$S \rightarrow AC|Sd|e$

(c) Can we run out of buffer space in case of Lexical analysis phase of complier design? Explain. 4

7. (a) Convert the NFA given below into corresponding DFA using the necessary algorithm. 5

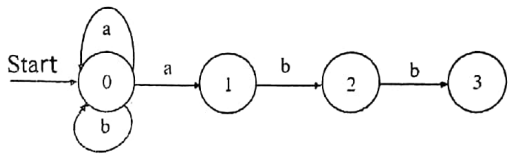


Figure 7(a): NFA

(b) Translate the expression :

$(a + b) * (c + d) + (a + b + c)$ into

(i) Quadruples (ii) Triples and (iii) Indirect Triples

(c) Develop a regular definition for unsigned numbers that includes integer or floating point numbers. (use short and notations). 3

8. (a) Explain the deep access and shallow access approaches for implementing dynamic scoping of non-local variables. 5

(b) Explain the significance of instructions selection to have efficient target program in code generation. Associate your explanation with suitable assembly code instruction. 5

(c) What is dangling reference? How garbage and dangling reference are related together? 4

# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

**3rd Year 2nd Semester BSc. (Engg.) Final Examination 2021**

**Course Title: Computer Peripherals and Interfacing** **Course Code: ICT 3205**

**Marks: 70** **Time: 3 hours**

**Answer any five questions. Illustrate where necessary.**

| | | | |
|---|---|---|---|
| 1 | a | What you mean by computer peripherals. Mention the complete classification of computer peripherals along with suitable example. | 4 |
| | b | What is a Keyboard Buffer? Briefly explain the mechanical contact of key switches. | 4 |
| | c | Explain briefly about plug and play systems with germane instance. | 3 |
| | d | What do you mean by barcode reader? How QR code is different from barcode? | 3 |
| 2 | a | What is the main purpose of Scanner? Write down the basic steps of Scanning process elaborately. | 5 |
| | b | Write short notes on: LCD Technology | 4 |
| | c | What is Barcode Reader? Why UPC-A, UPC-E, UPC Supplemental are needed? | 5 |
| 3 | a | Mention essential components of laser printer and then explain the working principle. | 6 |
| | b | Differentiate between optical mouse and mechanical mouse. | 4 |
| | c | What is keyboard layout? Writes short notes on QWERTY and DEVORAK keyboard layout | 4 |
| 4 | a | 8253 operates in three operational modes: Mode 0, Mode 1, Mode 2. Explain them with right control word | 6 |
| | b | Draw the block diagram of 8255 architecture. Write down the port functions of 8255. | 5 |
| | c | What do you mean by cycle stealing in DMA? | 3 |
| 5 | a | Consider a typical disk that rotates at 30000 RPM and has a transfer rate of $25 \times 10^6$ bytes/sec. If the average seek time of the disk is twice the average rotational delay and the controller's transfer time is 10 times the disk transfer time. | 8 |
| | | (i) Calculate the average seek time. | |
| | | (ii) Calculate average rotational delay. | |
| | | (iii) What is the average time (in milliseconds) to read or write a 256 byte sector of the disk? | |
| | | (iv) Calculate the controllers transfer time. | |
| | b | What do you mean by priority interrupt? Delineate priority interrupt hardware with the help of interrupt registers, mask register and priority encoder. | 6 |
| 6 | a | Write down prominent features including advantages, disadvantages and real time applications of OMR and OCR | 5 |
| | b | Make comparative discussion about laser printer and dot matrix printer. | 5 |
| | | What is scanner? Explain the working principle of scanner with associated diagram. | 4 |
| 7 | a | Draw and discuss ne stage of the daisy-chain priority arrangement. | 5 |
| | b | Explain synchronous and asynchronous communication with example. | 3 |
| | c | Briefly discuss the 8284A Programmable Timer. | 4 |
| | d | What are the differences between parallel and serial ports? | 2 |
| 8 | a | Define embedded system. How many categories of embedded system. Discuss pivotal characteristics embedded system. | 5 |
| | b | Explain the embedded product development life cycle with associated diagram. | 5 |
| | c | Explain the working procedure of an embedded system. | 4 |

# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

## 3rd year 2nd Semester B. Sc (Engg.) Final Examination 2021

Course Title: Computer Networks
Full Marks: 70

Course Code: ICT 3207
Time: 3 hour

Answer any **five** from the following questions

1. (a) Consider a ***MESH topology*** network having 7 communication nodes are connected. Now determine the total minimum number of half-duplex and full-duplex connected links that satisfy the ***MESH Topology*** concept. 3

(b) Write down the communication standard for the following IEEE standard numbers. 3

I. 802.3
II. 802.11
III. 802.16

(c) ***TCP/IP*** reference model is more organized model compared to ***ISO-OSI*** model- do you agree? Explain with your answer. 4

(d) A ***multiplexer*** combines four 100-kbps channels using a time slot of 2 bits. Show the output with four arbitrary inputs. What is the ***frame rate***? What is the ***frame duration***? What is the ***bit rate***? What is the ***bit duration***? 4

2. (a) Assume that a voice channel occupies a bandwidth of 5 kHz. We need to combine three voice channels into a link with a bandwidth of 20 kHz, from 20 to 40 kHz where each channel using a guard band of 2KHz. Now, draw the FDM configuration, in the frequency domain. 4

(b) ***Statistical TDM*** is more efficient than ***synchronous TDM***- do you agree? Explain your answer with appropriate illustration. 4

(c) ***Cumulative acknowledgement*** can enhance the throughput of ***Go-Back-N protocol***- Do you agree? Explain your answer 3

(d) A system uses the Stop-and-Wait ARQ Protocol. If each packet carries 1000 bits of data, how long does it take to send 1 million bits of data if the distance between the sender and receiver is 5000 Km and the propagation speed is 2 x 108 m? Ignore trans- mission, waiting, and processing delays. We assume no data or control frame is lost or damaged. 3

3. (a) Distinguish among the ***Packet Switching, Circuit Switching*** *and* ***Message Switching network.*** 5

(b) Five equal-size datagrams belonging to the same message leave for the destination one after another. However, they travel through different paths as shown in table below. 5

| Datagram | Path Length | Visited Switches |
|---|---|---|
| 1 | 3200 km | 1, 3, 5 |
| 2 | 11,700 km | 1, 2, 5 |
| 3 | 12,200 km | 1, 2, 3, 5 |
| 4 | 10,200 km | 1, 4, 5 |
| 5 | 10,700 km | 1, 4, 3, 5 |

We assume that the delay for each switch (including waiting and processing) is 3, 10, 20, 7, and 20 ms respectively. Assuming that the propagation speed is $2 \times 10^8$ m/s, find the order the datagrams arrive at the destination and the delay for each. Ignore any other delays in transmission.

(c) Evaluate the total ***delay*** for both a ***datagram and virtual circuit network.*** 4

4. (a) Describe the ***hamming code*** correction mechanism with the encoder-decoder design and explain the ***logical analyzer*** to detect and correct errors. 6

(b) Determine the dataword-codeword C(7,4) table for the ***cyclic redundancy check(CRC)*** in aspects of CRC encoder operation for the following data word. 4

I. 0001 II. 0100
II. 1001 IV. 1011

(c) What is ***checksum***? Explain the ***checksum*** error detection method with appropriate example. 4

5. (a) What is a ***multiple access***? An ALOHA network transmits 200-bit frames on a shared channel of 200 kbps. What is the throughput if the system (all stations together) produces 4

I. 1000 frames per second

II. 500 frames per second

Repeat the same configuration for slotted ALOHA network.

(b) Explain the ***code division multiple access (CDMA)*** with its ***chip sequence*** and **channel sharing** mechanism. 4

(c) An ISP is granted a block of addresses starting with 190.100.0.0/16 (65,536 addresses). The ISP needs to distribute these addresses to three groups of customers as follows: 4

I. The first group has 64 customers; each need 256 addresses.

II. The second group has 128 customers; each need 128 addresses.

Design the sub blocks and find out how many addresses are still available after these allocations.

(d) Explain the ***Address Resolution Protocol (ARP)*** with appropriate diagram. 2

6. (a) Why are protocols needed? Draw a hybrid topology with a ring backbone and three bus networks? 4

(b) In which transmission strategy do we need to encapsulate IPv6 packets in the IPv4 packets? Briefly explain. 4

(c) What is sub-netting? An organization is granted the block 130.56.0.0/16. The administrator wants to create 512 subnets. 6

(i) Find the subnet mask.

(ii) Find the number of addresses in each subnet

(iii) Find the first and last addresses in subnet 1

(iv) Find the first and last addresses in subnet 512

7. (a) What are the responsibilities of the transport layer in the Internet model? Draw the IPv4 datagram format. 5

(b) If the data link layer can detect errors between hops, why do you think we need another checking mechanism at the transport layer? 3

(c) Draw the flowchart of CSMA/CD. Explain the working principles of CSMA/CD. 6

8. (a) Write the working procedures of Go-Back N ARQ protocol and Selective Repeat ARQ for noisy channel. 6

(b) Differentiate Synchronous TDM and Statistical TDM. 3

(c) Briefly describe the routing protocol Border gateway Protocol (BGP) and Open Shortest Path First (OSPF). 5

# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

### 3rd Year 2nd Semester B.Sc. (Engg.) Final Examination 2021

**Course Title:** Software Engineering **Course Code:** ICT-3209
**Marks:** 70 **Time:** 3 Hours

**[Answer any five from the following questions]**

**1.** Software is a program or set of programs containing instructions that provide desired functionality and Engineering is the process of designing and building something that serves a particular purpose and finds a cost-effective solution to problems. Software Engineering is mainly used for large projects based on software systems rather than single programs or applications. The main goal of software Engineering is to develop software application for improving the quality, budget, and time efficiency.

Now answer the following question precisely:

a) Write the difference between ***Software Engineering*** and ***System Engineering***. [2]
b) Describe the essential qualities that a ***Software*** should meet. [5]
c) Explain the essence of ***Software Engineering*** practice in details. [7]

**2.** *Homework assignment and collection are an integral part of any educational system. Today, this task is performed manually. What we want the homework assignment distribution and collection system to do is to automate this process. The system will be used by the Instructor/Teacher to distribute the homework assignments, review the students' solutions, distribute suggested solution, and distribute student grades on each assignment. This system will also help the students by automatically distributing the assignments to the students, provide a facility where the students can submit their solutions, remind the students when an assignment is almost due, remind the students when an assignment is overdue.*

Considering the above scenario answer the following question precisely:

a) What do you mean by ***Requirements Analysis*** and ***Requirement Engineering***? Explain in brief. [2]
b) Explain the steps in ***Software Requirement Engineering*** in details. [5]
c) Prepare a ***Use Case Diagram*** for the above case study. [7]

**3.** a) TDD (Test riven Development) is neither about "Testing" nor abut "Design". Justify this statement. [4]
b) Compare between Agile, Scrum and Kanban model in perspective of software development. [5]
c) Discuss about the fault tolerance and load balancing based on software system. Provie a real-life example oof synchronous and asynchronous system. [5]

**4.** *Off Beat Restaurant is a very renowned hotel in Comilla. Their services are so good that they have a growing number of tourists coming at their hotel every year. To make their services easier they want your help to develop a CRM system. In this CRM system, Customer can check in to the hotel. Customer has ID, name, cellphone, address and room number. Customer can also check out, pay bill and order food item. Receptionist book room for customer after checking room availability. Receptionist has ID, name cellphone and address. Every room has room no. and location. At the time of ordering food, customer choses food items from menu and places food order. Every food order has ID, name and price. Chef accepts order from customer and he has ID, name and location. When the food is ready, it is sent to the customer via House Keeping Staff who has ID, name and location. House Keeping staff also cleans room. At the time of checking out, receptionist generates bill for customer. Every bill has bill no., customer name and ..mount. Customer can make complaints or give feedback about the hotel services to the Manager. Manager has name, ID, cellphone and location. Manager manages hotel staffs and purchases inventory. Every inventory item has type, status and quantity.*

Considering the above scenario answer the following question precisely:

a) Prepare a ***Sequence diagram*** for the above scenario. [7]
b) Prepare a ***Class Diagram*** based on the above scenario. [7]

5. In software engineering, a software development process is a process of dividing software development work into smaller, parallel, or sequential steps or sub-processes to improve design, product management. It is also known as a software development life cycle (SDLC). The methodology may include the pre-definition of specific deliverables and artifacts that are created and completed by a project team to develop or maintain an application.

Considering the above scenario answer the following question precisely:

a) Selection of a ***Software Life Cycle*** Model depends on some factors. Write down the factors. [2]
b) Explain the steps in a generic ***Software Process model***. [5]
c) What are the different types of ***Software Process flow***? Explain each flow with appropriate diagram and details. [7]

6. Software Testing is a method to check whether the actual software product matches expected requirements and to ensure that the software product is defect free. It involves the execution of software/system components using manual or automated tools to evaluate one or more properties of interest. The purpose of software testing is to identify errors, gaps, or missing requirements in contrast to actual requirements.

Now answer the following question precisely:

a) Differentiate between bug, error and defect [3]
b) Show a tabular difference between ***Functional Testing*** and ***Structural Testing***. [5]
c) Define Test Suite with an example and also prove the statement ***"Larger test suite does not always detect more error"*** with necessary example. [6]

7. a) What is ***Grey Box Testing***? Define the following term associated in Software Testing: i) Failure, ii) Test Case, & iii) Test Suite. [3]
b) [4]

```
int compute_gcd(x, y) {
        int x, y;
        while (x! = y) {
                if (x>y)
                  x= x – y;
                else
            y= y – x;
        }
        return x;
}
```

Consider the above code and write 2 test suite using ***White Box Testing*** approach.

c) Explain the concept of clean code. [2]
d) Explain how design principles are different from design patterns. Give proper example. [5]

8. Assume that you are working as a Software Project Manager in a Software Company. Currently there is an ongoing project where there is a mix of experienced and inexperienced software engineers. The software product has been estimated to be 50,000 lines of source code. During the maintenance 1200 lines of code was added and 500 lines were removed. Assume that the average salary of software engineers is BDT. 40,000/= per month.

Now answer the following question precisely:

a) Define ***Reverse Engineering*** and ***Forward Engineering*** in Software Maintenance. [3]
b) Explain the different categories of ***Software Maintenance*** in details [5]
c) Calculate the following using ***COCOMO model*** based on the above scenario: [6]
   1. The effort required to develop the Software
   2. Nominal Development Time
   3. Approximate Development Cost
   4. Approximate Maintenance Cost

# Mawlana Bhashani Science and Technology University

## Department of Information and Communication Technology

## 3rd year 2nd Semester B. Sc (Engg.) Final Examination 2021

Course Title: Bio-Informatics — Course Code: ICT 3211

Full Marks: 70 — Time: 3 hour

Answer any **five** from the following questions

1. (a) Define the term bioinformatics? What are the key advantages of bioinformatics — 3
   (b) Central dogma is the process by which the instructions in DNA are converted into a functional product. Now explain the central dogma process with proper example. — 4
   (c) What do you mean by mutation and SNP? Write the effects of SNP in human 3 body. Write a program (in any programming language preferably in Python) that determines the distances between two sequences that occur through mutation or SNPs — 3
   (d) Mention few features that are desirable for comparative genome annotation system. — 4

2. (a) Write short note on human genome facts. What are the different types of databases 3 dealing with biological information retrieved from genome analysis? — 6
   (b) In an EMBL data format, what types of information it includes? Discuss in brief. — 3
   (c) Write the names of different types of protein databases. Explain any two of them. — 3
   (d) Give few examples of heredity diseases. — 2

3. (a) What are the key differences between global and local sequence alignment? Explain with an example. — 3
   (b) What are the methods used in pairwise alignment? How mutations, deletions and — 3
   (c) Using **Dot matrix** comparing two sequences and find out the similarity index in percentage. — 8

   $S_1$= AGCTAGGA

   $S_2$=CACTAGGC

4. (a) Here two sequences are provided. By employing the **Needleman and Wunsch** algorithm determines the similarity score which will be must a positive integer. — 10

| Sequences | Scoring in S |
|---|---|
| ***X= CGTCAG*** | *Match = 7* |
| ***Y= CGTAG*** | *Mismatch = -1* |
| | *Gap = 3* |

   (b) List the different types of PAM and BLOSUM scoring matrices. Which type of 4 scoring matrix used in different genome analysis? Explain in brief. — 4

5. (a) Define drug? Write down name of the stages drug discovery. How bioinformatics offers advantages in the process of drug discovery? — 7
   (b) What do you know about microarray data analysis? Discuss microarray experiment with a figure and mention the names of different microarray platforms. — 7

6. (a) What is distance matrix? — 4
   (b) Design a phylogenetic tree using Fitch and Margolish algorithm for below five sequences. — 10

| | A | B | C | D | E |
|---|---|---|---|---|---|
| A | - | 22 | 39 | 39 | 41 |
| B | | - | 41 | 41 | 43 |
| C | | | - | 18 | 20 |
| D | | | - | - | 10 |
| E | | | - | - | - |

7. (a) What do you mean by protein structures? — 3
   (b) Discuss alpha-helices and β-sheets with figure. — 4
   (c) Explain the theorem of the confirmation of the sugar phosphate backbone in your way. — 7

8. (a) "Species can evolve through only mutation"------justify this statement. — 4
   (b) Suppose you have given 4 sequences like AAG, AAA, GGA and AGA. Now how many phylogenetic tree can you create apply parsimony method? Explain details. — 6
   (c) Define domains and motifs. — 4