Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination **Fall 2021** **3rd Year 1st Semester**

Course Code: CSE 303 **Course Title: Data Communication** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.

Non-programmable calculators are allowed.

1. The 8B6T encoding scheme takes 8 bits of binary data and encodes them using 6 ternary signal elements. Recall that each Ternary signal element can take on one of three values (positive, negative, and zero voltage). Table 1 is attached with this question (check the last page of this question paper) and is a portion of the 8B6T code table. The complete table maps all possible 8-bit patterns to a unique code group of 6 ternary symbols. Suppose a hexadecimal value 370000 or in binary 00110111000000000000000 is sent from sender to receiver using NRZ-L, Manchester, and 8B6T. Now answer the following: [5*5 = 25]

   i. Draw the digital signal diagram for NRZ-L, Manchester, and 8B6T.

   ii. When considering the synchronization of the receiver, why is the NRZ-L signal a problem?

   iii. How does the Manchester signal solve the synchronization problem?

   iv. What cost does the Manchester signal incur in achieving this synchronization?

   v. The 8B6T signal also solves the synchronization problem. How?

   (Assumptions: for NRZ-L: bit 1 = -V, bit 0 = +V; for Manchester encoding: bit1 = -V to +V, bit 0 = +V to -V)

OR

Polar NRZ-L and Polar NRZ-I are two line coding schemes with few similarities and differences. Compare them based on the following points. Also, give short examples for each; you may use 011101 as your bit stream to draw the digital signal diagram. [6*3 +7= 25]

i. Baseline wandering

ii. Synchronization
iii. Change of polarity
iv. DC component

(Assumptions: For NRZ-L: bit 1 = -V, bit 0 = +V;
For NRZ-I: last voltage level was positive, bit 1= change, bit 0= no change)

2. a. You have to send a bit stream 0001111111110101001100000000 to your friend using 4B/5B block coding. Now solve the following: [8+6 +6 = 20]
   i. Apply the block coding scheme to identify the encoded sequence of bits that you will send to your friend.
   ii. Discuss how it solves the synchronization problem of NRZ-I
   iii. Illustrate the disadvantages that it may have over NRZ-I

   (Please see Table 2 for 4B/5B encoding table on the last page)

   b. In digital transmission, the receiver clock is 0.1 percent faster than the sender's clock. How many extra bits per second does the receiver receive if the data rate is 1 kbps? How many if the data rate is 1 Mbps? [5]

OR

   a. Considerations for choosing a good signal element are referred to as line encoding. Explain the important points that one needs to consider while choosing a good line encoding scheme. [15]

   b. The bipolar-AMI waveform representing the binary sequence"0100101011" is transmitted over a noisy channel. The received waveform is shown in Figure 1. It contains a single error. Locate the position of the error and explain your answer. You also need to draw the correct diagram. (Assume that the last non-zero pulse was negative) [10]

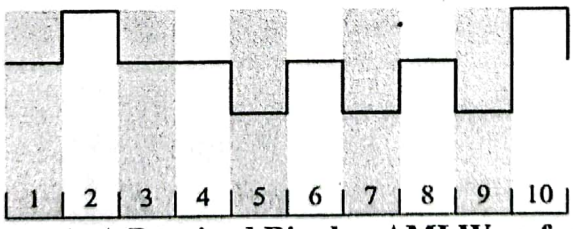

Figure 1: A Received Bipolar-AMI Waveform.

3. a. A receiver received a 7-bit Hamming code word 1011011. Assuming the even parity state, determine whether the received code word is correct or wrong. If it is wrong, locate the bit having the error and write the correct code word. [15]

   b. A bit stream 100000001 is received by the receiver side. The sender sent the bit stream using the standard CRC method. The generator polynomial was $x^3 + x^2 + 1$. Apply the CRC method to identify whether there is an error or not. You need to show the full calculation for the receiver side only. [10]

4. a. Unlike many other wireless standards, 802.11 runs on "free" portions of the radio [3*5

spectrum. Based on this concept, discuss the following: = 15]

i. Band allocations of 802.11 standard
ii. Popular naming for 802.11 standard
iii. Licensing policy and pricing
iv. Conflict of devices using the same free spectrum
v. List any two variations of 802.11 standards along with the features

b. List four key Differences Between Guided and Unguided Media. [10]

5. a. The data link layer is responsible for moving frames from one hop (node) to the next; on the other hand, the network layer is responsible for delivering individual packets from the source host to the destination host. From your point of view, discuss these two phenomena with proper figures. [15]

b. Compare the difference between circuit switching and packet switching. [10]

Topic	Circuit Switching	Packet Switching
Phases of switching		
Path information		
Data Processing		
Delay between data units		
Reliability		
Data transmission responsibility		
Congestion		
Recording of packet		
Physical path		
Wastages of resources		

6. a. Assume that a voice channel occupies a bandwidth of 8 kHz. We need to combine three voice channels into a link with a bandwidth of 24 kHz, from 20 to 44 kHz. Show the configuration, using the frequency domain, Assume the are no guard bands. [15]

b. Briefly discuss the concept of Bandwidth, Throughput, and Latency with proper examples. [10]

Data	Code	Data	Code	Data	Code	Data	Code
00	-+00-+	20	-++-00	40	-00+0+	60	0++0-0
01	0-+-+0	21	+00+--	41	0-00++	61	+0+-00
02	0-+0-+	22	-+0-++	42	0-0+0+	62	+0+0-0
03	0-++0-	23	+-0-++	43	0-0++0	63	+0+00-
04	-+0+0-	24	+-0+00	44	-00++0	64	0++00-
05	+0--+0	25	-+0+00	45	00-0++	65	++0-00
06	+0-0-+	26	+00-00	46	00-+0+	66	++00-0
07	+0-+0-	27	-+++--	47	00-++0	67	++000-
08	-+00+-	28	0++-0-	48	00+000	68	0++-+-
09	0-++-0	29	+0+0--	49	++-000	69	+0++--
0A	0-+0+-	2A	+0+-0-	4A	+-+000	6A	+0+-+-
0B	0-+-0+	2B	+0+--0	4B	-++000	6B	+0+--+
0C	-+0-0+	2C	0++--0	4C	0+-000	6C	0++--+
0D	+0-+-0	2D	++00--	4D	+0-000	6D	++0+--
0E	+0-0+-	2E	++0-0-	4E	0-+000	6E	++0-+-
0F	+0--0+	2F	++0---0	4F	-0+000	6F	++0--+
10	0--+0+	30	+-00-+	50	+--+0+	70	000++-
11	-0-0++	31	0+--+0	51	-+-0++	71	000+-+
12	-0-+0+	32	0+-0-+	52	-+-+0+	72	000-++
13	-0-++0	33	0+-+0-	53	-+-++0	73	000+00
14	0--++0	34	+-0+0-	54	+--++0	74	000+0-
15	--00++	35	-0+-+0	55	--+0++	75	000+-0
16	--0+0+	36	-0+0-+	56	--++0+	76	000-0+
17	--0++0	37	-0++0-	57	--++0	77	000-+0
18	-+0-+0	38	+-00+-	58	-+-0++	78	+++--0

Table 1: A Portion of the 8B6T Code Table

Data Sequence	Encoded Sequence	Data Sequence	Encoded Sequence
0000	11110	1000	10010
0001	01001	1001	10011
0010	10100	1010	10110
0011	10101	1011	10111
0100	01010	1100	11010
0101	01011	1101	11011
0110	01110	1110	11100
0111	01111	1111	11101

Table 2: 4B/5B encoding table

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Final Examination **Fall 2021** **3rd Year 1st Semester**

Course Code: CSE 305 **Course Title: System Analysis and Design** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Define Return on Investment (ROI). [5]

   b. The cost summary of business includes facilitation fees of Tk.50, 000, materials costing Tk.100, 000, salaries of staffs amounting Tk.150, 000. The total annual benefit results as Tk.500, 000. Calculate Return on Investment (ROI). [10]

   c. An investor purchases property A, which is valued at $500,000. Two years later, the investor sells the property for $1,000,000. Calculate Return on Investment (ROI). [10]

2. a. Inspect how an Activity diagram can be used to model business requirements. [10]

   b. Analyze the workflow for a word process to create a document using an Activity diagram through the following steps: [15]
   - ❑ Open the word processing package.
   - ❑ Create a file.
   - ❑ Save the file under a unique name within its directory.
   - ❑ Type the document.
   - ❑ If graphics are necessary, open the graphics package, create the graphics, and paste the graphics into the document.
   - ❑ If a spreadsheet is necessary, open the spreadsheet package, create the spreadsheet, and paste the spreadsheet into the document.
   - ❑ Save the file.
   - ❑ Print a hard copy of the document.
   - ❑ Exit the word processing package

3. a. Analyze the swimlanes of activity diagram. [10]

   b. Compare the types of message arrows of sequence diagram. [15]

4. a. Identify the major notations of the sequence diagram. [10]

b. There is a volume of students renting books from the library. To regulate this, it's essential for students to have online access to the record of available books. The system will also inform the student if they exceeded the allotted time for renting a book and a penalty will apply accordingly. [15]

Develop a library management system using sequence diagram.

5. a. Identify the major components of class diagram. [10]

b. An automated teller machine (ATM) lets you access your bank account. With it, you can check your balance, enter the amount to withdraw, you can deposit the money and many more. [15]

Design a class diagram for the ATM.

OR

5. a. Categorize the relationships of class diagram with examples. [10]

b. Through the help of a hospital management system, the establishment will be able to manage the volume of information. Moreover, doctors or nurses will be able to track the status and health history of patients. [15]

Design a class diagram for a hospital management system.

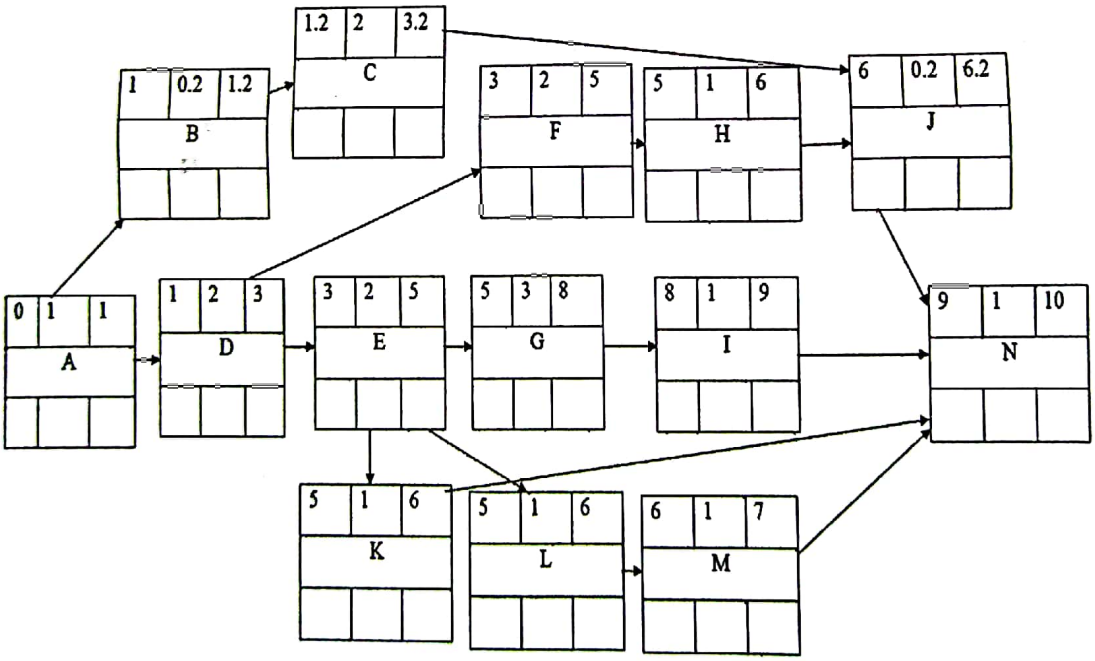
6. a. In the following example there are seven tasks, labeled *A* through *G*. Some tasks can be done concurrently (*A* and *B*) while others cannot be done until their predecessor task is complete (*C* cannot begin until *A* is complete). Additionally, each task has three time estimates: the optimistic time estimate (*o*), the realistic time (*r*), and the pessimistic time estimate (*p*). Calculate the expected time (*et*) using the data of the following Table. [25]

Activity	Predecessor	Time estimates		
		Optimistic (*o*)	Realistic (*r*)	Pessimistic (*p*)
A	—	2	4	6

B	—	3	5	9
C	*A*	4	5	7
D	*A*	4	6	10
E	*B, C*	4	5	7
F	*D*	3	4	8
G	*E*	3	5	8

OR

6. a. An Activity-On-Node (AON) diagram is given below. Fill in the blanks with appropriate data and then find out the critical path. [25]



Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination **Fall 2021** **3rd Year 1st Semester**

Course Code: CSE 307 **Course Title: Theory of Computation** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Design a Turing Machine for the following expression: **[12]**
   $L = 10^*1^*$

   b. Design a Turing Machine for the following expression: **[13]**
   $L = 0^{n+1}1^n$

2. a. Pushdown Automata (PDA) is more powerful than Finite Automata (FA). Do you agree with the statement? If yes, provide reasoning. **[5]**

   b. Design PDA that recognizes **[20]**
   i) $\{a^n b^n \mid n>0\}$
   ii) $A = \{w \in \{0, 1\}^* \mid w \text{ contains at least three 1s }\}$

3. a. Begin with the grammar: **[25]**

$$
\begin{aligned}
S &\rightarrow 0A0 \mid 1B1 \mid BB \\
A &\rightarrow C \\
B &\rightarrow S \mid A \\
C &\rightarrow S \mid \epsilon
\end{aligned}
$$

   i) Eliminate Є-productions.
   ii) Eliminate any unit productions in the resulting grammar.
   iii) Eliminate any useless symbols in the resulting grammar.
   iv) Put the resulting grammar into Chomsky Normal Form.

4. a. Write Context-free grammars for the following languages: **[16]**
   i) All strings in the language $L = \{a^n b^{2n}, n \geq 0\}$
   ii) All nonempty strings of 'a' and 'b' that start and end with the same symbol.

b. Consider the context-free grammar: [9]

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

Now, the given string is (a + a) * a.

i) Give a leftmost derivation for the string.
ii) Give a rightmost derivation for the string.
iii) Give a parse tree for the string.

5. a. Let L ={a, b} [15]

Suppose you have constructed the following language:
"The set of all strings consisting of zero or more instances of a or b, and having a substring *bab*."

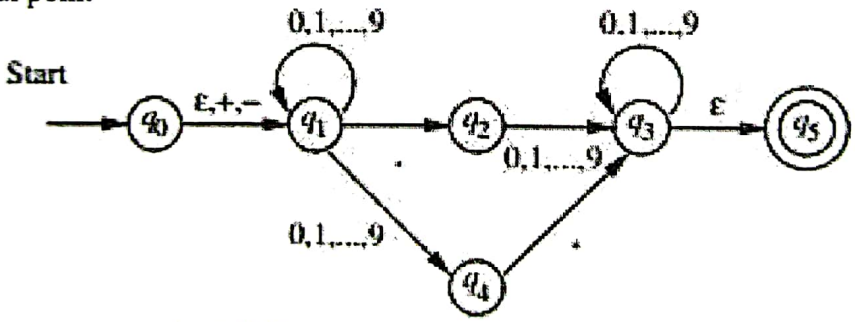
i) Write the regular expression for this language.
ii) Draw the corresponding NFA.
iii) Show the transition table as well DFA diagram.

b. Give a formal description of the Pumping Lemma. Use the Pumping lemma to show that $\{a^n b^n c^n \mid n>0\}$ is not regular. [10]

OR

5. a. Consider an NFA that accepts decimal numbers consisting of [15]

1. An optional + or - sign
2. A string of digits
3. A decimal point

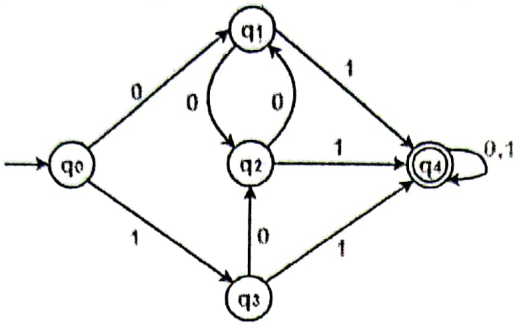


An ∈-NFA accepting decimal numbers

i) Find out the ∈-closure for each state.
ii) Convert it into DFA.
iii) Construct the Transaction Table for the converted DFA.

b. What is the purpose of the Pumping Lemma in case of regular language? Use the Pumping lemma to show that $\{0^n \mid n$ is perfect square$\}$ is not regular. [10]

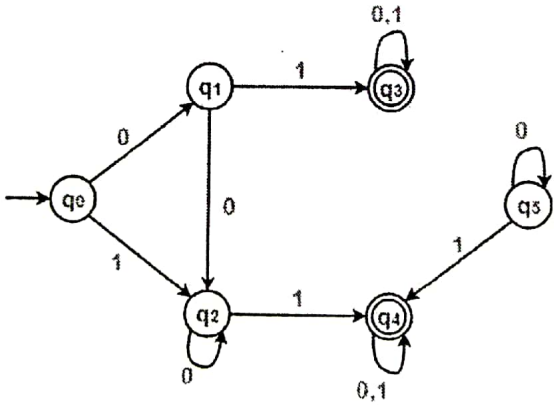
6 a. Minimize the following DFA **using table construction algorithm.** **[15]**



b. Write down the formal definition of Finite Automata. **[10]**

OR

6 a. Minimize the following DFA using **table construction algorithm.** **[15]**



b. State differences: **[10]**

i) NFA and ∈-NFA

ii) NFA and DFA

Department of Computer Science & Engineering

University of Asia Pacific (UAP)

Program: B.Sc. in Computer Science and Engineering

Final Examination	**Fall 2021**	**3rd Year 1st Semester**
Course Code: CSE 309	**Course Title: Object-Oriented Programming II: Visual and Web Programming**	**Credits: 3**
Full Marks: 150		**Duration: 3 Hours**

Instructions:

1. There are **Six (06)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Programmable calculators are not allowed.

1. **a)** Perform the following operations using Python Programming Language— 15

i. Take an integer 'n' from the user.

ii. Print the summation from 0 to that number using a for-loop.

iii. Print the multiplication from 1 to that number using a while-loop.

iv. Determine whether the number is odd or even using conditional statements.

b) Create a function that takes the parameter of a quadratic equation and prints out the real as well as complex solution of that equation. 10

If the equation is $ax^2+bx+c=0$, then the function parameters are a, b, and c. Use the following equation to print the solution—

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

2. **a)** Explain the difference between list, tuples, set, and dictionaries with coding examples. 15

b) Define a class that has two functions. One function will return the surface area of a cylinder and another function will return the volume of the cylinder. 5+5

The surface area of the cylinder is defined as, $A = 2\pi r(r + h)$.
The volume of the cylinder is, $V = \pi r^2 h$.
Here, r = Radius of the base of the cylinder.
h = Height of the cylinder.

3. **a)** Design an HTML page containing a table that has 3 columns and 4 rows. 8

b) Differentiate between margin, padding, and border using a CSS code example associated with an Image. 7

c) Demonstrate a code that will insert 10 random integers into an empty list. 10

4. a) Write a JavaScript code to iteratively print the elements of an array.
   b) Mention the necessary commands to run the server using Django.

OR,

   a) Write a JavaScript code to print the multiplication of 'n' numbers using a function.

   b) Mention the necessary commands to run a Web App using Django.

5. a) Create a function that will take two lists as parameters. The first list will contain some persons' names and the second list will contain the ages of those persons in order. The function will return a dictionary containing only the persons who are 18 years old or more. Here the persons' names will be the keys of the dictionary and ages will be the values of those keys.

   b) Write an HTML code to create a link using an Image.

6. a) Give an example of how could we run external CSS and JavaScript files using HTML.

   b) Write a CSS code to create a three-layer depth background.

OR,

6. a) Demonstrate 'div' and 'layout' tags using examples.
   b) Write a CSS code to demonstrate various relation position of an Image or Paragraph.

Department of Computer Science & Engineering
University of Asia Pacific (UAP)

Final Examination **Fall 2021** **3rd Year 1st Semester**

Course Code: CSE 311 **Course Title: Microprocessors and Assembly Language** **Credits: 3**

Full Marks: 150 **Duration: 3 Hours**

Instructions:

1. There are **Six (6)** Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.
2. Non-programmable calculators are allowed.

1. a. Illustrate the pin configuration of 8086 microprocessor using appropriate figure. **[10]**

   b. Discuss the utility of the following pins (any 5): **[15]**
   - i. DEN
   - ii. ALE
   - iii. M/IO
   - iv. RQ/GT0
   - v. QS1, QS0
   - vi. DT/R
   - vii. CLK

OR

a. Discuss the benefits of maximum mode configuration of 8086 microprocessor over minimum mode. State the reason of using multiplexed address/data lines in 8086. **[10]**

b. Illustrate the write cycle timing diagram for minimum mode operation and specify different control signals that are generated in different clock periods along with the purposes they serve during the cycle. **[15]**

2. a. 8086 has 16-bit data bus but the memory is organized in byte form. Explain how you can solve this problem using memory bank concept with proper diagram. **[10]**

   b. Explain the concept of pipelining to speed up microprocessor and how is it implemented in 8086. Mention the drawbacks of this concept (if any). **[15]**

OR

a. Evaluate the memory capacity or maximum addressable memory of a microprocessor containing the following specification: **[10]**

   Data Bus = 32 bit

   Address Bus = 32 bit

   Illustrate the corresponding memory architecture using bank layout.

b. Represent the block diagram of the internal architecture of 8086 microprocessor. **[15]**

3. a. Suppose, AL = (Last 2 digit of your student id) h. **[15]**

(i) Write a code segment that will set both LSB and MSB of AL keeping other bits unchanged.
(ii) Write a code segment that will clear the sign bit of AL.
(iii) Write a code segment that will toggle the bits of AL.

b. Write an assembly code to reverse a bit pattern using shift and rotate instruction. **[10]**

4. a. Assume, DX contains 0000h, AX contains 0005h and BX contains FFFEh. Determine the decimal quotient, decimal remainder and the values of AX and DX after the following operation has been performed: **[10]**

(i) DIV BX
(ii) IDIV BX

b. Evaluate the status of the CF, PF, ZF, SF and OF flags of the following instructions with proper justification where AX contains FFFFh, BX contains FFFFh and CX contains 8080h. Each of these instructions are independent of each other. **[15]**

i) MOV AX, -5
ii) ADD AX BX
iii) SUB AL, CL

5. a. Translate the following high level language assignment statement to assembly code: **[10]**
ANSWER = 7 * A + 13 – B * C + D where ANSWER, A, B, C and D are words in memory. Assume no overflow and perform unsigned multiplication.

b. Analyze the addressing modes of the following instructions providing appropriate justification for your answer: **[15]**

i) SUB BL, [SI+BP+4000]
ii) MOV AX, [BX+DI]
iii) MOV AX, [SI]
iv) ADD BL, 99
v) XCHG AX, DX

6. a. Suppose DH contains A7h, CF=1 and CL=3. Determine the values of DH and CF (carry flag) at each step after the instruction RCR DH, CL is executed. **[10]**

b. Divide the unsigned number 65143 by 8 using shift instruction. Put the quotient in BX. **[10]**

c. Suppose AH contains 56h. Perform a comparative analysis between ROR and RCR using the given value. **[5]**

University of Asia Pacific
Department of Computer Science & Engineering
Semester Final Examination, Fall - 2021
Program: B.Sc. in Computer Science & Engineering
Year: 3rd Semester: 1st

Course Code: HSS 301 Course Title: English for Communication Credit Hour: 3
Time: 3 hours Total Marks: 50

1. Write a summary of the following text in no more than 100 words: 10

The earth is losing its forests. Presently, trees cover about 30 percent of the earth's surface, but they are being destroyed at an alarming rate, especially in the tropics. Timber harvesting is a major reason for the destruction of the forests. Trees are used for building houses, making furniture, and providing pulp for paper products, such as newspapers and magazines. At least 40 hectares of rainforest are being felled every minute, mostly in order to extract the valuable timber.

Another way that man is destroying the world's forests is by burning them down. In the Amazon, for example, rainforests are being burnt down at a rate of 20 hectares a minute. The main reason for this is to clear the land for farming. Farmers in rainforest countries are often poor and cannot afford to buy land. Instead, these farmers clear rainforest land to raise their animals or grow their crops. Because tropical rainforest soil is so poor in nutrients, framers cannot reuse the same land year after year. In the following years, farmers just clear more land, destroying the forest piece by piece. Already more than 30 tropical countries have reached a critical level of forest destruction and one-time exporters of timber such as Nigeria and Thailand now have to import timber for their domestic needs.

Should we get all excited and worried about the loss of the forests? Yes, we should. Healthy trees are a vital part of the environment and keep the entire balance of the atmosphere agreeable to all life forms. Forests are catchment areas for rainwater, holding the rainwater in the leaves of the trees, so that it will not sink so quickly into the earth's crust. Furthermore, the forests help maintain the water cycles in the area. The masses of cloud that provide the rain are formed over the moist forests. Thus, the destruction of forests may also lead to a reduction in rainfall over the area, resulting in drought.

2. Fill in the blanks with appropriate linking words: 1×5=5

However	In spite of	Despite	Otherwise	Instead	Moreover	Though

a) She got the job _____ the fact that she had very little experience.
b) My sister's hand-writing is always so neat, _____ mine is a total chaos.
c) His brother requested him to leave after dinner. He left without having dinner _____.
d) You'd better wear a helmet when you go roller-blading._____, you could hurt yourself.

e) Reading is an excellent way to increase your vocabulary._____, it can help you improve your grammar.

3. Make WH questions for the following sentences: 1×5=5

a) He likes learning English. _____
b) He spent the whole night in the park. _____
c) She went to the yoga class regularly. _____
d) The food was neither sweet nor sour. _____
e) He was beaten for stealing the money. _____

4. Identify *transitive* or *intransitive* forms of the verb. Underline the verb and put *vt* or *vi* in brackets. For example, cook (vt). 1×5=5

a) I sent the suit to the laundry.
b) They escaped from the burning house.
c) I lay down after lunch.
d) He leaves home at 9.00 every day.
e) The book is selling well.

5. Complete the following sentences using proper conditionals: 1×10=10

a) UAP would remain closed tomorrow if … … …
b) … … … if I ace the SAT.
c) HSS 301 will be more fun if … … …
d) If it had not rained early in the morning, … … …
e) If you were me, … … …
f) If I did not get into UAP,
g) Had you been my friend, … … …
h) You might understand the joke if … … …
i) If animals could talk, … … …
j) What would have happened if … … …?

6. Attempt either of the following: 15

Suppose you have attended fewer classes than required to sit for your final exam, now write a formal letter to your class teacher through your advisor seeking permission to sit for the exam.

OR

Write a descriptive essay on the future of *Artificial Intelligence* (AI).