KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2019
Department of Computer Science and Engineering
CSE 4221
Natural Language Processing

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

## SECTION A

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

1. a) Why is the pattern matching by regular expression greedy? Explain with example. (09)
   b) Define text normalization. What is the difference between lemmatization and stemming? Explain with example. (10)
   c) Explain porter's algorithm with example. (11)
   d) What is types and tokens? How many types and tokens are there in the following sentence? "He stepped out into the hall, was delighted to encounter a water brother." (05)

2. a) "Finding the minimum edit distance is problem of the category 'dynamic programming' "- Explain the statement to convert one String X of length n to a String Y of length m. (12)
   b) Apply the minimum edit distance algorithm (using insertion cost = 1, deletion cost = 1 and substitution cost = 2) of "leda" to "deal". Show your work in edit distance grid. (10)
   c) Define bag of words problem. How is bag of words conditional independence assumption applied in Naïve Bayes text classification? Explain. (13)

3. a) Define Stop word. How do you handle Stop word in text classification? (08)
   b) Given the following text classification for classes $C_1$ and $C_2$ (10)
      i) PQR $\rightarrow C_1$
      ii) PPS $\rightarrow C_1$
      iii) PT $\rightarrow C_1$
      iv) UVP $\rightarrow C_2$

      Compute the most likely class for the text "PPPUV".
   c) Consider the following likelihood for a review (05)

| | Pos | Neg |
|---|---|---|
| I | 0.09 | 0.16 |
| always | 0.07 | 0.06 |
| like | 0.29 | 0.06 |
| foreign | 0.04 | 0.15 |
| films | 0.08 | 0.11 |

   What class will the Naïve Bayes assign to the sentence "I always like foreign films"?
   d) Find the context free rules and hence the context free grammar (CFG) for the following English sentences. (12)
      i) I want a morning flight.
      ii) Which flight serves breakfast?
      iii) Show the lowest fare.
      iv) The flight should be at 11 am.

4. a) Consider the following grammar in CNF (10)

$$S \rightarrow AB \mid BB$$
$$A \rightarrow CC \mid AB \mid a$$
$$B \rightarrow BB \mid CA \mid b$$
$$C \rightarrow BA \mid AA \mid b$$

   Is 'aabb' in L(G)? Justify your answer using CYK algorithm.
   b) How does Early Parser differ from CYK Parser? Explain finite state chunking with example. (10)
   c) Define PCFG? How can you disambiguate a syntactic Parsing by PCFG? (06)
   d) Explain the IR based factoid question answering using example. (09)

## SECTION B

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

5. a) Define Natural Language Processing (NLP). Why do we need NLP? Write some industrial applications of NLP? Derive (10)
   b) What does smoothing mean? ~~Drive~~ the equation for Laplace smoothing. (10)
   c) Given the following corpus: (07)

      **I like NLP.**
      **I like Deep Learning.**
      **NLP and Deep Learning have huge area for research.**

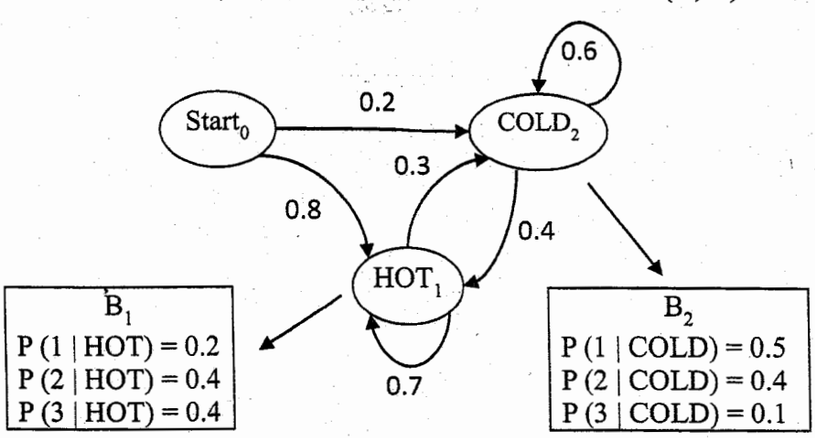
      Using Bigram Language model with add-one smoothing, what is P (NLP | like)?
   d) Define zero situation and discuss the effect of it. (08)

6. a) "POS tagging is a disambiguation task" – Justify the statement with example. (08)
   b) Define perplexity. Derive the equation of computing W with a Bigram Language model. (10)
   c) For Hidden Markov Model (HMM) Pos tagging, using the following formula, find the equation of calculating tag transition probabilities (10)

$$\hat{t}_1^n = \underset{t_1^n}{argmax}\, P\,(t_1^n \mid w_1^n)$$

   d) Consider the sentence: "Eight/CD horses/NNS will/MD race/? For/IN the/DT cup./NN." Given the probabilities below, find the right Pos tag for the word "race".(VB or NN). (07)
      P (VB | MD) = 0.0045, P (NN | MD) = 0.062, P (race | NN) = 0.048, P (race | VB) = 0.014,
      P ( IN | VB) = 0.0012, P (IN | NN) = 0.0024

7. a) Define Markov chain. Explain the components of Markov chain. (06)
   b) For logistic regression, show that P (y = true | x) = 1 | (1 + $e^{-w.f}$) (10)
   c) Given a sequence of ice-cream observations 3 1 3 and an HMM λ = (A, B) in the following figure. (12)




   Find the best hidden weather sequence Q ( like H H H ).
   d) What are the statistical models for processing text and speech? Give example of fully connected & left to right HMM. (07)

8. a) Define sentence tokenization. Draw the architecture of a TTS. (07)
   b) Discuss about the steps of speech synthesis (text to waveform). Show the Hourglass Metaphor. (10)
   c) What is prosody? Discuss about the three aspects of prosody. (10)
   d) What is accent ratio? Why is accent ratio important? (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2019
Department of Computer Science and Engineering
CSE 4223
Digital System Design

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

## SECTION A

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

1. a) Define register with examples. Design a 4-bit three state register with proper block diagram. (12)
   b) "Ripple counter is too slow for application"-justify. Make a comparison between serial loading and parallel loading. (11)
   c) What is ROM? Design a 8×8 diode ROM and explain its operation. (12)

2. a) Explain the operation of SAP-1 architecture with block diagram. (13)
   b) Generate control word and draw timing diagram for ADD, SUB and OUT instructions in case of SAP-1 computer. (14)
   c) Write a SAP-1 program for the expression 24 – 20 + 10 – 6. (08)

3. a) What is register transfer logic? "In register transfer logic '+' symbol has two meanings"- justify. (12)
   b) "Sign 2's complement is better than other number representations"- explain with example. (08)
   c) What is control function? Give example. Show the H/W implementation for the following statements. Assume that, registers are 4-bit in length. (15)

$$T_0 : A \leftarrow R_0;\ T_1 : A \leftarrow R_1;\ T_2 : A \leftarrow R_2;\ T_3 : A \leftarrow R_3;$$

4. a) What is processor unit? Explain the operation of scratch-pad memory organization. Differentiate between main memory and scratch-pad memory. (15)
   b) Define overflow with example. Design an overflow detector circuit by discussing the underlying theory. (10)
   c) What is FPGA? Draw the internal block diagram of FPGA. What are the advantages and disadvantages of using FPGA? (10)

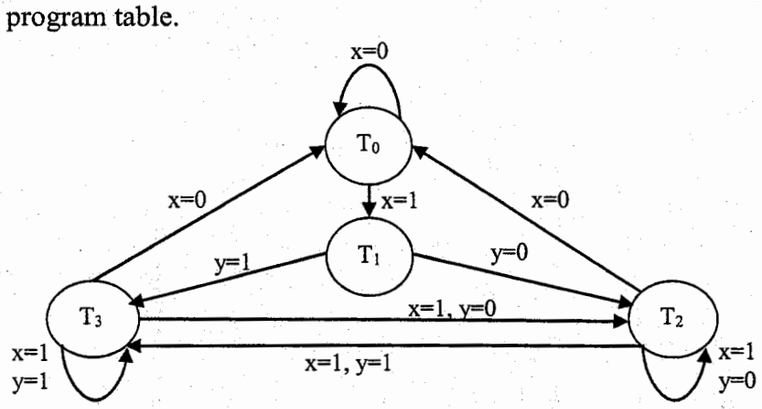
## SECTION B

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

5. a) Write down the purposes of control logic in any digital system. Briefly describe different methods of control logic design. (09)
   b) Describe an algorithm for sign magnitude addition and subtraction of binary number. Draw the flow chart, control state diagram and finally design the control by micro program control. (14)
   c) Draw state diagram and design the control unit with JK flip-flops for the following operations, where n varies from 0 to 3 and G is a two bit sequence register. (12)

$$xT_n : G \leftarrow G + 1;\ yT_n : G \leftarrow G - 1;\ \bar{x}\bar{y}T_n : G \leftarrow 00$$

6. a) What are the similarities and differences between a PLA control and a control logic with sequence register and decoder? (07)
   b) Design the control specified in the following state diagram by the sequence register and a PLA. List the PLA program table. (14)




   c) Design a micro program control for counting the number of 0's in a register and result store in another register. Draw flow chart, list symbolic micro-program with proper explanation and list binary micro-program. (14)

7. a) Draw block diagram of a digital computer with different registers and counters. Indicate data flow and control signal flow direction among the components with solid lines and dotted lines respectively. (17)
   b) What are the different type of instructions in a digital computer? Briefly describe significances of each type of instruction. (09)
   c) Why are different timing signals required in a digital system? Explain with proper example. (09)

8. a) Suppose, in a digital computer system, 3 bits are used to define different instructions and maximum 4 micro-operations are allowed to perform an instruction. Draw a general purpose micro-program control unit for such system and explain its transformation from fetch to execute for a particular instruction, such as ADD. (14)
   b) What are the basic input and output instructions considered in the studied small-scale digital computer? Briefly explain their operations. (07)
   c) Suppose, you need to design a digital system which needs 14 individual instructions and its accumulator size is 16. Calculate the sizes of other registers and memory. (14)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th year 2nd Term Examination, 2019
Department of Computer Science and Engineering
CSE 4225
Embedded Systems

TIME: 3 hours FULL MARKS: 210

N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

## SECTION A

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

1. a) Define embedded systems. Explain the distinguish characteristics of an embedded system. (10)
   b) Classify embedded systems according to the level of integration. (08)
   c) What are the types of system memory in embedded system? How are ROM images generated? Explain briefly. (11)
   d) Write short notes on: (i) ASIP (ii) ASIC. (06)

2. a) Specify middleware with example. Explain three layer model of embedded system. (10)
   b) Describe the several steps for the design process of an embedded system. (07)
   c) Define design metrics for an embedded system. What are the different competing design metrics? Explain briefly. (11)
   d) List the challenges faced in designing an embedded system. (07)

3. a) Explain the software modules and tools for implementation of an embedded system. (10)
   b) Describe the functions of a device programmer. Write down the main features of a source-code engineering tool. (10)
   c) What is sensor? Write down the desirable characteristic s of sensors. (07)
   d) Write an algorithm to deduce the distance of an object by an ultrasonic sensor. (08)

4. a) What are the criteria for choosing a sensor? (06)
   b) Mention the working principle of the following sensors: (09)
      (i) PIR sensor (ii) temperature sensor (iii) Accelerometer.
   c) Define actuator. What are the types of actuator in IoT environment? (08)
   d) Suppose, you have to design an embedded system for automatic fall detection in a device type invariant IoT environment. Briefly explain the following issues in your design. (12)
      (i) Sensor object, (ii) Controller object, (iii) Actuator object and (iv) Actions of the server and client in a fall scenario.

## SECTION B

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

5. a) Suppose, you have to develop an embedded system for an Automatic Chocolate Vending Machine (ACVM). (15)
      (i) Draw the diagram of basic system in ACVM.
      (ii) What are the specification will you suggest?
      (iii) Specify design metrics for ACVM.
   b) To develop a smart card system, (i) what hardware architecture will you include in the system? (ii) Also, describe software architecture. (13)
   c) Briefly explain OS security issues. (07)

6. a) Explain several ways to accelerate performance in co-design issues. (10)
   b) Briefly explain hardware implementation advantages and software implementation advantages for embedded systems. (10)
   c) Explain the factors for choosing a right platform. (05)
   d) What factors should be considered for platform depending issues? (10)

7. a) What is RTOS? Briefly explain RTOS services. (10)
   b) How can you design hard real time and soft real time system? (12)
   c) Explain RTOS preemptive scheduling. The priority of 3 tasks are assigned Task_1>task_2>task_3.How does preemptive scheduling work for these 3 tasks? (13)

8. a) What is hardware-software co-design? Draw a flow diagram for a typical co-design process. (10)
   b) Briefly explain testing steps of Host Machine. (10)
   c) How can you consider white box testing and black box testing in your system? (08)
   d) Explain the features of simulator VxSim. (07)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2019
Department of Computer Science and Engineering
CSE 4239
Data Mining

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 data mining? Discuss each of the following data mining functionalities: (15)
   (i) Characterization (ii) Discrimination
   (iii) Association and Co-relation (iv) Regression
   b) Why do we need data pre-processing? Explain major tasks of data pre-processing. (10)
   c) Define data warehouse. How is a data warehouse different from a database? How are they similar? (10)

2. a) Suppose that a data warehouse consists of three dimensions <time, doctor, patient> and two measures <count>, <charge>, where charge is the fee that a doctor charges a patient for a visit. (12)
   i) Draw the snowflake schema diagram for the data warehouse.
   ii) Starting with the base cuboid [day, doctor, patient], what specific OLAP operations should be necessary to list the total fee collected by each doctor in 2010?
   iii) To obtain the same list as (ii) write an SQL query assuming the data are stored in a relational database with the schema FEE(day, month, year, doctor, hospital, patient, count, charge).
   b) "A data warehouse is based on a multidimensional data model" – Justify the statement. (11)
   c) "Creating a data cube in run time is very much time and space consuming" – Why? Mention the remedies of this problem. (12)

3. a) Consider the database mentioned in the following table. (12)

| TID | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | $a_1$ | $b_1$ | $c_1$ | $d_1$ | $e_1$ |
| 2 | $a_1$ | $b_2$ | $c_1$ | $d_2$ | $e_1$ |
| 3 | $a_1$ | $b_2$ | $c_1$ | $d_1$ | $e_2$ |
| 4 | $a_2$ | $b_1$ | $c_1$ | $d_1$ | $e_2$ |
| 5 | $a_2$ | $b_1$ | $c_1$ | $d_1$ | $e_3$ |

Let fragment_size = 3. Now compute Shell Fragments for the above data cube.
   b) Explain hashing technique to improve the performance of an Apriori algorithm. (08)
   c) What are the advantages of FP growth over Apriori method? Draw the FP-tree from the following table of five transactions, where minimum support count = 3. (15)

| TID | Item |
|---|---|
| $T_1$ | C, D, G, I, M, P, F, A |
| $T_2$ | F, L, M, O, A, B, C |
| $T_3$ | B, F, H, J, O |
| $T_4$ | B, C, K, S, P |
| $T_5$ | E, L, P, N, M, A, F, C |

4. a) Consider a transactional database mentioned in the following table. (15)

| A | B | C | D | Count |
|---|---|---|---|---|
| $a_1$ | $b_1$ | $c_1$ | $d_1$ | 1 |
| $a_1$ | $b_1$ | $c_4$ | $d_3$ | 1 |
| $a_1$ | $b_2$ | $c_2$ | $d_2$ | 1 |
| $a_2$ | $b_3$ | $c_3$ | $d_4$ | 1 |
| $a_2$ | $b_4$ | $c_3$ | $d_4$ | 1 |

Now compress the database using star cubing and aggregates the compressed one for shared dimension BCD, ACD/A, ABD/AB and ABC/ABC.
   b) Define frequent pattern. Suppose, an association rule A→B has support = 60% and confidence = 80%. What do you mean by this statement? Explain. (07)
   c) A database has five transactions described in the following table. (13)

| TID | Items Bought |
|---|---|
| $T_{100}$ | M, O, N, K, E, Y |
| $T_{200}$ | D, O, N, K, E, Y |
| $T_{300}$ | M, A, K, E |
| $T_{400}$ | M, U, C, K, Y |
| $T_{500}$ | C, O, O, K, I, E |

Let min_sup = 4 and min_confidence = 80%. Now,

i) Find the frequent item set using Apriori principle.

ii) List all the strong association rules.

## SECTION B

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

5. a) How you measure the proximity using Jaccurd coefficient? (05)

b) Suppose, a hospital tested the age and body fat data for 10 randomly selected adults with following result: (15)

| **age** | 23 | 23 | 27 | 27 | 39 | 41 | 47 | 49 | 50 | 52 |
|---|---|---|---|---|---|---|---|---|---|---|
| **%fat** | 9.5 | 26.5 | 7.8 | 17.8 | 31.4 | 25.9 | 27.4 | 27.2 | 31.2 | 34.6 |

Now,

i) Draw the Boxplot for age.

ii) Calculate the Pearson's product moment coefficient.

c) Suppose, we have a 2-D data set mentioned in the following table. (15)

| | $A_1$ | $A_2$ |
|---|---|---|
| $x_1$ | 1.5 | 1.7 |
| $x_2$ | 2.0 | 1.9 |
| $x_3$ | 1.6 | 1.8 |
| $x_4$ | 1.2 | 1.5 |
| $x_5$ | 1.5 | 1.0 |

Now, for a tuple x = (1.4, 1.6), rank the database points based on similarity with the tuple x using the following:

(i) Euclidean Distance (ii) Manhattan Distance (iii) Cosine Distance

6. a) Consider the following database. (15)

| TID | $A_1$ | $A_2$ |
|---|---|---|
| 1 | 2.5 | 2.4 |
| 2 | 0.5 | 0.7 |
| 3 | 2.2 | 2.9 |
| 4 | 1.9 | 2.2 |
| 5 | 3.1 | 3.0 |
| 6 | 2.3 | 2.7 |
| 7 | 2.0 | 1.6 |
| 8 | 1.0 | 1.1 |
| 9 | 1.5 | 1.6 |
| 10 | 1.1 | 0.9 |

Now, calculate first and second principle components as measure of dimensionality reduction.

b) Consider the following data for the analysis of attribute age. (10)

13, 15, 16, 16, 19, 20, 21, 22, 22, 25, 30, 30, 33, 35, 35, 40, 45, 46, 52, 70

i) Using smoothing by bean means, smooth the above data using bean depth 3.

ii) Use min-max normalization to transform value 46 into range [0–1].

c) Give a comparison among the attribute selection measures of information gain, gain ratio and gini index. (10)

7. a) Consider the following table. (18)

| Refund | Marital Status | Income | Evade |
|---|---|---|---|
| Yes | Single | 125k | N |
| No | Married | 100k | N |
| No | Single | 70k | N |
| Yes | Married | 120k | N |
| No | Divorced | 95k | Y |
| No | Married | 60k | N |
| Yes | Divorced | 220k | N |
| No | Single | 85k | Y |
| No | Married | 75k | N |
| No | Single | 90k | Y |

Here, attributes are Refund{Yes, No}, Marital Status{Single, Married, Divorced}, Income{Split point is 80K} and Class Label is Evade{Y, N}. Construct a decision tree. You must use 'Gini Index' as attribute selection measure.

b) Build a Rule-Based classifier from the table mentioned in the question 7. (a). (07)

c) Define Mohalnobis distance. How can you use Mohalnobis distance as a measure of multivariate outlier detection? Explain. (10)

8. a) "Support Vector Machine is a method of classification for both linear and nonlinear data"– Explain the idea. (10)

b) What is class imbalance problem? How can you evaluate the performance of a classifier having class imbalance problem? (10)

c) Discuss the trade-off between eager and lazy learners. (05)

d) Explain Semi-Supervised classification and Transfer learning. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 4th Year 2nd Term Examination, 2019
Department of Computer Science and Engineering
CSE 4241
Biomedical 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.

## SECTION A

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

1. a) What is meant by Biomedical Engineering? How can you contribute in Biomedical Engineering fields and healthcare sector as a student/graduate of Computer Science and Engineering? (09)
   b) Draw the block diagram of generalized bioinstrumentation system. Explain it. (10)
   c) Describe the propagation of action potential of human body with necessary diagram. (11)
   d) Draw the electrical equivalent circuit of a small length nerve fiber. (05)

2. a) Compare different bio signal considering their voltage and frequency range. (06)
   b) What is ECG? Draw a typical ECG wave form and mention the electrophysiological condition of its waves and complex. (08)
   c) Explain different components of EEG in terms of signal characteristics and mental states. Also discuss on the role of EEG in Brain Computer Interfacing. (13)
   d) Define electrode. Explain the electrical equivalent circuit of an electrode placed on the surface of skin. (08)

3. a) Explain the role of Electronic Medical Records (EMR) in supporting clinical trials using necessary diagrams. (10)
   b) What types of services are demanding from integrated clinical work stations? Explain in details. (12)
   c) Define eHealth. Write down the scopes, trends and challenges of eHealth systems. (13)

4. a) Write short notes on: (i) Bioinformatics (ii) DICOM (10)
   b) Describe the applications of Artificial Intelligence (AI) in healthcare. (10)
   c) Explain the basic principle of X-ray imaging. (05)
   d) What is CT? Describe the Helical CT scanners for diagnosis of patients. (10)

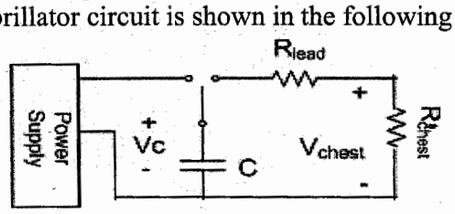
## SECTION B

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

5. a) What is patient monitoring system? Write down the specific applications of patient monitoring system. (08)
   b) What is ICU? Classify the ICUs and explain them briefly. (10)
   c) Draw the block diagram of NIBP module. (07)
   d) Draw the block diagram of $S_pO_2$ module. Explain its operation. (10)

6. a) Define and classify biosensor. Explain the desired features of a biosensor. (10)
   b) What is surgical diathermy? What are the main operating mode of surgical diathermy? (07)
   c) Describe the circuit operation of shortwave diathermy machine. (10)
   d) Describe the bio measurement system using biosensors to measure biological signal. (08)

7. a) What is defibrillator? Discuss the strength duration curve of defibrillator. (07)
   b) Define Cardioversion. Draw and explain the block diagram of Cardioverter. (09)
   c) A capacitive discharge defibrillator circuit is shown in the following figure (10)




Here, $R_{chest} = 95\Omega$, $R_{lead} = 5\Omega$, total energy stored in C is W = 300J, If you want to deliver 90% of W to heart in 8ms, what value of C should be used?

   d) Describe the operations of Square wave defibrillators in brief. (08)

8. a) What is Pacemaker? What is the need for Cardiac Pacemakers? (07)
   b) What are the basic requirements of implantable Cardiac Pacemakers? (08)
   c) Why do we need electrical safety for medical equipment? Discuss the electrical shock hazard in medical equipment. (10)
   d) Explain the effect of electric current in human body. (10)