MASTER OF COMPUTER APPLICATIONS (MCA_NEW)

ASSIGNMENTS
OF MCA_NEW (2Yrs) PROGRAMME
SEMESTER-I

(January - 2025 & July - 2025)

MCS-211, MCS-212, MCS-213, MCS-214, MCS-215

MCSL-216, MCSL-217

SCHOOL OF COMPUTER AND INFORMATION SCIENCES
INDIRA GANDHI NATIONAL OPEN UNIVERSITY
MAIDAN GARHI, NEW DELHI – 110 068

CONTENTS

Important Notes

1. Submit your assignments to the Coordinator of your Study Centre on or before the due date.
2. Assignment submission before due dates is compulsory to become eligible for appearing in corresponding Term End Examinations. For further details, please refer to Programme Guide of MCA (2Yrs).
3. To become eligible for appearing the Term End Practical Examination for the lab courses, it is essential to fulfill the minimum attendance requirements as well as submission of assignments (on or before the due date). For further details, please refer to the Programme Guide of MCA (2yrs).
4. The viva voce is compulsory for the assignments. For any course, if a student submitted the assignment and not attended the viva-voce, then the assignment is treated as not successfully completed and would be marked as ZERO.

Course Code	**:**	**MCS-211**
Course Title	**:**	**Design and Analysis of Algorithms**
Assignment Number	**:**	**MCA_NEW(I)/211/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April 2025 (for January Session)**
		31st October 2025 (for July Session)

This assignment has four questions (80 Marks). Answer all questions. The remaining 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme guide for the presentation format.

Q1: a) Design and develop an efficient algorithm to find the list of prime numbers in the range 501 to 2000. What is the complexity of this algorithm? **(2 Marks)**

b) Differentiate between Cubic-time and Factorial-time algorithms. Give example of one algorithm each for these two running times. **(2 Marks)**

c) Write an algorithm to multiply two square matrices of order n*n. Also explain the time complexity of this algorithm. **(2 Marks)**

d) What are asymptotic bounds for analysis of efficiency of algorithms? Why are asymptotic bounds used? What are their shortcomings? Explain the Big O and Big Θ notation with the help of a diagram. Find the Big O-notation and Θ-notation for the function: **(4 Marks)**

$$f(n)= 100n^4 +1000n^3 +100000$$

e) Write and explain the Left to Right binary exponentiation algorithm. Demonstrate the use of this algorithm to compute the value of 3^{29} (Show the steps of computation). Explain the worst-case complexity of this algorithm. **(4 Marks)**

f) Write and explain the Bubble sort algorithm. Discuss its best and worst-case time complexity. **(3 Marks)**

g) What are the uses of recurrence relations? Solve the following recurrence relations using the Master's method **(3 Marks)**

a. $T(n) = 4T\left(\frac{n}{4}\right) + n^1$

b. $T(n) = 4T\left(\frac{3n}{4}\right) + n^1$

Q2: a) What is an Optimisation Problem? Explain with the help of an example. When would you use a Greedy Approach to solve optimisation problem? Formulate the Task Scheduling Problem as an optimisation problem and write a greedy algorithm to solve this problem. Also, solve the following fractional Knapsack problem using greedy approach. Show all the steps. **(4 Marks)**

Suppose there is a knapsack of capacity 20 Kg and the following 6 items are to packed in it. The weight and profit of the items are as under:

$(p_1, p_2, \ldots, p_6) = (30,16,18,20,10, 7)$

$(w_1, w_2, \ldots, w_6) = (5, 4, 6, 4, 5, 7)$

Select a subset of the items that maximises the profit while keeping the total weight below or equal to the given capacity.

b) Assuming that data to be transmitted consists of only characters 'a' to 'g', design the Huffman code for the following frequencies of character data. Show all the steps of building a huffman tree. Also, show how a coded sequence using Huffman code can be decoded. **(4 Marks)**

a:5, b:25, c:10, d:15, e:8, f:7, g:30

c) Explain the Merge procedure of the Merge Sort algorithm. Demonstrate the use of recursive Merge sort algorithm for sorting the following data of size 8: [19, 18, 16, 12, 11, 10, 9, 8]. Compute the complexity of Merge Sort algorithm. **(4 Marks)**

d) Explain the divide and conquer approach of multiplying two large integers. Compute the time complexity of this approach. Also, explain the binary search algorithm and find its time complexity. **(4 Marks)**

e) Explain the Topological sorting with the help of an example. Also, explain the algorithm of finding strongly connected components in a directed Graph. **(4 Marks)**

Q3: Consider the following Graph:

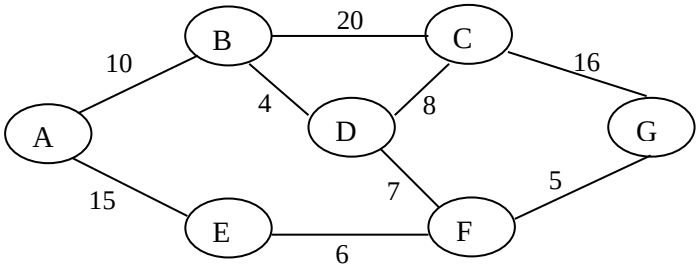


Figure 1: A sample weighted Graph

a) Write the Prim's algorithm to find the minimum cost spanning tree of a graph. Also, find the time complexity of Prim's algorithm. Demonstrate the use of Kruskal's algorithm and Prim's algorithm to find the minimum cost spanning tree for the Graph given in Figure 1. Show all the steps. **(4 Marks)**

b) Write the Dijkstra's shortest path algorithm. Also, find the time complexity of this shortest path algorithm. Find the shortest paths from the vertex 'A' using Dijkstra's shortest path algorithm for the graph given in Figure 1. Show all the steps of computation. **(4 Marks)**

c) Explain the algorithm to find the optimal Binary Search Tree. Demonstrate this algorithm to find the Optimal Binary Search Tree for the following probability data (where p_i represents the probability that the search will be for the key node k_i, whereas q_i represents that the search is for dummy node d_i. Make suitable assumptions, if any) **(6 Marks)**

i	**0**	**1**	**2**	**3**	**4**
p_i		**0.10**	**0.15**	**0.20**	**0.10**
q_i	**0.05**	**0.10**	**0.10**	**0.10**	**0.10**

d) Given the following sequence of chain multiplication of the matrices. Find the optimal way of multiplying these matrices: **(2 Marks)**

Matrix	Dimension
A1	10 × 15
A2	15 × 5
A3	5 × 20
A4	20 × 10

e) Explain the Rabin Karp algorithm for string matching with the help of an example. Find the time complexity of this algorithm. **(4 Marks)**

Q4: a) Explain the term Decision problem with the help of an example. Define the following problems and identify if they are decision problem or optimisation problem? Give reasons in support of your answer. **(4 Marks)**

(i) Travelling Salesman Problem
(ii) Graph Colouring Problem
(iii) 0-1 Knapsack Problem

b) What are P and NP class of Problems? Explain each class with the help of at least two examples. **(4 Marks)**

c) Define the NP-Hard and NP-Complete problem. How are they different from each other. Explain the use of polynomial time reduction with the help of an example. **(4 Marks)**

d) Define the following Problems: **(8 Marks)**

(i) SAT Problem
(ii) Clique problem
(iii) Hamiltonian Cycle Problem
(iv) Subset Sum Problem

Course Code	**:**	**MCS-212**
Course Title	**:**	**Discrete Mathematics**
Assignment Number	**:**	**MCA_NEW(I)/212/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30thApril 2025 (for January Session)** **31st October 2025 (for July Session)**

This assignment has 20 questions of 4 Marks each, amounting to 80 marks. Answer all questions. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1: Prove by mathematical induction that $\sum_{i = 1 \text{ to } n} \frac{1}{i(i+1)} = n/(n+1)$

Q2: Verify whether $\sqrt{11}$ is rational or irrational.

Q3: Write the following statements in the symbolic form.

i) Some students can not appear in exam.
ii) Everyone can not sing.

Q4: Draw logic circuit for the following Boolean Expression:
(x y z) + (x+y+z)'+(x'zy')

Q5: Explain whether function: $f(x) = x^2$ posses an inverse function or not.

Q6: Write the finite automata corresponding to the regular expression (a + b)*ab

Q7: If L1 and L2 are context free languages then, prove that L1 U L2 is a context free language.

Q8: Explain Decidable and Undecidable Problems. Give example for each.

Q9: What is equivalence relation? Explain use of equivalence relation with the help of an example.

Q10: There are three Companies, C1, C2 and C3. The party C1 has 4 members, C2 has 5 members and C3 has 6 members in an assembly. Suppose we want to select two persons, both from the same Company, to become president and vice president. In how many ways can this be done?

Q11: How many words can be formed using letter of DEPARTMENT using each letter at most once?

i) If each letter must be used,
ii) If some or all the letters may be omitted.

Q12: What is the probability that a number between 1 and 10,000 is divisible by neither 2, 3, 5 nor 7?

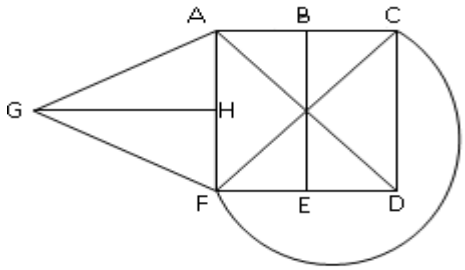
Q13: Explain inclusion-exclusion principle and Pigeon Hole Principle with example.

Q14: Find an explicit recurrence relation for minimum number of moves in which the n-disks in tower of Hanoi puzzle can be solved! Also solve the obtained recurrence relation through an iterative method.

Q15: Find the solution of the recurrences relation $a_n = a_{n-1} + 2a_{n-1}$, $n > 2$ with $a_0 = 0$, $a_1=1$

Q16: Prove that the complement of $\overline{G}$ is G

Q17: What is a chromatic number of a graph? What is a chromatic number of the following graph?



Q18: Determine whether the above graph has a Hamiltonian circuit. If it has, find such a circuit. If it does not have, justify it.

Q19: Explain and prove the Handshaking Theorem, with suitable example

Q20: Explain the terms PATH, CIRCUIT and CYCLES in context of Graphs.

Course Code	**:**	**MCS-213**
Course Title	**:**	**Software Engineering**
Assignment Number	**:**	**MCA_NEW(I)/213/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**40%**
Last Dates for Submission	**:**	**30th April 2025 (for January Session)** **31st October 2025 (for July Session)**

This assignment has one question for 80 marks. 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1:

Assume that you are assigned responsibility of developing an **Online Date Sheet Generation System (ODSGS)** for a University. **ODSGS** should run both on PCs and Mobile Devices. **ODSGS** will have fields such as Course Code, Course Title, Date of Exam, Time of Exam etc. The user of ODSGS will input the list of course codes and course titles and duration of examination. Sunday will be holiday. Starting date of exams will also be input by the user. There may be other information that is needed by ODSGS to generate the date sheet. So, you can list them and make provision for them in database structure. Make assumptions wherever necessary. Based on the inputs received, ODSGS should generate the Date Sheet.
For developing **ODSGS** as specified above,

(a) Which SDLC paradigm will be selected. You may also suggest a SDLC paradigm that is proposed by you and non-existent as on date. Justify your answer. **(10 Marks)**
(b) List the functional and non-functional requirements. **(10 Marks)**
(c) Estimate the cost. **(15 Marks)**
(d) Estimate the efforts. **(15 Marks)**
(e) Develop SRS using IEEE format. **(15 Marks)**
(f) List queries for whom Reports can be generated. **(5 Marks)**
(g) List specific requirements which enables **ODSGS** to run on both PCs and Mobile Devices. **(10 Marks)**

Course Code	**:**	**MCS-214**
Course Title	**:**	**Professional Skills and Ethics**
Assignment Number	**:**	**MCA_NEW(I)/214/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April 2025 (for January session)** **31st October 2025 (for July session)**

This assignment has eight questions. Answer all questions. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of presentation.

Q1:

Read the following passage and answer the questions given below: (10 X 2 = 20 Marks)

In today's interconnected world, technology is not just a tool; it is the foundation upon which modern communication and professional growth are built. The rise of digital platforms has revolutionized how we share information, collaborate, and make decisions. From instant messaging and video conferencing to collaborative software and cloud-based tools, technology bridges geographical gaps, enabling global teamwork and faster problem-solving.

Artificial Intelligence (AI) and automation are redefining workplace dynamics, creating a demand for adaptive soft skills like critical thinking, creativity, and emotional intelligence. Professionals now rely on virtual platforms to enhance productivity and efficiency, using tools such as project management software, digital calendars, and analytics dashboards.

However, the rise of technology also poses challenges. Over-reliance on digital communication can dilute interpersonal connections, and the fast-paced environment may lead to stress. Thus, striking a balance between leveraging technology and nurturing human interaction is essential for sustainable professional growth.
Moreover, being tech-savvy is no longer a luxury but a necessity in virtually every industry. Staying updated with the latest trends, mastering new tools, and understanding the ethical implications of technological advancements are integral to a successful career in the modern era.

i. What are some ways technology has revolutionized workplace communication?
ii. Discuss the role of Artificial Intelligence in shaping the future of professional skills.
iii. List three digital tools commonly used in professional environments and explain their significance.
iv. How has technology contributed to global collaboration in modern workplaces?
v. What challenges might arise from over-reliance on digital communication? Suggest solutions.
vi. Explain the importance of balancing technology use with interpersonal skills. Provide examples.
vii. Why is it essential to stay updated with technological advancements in your career?
viii. Describe the ethical considerations that professionals must keep in mind while using technology.
ix. How does technology enhance productivity, and what strategies can professionals use to manage tech-related stress?
x. What soft skills complement technological expertise in achieving professional success?

Q2: Pick out words/phrases from the passage which have the following meanings. **(10 Marks)**

i. connecting the world
ii. transformed
iii. career development
iv. spreading knowledge
v. groupware
vi. corporate behaviour
vii. global synergy
viii. over-dependence
ix. renewable / long lasting
x. moral overtones

Q3: Put the verbs in brackets in their correct form. **(10 Marks)**

Last weekend, I _____ (past tense of "decide") to spend a day at the park. Early in the morning, I _____ (past tense of "pack") my bag with snacks, a book, and a frisbee. When I _____ (past tense of "reach") the park, I _____ (past tense of "find") a quiet spot under a tree. I _____ (past tense of "sit") down and _____ (past tense of "read") a few chapters of my book.

Later, I _____ (past tense of "meet") some friends who _____ (past tense of "bring") a picnic basket. We _____ (past tense of "play") frisbee for hours and _____ (past tense of "enjoy") the warm sunshine. It was a day full of fun and relaxation.

Q4: Write short notes on **any four** of the following: **(20 Marks)**

i) Importance of communication skills in professional and personal settings.
ii) Role of emotional intelligence in building effective relationships at work.
iii) Time management skills contribute to productivity and success.
iv) Significance of teamwork and collaboration in achieving organizational goals.
v) Impact of problem-solving skills in decision-making processes.

Q5: You have seen *software testing engineer* job in a software company advertised online. Write a letter in about 200-250 words to the company applying for the job. Include relevant factors such as why you are interested in it, your qualifications, experience, what you are doing now and how you could contribute to the position. **(10 Marks)**

Q6: Read the advertisement below and write your Curriculum Vitae on the basis of it. **(10 Marks)**

Software Sales Executives (North)
For a
Leading Multinational Company

We are seeking enthusiastic and dynamic individuals, both male and female, to join our team as Sales Representatives for our Accounting Software. The role is based in Gurugram and involves managing sales operations across North India. While no prior experience is necessary, a working knowledge of accounting software is essential for this position.
We offer industry-leading remuneration, with a strong emphasis on performance-based rewards.

Apply to Mr.Rahul Sachdeva
Personal Executive
XYZ Co., Sector-17, Gurugram, Haryana

Q7: Mark the stress in the following words: **(10 Marks)**

i)	attend	attention
ii)	believe	belief
iii)	assist	assistance
iv)	lovely	loveliness
v)	commerce	commercial

Q8: Prepare a presentation ***on any one*** of the following: **(10 Marks)**

i) Artificial Intelligence in Education
ii) About Applications of IoT in Agriculture
iii) Cloud-Based Applications

The presentation must be about 20 slides.

Course Code	**:**	**MCS-215**
Course Title	**:**	**Security and Cyber Laws**
Assignment Number	**:**	**MCA_NEW(I)/215/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last date of Submission	**:**	**30th April 2025 (for January session)** **31st October 2025 (for July session)**

This assignment has six questions. Answer all questions. The remaining 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the Programme Guide for the format of the presentation.

Q1: **(3*4= 12 Marks)**

(a) Explain the terms Confidentiality, Integrity and Availability in digital security. Explain the Pros and Cons of digital security.

(b) Explain the following in the context of security issues/attacks:
- (i) Unauthorised access
- (ii) Social Engineering Attacks
- (iii) Internet of Things (IoT) attacks

(c) Explain (any three) ways technology can help you to counter different types of cyber security attacks.

(d) What are the laws related to Distributed Denial of Service Attacks and Crypto-jacking?

Q2: Explain the following terms with the help of an example of each. **(3*6=18 Marks)**

(a) Transposition Ciphers
(b) Advantages and Disadvantages of Symmetric Key Cryptography
(c) Steganography
(d) Data Encryption Standard (DES)
(e) Hash functions
(f) Key Establishment, Management and Certification in the context of cryptography

Q3: **(3*4= 12 Marks)**

(a) What are the practices for implementing the CIA triad in data security? Explain.

(b) Explain the following:
- **(i)** Ransomware attacks
- **(ii)** Cyber-physical attacks

(c) Explain the following data security measures:
- **(i)** Email Security
- **(ii)** Risk-Assessment Analysis

(d) What is a Security audit? Explain with the help of an example. What are the different trade-offs between security and usability?

Q4: **(3*4= 12 Marks)**

(a) How can cyberspace be regulated? Explain.
(b) What are the different approaches of regulating Internet content? Explain.
(c) What are the doctrines and Articles of UNCITRAL model law? Explain.
(d) What are the regulations for cyberspace content in India? Explain

Q5: **(3*5= 15 Marks)**

(a) How is cybercrime defined? Explain the classification of cybercrimes with the help of examples.
(b) List the Penalties and compensation in Section 44 of the Information Technology Act 2000.
(c) List any six offences under sections 65 and 66 as per the Information Technology Act, 2000.

(d) What are the grounds which exempt the network service providers from liability? Explain.
(e) What are the different cyber forensic investigation tools? Explain

Q6: **(6+3+2= 11 Marks)**

(a) Explain the following forms of IPR with the help of an example of each:
(i) Copyrights and related rights.
(ii) Trade Secrets
(iii) Geographical Indication
(b) Explain cyber-squatting and abuse of search engines with the help of an example of each.
(c) What remedies are available against infringement of IPR?

Course Code	**:**	**MCSL-216**
Course Title	**:**	**DAA and Web Design Lab**
Assignment Number	**:**	**MCA_NEW(I)/L-216/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**30%**
Last Dates for Submission	**:**	**30th April 2025 (for January session)** **31st October 2025 (for July session)**

This assignment has two sections. Answer all questions in each section. Each Section is of 20 marks. Your Lab Records will carry 40 Marks (20 Marks for each section). Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the programme guide for the format of presentation.

Note: You must execute the program and submit the program logic, sample input and output along with the necessary documentation. Assumptions can be made wherever necessary.

Section-1

Q1: Implement Quick Sort's algorithm on your machine to sort the following list of elements

12 20 22 16 25 18 8 10 6 15

Also, compare the performance of Quick Sort algorithm implemented for the data given above with the performance of the Quick Sort algorithm when used to sort the data given below

6 8 10 12 15 16 18 20 22 25

Note :

- Performance Comparison is required in terms of a number of comparisons, exchange operations and the number of times the loop will iterate?
- Show step by step processes, and support your code with suitable comments for better readability.

Q2: Apply Huffman's algorithm to construct an optimal binary prefix code for the letters and its frequencies in the table given below (Show the complete steps).

Letters	A	B	C	D	E	F	G
Frequency	15	25	5	7	10	13	9

Find out an average number of bits required per character. Also, Implement Huffman's coding algorithm and run for the given problem instance. Support your code with suitable comments for better readability

Section-2

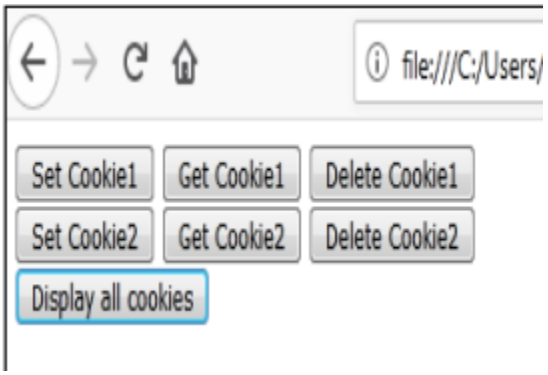
Q3: Design a form for the Patient Satisfaction Survey for a particular hospital having the following fields:

- Patient's name
- Patient's File number (Issued by the hospital)
- Which Unit of the hospital the patient was admitted Select V (Surgery, Medicine, etc.)
- Are you satisfied with overall treatment :
  Very Satisfied Satisfied Not Satisfied
- Are you satisfied with medical facilities in the hospital :
  Very Satisfied Satisfied Not Satisfied
- Overall Comments
- Submit
- Reset

Note : you are required judiciously choose the options for Text Box, Combo Box, Radio Button, Check Box, Buttons etc. for the respective fields required in the form

a) Submit button should enter all the fields' data to the database.
b) Error message should be shown if a text field is left blank.
c) Reset button resets all the fields to the blank.
d) Use JavaScript to validate the fields.

Q4: Create an HTML web page, as shown below. The cookie1 and cookie2 will be set on pressing Set Cookie1or Set Cookie2 button and the stored cookie value will be displayed on pressing Get Cookie1 or Get Cookie2 button respectively. On the other hand selectively cookie can be deleted by pressing Delete Cookie1 or Delete Cookie2 button. Display all cookies button will show all the stored cookies.



Course Code	**:**	**MCSL-217**
Course Title	**:**	**Software Engineering Lab**
Assignment Number	**:**	**MCA_NEW(I)/217/Assign/2025**
Maximum Marks	**:**	**100**
Weightage	**:**	**40%**
Last Dates for Submission	**:**	**30th April 2025 (for January session)** **31st October 2025 (for July session)**

This assignment has one question for 40 marks. Answer this question. Your Lab Records will carry 40 Marks. Rest 20 marks are for viva voce. You may use illustrations and diagrams to enhance the explanations. Please go through the guidelines regarding assignments given in the programme guide for the format of presentation.

Note: You must execute the program and submit the program logic, sample input and output along with the necessary documentation. Assumptions can be made wherever necessary.

Q1:

ABC is a network of Hospitals. Its having Hospitals across the World. Its possible to take appointment for any Doctor for an available slot on an available date through its website. Its having a Chatbot also. There are many specialities in each of its Hosptitals. However, not all specialities are available across all its Hospitals. Doctors may provide consultancy services in more than one hospital of its network. Its possible to make payment of consultation fee online while taking appointment or directly at hospital prior to consultation.
Make assumptions, wherever necessary. Also, list them very clearly.

Now, with reference to the above, answer the following:

(1) List the Entities **(10 Marks)**
(2) For each Entity, list Attributes **(10 Marks)**
(3) Define relationships between the Entities **(10 Marks)**
(4) Finally, draw the Entity Relationship Diagram **(10 Marks)**