

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Object Oriented Analysis and Design (CT651)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Differentiate between functional and non-functional requirement. What are the relationships in Use Case Diagrams and explain <<include>> and <<extend>> relationships with diagram? [5]

b) For the case study given below identify all the actors, use cases and relationships also draw use case diagram. [5]

A coffee Vending Machine dispenses coffee to customers. Customers order coffee by selecting a recipe from a set of recipes. Customers pay for the coffee using coins. Change is given back if any to the customers. The Services staff loads ingredients (coffee power, milk, sugar, water and chocolate) into the coffee machine. The service staff can also add a recipe by indicating the name of the coffee, the units of coffee powder, milk, sugar, water and chocolate to be added as well as the cost of the coffee.

2. Explain all types of external actors in relation to System under Discussion (SuD). Draw a system sequence diagram for the Library Management system with the following requirements. You can add additional elements if necessary.

A college library has 4 librarians to manage and issue the books to the users who are either students or faculty staffs. The library contains the books belonging to Computer and Humanities streams. The books are course books, reference books, book banks etc. The users must log into system to search the required books and may reserve the books earlier. The librarian issues the books to the users and also charge fine in case of delayed return or loss of the book. The librarian asks for the "Sanu Publisher" to supply the necessary books into the library. The librarian manages all the users. [2+6]

3. What do you mean by Domain Modeling? Present the guidelines to add attributes and associations in the domain model. [6]

4. How can you represent the dynamic behavior of the system in Object Oriented Analysis (OOA)? Explain with example. [6]

5. Draw the class diagram and map the design into code for "Health Care Center" as following: Patient can arrange and cancel appointment with physician using scheduler. Physician secedes to prescribe Medication for patient. Physician Specifies Drug Info: Medication name, Dosage Amount, Number Doses and Refills. Computer Cross-Checks for Conflict between Medication and Current Medications/Medical History Prescription Forwarded Electronically to Pharmacy or Else Printed for Patient. [10]

6. a) In many ways, a deployment diagram is just a special kind of class diagram, which focuses on a system's nodes. Justify this statement. [5]

b) Draw an exception class hierarchy to present the errors and exceptions derived from the Throewable class. [5]

7. How pattern different from framework? Explain information Expert, Creator and Low Coupling design patterns defined by GRASP Design Pattern.

[8]

8. a) Explain the concept of interface and implementation in object oriented design and implementation.

[5]

b) During object oriented implementation of design class diagram you may encounter one-to- many relationships between classes. With the help of collection and generic classes, explain how you can represent these relationships in object oriented programming.

[5]

9. Compare the followings:

[4×3]

- a) Forward Engineering vs. Backward Engineering
- b) Structural Model vs. Implementation Model
- c) Flowchart Vs. Structure chart

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**Examination Control Division**  
2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Object Oriented Analysis and Design (CT651)

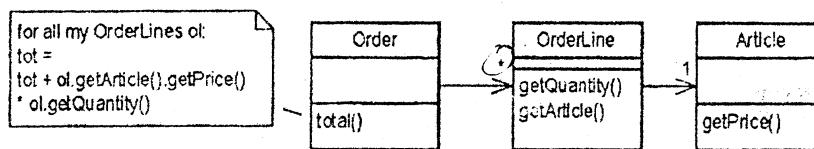
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1 What are the differences between algorithmic decomposition and object-oriented decomposition in the process of systems analysis for a complex system? What is the role of hierarchy, another feature of object-orientation, in such decomposition process? [6 + 4]
- 2 Explain four primary relations between classes; dependency, association, aggregation, and realization, with their corresponding notations. [8]
- 3 What is behavior modeling in object-oriented analysis? Present any four sample diagrams that are based on behavior modeling. [4 + 4]
- 4 A new bus service, Gana Rajya Express (GRE) is starting soon, which has the business plan and operation as detailed below. [10]

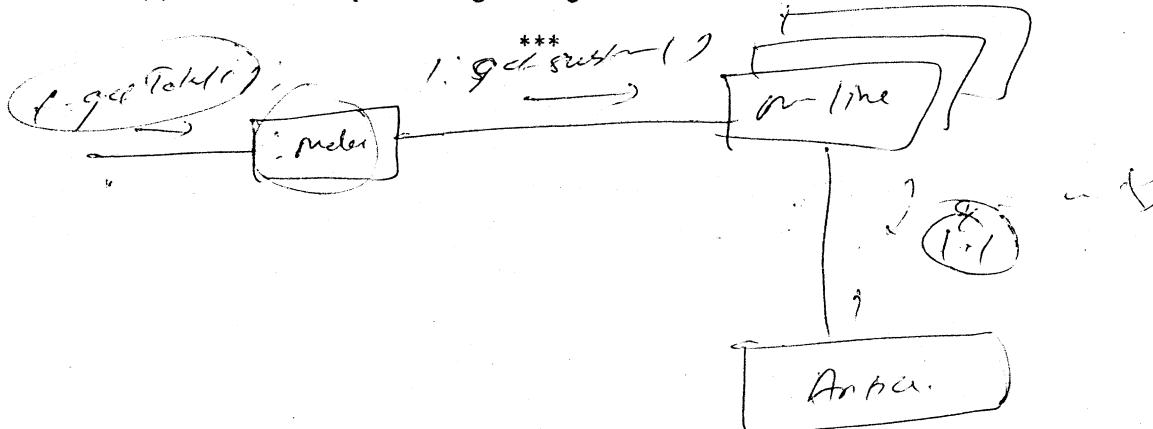
GRE sells tickets only through the web service, not in bus stations or in buses. Tickets must be paid by credit card or online bank payment. Tickets are not bookable. Ticket can be sold to the particular line, but not with particular seating location. The ticket can be cancelled, but GRE returns only a portion of the ticket price. Cancellation can be handled via Internet or via phone services. The closer to departure, the lower part of the price shall be refunded. In addition to ticket cancellation, it is possible to inquire about bus schedule information via phone service. Tickets are electronic tickets delivered via e-mail. The driver checks the right to travel by reading the barcode on the ticket using mobile reading terminal. GRE hires workers for different tasks. Traffic planner establishes and closes down lines. He also shifts in demand, and designs schedules. Price analyst adjusts prices depending on demand and competitors. Driver manager is the head of drivers and allocates drivers and buses, and schedules services and Transportation Department tests for the vehicles. GRE pays hourly rate for drivers and telephone service staff. Other staff will be paid by monthly salary basis. Non-core activities (accounting, payroll, vehicle maintenance, computer maintenance, etc.) will be outsourced.

Prepare and draw Use Cases with elaboration for the above scenario.

- 5 Bottle recycling machine has a control unit, bottle sensor, belt unit, the sum counter, the end button and the receipt printer. There are at least states such as waiting, on run, on service and receipt printing. The "on run" state can be refined with sub-states working, blocked, failure notification, emptying. You can add few new states according to your own realization. [8]
- Draw a state diagram for the control unit
- 6 Your manager reviews your design and codes of a sub-module that you have prepared, as depicted in the below figure. She suggests you to introduce *subtotal( )* somewhere in your model thinking about the performance of the system. [8]



- Modify your implementation and justify how does this update provides you better performance.
- 7 What is exception and error handling in the context of system implementation? How does it differ from other conventional method versus the object-oriented method based implementation? [5+5]
- 8 Explain the forking, joining, and branching features available in object-oriented based modeling? How does these primitive provide the closest implementation model? Relate with any arbitrary sample. [4+4]
- 9 Write short notes. [2\*5]
  - (a) Focus of control
  - (b) Methods of requirement gathering



Exam.	New Back (2066 & Later Batch)		
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**Subject:** - Object Oriented Analysis and Design (CT651)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. What are the main differences of OO based design cycle to other conventional design cycle? Explain with relevant example. [7]
2. In OOAD, there are various types of models, like conceptual, structural, behavioral, etc. What is the significance of these many different types of model? Explain with illustrative examples. [7]
3. How does the requirement elicitation process happen in object oriented analysis? Explain with reference to system behavior analysis of any exemplary system case. [7]
4. Prepare the list of essential components to be identified in building an activity diagram. Illustrate with an example of your own choice. [7]
5. The model depicts the online order processing system as illustrated in fig.1. Explain in detail of the diagram type with every symbols being used and semantics of this diagram. [8]

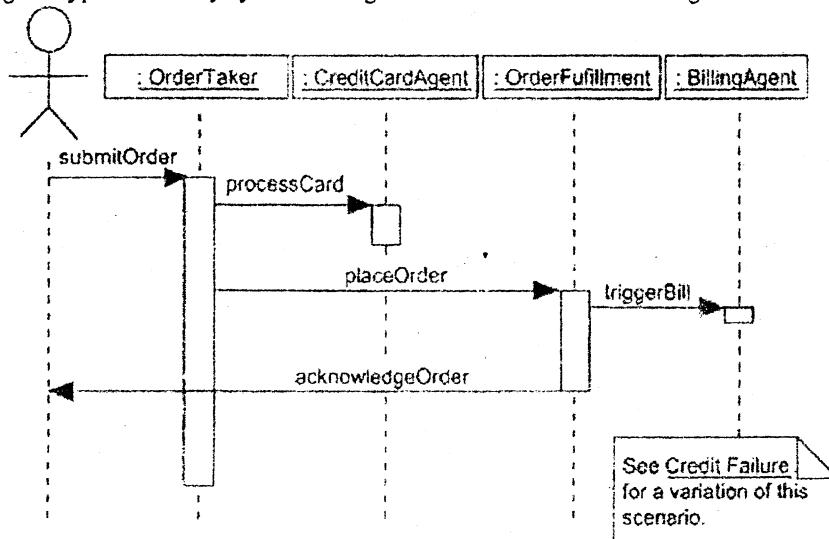


fig.1

- [4+8]
6. Imagine your school friend, Miss DilKhus Kumari Vaidya, a very successful entrepreneur at early age, is offering you systems manager position with very good salary in her new business of event management. The proposed system is a complete Online-Event-Management-System (OEMS) that should handle not only event details, rather the revenue, expenditure and transaction details related to various headings of each event and also every personnel involved. Now you have to prepare executive summary and also a class diagram for making your case very strong among the stakeholders for making decision about the project finalization. [7]
7. Present the mapping process for the fig.1 model using object-oriented based pseudo-codes for capturing all important aspects of the model diagram. [7]
8. Prepare a comparative note on forward versus reverse engineering with mentioning the merits, demerits and implementation challenges. [7]
9. Explain the importance of error handling issues to be resolved in a system. [6]
10. Write short notes on [4\*3]  
a) External agent in Use Case  
b) Effect of design patterns in deployment  
c) Issues on distributed system implementation

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**Examination Control Division.**

2069 Bhadra

<b>Exam.</b>	<b>Regular (2066 &amp; Later Batch)</b>		
<b>Level</b>	<b>BE</b>	<b>Full Marks</b>	<b>80</b>
<b>Programme</b>	<b>BCT</b>	<b>Pass Marks</b>	<b>32</b>
<b>Year / Part</b>	<b>III / II</b>	<b>Time</b>	<b>3 hrs.</b>

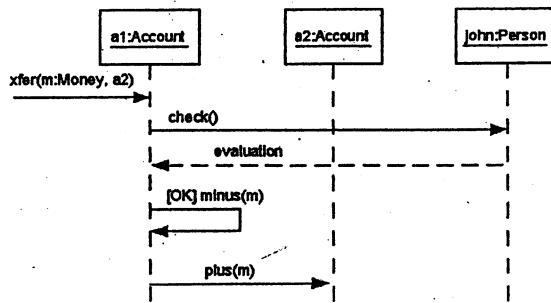
**Subject: - Object Oriented Analysis and Design (CT651)**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- (1) What is the meaning of *Encapsulation* from the viewpoint of structured systems analysis and design? Explain how does *Encapsulation* and *Abstraction* concepts work together in object-orientation? [4 + 6]
- (2) Here are some of the requirements for a system that you are going to build for the Grand Care Hospital, which is coming in operation soon. Identify which of the following information are used in building Conceptual, Specification and Implementation model. [6]
- (a) Each out-patient registration process takes an average of 90 seconds.
  - (b) Liver unit will treat the *Jaundice* patients.
  - (c) All bio-chemistry tests are carried out in Pathology department
  - (d) The newly installed GE USG machine can record diagnostic video too. Extended computer interfacing is required with Windows OS and mpeg-4 application.
  - (e) Each Gastro-patient going to operation theater (OT) is to be re-evaluated for bowel status exactly 30 minutes before their OT schedule.
  - (f) Some of the gastro-patients visit Liver unit too.
- (3) Explain four different types of relationships that we model in object-oriented analysis, which exists between two different classes represented as shown in below figure. [8]



- (4) Based on the below diagram for model action of money transfer, answer the following questions: [3\*3]
- (a) How many numbers of classes are involved in this transfer activity? What are they?
  - (b) What are the events followed for transfer complete?
  - (c) Why this *check()* function is required for this transfer?



- (5) A new digital clock, recently available in the market, simultaneously displays the time and date. The time and date displays can be adjusted by the buttons available within the unit. The clock has two buttons, "mode" and "forward". If you wish to change the time you should first press the mode button, after which the time may be changed by the forward-button. If the mode button is pressed again, you can change the date (by the forward-button). If the mode button is pressed once again, you will go back to normal state. When the forward-button is pressed, the display will go a single unit (seconds or days) ahead. If the button is held down for more than two seconds, the display will change rapidly (once in every 0.2 second) ahead so long as the button is pressed. [10]  
Draw a state diagram for this clock control unit.
- (6) Explain the forward and reverse engineering processes with outlining their merits and demerits in object-oriented implementation. [10]
- (7) The Premier Video Rental Shop (PVRS) decides to implement a database-based information system. PVRS acquires the video from the importer or chain trade. An agreement will be signed with both partners and it defines the date, number of copies, time frame of the lease and purchase price. As an additional info of importer also the address and bank details will be recorded. The customer rents a video from the PVRS. From each video the name, ID and rental price information will be recorded. The rental price is calculated from the rental period, the purchase price and the customer relationship. Video types include action, art and children's video. Video may also be a blend of action and art videos. As an action video info the degree of violence will be recorded, and from art videos the awards and from children's videos the age limit. The customer relationship can be a random customer, regular or member of PVRS club. As an overarching customer info the name will be recorded and from regular customer the cumulative sum of the number of rental events. [12]  
From the members of PVRS club information, the member address is used in order to advertise new products and offers.  
Draw a class diagram, which presents the main classes, properties, methods, and relationships between classes.
- (8) Write short notes. [3\*5]  
(a) Sequence diagram  
(b) Swimlanes  
(c) Polymorphic signal

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Object Oriented Analysis and Design (CT 651)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain object oriented system with reference to class, object, encapsulation, abstraction, message, inheritance, interface and polymorphism with suitable examples. [8]
2. IOE is willing to develop a system for the student result management of its BE program. Now prepare the problem statement from the side of Examination control Division. What are building blocks of UML? Explain with suitable examples and notations. [4+6]
3. A web-based online store has ‘Buy a Product’ scenario as follows:  
 The customer browses the catalog and adds desired items to the shopping basket. When the customer wishes to pay, the customer describes the shipping and credit card information and confirms the sale. The system checks the authorization on the credit card and confirms the sale both immediately and with a follow-up e-mail.  
 Now construct conceptual model for this scenario. [6]
4. Draw a class diagram for point of sale system with association and multiplicity. [6]
5. Read the following case study carefully and answer the given questions.  
 Ministry of Health and Population is willing to computerize its system. This new system will be able to tell the population of the country, zone and district and even of the ward of specific place. The system will update its data in monthly basis so that the birth rate and death rate can be easily seen. The home page is displayed when a person enters to the system. Administrators can enter to the admin panel by logging in with an ID and a password. He/she has privileges to enter and modify the data into the database. On the other hand, normal users can view the data but not modify them. They can also visualize the data in graphical form with animated charts, maps as well as in tabular form based on their selection of data. Besides, they can also view the forecasted data. (Make your assumptions if necessary)  
 Draw collaboration diagram and use case diagram. [6+6]
6. What is framework? How design pattern is useful? Explain any one design pattern in detail with suitable example. [6]
7. Explain development process with suitable example. How can you map design into code? Illustrate with diagrams produced in question number five by using any object oriented languages like C++, Java, C# etc. [4+7]
8. Construct a system sequence diagram for customer from a “Food ordering system” of a very busy restaurant where seating and ordering is regulated by seating manager. [6]
9. Illustrate how can you create classes from design class diagrams and methods from interaction diagrams (Use C#, Java etc.). [6]
10. Write short notes on:  
 a) Iterative cycles of development      b) Synchronization bar      c) Flow of object [3x3]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

***Subject:*** - Embedded System (CT655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. a) What are the common characteristics of embedded systems? How does a digital camera satisfy those characteristics? [4]
- b) Briefly describe the kernel operating system services. [4]
2. Design a single-purpose processor that outputs Fibonacci numbers up to 'n' places. Start with a function computing the desired result, translate it into a state diagram and sketch a probable datapath. [8]
3. Briefly explain the criterion for selecting processor? Explain the data path operation and its instruction cycles. [4+4]
4. What do you mean by write ability and storage permanence of memory? Explain associative cache mapping. [3+5]
5. What is the difference between memory-mapped I/O and standard I/O. Explain the operation of peripheral to memory transfer without DMA, using vectored interrupt. [3+5]
6. Differentiate between multiprocessing and multi tasking in RTOS. Three processes with process IDs, P1, P2, P3 with estimated completion time 6, 4, 2 ms respectively, enters the ready queue together in order P1, P2, P3. Calculate waiting time and TAT(Turn Around Time) for each process and average waiting time and TAT. Assume there is no I/O waiting for the processes and RR (Round-Robin) algorithm with time slice = 2 ms. [2+6]
7. Differentiate between closed loop and open loop control system. With neat diagram write the steps for designing Closed loop control system. [3+5]
8. Discuss the advantages and disadvantages of Full-Custom IC technology. Explain the basic steps of photo lithography process. [3+5]
9. Draw the pin diagram of 8051 microcontroller and explain ports 1 and 2 only. Write a program using C-programming language to find the sum between two 8-bit BCD data stored in RAM locations 50H and 51H and store the BCD sum at RAM locations 52H and 53H. [3+5]
10. Write an algorithm and VHDL code for a custom processor that calculates Least Common Multiple (LCM) of two numbers. [3+5]

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Embedded System (**CT655**)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ The figures in the margin indicate Full Marks.
  - ✓ Assume suitable data if necessary.
1. Differentiate between single-purpose processors, general-purpose processors, and application-specific processors. Using the simplified revenue model, derive the percentage revenue loss equation for any rise angle, rather than just for 45 degrees. [2+2]
  2. What is optimization? Explain optimization of single purpose processor in detail with suitable example. [8]
  3. Describe the operation of general - purpose processor in terms of datapath and controller. [5]
  4. Explain the testing and debugger. [3]
  5. Describe ROM and introduce its types in detail. Sketch the internal design of a  $4 \times 3$  ROM. [6+2]
  6. Explain different types of arbitration methods used in peripherals devices to gain control of system bus. Describe the significance of I<sup>2</sup>C serial communication protocol. [8]
  7. Describe the context switching process in detail. Three processes with process IDs P1, P2, P3 with estimated completion times 6, 8, 2 milliseconds respectively enters the ready queue together. Process P4 with estimated execution completion time 4 milliseconds enters the ready queue after 1 millisecond. Calculate the waiting time and turn-around-time for each process and the average waiting time and turn-around-time in the non-preemptive shortest-job-first scheduling. [3+3]
  8. Explain in detail the Coffman conditions that favor deadlock. Differentiate between user-level threads and Kernel-level threads. [3+3]
  9. Explain the operation of a PID control with a clean block diagram. [5]
  10. Define the following terms used in control system: Controller, Plant, Actuator. [3]
  11. Describe the steps involved in manufacturing an IC. Show the top-down view of the circuit  $F = xz + y$  on an IC. [4+4]
  12. Show the internal structure of the 8051 microcontroller. Provide a comparison chart of the 8051 family members. [4+4]
  13. Write the code for BCD counter to display 0 to 9999 in seven segment using VHDL. [8]

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<b>Exam.</b>	New Back (2066 & Later Batch)		
<b>Level</b>	BE	<b>Full Marks</b>	80
<b>Programme</b>	BEX, BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	III / II	<b>Time</b>	3 hrs.

**Subject:** - Embedded System (CT655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is an Embedded system? Describe its various applications. [1+3]
2. Design a dual-purpose processor that calculates the median and variance of 5 numbers entered by the user, by showing the algorithm, FSMD, FSM, data-path and controller design. [8]
3. Differentiate between application specific instruction set-processor and general purpose processor. Also discuss on issues related to selection of a particular processor. [8]
4. Design a ROM that will store the following words in the corresponding addresses. [5]

X	Y	z	F <sub>1</sub>	F <sub>2</sub>
0	0	0	1	0
0	0	1	1	0
0	1	0	0	1
0	1	1	0	1
1	0	0	0	0
1	0	1	1	1
1	1	0	0	1
1	1	1	1	0

5. Compose  $2^{k+1} \times m$  memory using  $2^k \times m$  memories. [3]
6. Describe the purpose of the direct-memory-access (DMA) controller. Draw the flow of actions between peripheral and memory using DMA. [2+2]
7. Describe the advanced communication principles used in embedded systems. [4]
8. Distinguish between process and thread. Write different states of task with appropriate example. [6]
9. What are the advantages of multithreading program? Write a simple multithreading program in C. [6]
10. Write the pseudo-code for a PID controller. What is the purpose of PID tuning, and what are the benefits of computer based control implementations? [4+4]
11. Explain the IC manufacturing steps with a neat block diagram. [5]
12. List the three major IC technologies with brief definitions. [3]
13. Write 8051 program and draw circuit diagram to display number from 99 to 00 in seven segment display. The program should write in both assembly and C. [8]
14. How does a FPGA differ from a microcontroller? Design a sequence detector for the string "1101", that outputs a one when the input matches this string, show the FSM and its VHDL implementation. [1+7]

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Embedded System Design Using ARM Technology (*Elective I*) (CT725)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1) Explain Embedded System Hardware. Briefly describe the role of Interrupt Controller and Memory Controller. [5]
- 2) Explain ARM exceptions and modes for ARMv7-A and ARMv7-M Architectures. [5]
- 3) (a) Describe SPI peripheral for bus interfacing. [4]
  - (b) Explain the data transfer instruction execution with three-stage pipeline organization data flow block diagram. [6]
- 4) Explain leaf procedures, Nested procedures and Recursion and translate the following C code into Assembly code. [6]
 

```
while (save[i] == k)
    i +=1;
```
- 5) Develop the bootloader in ARM Assembly that loads program from Flash ROM to SRAM with startaddress and endaddress in Flash ROM with starting address 0x00000000 in destination and relinquish the control to program. [6]
- 6) (a) Explain branch instructions and Write ARM Instruction mnemonic for data processing instructions, data transfer instructions and branch instructions. [4]
  - (b) Draw the binary encoding format figure for ARM Data transfer Instruction for single word and unsigned byte. Translate the following ARM data transfer instruction instructions into machine instruction code in 32-bit format. [8]
 

```
LDRB r5, [r1, #4]
LDR r3, [r7], #8
STRB r0, [r3, r8]
STR r1, [r2, r4 LSL #4]
```
- 7) Differentiate between 16-bit Thumb Instruction Set and 32-bit Thumb Instruction Set and explain Thumb Software interrupt instruction. [6]
- 8) (a) Explain the objective of ARM reference peripheral specification and describe the base components. [5]
  - (b) Describe AMBA and explain bus signals used by bus masters. [5]
- 9) (a) Develop the initialization code that includes the vector table and initialization of stack pointer for IRQ and FIQ mode. [5]
  - (b) Describe the steps to build Embedded Linux System. [5]
- 10) Explain briefly MPEG-1 standard and describe the operation for MPEG-1 in terms of block diagram. Write the steps to develop the MP3 player to play music using ARM Cortex-M4 Microcontroller? [10]

Regular (2066 & Later Batch)			
Exam.	BE	Full Marks	80
Programme	BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Embedded System (CT655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What are the common characteristics of embedded systems? Explain. [4]
2. Design a processor that calculates the LCM of two numbers. Show the design of data path only and construct the diagram of controller. [8]
3. What are the programmer considerations? Explain the software development processes according to embedded systems. [2+6]
4. a) Explain the operations of storing and earsing the data in UV-EPROM. [6]  
 b) Describe the cache write techniques. [2]
5. Explain arbitration systems that implemented to communicate with peripheral devices from the microprocessor. Differentiate between memory mapped I/O with standard I/O. [8]
6. Explain the basic functions of Real-time kernel. [6]
7. Describe the control switching mechanism. [4]
8. Define throughput of a system. [2]
9. What is PID tuning? Discuss on the practical issues related with computer based control. [8]
10. Define the photolithography. Explain the various steps involved in photolithography. [2+6]
11. Why 8051 microcontroller is used ? Write an assembly program to get data from P0 and send it to P1 and compare with correspoding C program. [3+5]
12. Write the VHDL code for processor (GCD) that calculates greatest common divisor of two integer data with its state diagram. [8]

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32G TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
**2064 Poush**

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

***Subject: - Embedded System (Elective)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ All questions carry equal marks.
  - ✓ Assume suitable data if necessary.
1. Define and describe embedded system with suitable example.
2. Justify "Processor is the heart of any embedded system." Also mention the structural units of a processor.
3. What is Direct Memory Access (DMA)? Why such circuitry is needed? Explain with its block diagram.
4. What is device driver? Explain its importance while connecting the peripherals in the system.
5. Describe the terms IRQ, ISR, IVT, PUSH, POP and Interrupt Latency used in Interrupt based designs.
6. Briefly explain RTOS (Real Time Operating System) with its services.
7. What is a scheduler? Describe its role in managing task states in detail.
8. In an RTOS environment, different tasks may share same variables and functions. Explain the problem(s) faced due to this type of sharing and also suggest the solutions.
9. Explain Spiral Model of Embedded Software Development Life Cycle.
10. Differentiate Microprocessor and Microcontroller highlighting its uses. Also explain the Addressing Modes of 8051 microcontroller.

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Exam.		Regular / Back ♦	
Level	BE	Full Marks	80
Programme	BEX	Pass Marks	32
Year / Part	IV / II	Time	3 hrs.

**Subject:** - Embedded System Design Using ARM Technology (EG785EX)  
*(Elective II)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

- 1) Describe the design metrics and design methodologies for designing and developing low-end and high-end mobile handsets. [5]
- 2) Differentiate between privileged mode vs. unprivileged mode. Explain Exception/Interrupts and Vector Table. [5]
- 3) Describe pipelining and explain the ARM instruction execution for Data Transfer instructions with data flow block diagram [10]
- 4) Write c program for recursive procedure that calculates factorial n and write the ARM assembly code for the following C statement. [5]
 

$g = h + A[8];$   
 $A[12] = h + A[8];$

Assume A is an array of 100 words and that the compiler has associated the variables g and h with registers r1 and r2 and uses r5 as temporary register. Let's also assume that the starting address or base address of the array is in r3.
- 5) Explain leaf and nested procedure. Translate the following C program for leaf procedure that computes  $Y = (A+B) + (C+D) + (A*D)$  into ARM Assembly Code. [5]

Int leaf\_ad (int A, int B, Int C, Int D)

```
Int Y;
Y = (A+B) + (C+D) + (A*D)
Return Y;
```

The parameter variables A, B, C, and D correspond to the argument registers r0, r1, r2 and r3 and Y corresponds to r4. Use r7, r8, r9, and r10 as temporary variables for stack use.

- 6) (a) Explain ARM registers usage in both privileged and unprivileged mode and write ARM exceptions and its corresponding modes and functionalities. [10]
- (b) Write the single register store instructions for Half-word using different addressing mode using the following information for ARM instruction set. [6]

**Base register = rn = r1**  
**Source/destination register = rd = r8**  
**Immediate offset = 4**  
**Register = r5**  
**Scaled register offset = r6, LSL #20**  
**(a) Preindex/auto index/post index with immediate offset**  
**(b) Preindex/auto index/post index with register offset**  
**(c) Preindex/auto index/post index with scaled register offset (with immediate value for scaled register)**

- 7) Explain Thumb entry and exit and write the following thumb data processing instructions for processing data. [8]
- |                              |                           |
|------------------------------|---------------------------|
| 1. Move Instruction          | 2. Arithmetic Instruction |
| 3. Logical Instruction       | 4. Comparison Instruction |
| 5. Logical Shift Instruction | 6. Multiply Instruction   |
- 8) Explain hardware prototyping tool and describe JTAG boundary scan architecture and the ARM debugger architecture with EmbeddedICE. [8]
- 9) Explain firmware and embedded operating system and steps to develop firmware and embedded operating system. [8]
- 10) Describe the frame, slot, physical signals (reference signals and synchronization signals), OFDM symbols, short and long cyclic prefix, OFDM, and OFDMA for LTE standard. [10]

Or

Write the LTE protocol stack for eNodeB and UE and describe the downlink logical, transport and physical channels functions.

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Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Artificial Intelligence (CT653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is an Artificial Intelligence (AI)? Explain any two applications of AI in real field. [7]
2. What do you understand by Constraint satisfaction problem? Solve the following Crypt-arithmetic problem. [1+6]

SEND  
 + MORE  
 MONEY

3. What is a searching? Explain Breadth First Search and Depth First Search and compare their performance criteria. [9]
4. What is a knowledge, representation and reasoning? Describe forward chaining with practical example. [2+5]
5. Assume the following facts: [7]
  - John likes all kinds of food.
  - Apples are food.
  - Chicken is food.
  - Anything anyone eats and isn't killed by is food.
  - Bill eats peanuts and is still alive.
  - Sue eats everything Bill eats.

Prove that John likes peanuts using resolution refutation

6. What are semantic nets and frames? How frames are useful in semantic nets. [7]
7. What is a machine learning? Explain in detail about Boltzmann machines with suitable algorithm and explanations. [2+8]
8. What is a neural network? Explain the back propagation algorithms and perceptron. [2+4+4]
9. What is an expert system? Explain its advantages and disadvantages. [8]
10. What is a Natural Language Processing? Describe Natural Language Processing Steps and its application. [2+6]

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41 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
**2070 Bhadra**

Exam.		Regular	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

***Subject: - Artificial Intelligence (CT653)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
  - ✓ Attempt All questions.
  - ✓ The figures in the margin indicate Full Marks.
  - ✓ Assume suitable data if necessary.
1. Define AI. When a machine is said to be passed Turing test? Give any two examples of constraint satisfaction problem. [2+5+1]
2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. WRONG + WRONG = RIGHT. Explain the steps that you have followed. [5+3]
3. Differentiate between informed and blind search. How depth search is different to breadth first search. Compare with evaluation parameters. [4+4]
4. All oversmart persons are stupid. Children of oversmart presons are naughty. Ram is children of Hari. Hari is oversmart. Show that Ram is naughty. Using FOPL based resolution method. [8]
5. Explain the step involved in conjunctive normal form (CNF) with suitable example. [8]
6. What is semantic net? Explain with suitable example. [8]
7. What is machine vision? Discuss about the algorithm of Genetic Algorithm. [2+6]
8. What is neural network? Explain back-propagation algorithm learning. [4+4]
9. What is an Expert System? Explain the steps of an Expert System development. [4+4]
10. Define machine translation in NLP. Explain the challenges of machine translation. [1+7]

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Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Artificial Intelligence (CT653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is Artificial Intelligence (AI)? Discuss brief history of AI with Chronological development. [2+6]
2. Why searching is necessary in AI? Explain about the role of production system with suitable example. [2+6]
3. What is horn clause? Differentiate between Depth First Search and Breadth First Search. [1+7]
4. Explain backward chaining with suitable example and compare with forward chaining. [4+4]
5. Why do we need FOPL? State any three rules of inference. How can we make the machine with learning capacity? [2+3+3]
6. Define Boltzmann Machine. How knowledge can be represented using semantic network? Explain with suitable example. [1+7]
7. What is Machine Learning? What is Fuzzy Logic? Explain the Fuzzy Inference with suitable example. [2+6]
8. Differentiate declarative knowledge and procedural knowledge. Explain the architecture of expert system. [2+6]
9. What is the role of perceptron in neural network? Explain about backpropagation algorithm. [3+5]
10. What is Natural Language Processing (NLP)? Discuss the different issues related with NLP with example. [2+6]

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Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence (EG743CT)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define Artificial Intelligence (AI)? Justify that “AI makes machine working more human friendly”. [8]
2. Define expert system. What are the building blocks of expert system? [8]
3. Compare the search strategy of breadth first search with depth first search. [8]
4. Convert the following sentences in to FOPL and hence into CNF [8]
  - i. Everyone likes someone.
  - ii. All the students who visited science museum are not engineering student.
  - iii. Sumit likes all fruits that are rich vitamin A.
  - iv. Shyam likes all the movies that Krishna likes.
5. Explain learning framework with suitable example. [8]
6. What is backward chaining? Explain with suitable example. [8]
7. What are the different operators associated in genetic algorithm. [8]
8. Differentiate between supervised learning and unsupervised learning. [8]
9. Explain the different issues of Natural Language Processing (NLP). [8]
10. Explain different forms of knowledge modelling techniques. [8]

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41 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division.**  
 2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Artificial Intelligence (CT 653)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Discuss any two fields of your daily life where artificial intelligence has been applied. (7)
2. Solve the following crypto-arithmetic problem, where different letters denote different integers and identical letters denote same integer. LOGIC + LOGIC = PROLOG  
 Show all the step of solving through constraint satisfaction problem. (7)
3. Discuss the hill-climbing search algorithm along with problems associated with it and discuss their solutions. (9)
4. Given premises: Every American who sells weapons to hostile nations is a criminal. The country Abc is enemy of America. All of the missiles in Abc were sold by John. John is an American.  
 Proof: John is a criminal. (10)
5. What are the different knowledge representation models? Discuss semantic nets with an example. (7)
6. What is Fuzzy learning? Explain with a practical example. (4)
7. Explain the learning framework with suitable example. (6)
8. What is a Hopfield Network? Explain all the steps involved in the Hopfield Network with suitable example. (8)
9. Explain different steps of expert system development with an example. (8)
10. What is a natural language processing? Explain it. (6)
11. Write short notes: (any two) (4 x 2 = 8)
  - i. Skolemization
  - ii. Machine vision
  - iii. Human Brain verses Neural Network

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Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define and differentiate between “system that think like humans” and “system that act like humans”. What are the ethical issues in the artificial intelligence?
2. How can you convert to conjunctive normal form? Explain all the steps with suitable examples.
3. “All married employees earning Rs. 225,000 or more per year in Nepal pay taxes. All unmarried employees earning Rs. 200,000 or more per year in Nepal pay taxes. The university professor of Nepal earns Rs. 400,000 and has to pay 25% taxes. No other employee earns more than the professor in the university. Some of Nepalese citizens earn less than Rs. 200 per day and they don’t have to pay any taxes”. Represent the above sentences in first-order logic and explain each step.
4. Draw the block diagram of the structure of an expert system and explain it. How can you represent expert system using if-then rules?
5. What is a depth first search? Explain it with required algorithm. How can you modify it to be an informed search?
6. Explain in detail about ID3 process with suitable example. Explain different factors involved in the learning.
7. What is a fuzzy logic and explain its importance? Explain the steps involved in the fuzzy logics.
8. What is a McCulloch/Pitts neural network? Explain it with reference to AND gate. Justify that McCulloch/Pitts neural network can't be applied to EX\_OR gate.
9. Explain in detail about forward chaining with suitable example. What are the applications of forward chaninig?
10. Explain the importances of natural language processing. What are the issues in the natural language processing?

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3-hrs

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Justify that "system that thinks rationally" and "system that acts rationally" is important part of artificial intelligence with examples.
2. Explain all the steps involved in the conjunctive normal form with suitable practical examples. How can you realize it using suitable hardware?
3. "A key property of deductive systems is that they are purely syntactic, so that derivations can be verified without considering any interpretation. Thus a sound argument is correct in every possible interpretation of the language, regardless whether that interpretation is about mathematics, economics, or some other area." Represent the above sentences in first-order logic and explain each step.
4. What is an expert system? Draw the block diagram of an expert system and explain it. Explain the importance of if then rules in the expert system.
5. Justify that the application of queue is important in the searching. Explain any one informed search technique involving queue along with its algorithm.
6. What do you mean by ID3 process? Explain in detail about ID3 process with suitable example.
7. Justify that the study of gene is one of the important part in the AI. Explain the steps involved in the genetic algorithm.
8. What do you mean by supervised learning? Explain any one type of supervised learning with practical example.
9. What do you mean by forward chaining? Explain it with suitable block diagram. Differentiate it with backward chaining.
10. Differentiate between natural language understanding and natural language generating. Explain the different steps in the natural language processing.

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

by

1. What do you mean data driven reasoning? How can you relate with chaining? Explain it with practical examples.
2. Is Turing test important in the artificial intelligence? Explain it with suitable diagram and examples.
3. What is a first order predicate logic? How do you convert it to the disjunctive normal form? Explain with suitable examples.
4. "The Department of Electronics and Computer Engineering offers two undergraduate degrees, Computer Engineering and Electronics and Communication Engineering. Almost 75% of those courses are similar. If the students of any of those engineering study another one year more can be eligible to get both degrees. Only some of them may be interested to get Bachelor in Computer, Electronics and Communication Engineering". Represent the above sentences in first-order predicate logic and explain each step.
5. Justify that informed search is the modification of blind search. Explain in detail about simulated annealing with practical examples.
6. Differentiate between supervised and unsupervised learning. Explain about learning framework with suitable block diagram and examples.
7. What is a Boltzmann machines? Explain its algorithm with suitable explanation and example.
8. What do you mean by hetro-associative structure? Explain it with suitable example and its limitation.
9. Compare expert systems and human experts. Explain each point with suitable practical examples.
10. Justify that natural language processing is one of the important part of an artificial intelligence. Explain the steps involved in the natural language processing.

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	I <sup>7</sup> / I	Time	3 hrs.

*Subject:* - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. What do you mean by forward chaining? Why it is required? Explain it with two practical examples.
2. Justify that "System that think rationally" and "System that act rationally" are the part of artificial intelligence. Explain it with practical examples.
3. How do you convert to conjugate normal form? Explain all the steps with suitable practical examples.
4. "A deductive system is sound if any formula that can be derived in the system is logically valid. Conversely, a deductive system is complete if every logically valid formula is derivable. All of the systems discussed in this article are both sound and complete. They also share the property that it is possible to effectively verify that a purportedly valid deduction is actually a deduction; such deduction systems are called effective". Represent the above sentences in first-order logic and explain each step.
5. Justify that AI can't exist without searching. Explain in detail about any two types of informed search with practical examples.
6. Why do we require learning? Explain about learning framework with suitable block diagram and examples.
7. How a genetic idea can be converted to an algorithm? Explain all steps of genetic algorithm in brief.
8. What is a Hopfield Network? Explain all the steps involved in the Hopfield Network with suitable example. Compare it with Kohonen Network.
9. Why do we require expert system structure? Draw the block diagram and explain it with practical examples.
10. Explain the different steps involved in the natural language processing (NLP) with suitable block diagram and examples.

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define and differentiate between "system that think rationally" and "system that act rationally". AI research is ethical justify it.
2. Why conjunctive normal form is required? Explain all the steps with suitable practical examples.
3. "All married employees earning Rs. 140,000 or more per year in Nepal pay taxes. All unmarried employees earning Rs. 115,000 or more per year in Nepal pay taxes. The president of Nepal earns Rs. 2,500,000 and has to pay maximum taxes. No other employee earns more than the president. Some of Nepalese citizens earn less than Rs. 100 per day and they don't have to pay any taxes". Represent the above sentences in first-order logic and explain each step.
4. Briefly explain different types of practical expert systems. Explain in detail about any one practical expert system used in the medical application.
5. Justify that AI can't exist without searching. Explain in detail about hill climbing searching and compare it with simulated annealing method.
6. Explain different factors involved in the learning? Explain in detail about ID3 process with suitable example.
7. What is a genetic algorithm and explain its importance? Explain the steps involved in the genetic algorithm.
8. Compare between computer and brain. Differentiate between supervised and unsupervised learning with suitable example.
9. Is an expert system important, justify it. Explain in detail about forward chaining with suitable example.
10. Why you have to study natural language processing? Explain the issues in the natural language processing.

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. Define an artificial intelligence (AI). Explain the behaviors of the AI. What do you mean by Turing test? Explain it.
2. Why disjunctive normal form is required? Explain all the steps with suitable practical examples.
3. "A person born in Nepal, and whose parents is a Nepali citizen by birth, is a Nepali citizen by birth. A person born outside Nepal, and one of whose parents is a Nepali citizen by birth, is a Nepali citizen by descent. Several developed countries have dual citizenship provision, but Nepal doesn't have that provision". Represent the above sentences in first-order logic and explain each step.
4. Differentiate between inference and reasoning. Why probabilistic reasoning is important in the AI? Explain with suitable example.
5. Justify that searching is one of the important part of AI. Explain in detail about depth first search and breadth first search techniques with suitable example.
6. Define learning. Why learning frame work is required? Explain about learning frame work with suitable block diagram and examples.
7. What is a genetic algorithm? Explain its applications. Explain all steps of GA in brief.
8. What is a back propagation? Explain all the steps involved in the back propagation with suitable example.
9. How can you construct expert system? Explain knowledge engineering with suitable block diagram.
10. Define a natural language processing. Explain the different issues involved in the natural language processing.

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Exam.		Regular/Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	IV / I	Time	3 hrs.

**Subject:** - Artificial Intelligence

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. List all categories of artificial intelligence and explain them with suitable examples.
2. Why conversion to clausal form is required? Explain all the steps with suitable examples.
3. Justify that "MYCIN" is a probabilistic reasoning with derivations and example.
4. Explain the importance of searching. Explain in detail about any two informed search techniques with suitable example.
5. What is an inductive learning? Why learning frame is required? Explain with suitable block diagram and examples.
6. Explain about semantic networks and frames with suitable examples.
7. Define a genetic algorithm and explain its importance. Explain different steps of genetic algorithm in brief.
8. Explain how brain works. Explain the mathematical representation of neural network system along with its algorithm.
9. Define an expert system. Differentiate between forward chaining and backward chaining with suitable examples.
10. Why natural language processing is required? Explain the issues in information extraction, information retrieval and machine translation in the natural language processing.

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Explain the Virtual Machine Structure. What are the benefits over other operating system structure? [2+2]
- b) What is operating system? Briefly explain the function of operating system. [1+4]
2. a) Differentiate between process and thread. Explain the advantages of multithreading. [2+2]
- b) Schedule the following set of processes according to HRRN and Round Robin algorithm (Time quantum=4) and calculate average waiting time and average turnaround time. [5]

Process	Arrival Time	CPU Time (ms)
A	0	12
B	2	8
C	5	7
D	10	9

3. What is TSL instruction? Why it is used? Solve producer-consumer problem using monitors. [1+2+7]
4. Define page fault and demand paging. Consider a paged memory system with eight pages of 8KB page size each and 16 page frames in memory. Using the given page table, compute the physical address for the logical address 18325. [3+6]

7	10
6	4
5	0
4	7
3	13
2	11
1	14
0	5

5. What is file system layout? Explain how operating system manages free blocks of secondary storage. [3+7]
6. What is disc scheduling? Explain details about the device independent I/O software with example. [3+6]
7. What is deadlock? Explain the essential condition for deadlock. How you detect deadlock? Explain with example. [2+4+4]
8. Explain the types of attacks. Explain, how can you implement security and protection on all components of a system. [3+6]
9. What is system administration? How is a special user different from a general user? Explain. [2+3]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What is the role of supervise call in an operating system? Write down the major differences between following types of operating system. [2+8]
  - a) Batch System
  - b) Interactive System
  - c) Real Time System
  - d) Time Sharing System
2. Define Context Switching. Discuss 5-state model of process. Schedule the following set of process according to multilevel feedback queue scheduling algorithm and compute AWT and ATAT. [2+3+5]

Process	P1	P2	P3	P4
Arrival Time	0	12	25	32
CPU Burst (ms)	25	18	4	10

Assume that there are three ready queues Q1, Q2 and Q3. The CPU time slice for Q1 and Q2 is 5 ms and 10 ms respectively and processes are scheduled on FCFS basis in Q3.

3. Define race condition with example. Explain Peterson's Algorithm. [3+7]
4. Differentiate compaction and coalescing techniques. How logical address is mapped to real physical address by paging technique? Explain with suitable example. What is the role of TLB? [4+4+2]
5. Describe different file allocation methods. Explain free disk space management with example? [6+4]
6. Consider a system with 5 processes P<sub>0</sub> through P<sub>4</sub> and three resources types A, B, C. Resources types A has 7 instances, B has 2 and C has 6 instances. Suppose at t0 time we have following state: [10]

Process	Allocation			Request			Available		
	A	B	C	A	B	C	A	B	C
P <sub>0</sub>	0	1	0	0	0	0	0	0	0
P <sub>1</sub>	2	0	0	2	0	2	0	0	0
P <sub>2</sub>	3	0	3	0	0	0	0	0	0
P <sub>3</sub>	2	1	1	1	0	0	0	0	0
P <sub>4</sub>	0	0	2	0	0	2	0	0	0

- a) Is the given system in deadlock state?
- b) Suppose P<sub>2</sub> makes an additional request (0, 0, 1) what will be the effect of this request to the system?

7. A disk with 1000 cylinders, numbered 0 to 999, compute the number of tracks the disk arm must move to satisfy all the requests in the disk queue. Assume the last request serviced was at track 345 and the head is moving towards track 0 (zero). The queue in FIFO order contains request for the following tracks:

[10]

123, 874, 693, 475, 105, 376

Perform the computation for the following scheduling algorithms:

- a) FIFO
- b) SSTF
- c) SCAN

8. Write short notes on:

[5+5]

- a) Types of network security attack
- b) Duties and responsibilities of system administrator

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Exam.	Old Back (2065 & Earlier Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

***Subject: - Operating System (EG682CT)***

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What do you understand by firmware? Can you relate with operating system? Are there any linkages among hardware, software, firmware and operating system? [10]
2. What makes the message passing IPC as one among the best methods of IPC implementation? Explain with pseudo0code details. [10]
3. Prepare a comparative note on the fixed and variable partition multiprogramming techniques for real memory management. [10]
4. a) What is paging? How does it work? [3]
  - b) Explain the differences in the degree to which (i) First Come First Serve (ii) Round Robin and (iii) Multi level queues, scheduling algorithms discriminate in favor of short processes. [7]
5. Consider a system consisting of m resource of the same type, being shared by n processes. Resources can be requested and released by processes only one at a time. Show that the system is deadlock free if the following two conditions hold: [10]
  - a) The maximum need of each process is between 1 and m resources.
  - b) The sum of all maximum needs is less than m + n.
6. a) What is a device controller? What is a device driver? How do they relieve programmer? Explain with an example of any I/O device. [7]
  - b) Explain the implementation of process. [3]
7. What is bootstrapping? Explain the working principle of a typical assembler. What are the different records present within object program? [10]
8. Compare the followings: [2.5×4]
  - a) Semaphore Vs Monitor
  - b) Latency time Vs seek time
  - c) Coalescing Vs Compaction
  - d) Real Memory Vs Virtual memory

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<b>Exam.</b>	New Back (2066 & Later Batch)		
<b>Level</b>	BE	<b>Full Marks</b>	80
<b>Programme</b>	BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	III / II	<b>Time</b>	3 hrs.

**Subject:** - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain operating system as an extended machine? Distinguish between Kernel and Micro-Kernel. Explain the purpose of system call. [2+3+3]
2. For the process listed in following table, what is the average turnaround time using: [10]
  - (a) FCFS
  - (b) RR (quantum=4)
  - (c) SJF
  - (d) SRT
  - (e) HRRN

Process	Arrival Time (ms)	Processing Time (ms)
A	0	3
B	2	6
C	4	4
D	6	5
E	8	2

3. Define critical section and mutual exclusion with respect to multiple-process system. Solve producer and consumer problem using semaphore. [3+5]
4. What is page fault? Consider the following page reference string: 1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6. How many page faults would occur for the FIFO, Optimal, LFU and LRU replacement algorithms having five frames? Remember all frames are initially empty, so your first unique page will cost one fault each. [2+8]
5. What are the different methods for allocating disk space for file? Explain free space management techniques. [2+6]
6. Suppose that a disk drive has 100 cylinders, numbered 0 to 99. The drive is currently serving a request at cylinder 43, and previous request was at cylinder 25. The queue of pending request, in FIFO order is: [10]
 

86, 70, 13, 74, 48, 9, 22, 50, 30

Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all pending requests for each of the following disk scheduling algorithms?

- a) First-come, First served
- b) Shortest Seek Time First
- c) Look
- d) C-Scan
- e) Scan
7. What is deadlock? How it occurs? Explain various deadlock avoidance methods with examples. [2+2+6]
8. What are the roles of system administrators for an organization? How can you increase operating system performance if you are selected as a system administrator? [4+4]
9. Write short notes on: (any two) [4+4]
  - a) Information security model
  - b) Security attack

<b>Exam.</b>	<b>-Regular (2066 &amp; Later Batch)</b>		
<b>Level</b>	BE	<b>Full Marks</b>	80
<b>Programme</b>	BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	III / II	<b>Time</b>	3 hrs.

**Subject:** - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. How operating system creates abstraction? Explain with reference to OS as an extended machine. Define system call and explain its working mechanism with suitable example. [5+5]
2. What is Process Control Block? Explain scheduling algorithms in interactive system. [2+8]
3. What are conditions to get mutual exclusion? Define semaphore and solve the producer-consumer problem using semaphore. [2+8]
4. What is page fault? Assume that a virtual memory of size 64K is mapped to physical memory of 32K with page frame 4K. Initially, pages are mapped as: 0,1,2,3,4,5,9,11 correspond to 2,1,6,0,4,3,5,7 respectively. Calculate outgoing physical address for incoming virtual address 20482 with necessary mapping diagrams. [2+8]
5. How file system can be implemented using linked list? Explain impact of block size selection on data rate and disk space utilization with necessary diagram and illustration. [4+6]
6. Explain working mechanism of device driver? Suppose a disk drive with 200 cylinders, numbered from 0 to 199. The drive is currently serving a request at cylinder 53. The queue of pending requests is: 98, 183, 37, 122, 14, 124, 65, 67. Starting from the current head position, calculate total distances (in cylinders) that the disk arm moves to satisfy all pending requests for FCFS, SSF and SCAN disk scheduling algorithms. [4+6]
7. Write four conditions for deadlock. A system has four processes P1, P2, P3, P4 and three resources R1, R2, R3 with existing resource E = (15 9 5). After following allocation, resource available becomes A = (3 2 0). Use Banker's algorithm to test whether the given state is safe or not. If it is safe state, show the sequence of execution of processes. [2+8]

	Allocation			Maximum			Need		
	R1	R2	R3	R1	R2	R3	R1	R2	R3
P1	3	0	1	3	2	2	0	2	1
P2	5	4	1	6	8	2	1	4	1
P3	2	2	0	3	2	4	1	0	4
P4	2	1	3	4	2	3	2	1	0

8. Explain protection domain and access control list (ACL). Suppose you are employed as a system administrator of CIT, Pulchowk campus. Detail your roles and also suggest the blowing ideas to maintain secure and reliable system. [5+5]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System (CT656)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. List the essential properties for the Batch-oriented and Interactive operating system. For each of the following application which system (Batch or Interactive) is more suitable? State the reason. [4+6]

- a) Word Processing
- b) Generating monthly bank statements
- c) Computing pi to million decimal places
- d) A flight simulator
- e) Generating mark statement by University
- f) Data acquisition from temperature sensor

2. Consider the following set of process with the length of the CPU burst time given in millisecond. [4+4]

Process	P1	P2	P3	P4	P5
Burst time	10	1	2	1	2
Priority	3	1	3	4	2

Assume the processes arrived in the order P1, P2, P3, P4 and P5 all at time 0, priority 1 as highest and 4 as lowest.

- a) Draw the Gantt chart for FCFS, SJF, Priority and Round Robin (Quantum = 2)
  - b) Which algorithm results in the maximum average waiting time?
3. What is race condition and critical section problem? Explain all possible approaches to handle the situation “while one process is busy updating shared memory, no other process will enter its critical section and cause trouble”. [2+8]
4. Calculate Hit and Faults using various page replacement algorithm policies. (FIFO, LRU, Optimal) for the following page sequence (The page frame size is 3) [2+6]
- 2 3 5 4 2 5 7 3 8 7
5. Explain file system layout in detail. What are the major differences between file system interfaces and file system implementation? [6+4]
6. What are the disadvantages of programmed I/O? Explained about DMA. What are the functions of device independent I/O software? [2+2+4]
7. What is deadlock? State the necessary conditions for deadlock to occur. Give reason, why all conditions are necessary. [10]
8. Explain the domain-object and ACL. How these mechanisms are implemented for security? [4+4]
9. Write short notes:
- a) Roles of System Administration [4]
  - b) Shell Scripts [4]

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System (CT656)

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Allocation			Maximum			Need			
R1	R2	R3	R1	R2	R3	R1	R2	R3	
P1	3	0	1	3	2	2	0	2	1
P2	5	4	1	6	8	2	1	4	1
P3	2	2	0	3	2	4	1	0	4
P4	2	1	3	4	2	3	2	1	0

8. Explain protection domain and access control list (ACL). Suppose you are employed as a system administrator of CIT, Pulchowk campus. Detail your roles and also suggest the blowing ideas to maintain secure and reliable system. [5+5]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What are the functions of an operating system? Explain about microkernel. [3+5]
2. What is a monitor? Solve dining philosopher man's problem using semaphore. [8]
3. Describe the difference between preemptive and non-preemptive scheduling algorithm. Explain about scheduling in real time. [4+4]
4. A system that uses the Banker's Algorithm deadlock avoidance has five processes (1, 2, 3, 4 and 5) and four types of resources (A, B, C and D). There are multiple resources of each type. Is the following state safe or not? If it is, show how the processes can complete. If not, show how they can deadlock. [8]

Process	Current loan	Max need	Current claim
	A B C D	A B C D	A B C D
1	1 0 2 0	3 2 4 2	2 2 2 2
2	0 3 1 2	3 5 1 2	3 2 0 0
3	2 4 5 1	2 7 7 5	0 3 2 4
4	3 0 0 6	5 5 0 8	2 5 0 2
5	4 2 1 3	6 2 1 4	2 0 0 1

Resources Available      Total Resources

A B C D	A B C D
3 4 0 1	13 13 9 13

5. What is a critical reason and race condition? What are the limitation of optimal page replacement algorithm? [4+4]
6. What is segmentation? Suppose a machine has 48 bit virtual addresses and 32 bit physical address. [3+5]
  - a) If pages are 4KB, How many entries are in the page table?
  - b) Suppose the same system has a TLB (Translation Look a side buffer) with 32 entries. Furthermore suppose that a program contains instructions that fit into one page and it sequentially reads long integer elements from an array that spans thousands of pages. How effective will the TLB for this case?
7. What is a file system layout? Explain about I- Node and file system backup. [3+5]
8. What is a interleaving? Consider a Winchester – style hard disc with 100 cylinders, four double – sided platters and 25 sectors per track. The following is the (time – ordered) sequence of requests for disc sectors: {3518, 1846, 8924, 6672, 1590, 4126, 107, 9750, 158, 6621, 446, 11} The disc arm is currently at cylinder 10, moving towards 100. For each of SSTF, SCAN and C-SCAN, give the order in which the above requests would be served. [2+6]
9. What is a trap door? Explain in firewalls and access control lists. [2+6]
10. What are the goals of UNIX? Explain about NFS protocol and draw the structure of NFS. [2+6]

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
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1. How an operating system acts as a virtual machine? What are the different structures of an operating system? Explain in detail about context switching. [2+2+4]
2. What is the difference between process and thread? Solve Dining philosophers problem using semaphores. [3+5]
3. What is dispatcher? Schedule the following process applying highest response ratio next scheduling algorithm. Assume P<sub>1</sub> is the first process [1+7]

Process No	P <sub>1</sub>	P <sub>2</sub>	P <sub>3</sub>	P <sub>4</sub>
Arrival time (sec)	1	2	4	15
Service time (sec)	10	30	20	20

If P<sub>4</sub> need 2 second of service time does the sequence of schedule change?

4. Explain the algorithm for detecting dead lock for one resource of each type. Consider that the system consists of m resources of same type being shared by n process each of which need at most two resource. Explain whether the system is deadlock free or not? [8]
5. What are the requirements of long term information storage? What is I-node? Draw the block diagram of virtual file system. [2+3+3]
6. What is paging? Consider a swapping system in which memory consists of the following hole size in memory order 10KB, 4KB, 20KB, 18KB, 7KB, 9KB, 12KB and 15KB. Which hole is taken for successive segment request of [2+6]
  - a) 12KB
  - b) 10KB
  - c) 9KB for first fit, next fit and best fit placement strategies.
7. What is the disadvantage of programmed I/O? Explain about DMA. What are the functions of device independent I/O software? [2+4+2]
8. What are the goals of Unix system? Draw the structure of Linux kernel. [2+6]
9. What is firewall? Explain about device driver structure. [3+5]
10. Explain in detail about any one distribution of Linux system [8]

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41 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**  
2066 Magh

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Operating System**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. What features does an operating system expose on top of the hardware to enhance user experience? Explain.
2. Disabling interrupts may help avoid race conditions. Explain its drawbacks as well.
3. Give an algorithm for deadlock detection for a system with multiple resources of the same kind.
4. What is the major drawback of implementing file system with linked list allocation using a table in memory? Give an implementation scheme that removes this drawback.
5. Multiprogramming systems have a considerable overhead because of process switching.  
Does multiprogramming indeed optimize CPU utilization? Illustrate with a genuine example.
6. Differentiate between paging and segmentation.
7. Explain in detail about the device independent I/O software.
8. What are protection domains? Compare protection domains with access control lists.

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: - Operating System**

- ✓ Candidates are required to give their answers in their own words as far as practicable.
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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject: Operating Systems**

✓ Candidates are required to give their answers in their own words as far as practicable.

✓ Attempt All questions.

✓ The figures in the margin indicate **Full Marks**.

✓ Assume suitable data if necessary.

1. What is a process? Explain different process states and process state transitions. [1+7]

2. Describe the top-down view and bottom-up view of operating system. [8]

3. What do you understand by mutual exclusion and critical section? Explain how semaphores are utilized to solve the producer consumer problem. [2+6]

4. What is processor scheduling? Explain how Shortest Job First (SJF) and multilevel queues work? Which do you think is better and why? [1+7+2]

5. How can you eliminate waste in variable partition multiprogramming? Also explain the drawbacks of such methods. [4+4]

6. How can you manage memory using linked lists? [6]

7. What are the strategies for deadlock handling? Explain any two techniques for preventing deadlock. [2+6]

8. Explain the working principles of a general device driver. [6]

9. Differentiate between absolute and relocating loader. [6]

10. Consider a disk drive with 200 cylinders, numbered 0 to 199. A request comes in to read a block on cylinder 25. While the drive is serving the request at cylinder 25, new requests come in for cylinders in the order of 87, 146, 90, 99; 183, 15, 48, 19. Which of the disk arm scheduling algorithms among FCFS, SSF and SCAN is best for the given set of requests? Justify with calculation. [8]

11. Write short notes on: (any two) [2×2]

- a) I-nodes
- b) Cylinder skew and interleaving in disk
- c) Least Recently Used (LRU) replacement

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Operating System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. What is an operating system? Can you justify that an operating system acts as a resource manager?
2. Differentiate between a process and a thread. What is a process control block? Explain.
3. What is semaphore? What is its use in inter-process communication? Explain with a suitable example.
4. What is a deadlock? How can a system recover from deadlock? List all possible alternatives and also state the problems they would induce.
5. What is virtual memory? How is it possible to work on memory space larger than the actual available physical memory? Assume a virtual memory configuration with a page frame of size 2K, virtual address space of size 32k and physical address space of 16K. With a page mapping of your choice determine the actual physical address corresponding to the virtual address 0573H.
6. What are the different types of I/O software layers? What are the tasks of device independent I/O software? Explain.
7. What is file allocation table? How does it eliminate the problem in linked list allocation? Does it induce any problem?
8. What is security? What are the possible attacks from inside the system?
9. Differentiate between an absolute and a relocation loader. Explain in brief about the bootstrap loader.
10. Write short notes on any two:
  - a) Real time operating system
  - b) Login spoofing
  - c) Kernel

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, BGE	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain why the subject of engineering economics is important to Civil Engineer. [4]
2. What is difference between nominal and effective interest rate?

You deposit Rs. 1000 in your bank account. If the bank pays 4% simple interest, how much will you accumulate in your account after 10 years? What if the bank pays compound interest? How much of your earnings will be interest on interest? [2+4]

3. a) Calculate IRR from the following cash flow and draw investment balance diagram. [6]

Year	0	1	2	3	4	5
Cash Flow	-800	250	300	400	-150	600

- b) Calculate both types of BCR of a project with following details. MARR = 12% [6]

Initial Investment	Annual Income	Annual Cost	Useful Life	Salvage Value
Rs. 100000	Rs. 20000 at the end of first year and increase by 5% per year	Rs. 3000 at the end of first year and increase by Rs. 500 per year	12 years	25000

4. a) Select the best project by ERR method. Take MARR = 10% and  $\epsilon = 20\%$  [6]

EOY →	0	1	2	3	4	5	6
PROJECT A	-64,000	26,200	29,000	30,200	31,000	31,000	26,000
PROJECT B	-68,000	-4,000	39,200	38,000	38,000	38,000	38,000
PROJECT C	-75,500	20,500	40,600	40,000	39,000	39,000	32,400

- b) Co-terminating both project at 5 years and select the best project by modified BCR (using AW formulation). Take Salvage Value of each project = 10% of First Cost, MARR = 15% [6]

PROJECT	First Cost	Annual Benefits	Annual O & M Costs	Useful Life
A	Rs. 4,00,000	Rs. 175,000	Rs. 25,000	6 years
B	Rs. 7,00,000	Rs. 250,000	Rs. 35,000	8 years

5. a) An existing machine has market value of Rs. 10000 and decreases by Rs. 2000 per year. Its operating cost is Rs. 2500 in year 1 and increases by 20% each year for 4 years. New machine costs Rs. 20000 now and its market value will decreases by Rs.20% per year for 4 years. Operating cost is Rs.1500 in first year and increase by 30% each year. Calculate equivalent uniform annual cost of both existing and new machines. MARR = 15%. Formulate the best replacement strategy if we need the machine for four years only. [4+4+4]

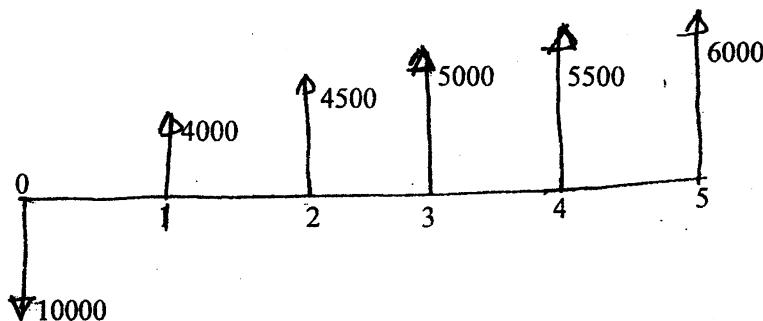
- b) Define mutually exclusive project, independent project and contingent project with proper combinations. [4]

6. a) A company produces an electronics timing switch that is used in consumer and commercial products made by several other manufacturing firms. The fixed cost and total cost are Rs. 40,000 and Rs. 85,000 respectively. The total sales are Rs. 1,05,000 and sales volume is 15,000 for this situation. [4]

- i) Find the breakeven points in terms of number of units
- ii) What should be the output if the profit desired is Rs. 50,000?

- b) Draw sensitivity chart using PW formulation of the following cash inflows. It is desired to evaluate the sensitivity of PW to  $\pm 30\%$  changes on: [8]

- i) Interest
- ii) Investment



7. a) Explain the general procedure for after tax economic analysis with suitable example. [4]

- b) Considering the following information, compute the annual depreciation and book value of each year by (i) SL method (ii) DB method (iii) SOYD method and (iv) Sinking fund method. [1+2+3+2]

Cost basis	Salvage Value	Useful Life	MARR
\$ 7,000	\$ 2,000	5 years	10%

8. Choose the best project from the following alternatives. [6]

Project	Machine	Machine
	X	Y
First Cost	15,00000	20,00000
Life	7 years	7 years
Salvage Value	200000	300000
Annual operating and maintenance cost	300000	250000

Assume an average inflation of 5% for the next five years and interest rate is 15% / year.

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define Engineering Economics. Write down the principles of Engineering Economic Analysis. [4]

2. What is nominal and effective interest rate? Evaluate FW at the end of 15 years with 10% interest rate compounded monthly of a cash flow of Rs. 50,000 at the beginning of each year for first 10 years. [3+5]

3. Define IRR. Find IRR and ERR of the following project. MARR =  $\varepsilon = 15\%$ . [2+6]

Year	0	1	3	4	5
Cash flow	-50	-10	30	40	50

4.

	Machine A
Initial Investment	Rs. 6000
Annual Benefits	Rs. 3000
O & M Cost	Rs. 1000
Salvage Value	Rs. 1500
MARR	10%

a) Evaluate both type of BCR (FW Formulation). Take Useful life = 10 years. [4]

b) Evaluate both type of Payback Period. If Useful life = 5 years. (Take Standard payback period = 3 years) [4]

c) Explain the factors affecting determination of MARR. [4]

5. a) Use Repeatability assumption to select the best project from the following three projects. [6]

Project	A	B	C
Initial Investment	100000	200000	250000
Annual Expenditure	25000	20000	15000
Useful Life, Years	3	5	7
Salvage Value	40000	50000	60000
MARR	14%		

(b) Explain about the Sunk Cost, Economic life and reasons for replacement of an asset.

The Annual Equivalent Cost of defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 10%. The planning horizon of the project is 8 years. [8+4]

End of year (n)	1	2	3	4	5	6
(AEC) <sub>D</sub>	5400	5200	5500	5700	6200	6600
(AEC) <sub>C</sub>	7700	6200	5700	5600	5680	5900

6. a) For the improvement of a manufacturing plant, following three alternatives are being considered. The estimated investments and the corresponding increment in income are also given as below. Draw decision tree diagram of the situation and decide on the best alternative using FW formulation. MARR = 15%. Life of the Project is 6 years.

[6]

Alternatives	Investment Cost	Sales			Annual Income
		High Success	Probability = 0.4	500000	
A	1000000	Medium Success	Probability = 0.5	300000	
		Low Success	Probability = 0.1	125500	
		High Success	Probability = 0.2	400000	
B	600000	Medium Success	Probability = 0.5	250000	
		Low Success	Probability = 0.3	100000	
		High Success	Probability = 0.5	200000	
C	400000	Medium Success	Probability = 0.1	125000	
		Low Success	Probability = 0.4	50000	

- b) Perform sensitivity analysis of the following project over a range of 10 to 50 percent in (i) initial investment and (ii) MARR using PW formulation. Assume  $S_v = 0$ . Draw sensitivity diagram also.  $\rightarrow$  look whiteboard.

[6]

7. What do you mean by depreciation? Explain about the causes of it. Explain about any three methods of depreciation calculation that are used commonly. A machine purchased for Rs. 60,000 by expecting useful life of 10 years. Calculate the depreciation amount for each year by using deciding balance method when rate of depreciation is 20% per year.

[6+6]

8. Define Constant dollar amount and Actual dollar amount. Suppose you borrowed Rs. 100000 from a bank to buy a bike and you have promised to pay Rs. 5500 per month for two years. What is the inflation free interest rate you are supposed to pay if average inflation rate is 0.75% per month?

[2+4]

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04 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
 2070 Bhadra

Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT, B.Agro.	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Scarcity is an emerging issue in engineering field. How does the study of economics help to engineers in decision making process? Discuss. [5]
2. What is effective and nominal interest rate? Evaluate FW at the end of 10 years with 8% interest rate compounded continuously of a cash flow of Rs. 500 at the beginning of each year for first 5 years. [2+4]
3. Initial Investment = Rs. 100,000  
 Salvage Value = 0  
 Annual O&M Cost = Rs. 20,000  
 Useful Life = 5 years  
 Annual Benefit = 60,000 at the end of first year, thereafter decreases by 4,000 each year for the remaining years.  
 a) Draw U/B diagram.  
 b) Evaluate conventional BCR using PW formulation. Take salvage value = 10,000.  
 c) Evaluate Discounted Payback Period. Take standard (cut off) Payback Period = 3 years.
4. Use IRR method to select best project. MARR = 12%. [8+4]

	A	B	C	D
Initial Investment	1100	1500	2750	2000
Annual Income	500	700	1200	950
Useful Life	4	4	4	4
Salvage Value	250	500	800	1000
MARR	✓ 15%			

Select the best combination if A, B and C are mutually exclusive.

5. Explain about the reasons for replacement of asset. The Annual Equivalent Cost (AEC) of the defender and challenger are given in the table below. What is the best replacement strategy? Use MARR = 12%. The planning horizon of the project is 8 years. [4+8]

End of Year (n)	1	2	3	4	5	6
(AEC) <sub>D</sub>	5300	5250	5400	5750	6200	6550
(AEC) <sub>C</sub>	7700	6150	5700	5600	5675	5800

6. What are the sources of risk in engineering projects in Nepal? A real-state developer seeks to determine the most economical height for a new office building which will be sold after five years. The relevant net annual revenues and net resale values are as given below.

[4+8]

	Height	
	4 Floors	5 Floors
First Cost	125,000,000	200,000,000
Annual Revenues	19,910,000	37,815,000
Net Resale Value	200,000,000	300,000,000

The developer is uncertain about the interest rate  $i$  to use, but is certain that it is in the range of 5 to 30%. For each building height, find the range of values of  $i$  for which that building height is the most economical. Draw sensitivity diagram to support your answer.

7. An asset has installed value of 45,000.  $S_s = 0$ . It is classed as a 5 year property. Determine approximate MACRS depreciation schedule. Over 6 years it is estimated to generate revenue of Rs. 23,000 per year with annual operating cost 7300. Required rate of return = 15% after tax. Tax rate = 40%. Evaluate after tax IRR with annual worth method.

[6+6]

8. The annual fuel cost required to operate a small solid waste treatment plant are projected to be Rs. 200000 without considering any future inflation. The best estimate indicates that the annual inflation free interest rate  $I'$  will be 6% and the general inflation rate,  $f$ , will be 5%. If the plant has the remaining useful life of four years, what is the present equivalent of its fuel costs? Use actual dollar analysis.

[5]

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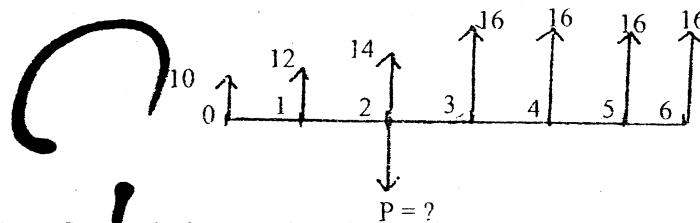
04 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
 2070 Magh

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain the roles of engineers in making economic decision with appropriate examples. [4]
2. a) If you deposit Rs.10000 in a saving account now which gives 10% nominal interest rate, what will be the amount after 5 years if interest is compounded (i) semi-annually [2]  
 (ii) Monthly
- b) Find the value of P if  $i=10\%$ . Use gradient formula also. [4]



3. a) Define equivalent worth and rate of return method. How much rupees should you deposit now in a bank account that gives 8% interest per year if you wish to draw Rs.10,000 per month for 10 years? [2+4]
- b) What is the difference between financial and economic analysis? Determine both type of B/C ratio from the following cashflow. [2+4]

Initial investment = 3,00,000

Annual revenue = 85,000

Annual costs = 15,000

Salvage value = 20% of initial investment

Useful life = 6 years

MARR = 10%

- c) Compute IRR by using trial and error process of the following project. Determine also investment decision. [4]

Initial investment = 25,000

Annual revenue = 8,000

Salvage value = 5,000

Useful life = 5 years

MARR = 20%

4. a) Select the best proposal using ERR ( $\epsilon=25\%$ , MARR=20%) [4]

EOY	0	1	2	3	4	5	6
Proposal A	-6400	2620	2900	3020	3100	3100	2600
Proposal B	-7550	2050	4060	4000	3900	3900	3400

- b) State and explain about the cases of mutually exclusive, contingent and independent projects with example. Compare the following projects by using repeatability assumption when MARR is 12% [4+4]

Project	A	B
Initial investment	2,00,000	3,00,000
Annual revenue	25,000	30,000
Annual costs	7,000	9,000
Useful life year	6	8
Salvage value	10,000	20,000

5. The new machine costs 10,000 operating cost 2200 in first year, then increases by 20% per year. Market value is 6000 after one year and will decline by 15% each year  $N = 5$  years. If required, old machine can work another 3 years. Market value now is 5000 and will decline by 25% each year. Immediate overhauling to restore to operable condition costs 1200. Operating costs 2000 in the first year increases by 1500 per year thereafter. MARR = 15% [8+4]

- i) Find the economic service life of this machine (new)  
ii) AEC of defender is as followings:

(AEC)				
N	1	2	3	4
AEC	5380	5203	5468	5845

When should the old machine be replaced with the new machine.

6. a) Explain decision free Analysis: [4]  
b) Calculate break-even hours of operation per year to become cost equal and recommended economic pump if it is to be operated 5 hours daily at full load. [8]

	KHASA Pump	SARVO Pump
Capacity	100 hp	100 hp
Purchase cost (Rs.)	5,00,000	10,00,000
Tax per year (Rs.)	10,000	15,000
Maintenance cost per year (Rs.)	36,500	29,200
Efficiency	80%	90%
Life year	5	5
Salvage value	20 % of purchase cost for both	
MARR	20% per year	
Electricity cost	Rs. 10/kwhr	

7. a) Define depreciation. What are the causes for it? If a machine costing of Rs. 1,50,000 is purchased by expecting salvage value Rs.40,000 at the end of 6<sup>th</sup> year. Calculate depreciation amount for each years by [2+5]
- i) SOYD  
ii) Declining balance
- b) Suppose an equipment purchased for Rs.10,00,000. It is expected to generate income of Rs. 3,50,000 per year during 5 years and corporate income tax rate is 25% per year. Under the recovery periods depreciation are as follows. [6]

Year	1	2	3	4	5
Depreciation amount	1,00,000	2,00,000	2,00,000	2,00,000	1,00,000

Calculate ATCFs and determine profitability (IRR) when MARR is 15% by using PW method.

8. Evaluate the PW of the following project: [5]

Initial investment = Rs. 1,00,000 → in constant dollars  
Annual sales income = Rs. 40,000 → in constant dollars  
Annual labour cost = Rs. 3,000 → in constant dollars  
Annual material X = Rs. 2,000 → in constant dollars  
Annual material Y = Rs. 1,000 → in constant dollars  
Salvage Value = 20% of initial investment - in constant dollars

Inflation rate for sales income, labour cost, materials X, material Y and salvage value are 5%, 8%, 0%, 6% and 3% respectively for the project period. Take market interest rate = 20% project life is 4 years.

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03 TRIBHUVAN UNIVERSITY  
INSTITUTE OF ENGINEERING  
**Examination Control Division**

2069 Poush

Exam.	New Back (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL,BEX BCT.	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ All questions carry equal marks.
- ✓ Assume suitable data if necessary.

1. a) What are the principles of engineering economics? How does it help to decision making process?  
b) Differentiate between simple interest and compound interest. How many deposits of Rs.50, 000 each should make per month so that the future amount will be Rs. 20, 00,000 if the bank interest rate is 10% per year?
2. a) An equipment costing of Rs.5,00,000 is estimated to have life of 10 years and expected annual revenue is Rs.1,10,000 with annual cost of Rs.20,000. Determine the investment decision from PW, AW, and FW method to this equipment when salvage value is Rs.1, 00,000 and MARR is 12%.  
b) Use IRR method to evaluate following project when MARR is 20%.

End of year	cash flow
0	-60,000
1	20,000
2	40,000
3	50,000
4	50,000
5	70,000

3. a) Determine both types of B/C ratio by using FW formulation:

Initial investment (Rs.)	2,50,000
Annual revenue(Rs.)	50,000 at the end of first year and increasing by Rs. 30,000 for each year
Annual O&M cost(Rs.)	30,000
Salvage value (Rs.)	50,000
Useful life year	5
MARR	15%

- b) Recommend the best project from the following information by using repeatability assumption when MARR is 12%.

Project	A	B
Initial investment(Rs.)	4,00,000	7,00,000
Annual revenue(Rs.)	1,75,000	2,50,000
Annual cost (Rs.)	25,000	35,000
Salvage value (Rs.)	40,000	70,000
Useful life(year)	6	8

4. a) What do you mean by replacement analysis? Determine the choice between defender and challenger with following information from AEC approach when useful life is 5 years and MARR is 10%.

Item	Defender	Challenger
Initial investment(Rs.)	25,00,000	35,00,000
Annual cost(Rs.)	10,00,000	7,50,000
Salvage value(Rs.)	5,00,000	12,00,000

- b) Define economic service life of an asset. From the following information find the economic service life of an asset.

Initial investment(Rs.)	50,000
Annual operating cost (Rs.)	10,000 for the first year and increasing by 15% over the previous year
Salvage value(Rs.)	Declining each year by 20% from the previous year's salvage value
Useful life (year)	7
MARR	15%

5. a) Perform sensitivity analysis of the following project over a range of  $\pm 30\%$  in i) initial investment ii) net annual revenue iii) useful life year. Draw also sensitivity diagram.

Initial investment(Rs.)	5,00,000
Net annual revenue(Rs.)	1,20,000
Salvage value(Rs.)	80,000
Useful life(year)	6
MARR	10%

- b) If the cost of 25 watt CFL bulb is Rs.260 whereas the cost of 100 watt Filament bulb is Rs.35 but these bulbs have equal lighting power. Which bulb do you prefer in your use and why? When electricity cost is Rs.11 per unit (kw-hr).

6. a) What do you mean by depreciation and what are its causes? A machine purchased for Rs. 50,000 by expecting useful life of 10 years. Calculate its depreciation amount for each year by using declining balance method when rate of depreciation is 20% per year.

- b) Write short notes on  
 i) MACRS for depreciation  
 ii) Inflation and CPI  
 iii) Market interest rate and inflation free interest rate.

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03 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division.**  
 2069 Bhadra

Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics (CE655)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Define engineering economy. Enlist the principles of engineering economy. [1+3]

2. Ramesh, a Civil Engineer is planning to place a total of 20% of his salary, which is Rs. 250000. per year now, each year in mutual fund. He expects 7% salary increase each year for next 15 years. If the mutual fund will average 10% annual return, what will be the sum-amount at the end of 15 years? If salary increases by Rs 25000 per year. What will be the amount? [4+4]

3. a) From the following cashflow [4]

EOY	0	1	2	3	4	5
Cash flow	-3000	800	1000	1100	1210	1464

Calculate both type of payback period. MARR = 10%.

b) Equipment costs 2,50,000 and has salvage value of 50,000 at the end of its expected life 5 years. Annual expenses will be 40,000. It will produce a revenue of 120,000 per year. MARR = 20%. = ε [4+4+4]

- Evaluate IRR using AW formulation.
- Evaluate both type of B/C ratio with FW formulation.
- Find ERR.

4. From the following information select the best project.

	Project A	Project B
Initial Investment	35,000	50,000
Annual Revenue	16,450	25,000
Annual costs	3,000	13,830
Useful life	4 years	8 years
Salvage value at the end of useful life	0	0

MARR = 10%

When service period required is:

- 4 years by FW method
- 8 years by IRR method with PW formulation

[4]

[8]

5. What is the economic service life of an asset? Find the economic service life of a new electric lift truck which costs \$ 20,000, have a operating cost of \$1000 in the first year and have salvage value of \$12,000 at the end of the first year. For the remaining years,

operating costs increase each year by 10% over the previous years operating costs. Similarly the salvage value declines each year by 20% from the previous years salvage value. The lift truck has a maximum life of 7 years. An overhaul costing of \$3000 and \$5000 will be required during the fifth and seventh year of service respectively. The firm's required rate of return is 15% per year.

**OR**

A firm has a contract to provide printing service to IOE for next 8 years. It can provide the service using its old printing machine (the current defender) or the newly bought machine (the challenger). After the contract work neither the old machine nor the new machine will be retained. Considering the annual equivalent costs of the old machine and new machine as follows, what are their economic service life? And what is the best replacement strategy?

[2+10]

Number of years (n)	Annual equivalent cost (Rs)	
	Old machine	New machine
1	515,000	750,000
2	510,000	615,000
3	550,000	586,000
4	596,000	583,000
5	644,000	590,000

6. a) Calculate breakeven volume of a cable manufacturing company from the following data: Total cost = Rs. 1,200,000; Variable cost = Rs. 400,000 Income from sales = 15,00,000. at production of 5000 unit.

[4]

- b) A proposal is described by the following estimates:  $P = \$20000$ ,  $S = 0$ ,  $N = 5$  and net annual receipts = \$7000. A rate of return of 20 percent is desired on such proposals. Construct a sensitivity graph of the life, annual receipts, and rate of return for deviations over a range of  $\pm 20$  percent. To which element is the decision most sensitive?

[8]

7. a) Define depreciation and list out important methods of calculating depreciation deductions.

[4]

- b) A machine costs Rs 15000. Its useful life is 5 years and salvage value is Rs 900. Compute the annual depreciation allowances and resulting book values using double declining balance depreciation methods.

[8]

8. a) Define inflation. List out its effects. If the inflation rate is 5% per year and the market interest rate is 13% per year. What is the implied interest (inflation free) rate in inflationary economy?

[1+1+2]

**OR**

A series of five constant dollar (or real dollar) income (beginning with \$5000 at the end of the first year) are increasing at the rate of 7% per year for five years. Inflation free interest rate is 5% and inflation is 8%. Is it feasible investment if investment cost is \$20,000?

[4]

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Exam.	Back
Level	Full Marks
Programme	Pass Marks
III / II	3 hrs

**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Differentiate between nominal and effective interest? Calculate both nominal and effective annual interest if you deposit now, Rs 1,00,000 and you can draw Rs 1000 per month for ever. [6]
- b) A machine cost Rs 20 million with no salvage value. Rs 8 million revenues per year can be gained. Given: useful life = 4 years. Tax rate = 50%, MARR = 10%. Use straight line depreciation method to evaluate (i) PW (ii) IRR [10]
2. a) Explain decision tree analysis. [6]
- b) Select the best project using IRR method. Useful life of all projects are 15 years. MARR = 10%. [10]

Particulars	Project A	Project B	Project C
Initial investment	7500,000	5500,000	4000,000
Annual revenue	960,000	720,000	600,000
Salvage value	7500,000	5500,000	4000,000

3. a) What are the drawbacks of IRR method? How does ERR method eliminates some of these drawbacks. [6]
- b) Perform cost variance analysis. [10]

	Standard (Rs)	Actual (Rs)
Production (Units)	9,000	8,000
Direct Labour (Hours)	72,000	60,000
Direct Labour cost (Rs.)	756,000	600,000
Fixed overhead cost (Rs.)	900,000	810,000
Variable overhead cost (Rs.)	684,000	630,000

4. a) Explain the methods for assessing risk/uncertainty. [6]
- b) Perform sensitivity analysis over a range of  $\pm 30\%$  in (i) initial investment (ii) annual net revenue (iii) useful life. [10]

Initial Investment = Rs. 100,000	Salvage value = Rs 10,000
Annual benefits = Rs 25,000	Annual expenses = Rs 3,000
Useful life = 10 years	MARR = 10%

Draw sensitivity diagram and interpret the result.

5. a) Evaluate the modified B/C ratio for the problem in Q 4(b). [6]

b) Select the best project. Required study period is 5 years. [10]

	Project P	Project Q
Initial Investment(Rs.)	5,00,000	3,50,000
Annual net revenue (Rs.)	2,00,000	1,75,000
Salvage value(Rs.)	50,000	35,000
Useful life (Years)	6	5
MARR	10%	10%

6. a) Define engineering economics. Explain capitalistic OR Socialistic economy. [6]

b) Evaluate ERR. MARR = 10% E=8% [8]

EOY	0	1	2	3	4	5
Cash inflow	-	+40,000	+150,00	+120,000	+800,000	+200,000
Cash outflow	-480,000	-80,000	-50,000	-500,000	-200,000	-400,000

c) What are the elements of cost? [2]

7. Write short notes: (any 4) [4x4]

- a) Sources of uncertainty
- b) Market research
- c) Continuous compounding
- d) Job and process costing
- e) Statistic approach to demand analysis

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Exam.	Regular / Back	
Level	Full Marks	80
Programme	Pass Marks	32
Year / Part	III / II	Time

**Subject:** - Engineering Economics

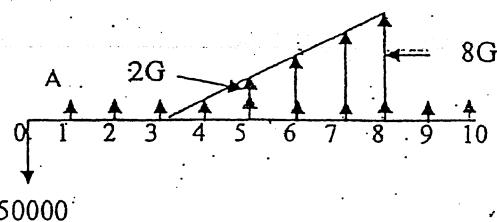
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define economic system. Write advantages of socialistic economy. [1+3]
- b) Explain overhead cost and opportunity cost. [4]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system. [8]

	Estimated	Actual
Production Units	~ 1,15	600
Cement (bags)	5	3,600
Cement Cost (Rs.)	3,500	21,600
Skilled Labour (mason) Days	2	900
Skilled Labour (mason) Cost Rs.	300 per day	325 per day
Fixed Overhead (Rs.)	10,000	15,000

Find all the variances (Including all its components)

2. a) Mr. Basnet purchases a car which cost Rs. 20,00,000. He pays 40% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 25,000 per month for next five years. What annual interest rate will he be paying? At the end of 3rd year, what lump sum amount should he pay to clear all his dues? [4+4]
- b) Find the value of A and G if  $i = 10\%$ .  $A = 3G$  [8]



3. a) Describe any two drawbacks of IRR. [4]
- b) Use ERR method to evaluate the project with following cash flow. MARR =  $\epsilon = 10\%$ . [6]

Year	1 <sup>st</sup>	2 <sup>nd</sup>	3 <sup>rd</sup>	4 <sup>th</sup>	5 <sup>th</sup>	6 <sup>th</sup>
Cash flow	-8,00,000	2,00,000	2,00,000	-50,000	4,00,000	4,00,000

- c) A preliminary estimate of a multipurpose hydropower project produced the following data:

Initial Investment	Annual Power sales	Annual irrigation benefit	Annual recreational benefit	Annual operation and maintenance	Life of the project	Salvage value
Rs. 50 crore	Rs. 8 crore	Rs. 1 crore	Rs. 2 Crore	Rs. 1.5 crore	50 yrs	Rs. 40 crore

Give your suggestion to the government about the implementation of the project.  
 Take MARR = 8%.

4. a) Recommend which one is best out of the following three mutually exclusive projects.  
Study period is 10 years. MARR = 12%. [8]

Project	A	B	C
Initial Investment	5,00,000	6,00,000	7,00,000
Annual Revenues	1,50,000	1,50,000	1,70,000
Annual cost	25,000	25,000	25,000
Salvage value	1,00,000	1,00,000	70,000
Useful life	4	6	8

- b) Define capitalized worth. How much money should Mr X should deposit now in a bank which gives 12% interest annually, so that he can draw (i) Rs 3000 per month plus Rs. 20,000 annually and Rs. 50,000 in every five years for infinite period. [2+6]
5. a) Explain mutually exclusive and independent projects. [4]
- b) Select the best alternative using incremental IRR methods. Useful life is 10 years and salvage value is 25% of initial investment. MARR = 10%. [12]

Project	A	B	C	D
Initial Investment	600	500	800	700
Annual Revenues	150	125	175	160
Annual Cost	40	25	30	35

6. a) What will be the impact of change in value of present worth of the following project if changes occurs in (i) initial investment (ii) net annual income and (iii) Useful life by ±25%? Draw necessary graph also. [10]

Initial Investment	Rs. 4,00,000
Net Annual income	Rs. 50,000
Useful life	12 years
MARR	15%

- b) Based on the following data, forecast the demand of CFL for next five years. [6]
- | Year          | 2007     | 2008     | 2009     | 2010     |
|---------------|----------|----------|----------|----------|
| Demand (Nos.) | 1,00,000 | 1,25,000 | 2,00,000 | 3,00,000 |

7. Write short notes on: (any four) [4x4]
- a) Taxation system in Nepal
  - b) Methods of calculating depreciation
  - c) Decision tree analysis
  - d) Market Research
  - e) Factors affecting demand

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Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any **Five** questions.
- ✓ The figures in the margin indicate **Full Marks**.
- ✓ Assume suitable data if necessary.

1. a) Explain the terms, socialistic economy and cash flow diagram. [4]

b) In the standard card, it is observed that one unit of product 'X', requires fixed overhead of 2 hrs at the rate of Rs. 15/hr. During the month of February, 800 units are produced at the actual fixed overhead of Rs. 18/hr in 1800 hours. Budgeted fixed overhead is Rs. 30,000. Perform cost variance analysis. [6]

c) Evaluate both type of B/C ratio using PW. [6]

Initial cost = Rs. 25 lakh

Salvage value = Rs. 5 lakh

Useful life = 10 years

Annual benefits = Rs. 10 lakh

Annual O & M = Rs. 5 lakh

MARR = 8%

2. a) Explain incremental analysis or break-even analysis. [4]

b) Select the best project using, ERR method. MARR = 18%. E = 12%. [8]

Year	0	1	2	3	4	5
Project A	-40,000	-38,000	+35,000	+35,000	+35,000	+35,000
Project B	-60,000	+25,000	+40,000	-50,000	+50,000	+75,000

c) Fixed cost = Rs. 60 million, Variable cost/unit = Rs. 50,000, Selling price/unit = Rs. 8,000. Find BEP volume. What would be the effect on profit/loss when  $S_p$  increases by 20%. [4]

3. a) How much money should Mr Ram deposit now in a bank so that he and his successor can draw Rs 5000 bimonthly for infinite period? Interest rate is 12 % per year. [6]

b) Select the best combination of the project where A is independent and B is contingent on C. [10]

Project	A	B	C
Initial Investment	40,000	70,000	50,000
Annual Revenues	15,000	20,000	20000
Annual cost	2,500	3,500	0
Useful life (Yrs.)	8	8	8

The Investment is limited to Rs. 120,000. MARR = 10%.

4. a) Panchakanya has recorded the sales of its products in different years as below. Forecast the sales for year 2020.

[8]

Year	2001	2002	2003	2004	2005	2006	2007
Sales (Rs. in Million)	500	550	575	675	650	700	780

- b) Write short notes on any two:

[2×4]

- i) Advantages of Payback Period
- ii) Depreciation Methods
- iii) Job and Process Costing

5. a) Explain repeatability and cotermination assumptions.

[8]

b)

Project	Initial Investment (NRs.)	Annual Revenue (NRs.)	Annual Expenses (NRs.)	Salvage Value	N	MARR
P	5000	3000	2000	1000	8 year	12%
Q	3500	2000	800	350	4 year	12%

Select the best (i) if study period is 10 years (ii) using capitalized worth method.

[8]

6. a) Explain tax and depreciation or decision tree.

[4]

- b) A machine costs Rs. 20 million and expect to save Rs. 4 million/year, Tax rate = 50%, MARR = 10%. Evaluate the PW.

[4]

- c) Perform sensitivity analysis over  $\pm 30\%$  is initial cost and useful life. Draw sensitivity diagram and interpret the result for the problem no 1(c).

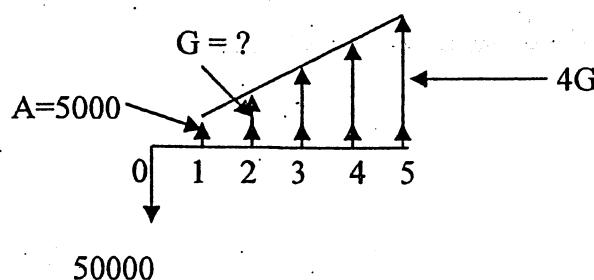
[8]

7. a) Define 'Capital Recovery Cost'. Mr. Fox purchased a motorbike which cost Rs. 2,00,000. He pays 30% as down payment. Remaining amount will be paid on installment basis and wishes to pay Rs. 10,000 per month for 20 months. What annual interest rate is he paying?

[2+6]

- b) Find the value of G if  $i = 10\%$

[8]



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04 TRIBHUVAN UNIVERSITY  
 INSTITUTE OF ENGINEERING  
**Examination Control Division**  
 2065 Chaitra

Exam.	Regular/Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics

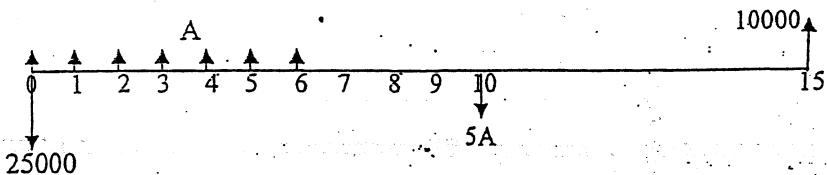
- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. a) Define economic system. Discuss briefly on the characteristics of capitalistic economy. [2+2]
- b) What are the elements of cost? Discuss briefly on the prime cost and overhead costs. [2+2]
- c) The following information has been obtained from the records of a manufacturing company using standard costing system [8]

	Standard	Actual
Production (Unit)	3000	2500
Working days	27	25
Fixed overhead variance	14000	12500
Variable overhead variance	10000	11000

Find all the variances (Including all its components).

2. a) Find the value of A if  $i = 15\%$  [8]



- b) Mr. X receives a loan of Rs 120,000 from a bank at an interest rate of 12 % per year.
  - i) He wishes to repay the loan in monthly installment with Rs. 3000 per month. How many installments are necessary to complete his payment? [4]
  - ii) What annual interest rate is he paying if the Bank asks him to pay Rs 5000 per month for 30 times. [4]
- a) A construction company needs an equipment which costs Rs 10,00,000 and has salvage value of Rs. 1,00,000 at the end of 10 years. The equipment supplier is also willing to provide the equipment on hire for Rs 1,25,000 per year for 10 years. What will you do? Purchase or Hire. MARR = 12% [6]
- b) Find IRR of the following project with initial investment of the Rs 5,00,000 and Salvage value of Rs 1,00,000 at the end of 5 year. The Annual benefit and Operation and Maintenance cost are as following. [10]

End of Year	Benefit	Operation and Maintenance
1	105000	5000
2	115000	10000
3	125000	15000
4	135000	20000
5	145000	25000

Draw unrecovered investment balance diagram also

4. a) From the following four mutually exclusive projects recommend the best one using Payback Period, ERR and BCR methods. The study period is 5 years and  $MARR = \epsilon = 15\%$ . [16]

Project	A	B	C	D
Initial investment	500000	400000	700000	600000
Net annual revenue	125000	110000	170000	135000

Salvage Value is 20 % of the initial investment.

5. a) What is breakeven value? Discuss with suitable example. [6]  
 b) Nepal Airlines is planning to purchase a Jet plane. The estimate on two types of plane under consideration are; [10]

Project	Plane A	Plane B
First investment cost	25,00,00,000	30,00,00,000
Annual O & M	1,50,00,000	1,00,00,000
Useful Life	4 years	6 years
Salvage value	5,00,00,000	6,00,00,000
MARR = 12 %		

Which plane is the best one if it is believed that the plane will be used for i) 4 years and ii) infinite period?

6. a) Define the concept of certainty, Uncertainty and Risk. [4]  
 b) Perform sensitivity analysis of a following project over a range of  $\pm 30\%$  in i) Initial investment ii) Net annual cash flow using annual worth formulation. [6]

Initial Cost	Rs. 5,00,000
Annual revenue	Rs. 75,000
Annual maintenance cost	Rs. 10,000
Useful life	10 years
Salvage value	Rs. 50,000
MARR	10%

- c) Following data shows the demands for fish when the prices are as shown. Calculate the hypothesized regression equation. What shall be the demand if the price is set to be Rs. 60 per kg? [6]

S.N	Price per kg.	Quantity (tones.)	S.N	Price per Kg.	Quantity (tones).
1	64	65	5	82	51
2	53	75	6	59	65
3	67	56	7	67	63
4	52	69	8	71	55

7. Write short notes on any four [4x4]

- a) Job and process costing
- b) Drawbacks of IRR
- c) Depreciation
- d) Factors affecting demand
- e) Methods of demand analysis

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Exam.	Back		
Level	BE	Full Marks	80
Programme	BCE, BEL, BEX, BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Engineering Economics

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt any Five questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Take MARR = 10% if not specified.
- ✓ Draw necessary cash flow diagrams.
- ✓ Assume suitable data if necessary.

1. Select the best project.

[16]

	Project A	Project B
Initial investment (Rs.)	3,50,000	5,00,000
Annual revenues (Rs.)	1,90,000	2,50,000
Annual expenses (Rs.)	64,500	1,38,000
Useful life (years)	4	8
Salvage value at the end of useful life	0	0

Use

- a) Repeatability assumption
- b) Study period is 4 years
- c) Infinite project life

2. a) Recommend the best using ERR method E = 20%

[12]

ERR	Project	End of the cash flows (in Rs. '000)						
		0	1	2	3	4	5	6
28.3%	A	-640	262	290	302	310	310	260
26.4%	B	-680	-40	392	380	380	380	380
28.5%	C	-755	205	406	400	390	390	324

b) Recommend the best using payback period for the problem no. 2(a).

[4]

3. a) Explain the mutually exclusive project, independent projects and contingent with suitable examples.

[6]

b) Forecast the sales for year 2010.

[10]

Year	2000	2001	2002	2003	2004	2005	2006	2007
Sales Rs. '000	416	287	307	268	378	523	457	587

4. a) Calculate variance for the following:

[8]

	Standard	Actual
Production units	9,300	10,500
Direct labour hours	102,300	136,500
Fixed overhead (Rs.)	21,483,000	28,392,000
Variable overhead (Rs.)	15,345,000	17,199,000

- b) Perform sensitivity analysis over  $\pm 30\%$  (varying in increment of 10%) in (i) initial investment (ii) annual net revenue (iii) useful life. Draw sensitivity diagram and interpret the result. [8]

Initial investment = Rs. 20,000

Useful life = 10 years

Revenues/Year = Rs. 6,000

Expenses/Year = Rs. 2,000

5. a) Find the required annual receipts 'A' for the following investment proposal:-

[8]

Initial investment = Rs. 10,00,000

Salvage value = Rs. 1,00,000

O & M expenses/year = Rs. 50,000

End of year	1	2	3	4	5
Benefits	A+70,000	A+80,000	A+90,000	A+100,000	A+110,000

- b) Find the modified B/C ratio for the problem no. 5(a) [8]

6. a) Explain the economic system. [8]

- b) Find IRR and show the unrecovered investment balance in the graphical and tabular form. [8]

Investment (First) Cost = Rs. 2,50,000

Revenues/Year = Rs. 1,00,000

Expneses/Year = Rs. 30,000

Salvage Value = Rs. 50,000

Useful life = 5 years

7. a) Explain the uncertainty and its sources. Differentiate between nominal interest rate and effective interest rate. If monthly interest rate is 1%, what will be the quarterly interest rate? [4+4]

- b) Explain tax and depreciation with suitable examples. Find BEP volume for the following project: [4+4]

Fixed cost = Rs. 24 lakh

Selling price = Rs. 800 per unit

Variable cost = Rs. 500 per unit

What would be effect on BEP, when fixed cost increases by 10% and variable decreases by 20%?

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Exam.		Regular	
Level	BE	Full Marks	50
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System (CT652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Why data independence is importance in data modeling? Differentiate between physical and logical data independence. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between strong and weak entity sets?

Patients are treated in a single ward by the doctors assigned to them. Healthcare assistants also attend to the patients; a number of these are associated with each ward. Each patient is required to take a variety of drugs a certain number of times per day and for varying lengths of time. The system must record details concerning patient treatment and staff payment. Some staffs are paid part time and doctors and healthcare assistants work varying amounts of overtime at varying rates, the system will also need to track what treatments are required for which patients. [8+4]

3. Write relational algebra queries for (a, b, c). Write SQL queries for (i, ii, iii)
  - a) Retrieve the detail of employee with eno, add, dob, phone with highest salary. [2]
    - i) Create above table Emp as indicated. [2]
    - ii) Find employee who earns more than 50000, works in CS department and name contains alphabet a. [2]
    - iii) Increase salary of those employee who earns less than average by 25% [2]
  - b) Find total amount spent by ECON department for its employee salary. [2]
  - c) Find total number of post in CS department. [2]
4. a) What is lossless decomposition and dependency preservation? Suppose that we decompose the schema  $R = (A, B, C, D, E)$  into  $(A, B, C)$  and  $(C, D, E)$ . Is it lossless decomposition? Is it dependency preserving? [3+4]
 

Consider that the following set F of functional dependencies hold.

$A \rightarrow BC$   
 $CD \rightarrow E$   
 $B \rightarrow D$   
 $E \rightarrow A$
- b) What is the importance of normalization? Define BCNF. [2+3]
5. Explain the steps involved in query processing. What is the significance of materialized views? [6+2]
6. Write about fixed-length record and variable length record organization DBMS. Define B+ free structure used for indexing. [4+4]
7. Explain different states of a transaction along with state transition diagram. Explain conflict Serializability with example. [4+4]
8. Explain briefly two phase locking protocol for Concurrency Control. [4]
9. Explain in detail the working of log-based recovery method. [6]
10. Explain the importance of data warehouse in decision making. Write the application areas of spatial database. [3+3]

Exam.		Regular / Back	
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System (CT652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What difficulties would you face if you used file system directly to implement a database application? What is physical data independence? [3+1]

2. Draw a complete ER-diagram for the following case.

*"A Bus Company owns a number of busses. Each bus is allocated to a particular route, although some routes may have several busses. Each route passes through a number of towns. One or more drivers are allocated to each stage of a route, which corresponds to a journey through some or all of the towns on a route. Some of the towns have a garage where busses are kept and each of the busses are identified by the registration number and can carry different numbers of passengers, since the vehicles vary in size and can be single or double-decked. Each route is identified by a route number and information is available on the average number of passengers carried per day for each route. Drivers have an employee number, name, address, and sometimes a telephone number."*

What is the difference between the degree and cardinality of a relationship? [8 + 4]

3. Consider the following relational database model

*Employee(eid, name, address, supervisor\_eid)  
 Department(dept\_id, name)  
 Project(pid, title, dept\_id)  
 Works\_on(eid, pid, hours)*

Write relational algebra expressions for the following: [2 X 4 = 8]

- List the name of all employees from Computer department along with the name of their supervisor.
- Find the name of all employees who work on the "Network monitoring" project for more than 15 hours.
- Delete all projects which belong to the "Electrical" department.
- Find the total number of projects from each department, along with the department name.

4. Consider the relational schema given below. [2 X 4 = 8]

*Product (pid, name, price, category, maker-cid)  
 Purchase (buyer-ssn, seller-ssn, quantity, pid)  
 Company (cid, name, stock price, country)  
 Person(ssn, name, phone number, city)*

- a) Write an SQL query to find the name and price of all products of "camera" category made in "Japan".
- b) Write an SQL query to create a view to expose only the Buyer name, Seller name and product name from all transactions.
- c) Write a query in SQL to increase the price of all products from DELL company by 5 %.
- d) Write skeleton tables in QBE to find the name and phone number of all persons who purchased products of Laptop category with price greater than 80,000.
5. a) Explain what is referential integrity constraint along with an example? Briefly explain cascading actions in referential integrity constraints. [3+3]
- b) Briefly explain how to normalize a database from un-normalized form to 1NF, 2NF, 3NF and 4NF? [6]

6. Explain the difference between cost-based and heuristics-based methods for query optimization. How can you optimize the following query? [3+5]

$\Pi_{name, title}(\sigma_{dept\_name = "Music"}(instructor \bowtie \Pi_{course\_id, title}(teaches \bowtie course)))$

7

7. a) What is the difference between ordered indices and hash indices in a database? What is the advantage of using a sparse index? [2+2]
- b) What is a RAID? How would you choose the best RAID level for your database server? [1+3]

8. Explain Atomicity and Isolation properties of a database transaction. Describe the concept of conflict serializability for concurrent execution of transactions. [4+4]

9. Briefly explain the idea of a stable storage. Explain the architecture of a remote backup system. [3+3]

10. Write short notes on the following

- a) Types of distributed databases [3]
- b) Data warehousing [3]

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<b>New Back (2066 &amp; Later Batch)</b>			
<b>Exam.</b>	<b>Level</b>	<b>Full Marks</b>	<b>80</b>
<b>Programme</b>	BCT	<b>Pass Marks</b>	32
<b>Year / Part</b>	III / II	<b>Time</b>	3 hrs.

**Subject:** - Database Management System (CT652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Explain the difference between DDL, DML and DCL along with examples. [4]

2. Assume that at Pine Valley Furniture each product (described by Product No., Description, and Cost) is comprised of at least three components (described by Component No., Description, and Unit of Measure) and components are used to make one or many products (i.e., must be used in at least one product). In addition, assume that components are used to make other components and that raw materials are also considered to be components. In both cases of components being used to make other components, we need to keep track of how many components go into making something else.

Draw an ER-diagram for this case. Describe what is total participation using an ER-diagram example. [8 + 4]

3. Consider the following relational database model

*Product (pid, name, price, category, maker-cid)  
Purchase (buyer-ssn, seller-ssn, quantity, pid)  
Company (cid, name, stock price, country)  
Person(ssn, name, phone number, city)*

Write relational algebra expressions for the following: [2 X 4]

- Find the *ssn* and *name* of all people who have purchased products of category "telephone".
- List the *pid* and *name* of all products which is more expensive than \$500 and made in China.
- Increase the price of all products of "television" category by 10%.
- List the *ssn* and *name* of each seller along with the total quantity of products sold.

4. Consider the relational schema given below. [2 X 4]

*Hotel (Hotel\_No, Name, Address)  
Room (Room\_No, Hotel\_No, Type, Price)  
Booking (Hotel\_No, Guest\_No, Date\_From, Date\_To, Room\_No)  
Guest (Guest\_No, Name, Address)*

- Write an SQL query to list all guests who have booked rooms at the Himalayan Hotel.
- Write an SQL query to create a view to expose only the *Hotel\_No*, *Guest\_No*, *Room\_No* and *Price* of the room of all booked rooms.
- Write a query to offer 5% discount on all rooms of type "Delux" for the Everest Hotel.
- Write skeleton tables in QBE to find the Check-in date and Name of all guests currently booked for the Everest Hotel.

5. a) Explain the necessary condition for decomposing a relational database table into two tables. Why is normalization needed? [4+4]
- b) Compare 3NF and BCNF normal forms? [4]
6. Explain the process how a query is evaluated in RDBMS systems. How are equivalence rules for relation algebra helpful for query optimization? Explain with example. [3+5]
7. a) Distinguish between dense index and sparse index? What is a secondary index? [3+2]
- b) Briefly explain how variable length records are stored in databases? [3]
8. What do you understand by the ACID properties of transactions? Explain with examples. [8]
9. Explain the functions of Undo and Redo operations in a log-based recovery of database. [6]
10. a) Briefly explain horizontal and vertical fragmentation in distributed databases. [3]
- b) Write a short note on Data warehouse and associated applications. [3]

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Exam.	Regular		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System (CT652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *The figures in the margin indicate Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Briefly explain different levels of data abstraction in a database system. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between strong and weak entity sets? [8+4]

Each employee in an engineering company has at most one recognized skill, but a given skill may be possessed by several employees. An employee is able to operate given machine-type (e.g., lathe, grinder) if he has one of several skills, but each skill is associated with the operation of only one machine type. Possession of a given skill (e.g., mechanic, electrician) allows an employee to maintain several machine-types, although maintenance of any given machine-type requires a specific skill (e.g., a lathe must be maintained by a mechanic).

3. Consider the following relational database model:

employee (employee-name, street, city)  
 works (employee-name, company-name, salary)  
 company (company-name, city)  
 manages (employee-name, manager-name)

- a) Write SQL queries for the following needs. [2x4]
  - i) Modify the database so that Jones now lives in city Pokhara.
  - ii) Give all employees of 'NABIL Bank' a 10 percent raise.
  - iii) Give all managers of 'NABIL Bank' a 30 percent raise unless the salary becomes greater than 100,000.
  - iv) Delete employee who has maximum amount of salary.
- b) The relation works has attribute company-name, company-name is primary key in relation company. How the relation between these two relations is preserved? Explain with solution with SQL query to achieve this relationship. [4]
4. a) What is a lossless-join decomposition? What is a functional dependency? Explain. [4+4]
  - b) What is the advantage of 3NF over BCNF? [4]
5. What do you mean by term functional dependency? Discuss various types of functional dependencies. [6]
6. How can pipelining approach improve query-evaluation efficiency? [4]
7. a) What is the use of RAID storage device? What are the advantages and disadvantages of mirroring? [3+2]

- b) What is a remote backup system? Explain. [3]
8. a) List the ACID properties. Explain the usefulness of each. [4]
- b) During its execution, a transaction passes through several states, until it finally commits or aborts. List all possible sequences of states through which a transaction may pass. Explain why each state transition may occur. [4]
- c) How two phase locking protocol helps in avoiding deadlock? Explain with examples. [4]
9. Suppose following contents are present in the log when a crash occurs. Explain what happens for a log-based recovery. [6]

```
<T0 start>
<T0, B, 2000, 2050>
<T1 start>
<checkpoint {T0, T1}>
<T1, C, 700, 600>
<T1, commit>
<T2 start>
<T2, A, 500, 400>
<T0, B, 2000>
<T0 abort>
<T2, A, 500>
<T2 abort>
```

10. Briefly explain properties of distributed databases. [4]

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Exam.	Regular (2066 & Later Batch)		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System (CT652)

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. Briefly highlight your significant differences between a file-processing system and a DBMS. [4]
2. Draw an ER-diagram for the following mini-case. What is the difference between cardinality and degree of a relationship?

A university registrar's maintains data about the following entities: (a) Courses, including number, title, credits, syllabus and prerequisites; (b) Course offerings, including course number, year, semester, section number, instructor(s), timings and classroom; (c) Students, including student-id, name, and program; and (d) instructors, including identification number, name, department, and title. Further, the enrollment of students in courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. [8+4]

3. a. Mention the two conditions to be satisfied by any two sets for union, intersection and set difference operation between them. [1]  
 b. employee(empname, street, city)  
 works(empname, companyname, salary)  
 company(companyname, city)  
 manages(empname, managername)  
 For the case of above database schema:  
 I. Write an expression in SQL to create the table employee.  
 II. Write an expression in SQL to inset a row into the table works.  
 III. Write an expression in SQL to find the name and cities of resident of all the employees who do not work for XYZ Pvt. Ltd.  
 IV. Write an expression Relational Algebra to find the company name that has the highest number of employees. [4×2]
- c. Suppose you are assigned as the Database Administrator of a Bank. How can you enhance the security by implementing concept of views on the database? [3]
4. What do you mean by integrity constrains? Explain any four constraints that can be enforced to database tables. [6]
5. What are the advantages of normalization of database? Explain 1NF, 2NF and 3NF.  
 When database de-normalization is preferred? [2+3+1]
6. Explain the process of query optimization. What is cost-based optimization? [6+2]
7. What do you mean by ordered index and hash index? Explain limitation of static hashing.  
 How extendable hashing overcome such limitation? [2+2+4]

8. a) Explain conflict serializability with example. [8]
- b) Differentiate between fine granularity and coarse granularity locking in multiple granularity locking protocol. [4]
- 9 Explain redo phase and undo phase of log based failure recovery mechanism. [6]
10. a) What is object-oriented databases? Explain briefly. [3]
- b) Explain the benefit of parallel database? [3]

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Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management Systems

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. What are the drawbacks of using file systems to store data? Explain. [6]

2. Draw an ER-diagram for the following mini-case

Procurement department of the Ministry of Transportation (MOT) keeps track of all the items (furniture and equipment such as a chair or printer) in the Ministry offices. There are several MOT buildings and each one is given a different name to identify it. Each item is assigned a unique ID when it is purchased. This ID is used to keep track of the item, which is assigned to a room within a building. Each room within a building is assigned to a department, and each department has a single employee as its manager. [8]

3. Consider the following relational database model

*employee (person-name, street, city)*  
*works (person-name, company-name, salary)*  
*company (company-name, city)*  
*manages (person-name, manager-name)*

Write relational algebra expressions for the following: [2 X 4 = 8]

- Find the names and street address of all employees who work for First Bank Corp. and earn more than \$10,000 per annum.
- Find the names of all employees who do not work for First Bank Corp.
- Give all employees working at First Bank Corp. a 10 % salary raise.
- Count the number of employees in each company.

4. Consider the following relational database. [2 X 5 = 10]

*account (account-number, branch-name, balance)*  
*branch (branch-name, branch-city, assets)*  
*customer (customer-name, customer-street, customer-city)*  
*loan (loan-number, branch-name, amount)*  
*depositor (customer-name, account-number)*  
*borrower (customer-name, loan-number)*

- Write an SQL query to list the names of all depositors along with their account number, street and city address.
- Write a query in SQL to list the branch-cities and total assets where the total assets are more than \$1,000,000 in the city.
- Write an SQL query to find the names and loan-numbers of all customers who have a loan of over \$15,000.
- Write a query in SQL to increase all accounts with balances over \$10,000 by 6%.
- Give an expression in QBE to find the customer-name, loan-number, and amount for all customers who have a loan from the "PATAN" branch.

5. Explain the conditions of BCNF. Compare BCNF and 3NF with example. [3+5]
6. Explain the process of query optimization. What is the significance of materialized views? [6+2]
7. What is RAID? Explain the B+ tree index with an example? [3 + 8]
8. Explain the granting and revoking of privileges to database users. [5]
9. Consider the following log contents when a crash occurs. Briefly explain how a recovery would be done. [5]

< $T_0$  start>  
< $T_0$ , A, 1000, 950>  
< $T_0$ , B, 2000, 2050>  
< $T_0$  commit>  
< $T_1$  start>  
< $T_1$ , C, 700, 600>

10. What is a transaction? What is a serializable schedule? [5]
11. a) What is an ORM? [3]  
b) What is the difference between a homogeneous and a heterogeneous distributed database? [3]

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**Examination Control Division**

2067 Mangsir

Exam.	Regular / Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. List and explain the five significant differences between a file processing and database management system. [5]

2. a) Construct an E-R diagram with proper mapping constraints for Registrar's Office that maintains data about courses, course offerings, students and instructors, enrollment of students in various courses and grades awarded to students in each course they are enrolled for must be appropriately modeled. [5]

b) What is data definition language? Explain strong and weak entity with suitable examples. [5]

3. Consider the relational data base as follows: [3×5]

employee (employee-name, street, city)

works (employee-name, company-name, salary)

company (company-name, city)

managers (employee-name, manager-name)

a) Write relational algebra to find the name of the manager who manages the employee "Shakti".

b) Write a SQL statement to find the name of all employees who live in the same cities and same streets as the employee "Achyut" and the same cities as the companies for which they work.

c) Write the QBE for: Delete all employees and who work for "XYZ" company.

d) Write an expression in tuple relational calculus to find the name of all employees who works for "ABC" company but do not earn more than 50000.

e) Write an expression in domain relational calculus to find the name of the employee, company name and salary for employee with earning over 50000.

4. a) What is normalization? What are their levels? State 3NF and BCNF. [2+1+4]

b) What do you mean by trivial and non-trivial functional dependencies? [3]

5. a) What do you mean by file organization? Why dynamic hashing is needed? [5]

b) Let R = (A, B, C, D, E, F) and F = {A→BC, E→AF}. Decompose R to get all smaller relations in BCNF. [5]

6. a) What are the properties that must be hold by transaction? Explain the usefulness of each. [5]

b) Differentiate between primary index and secondary index. [5]

7. a) Explain deferred database modification technique of log based recovery with examples. [8]

b) How do you estimate query cost? [2]

8. Write short notes on: (any two) [2×5]

a) Object containment

b) Multiple granularity locking

c) Query optimization

Exam.	Back		
Level	BE	Full Marks	80
Programme	BCT	Pass Marks	32
Year / Part	III / II	Time	3 hrs.

**Subject:** - Database Management System

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ Attempt All questions.
- ✓ The figures in the margin indicate Full Marks.
- ✓ Assume suitable data if necessary.

1. List and explain all the aspects of database system that might be subjects to change in physical storage. [6]
2. How do you represent composite and multivalued attributes of E-R diagram in tables? Explain with example. [4]
3. Construct an E-R diagram with proper mapping constraints, attributes and relationship sets for book shopping center that has entity sets book, author, publisher, customer, shopping-basket and warehouse. [4]
4. Consider the relational database as follow [2x7]

account (account-number, branch-name, balance)  
 branch (branch-name, branch-city, assets)  
 customer (customer-name, customer-street, customer-city)  
 loan (loan-number, branch-name, amount)  
 depositor (customer-name, account-number)  
 borrower (customer-name, loan-number)

- a) Give an expression in the relational algebra to find the name of all customers who have a loan at KANTIPATH branch but do not have an account at any branch of the bank.
  - b) Give an expression in the relational algebra to find the name of all customers who live in the same street as BINOD.
  - c) Give an expression in tuple relational calculus to find the name of all customers who have a loan and an account at the bank.
  - d) Give an expression in domain relational calculus to find the name of all customers who have a loan of over \$12000.
  - e) Give an expression in SQL to delete all loans with loan amount between \$1400 and \$1700.
  - f) Give an expression in SQL to find the name of all customers who have a loan at the bank but do not have an account at the bank.
  - g) Give an expression in QBE to provide as a gift for all loan customers of the PATAN branch, a new \$200 savings account for every loan account they have, with the loan number serving as the account number for the new savings account.
5. a) Suppose that we decompose the schema  $R = (A, B, C)$  into  $R_1 = (A, B)$ ,  $R_2 = (A, C)$ . Show that this decomposition is a lossless-join decomposition and not dependency preserving if the  $F = \{A \rightarrow B, B \rightarrow C\}$ . [6]

- b) What are the minimal conditions that must be hold by a relation schema R to be in third normal form (3NF)? [2]
6. What are the major disadvantages of using materialization approach for evaluation of expression? And how does pipelining approach overcome those disadvantages? [6]
7. Discuss the pointer method to represents the variable records by fixed-length representation. How does anchor and overflow block improve the pointer method? [6]
8. What are the different roles are created and granted to users in database? Discuss the authorization grant graph and attempt to defeat authorization revocation. [2+2]
9. How checkpoint mechanism improves the performance of log based crash recovery techniques? Explain. [8]
10. What do you mean by cascading rollback and why this must be removed? How strict two phase locking protocol improves the two phase locking protocol? [3+3]
11. How and why data replication and fragmentation techniques are used in distributed data storage? [6]
12. Write short notes on: [2x4]
- a) Recursive Relationship
  - b) Compensating Transaction

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