2015-16  
B.TECH. (AUTUMN SEMESTER) EXAMINATION  
COMPUTER ENGINEERING  
OPERATING SYSTEMS  
CO-303/310  
Credits: 05/04  
Duration: Three Hours

Maximum Marks: 60

Answer all the questions. 
Assume suitable data if missing. 
Notations used have their usual meaning.

<table>
<thead>
<tr>
<th>QNo</th>
<th>Question</th>
<th>MM</th>
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</thead>
</table>
| 1   | Attempt any two parts.  
(a) What are multi-programmed batch systems? Explain. Why application programmers prefer programming according to API rather than invoking actual systems calls?  
(b) What services are provided by an operating system?  
(c) What is a virtual machine? How can they be classified? Explain the implementation of java virtual machine in brief. | \(6\times 2 = 12\) |
| 2   | Attempt any two parts.  
(a) Explain the following CPU scheduling algorithms with suitable examples-  
(a) Multilevel Queue  
(b) Shortest Job first  
(b) Differentiate between message passing and shared memory models of process communication. Explain how communication between two processes takes place in Windows XP.  
(c) What are threads? Discuss any two threading issues. Provide two programming examples in which multithreading does not provide better solution than single threaded solution. | \(6\times 2 = 12\) |
| 3   | Attempt any two parts.  
(a) What are semaphores? How can they be used for synchronization? Discuss any two problems associated with them.  
(b) What is race condition? Give an example situation which can lead into race condition. How can they be avoided?  
(c) What are the four characteristics of deadlock? Considering the deadlock situation in the dining philosopher problem, discuss how deadlock could be avoided using deadlock prevention methods by eliminating each of the four conditions. | \(6\times 2 = 12\) |
| 4   | Attempt any two parts.  
(a) Differentiate between paging and virtual memory? List the steps taken by operating system in case of page fault.  
(b) Discuss any three LRU page replacement approximation algorithms.  
(c) How memory access time is improved in paging? Explain it using a suitable diagram. | \(6\times 2 = 12\) |
<p>| 5(a) | Explain the SSTF disk scheduling algorithm with a suitable example. | 4 |
| 5(b) | Discuss various methods for free space management on disk. | 4 |
| 5(c) | Explain the Linux process scheduling method in brief. | 4 |</p>
<table>
<thead>
<tr>
<th>Q.No</th>
<th>Question</th>
<th>MM</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Attempt any two parts.</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>A PARTS file with Part# as the key field includes records with the following Part# values: 23, 65, 37, 60, 46, 92, 48, 71, 56, 59, 18, 21, 10, 74, 78, 15, 16, 20, 24, 28, 39, 43, 47, 50, 69, 75, 8, 49, 33, 38. Suppose that the search field values are inserted in the given order in a B-t-tree of order p = 4 and pleaf = 3; show how the tree will expand and what the final tree will look like. Show only those steps where a tree node is split.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>(b)</td>
<td>Explain how conceptual modelling is helpful in database design? Also draw the complete ER-diagram for the following scenario: A Trainer trains one or many horses and a horse is trained by no more than one Trainer. A given horse competes in a particular race ridden by a particular jockey on a specific date and the position (i.e. 1st, 2nd etc.) in which a horse finishes is recorded.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>(c)</td>
<td>A PARTS file includes records with the following Part# values: 2369, 3760, 4692, 4871, 5659, 1821, 1074, 7115, 1620 and 9208. Load these records into expandable hash files based on extendible hashing. Show the structure of the directory at each step, and the global and local depths. Use the hash function h(K) = K mod 128 and bucket size equal to 3 records.</td>
<td>[7.5]</td>
</tr>
<tr>
<td>2</td>
<td>Attempt any two parts.</td>
<td></td>
</tr>
<tr>
<td>(a)</td>
<td>In what sense does relational calculus differ from relational algebra? Elaborate how a relational calculus statement is written explaining the use of range variables, formulae and quantifiers.</td>
<td>[7.5]</td>
</tr>
</tbody>
</table>

Contd.....2.
(b) What are the entity integrity and referential integrity constraints? How can these constraints be enforced by the DBMS? Is the enforcement technique you suggest difficult to implement?

(c) What are data definition statements in SQL? Explain the syntax and semantic of any three data definition statements.

3 Attempt any two parts.

(a) What is the difference between third normal form and boyce-codd normal form? The schema \( R(A; B; C; D; E) \) has the following functional dependencies.
\[
\begin{align*}
AB & \rightarrow C \\
BC & \rightarrow D \\
CD & \rightarrow E \\
DE & \rightarrow A
\end{align*}
\]
Which functional dependencies violate Boyce-Codd and third Normal forms? Find a lossless-join decomposition of \( R \) into BCNF relations.

(b) Let \( R(A; B; C; D; E) \) be a relational schema with the following functional dependencies
\[
\begin{align*}
AB & \rightarrow C \\
DE & \rightarrow C \\
B & \rightarrow D
\end{align*}
\]
What is the closure of \( (A, B) \) and \( (B, E) \)?
Decompose the schema to BCNF in two different ways. In each case, are all dependencies preserved? Explain.

(c) Discuss how isolation among the concurrent transactions are achieved in a database system. What would happen if full isolation is not enforced? Which of the following schedules is (conflict) serializable? For each serializable schedule, determine the equivalent serial schedules.
\[
\begin{align*}
a. & \ r1(X); r3(X); w1(X); r2(X); w3(X); \\
b. & \ r1(X); r3(X); w3(X); w1(X); r2(X); \\
c. & \ r3(X); r2(X); w3(X); r1(X); w1(X); \\
d. & \ r3(X); r2(X); r1(X); w3(X); w1(X);
\end{align*}
\]

4 Attempt any two parts.

(a) What kind of metadata is stored in the database catalog, which is used for query optimization? Write and explain index-lookup and hash-lookup methods for implementing JOIN operation.

(b) Discuss the update propagation and concurrency control problems in distributed databases? What solution you would suggest to handle these two problems? What are the disadvantages of the solution suggested by you?

(c) What is an association rule? Clearly explain Apriori algorithm for mining frequent patterns in a transactional database using a suitable example.
Maximum Marks: 60  
Credits: 05  
Duration: Three Hours

Answer all the questions.  
Abbreviations and symbols have their usual meanings.

Q.No.  
1  Give formal definitions of  
   (i) Non deterministic pushdown automata  
   (ii) Chomsky Language Classification  
   (iii) NP Hard problems  
   (iv) Pumping property of regular languages  

2(a) Design a DFA for accepting strings that represent binary numbers divisible by 3.  

2(b) Find the regular expression for the language of the following NFA.:  

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>→ *q₁</td>
<td>{q₁, q₂}</td>
<td>{q₁}</td>
</tr>
<tr>
<td>q₂</td>
<td>{q₃}</td>
<td>{q₃}</td>
</tr>
<tr>
<td>q₃</td>
<td>{q₄}</td>
<td>{q₄}</td>
</tr>
<tr>
<td>q₄</td>
<td>{q₅}</td>
<td>φ</td>
</tr>
<tr>
<td>q₅</td>
<td>φ</td>
<td>{q₅}</td>
</tr>
</tbody>
</table>

3(a) Consider the grammar given below:

- \(S \rightarrow 0A0 | 1B1 | BB\)
- \(A \rightarrow C\)
- \(B \rightarrow S | A\)
- \(C \rightarrow S | \varepsilon\)

   (i) Eliminate unit productions from the grammar.  
   (ii) Convert the grammar into Chomsky Normal Form.

Contd.....2.
3(b) Show that the language \( L = \{a^n b^n : n \geq 0, n \neq 100\} \) is context free. [04]

4(a) Design a TM that accepts \( w w^R \) where \( w \) is a string in \( \{0, 1\}^* \). [06]
4(b) Define Post’s Correspondence Problem. Is it decidable or undecidable problem? [06]

OR

4' (a) Define the Universal Language. [06]
4' (b) What do you understand by complement of recursive and recursively enumerable languages? [06]

5(a) Explain the P-class, NP-class, and NP-complete problems, giving examples of each. [06]
5(b) Show that there exists a non recursively enumerable language. [06]

OR

5' Show that SAT is NP Complete [12]
2015-16  
B.TECH. (WINTER SEMESTER) EXAMINATION  
COMPUTER ENGINEERING  
COMPUTER NETWORKS  
CO-313  
Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

Answer all the questions.  
Assume suitable data if missing.  
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<table>
<thead>
<tr>
<th>Q.No</th>
<th>Question</th>
<th>MM</th>
</tr>
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<tbody>
<tr>
<td>1(a)</td>
<td>Describe the functions of different layers of the Internet protocol stack.</td>
<td>[8]</td>
</tr>
</tbody>
</table>
| (b)  | Consider an application that transmits data at a steady rate (for example, the sender generates an N-bit unit of data every k time units, where k is small and fixed). Also, when such an application starts, it will continue running for a relatively long period of time. Answer the following questions, briefly justifying your answer:  
  (i) Would a packet-switched network or a circuit-switched network be more appropriate for this application? Why?  
  (ii) Suppose that a packet-switched network is used and the only traffic in this network comes from such applications as described above. Furthermore, assume that the sum of the application data rates is less than the capacities of each and every link. Is some form of congestion control needed? Why? | [7]|
|      | OR  
|      | (b') Consider sending a large file of F bits from Host A to Host B. There are two links (and one switch) between A and B, and the links are uncongested (that is, no queuing delays). Host A segments the file into segments of S bits each and adds h bits of header to each segment, forming packets of \(L = (S + h)\) bits. Each link has a transmission rate of \(R\) bps. Find the value of \(S\) that minimizes the delay of moving the file from Host A to Host B. Disregard propagation delay. |    |
| 2(a) | With the help of appropriate examples, describe general formats of HTTP request and response messages. Explain the mechanism of cookies for interactions among users and servers. | [7]|
|      | OR  
|      | **Contd.....**2. |   |
(a') In this problem, we explore designing a KaZaA-like system that has ordinary nodes, group leaders, and super group leaders.

(i) Suppose each super-group leader is roughly responsible for 200 group leaders, and each group leader is roughly responsible for 200 ordinary peers. How many super-group leaders would be necessary for a network of four million peers?

(ii) What information might each group leader store? What information might each super-group leader store? How might search be performed in such a three-tier design?

(b) Consider Figure 1 (a), for which there is an institutional network connected to the Internet. Suppose that the average object size is 900,000 bits and that the average request rate from the institution’s browsers to the origin server is 1.5 requests per second. Also suppose that the amount of time it takes from when the router on the Internet side of the access link forwards an HTTP request until it receives the response in two seconds on an average. Model the total average response time as the sum of the average access delay (that is, the delay from the Internet router to institution router) and the average Internet delay. For the average access delay, use

$$\frac{\Delta}{1-\Delta \beta}$$,

where $\Delta$ is the average time required to send an object over the access link and $\beta$ is the arrival rate of objects to the access link.

(i) Find the total average response time.

(ii) Now suppose a cache is installed in the institutional LAN as shown in Figure 1(b). Suppose the hit ratio is 0.4. Find the total response time.

3(a) Consider the idealized model for the steady-state dynamics of TCP. In the period of time from when the connection’s window size varies from $W/(2RTT)$ to $WRRT$, only one packet is lost (at the very end of the period).

(i) Show that the loss rate is given by

$$L = \text{loss rate} = \frac{1}{\frac{3}{8}w^3 + \frac{3}{4}w}$$

(ii) Use the result above to show that if a connection has loss rate $L$, then its average bandwidth is approximately given by

Contd......3.
\[
\approx \frac{1.22 \text{ MSS}}{\text{RTT} \sqrt{L}}
\]

where MSS is Maximum Segment Size.

OR

(a') Consider the TCP procedure for estimating RTT. Suppose that \( \alpha = 0.1 \). Let \( \text{SampleRTT}_1 \) be the most recent sample RTT, let \( \text{SampleRTT}_2 \) be the next most recent sample RTT, and so on.

(i) For a given TCP connection, suppose four acknowledgements have been returned with corresponding sample RTTs \( \text{SampleRTT}_1, \text{SampleRTT}_2, \text{SampleRTT}_3, \) and \( \text{SampleRTT}_4 \). Express EstimatedRTT in terms of the four sample RTTs.

(ii) Generalize your formula for \( n \) sample RTTs.

(iii) For the formula in part (ii) let \( n \) approaches infinity. Comment on why this averaging procedure is called an exponential moving average.

(b) In a Go-Back-N protocol (GBN), the sender is allowed to transmit multiple packets (when available) without waiting for an acknowledgement, but is constrained to have no more than some maximum allowable number, \( N \), of unacknowledged packets in the pipeline. Design an ACK-based, NAK-free, GBN protocol for reliable data transfer at the transport layer. Provide extended FSM descriptions of the GBN sender and the receiver. With the help of a suitable diagram, explain the operation of the GBN protocol for the case of a window size of four packets.

4(a) What is inside a router? Describe in detail with the help of suitable diagrams.

(b) Consider a router that interconnects three subnets: Subnet 1, Subnet 2, and Subnet 3. Suppose all of the interfaces in each of these three subnets are required to have the prefix 223.1.17/24. Also suppose that Subnet 1 is required to support up to 125 interfaces, and Subnets 2 and 3 are each required to support up to 60 interfaces. Provide three network addresses (of the form a.b.c.d/x) that satisfy these constraints. Also provide the range of addresses for each of the three subnets.

OR

(b') Consider a datagram network using 32-bit host addresses. Suppose a router has four links, numbered 0 through 3, and packets are to be forwarded to the link interfaces as follows:
Destination Address Range
11100000 00000000 00000000 00000000
through
11100000 11111111 11111111 11111111
11100001 00000000 00000000 00000000
through
11100001 00000000 11111111 11111111
11100001 00000001 00000000 00000000
through
11100001 11111111 11111111 11111111
otherwise

Link Interface
0
1
2
3

(i) Provide a forwarding table that has four entries, uses longest-prefix matching, and forwards packets to the correct link interfaces.
(ii) Describe how your forwarding table determines the appropriate link interface for datagrams with destination addresses:
    11001000 10010001 01010001 01010101
    11100001 00000000 11000011 00111100
    11100001 10000000 00010001 01110111

Contd... 5
Figure 1(a): Institutional network connected to the Internet without a Web cache (figure for Q2(b)).

Figure 1(b): Adding a cache to the institutional network (figure for Q2(b)).
2015-16
B.TECH. (WINTER SEMESTER) EXAMINATION
COMPUTER ENGINEERING
DESIGN AND ANALYSIS OF ALGORITHMS
CO-314

Maximum Marks: 60  Credits: 04  Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
Notations used have their usual meaning.

Q.No.   Question                                                                 M.M.

1(a)    Write a recursive algorithm to solve the Towers of Hanoi problem. Analyze the algorithm to find its time complexity. [8]

1(b)    Discuss the Master method to solve recurrence equations. Use the method to solve the following recurrence equations:

         (i) $T(n) = T(n/2) + 2^n$
         (ii) $T(n) = 3T(n/2) + n$

OR


2(a)    Describe the Travelling Salesman problem. For the problem instance represented by the following graph, find the solution using backtracking. [8]

![Graph Image]

Contd......2.
2(b) A machine has \( n \) components. For each component there are three suppliers. The weight of component \( i \) from \( j^{th} \) supplier is \( W_{ij} \), and its cost is \( C_{ij} \), \( 1 \leq j \leq 3 \). The cost of the machine is the sum of the component costs and the weight of the machine is sum of the component weights. Design a dynamic programming algorithm to determine from which supplier to buy each component so as to have the lightest machine with cost no more than \( C \). Assume that the costs are integer.

OR

2'(a) The character coding problem is the problem of finding, given an alphabet \( C = \{a_1, \ldots, a_n\} \) and its frequencies \( F = \{f_1, \ldots, f_n\} \), a set of prefix-free binary code \( W = [w_1, \ldots, w_n] \) that minimizes the average code length

\[
\sum_{i=1}^{n} f_i \cdot |w_i|
\]

where, \( |w_i| \) is the length of the binary code for the character \( a_i \) and \( f_i \) is the frequency of the character \( a_i \).

Devise a greedy method for solving the problem and use it to obtain set of prefix-free binary code, when \( C = \{a, b, c, d, e, f\} \) and \( F = \{45, 13, 12, 16, 9, 5\} \)

2'(b) Find the optimal solution to the 0/1 Knapsack problem for the following knapsack instance by using Branch and Bound technique

Number of Items, \( N = 4 \)  
Profit Values of items, \( P = [10, 25, 28, 12] \)  
Weights of Items, \( W = [3, 6, 8, 6] \)  
Capacity of knapsack, \( C = 12 \)

3(a) Write down the Ford Fulkerson algorithm for finding maximum flow in a given flow network. Use the algorithm to find maximum flow in the flow network represented by the following graph. Show the steps of your solution.
3(b) What do you mean by a minimum spanning tree (MST) of a graph? State and prove the MST property. Find the minimum spanning tree for the following graph using Kruskal’s algorithm. Show the steps of your solution.

![Graph Image]

4(a) Describe the Circuit Satisfiability problem (CIRCUIT-SAT). Prove that the CIRCUIT-SAT is a NP-Hard problem.

4(b) What do you mean by NP-Complete problems? List and describe five NP-Complete decision problems.

OR

4(b') What do you mean by undecidable problems? Prove that the Halting problem of Turing machine is undecidable.
Maximum Marks: 60  
Credits: 04  
Duration: Three Hours

Answer all the questions.
Assume suitable data if missing.
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<th>M.M.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Write brief answers for any Five of the following:</td>
<td>[5x3]</td>
</tr>
<tr>
<td></td>
<td>i) List important graphics cards and the resolutions supported by them.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ii) Differentiate between HD and FHD displays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iii) Role of Colour Lookup Table in graphics processor</td>
<td></td>
</tr>
<tr>
<td></td>
<td>iv) Operating principle of Liquid Crystal Displays with illustrations</td>
<td></td>
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<tr>
<td></td>
<td>v) List three advantages as well as drawbacks of LCD devices.</td>
<td></td>
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<tr>
<td></td>
<td>vi) Operation of Touch Screens.</td>
<td></td>
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<tr>
<td></td>
<td>vii) Use of OpenGL in Computer Graphics</td>
<td></td>
</tr>
<tr>
<td>2(a)</td>
<td>Derive Mid-point circle algorithm. Use this algorithm to plot a circle centred at origin and radius = 10 in at least one octant.</td>
<td>[10]</td>
</tr>
<tr>
<td>2(b)</td>
<td>Give the classification of Planar Geometric Projections and illustrate with suitable examples.</td>
<td>[05]</td>
</tr>
<tr>
<td>OR</td>
<td></td>
<td></td>
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<tr>
<td>2(b')</td>
<td>Write a program in C to plot Bezier Curves.</td>
<td>[05]</td>
</tr>
<tr>
<td>3(a)</td>
<td>What do understand by Shear? Derive the 2D transformation that rotates an object about a fixed point other than origin.</td>
<td>[05]</td>
</tr>
<tr>
<td>3(b)</td>
<td>Describe Sutherland-Hodgman Polygon Clipping algorithm. Apply it to the polygon drawn in Figure 1. and redraw the clipped polygon.</td>
<td>[10]</td>
</tr>
</tbody>
</table>

Contd.....2.
4(a) What is the need for VSD? Explain the Z-buffer algorithm and also list its merits and demerits.

4(b) Explain the phenomenon of Ray tracing? Write down pseudo code of ray tracing algorithm.

OR

4(b') Describe Ray Casting method in brief.

4(c) Why is interpolative shading technique required in CG? Distinguish between Gouraud and Phong shading techniques.

OR

4(c') What is the role of Diffused illumination and Specular Reflection in object shading? Illustrate with examples.

Figure 1.
1(a) An old wooden bridge over a bay is in danger of collapse. The highway department is currently considering two alternatives to alleviate the situation and provide for expected increases in future traffic. One plan is a conventional steel bridge, and the other is a tunnel under the bay. The department is familiar with bridge construction and maintenance but has no experience with maintenance costs for tunnels. The following data has been developed for the bridge:

- First Cost: $170,000
- Painting every 6 years: $10,000
- Deck resurfacing every 8 years: $30,000
- Structural overhaul at the end of 12 years: $40,000
- Annual maintenance: $3,000

The tunnel is expected to cost $240,000 and will require repaving every 8 years at a cost of $20,000. Both designs are expected to last 20 years with negligible salvage value. Since the tunnel under bay would require less supervision it would be preferred by the highway department. Determine the additional equivalent annual amount, if any, for maintenance that could be permitted for the tunnel if the present worth for both the alternatives is same. (i=8% per annum)

1(b) What are the different types of market segments? Explain the phenomenon of inflation and explain it with the help of supply-demand curve.

OR

1'(a) A machine was purchased 5 years ago for Rs. 100,000. Its annual maintenance expense has been Rs. 5,000 per year. At the end of three years, Rs. 9,000 were spent on maintenance. At the end of five years (now), the machine is sold for Rs. 120,000. During the period of ownership the machine was rented for Rs. 10,000 per year paid at the beginning of each year. Find the Annual Worth of this investment when the interest rate is 12% per year.

Contd.....2.
1(b) Consider the following cash flow series. What value of C makes the deposit series equivalent to the withdrawal series at an interest rate of 12% compounded annually?

<table>
<thead>
<tr>
<th>EOY</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deposits (in $)</td>
<td>1000</td>
<td>800</td>
<td>600</td>
<td>400</td>
<td>200</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Withdrawals (in $)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>C</td>
<td>2C</td>
<td>3C</td>
<td>4C</td>
<td>5C</td>
<td>6C</td>
</tr>
</tbody>
</table>

2(a) A grinder was purchased 3 years ago for $40,000. It has provided adequate service, but an improved version is now available for $35,000 that will reduce operating costs and cut inspection expenses. Costs and salvage values for the two machines are shown below. Costs that are the same for either machine are not included. Also, the operating costs for the challenger are very low due to warranted equipment. Should a replacement be made if the required rate of return is 15% and the service of the grinder will be needed for only 4 more years?

<table>
<thead>
<tr>
<th>Year</th>
<th>Defender D</th>
<th>Challenger C</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Operating Cost ($)</td>
<td>Salvage Value ($)</td>
</tr>
<tr>
<td>0</td>
<td>-</td>
<td>12000</td>
</tr>
<tr>
<td>1</td>
<td>3400</td>
<td>7000</td>
</tr>
<tr>
<td>2</td>
<td>3900</td>
<td>4000</td>
</tr>
<tr>
<td>3</td>
<td>4600</td>
<td>2500</td>
</tr>
<tr>
<td>4</td>
<td>5600</td>
<td>1000</td>
</tr>
<tr>
<td>5</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2(b) An asset for drilling was purchased and placed in service by a petroleum production company. Its cost Basis is Rs 60000 and it has an estimated Market value of Rs, 12000 at the end of an estimated useful life of 14 years. Compute the depreciation amount in the third year and the Book Value at the end of the Fifth year by using (i) Straight line method (ii) Double Declining Balance Method.

3(a) Differentiate the working of managers by level and area in an organization.

3(b) What are the three basic areas of concern for managerial ethics? Explain.

3(c) Explain the different decision making environments with suitable examples.

4(a) Define “Control” as a function of management and explain its purpose.

4(b) Describe the Managerial Grid and explain the different kind of leadership styles.

4(e) Define Motivation and explain Hertzberg’s theory of motivation.

OR

Contd.....3.
4'(a) Differentiate between the following:
   (i)  Power and authority
   (ii) Hierarchy and chain of commands

4'(b) Differentiate between strategic and operational plans with suitable examples.

4'(c) What is the need for coordination? What are its different forms? Explain any one.

5(a) Derive an expression for economic order quantity. Explain the various costs considered in the model.

5(b) Differentiate between income statement and balance sheet. Define any two financial ratios.

5(c) What is internationalization of an organization? Explain any two alternatives.