## Scoring Indicators

**COURSE NAME: Virtualization Technology and Cloud Computing**

**COURSE CODE: 5133A** **QID : 2109230291**

| Q No | Scoring Indicators | Split score | Sub Total | Total score |
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| | **PART A** | | | **9** |
| I. 1 | The ability to abstract a physical machine into a virtual machine | 1 | 1 | |
| I. 2 | 4:1 | 1 | 1 | |
| I. 3 | Snapshots a capturing of a VM's state at a particular point in time. A snapshot preserves the state of a VM, its data, and its hardware configuration. | 1 | 1 | |
| I. 4 | 8 Cores | 1 | 1 | |
| I. 5 | The movement of VMs from one resource to another, such as from one physical host to another physical host, or data store to data store, is known as VM migration. | Any 2 * ½ | 1 | |
| I. 6 | Scalability | 1 | 1 | |
| I. 7 | Service Level Agreement is a type of agreement or contract between the cloud provider and cloud users for availing service from the cloud system | 1 | 1 | |
| I. 8 | The cloud infrastructure is provisioned for exclusive use by a single organization comprising multiple customers (e.g : Business units). It may be owned, managed, and operated by the organization, a third party, or some combinations of them, and it may exist on or off premises. | 1 | 1 | |

<table>
<tr><td>I. 9</td><td colspan="2">Cloud storage is a service model where in data is data is maintained, controlled and backed up distantly with distantly and made accessible to users over a network.</td><td>1</td><td>1</td><td></td></tr>
<tr><td></td><td colspan="2">PART B</td><td></td><td></td><td>24</td></tr>
<tr><td>II. 1</td><td colspan="2">Servers' ability to condense multiple physical servers into one server.<br>That would run many virtual machines in a single server allowing that physical server to run at a much higher rate of utilization.</td><td>3</td><td>3</td><td></td></tr>
<tr><td>II. 2</td><td colspan="2">• Operational Flexibility<br>• Reducing overhead<br>• Centralization<br>• Scalability<br>• Disaster recovery</td><td>Any three with description 1 x 3</td><td>3</td><td></td></tr>
<tr><td>II. 3</td><td colspan="2">Virtual Switch is like a logical switching built into VMWare so that a virtual machine network can be managed as per the requirement<br>Virtual switches act as an interface between virtual ethernet and the physical ethernet<br>Internal and External virtual switch are two types of virtual switch</td><td>3</td><td>3</td><td></td></tr>
<tr><td>II. 4</td><td>Clone</td><td>Template</td><td rowspan="4">3 x 1</td><td rowspan="4">3</td><td rowspan="4"></td></tr>
<tr><td>Clone is the exact copy of the existing VM. You can alter the name and configuration during the cloning process.</td><td>A template is a master copy of a VM that can be used to create many clones.</td></tr>
<tr><td>the clone is running one</td><td>a template cannot run</td></tr>
<tr><td>We can run clone and make changes</td><td>in order to make changes to it (applying patches, for</td></tr>
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| | | example), a template must first be converted back to a virtual machine. | | | |
| | Clone VMs are best suited for Tests or DR environments. | The template is good for mass VM deployment in the production environment. | | | |
| II. 5 | RDS is a desktop virtualization technique. Remote desktop services (RDS) are traditionally known as terminal services. In RDS, a terminal service runs on top of a Windows installation and provides individual sessions to client systems. These sessions can provide a thorough desktop experience while remotely accessing via a terminal services client, The station receives the visual feedback of the session while resource consumption takes place on the server. | | 3 | 3 | |
| II. 6 | Availability of service<br>Data lock in<br>Data segregation<br>Privilege neglect<br>Scaling resources<br>Data Location<br>Deletion of data<br>Recovery and backup<br>Unpredictable performance | | 3 | 3 | |
| II. 7 | On-demand computing is a model of computing at enterprise level<br>Resources are offered on a pay-per-use basis.<br>ODC accomplishes computing resources accessible to consumers when and as required for particular provisional projects | | 3 | 3 | |

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| | The main benefit of ODC is its low basic price<br><br>The ODC model was established to fulfill changeable requirement competently<br><br>On-request computing goods are swiftly becoming common in the market | | | |
| II. 8 | Compute consists of physical components (hardware devices) that communicate with one another using logical component (software and protocol).<br>It has three chief physical constituents – memory, CPU and Input/output tools<br>Communication may be user to compute interaction and Compute to storage/Compute Interaction | 3 | 3 | |
| II.9 | • Straight forward expenses are nil<br>• You only need a web browser to access the application. It doesn't require other hardware purchase or software installation<br>• It provides quick operation service<br>• SaaS is extremely scalable<br>• Since the source code is the same for each customer, it is a multi-tenant design that makes it extremely proficient<br>• SaaS can endure every demand, because of easy arrangement: this is usually not simple with conventional application<br>• Any noble technical modernization is effortlessly incorporated by the supplier that is accessible to all subscribers | 3 | 3 | |
| II.10 | The hybrid cloud storage is an amalgamation of the other two models, which comprise no less than a single public cloud and | 3 | 3 | |

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| | a single private cloud infrastructure. A corporation cloud, for instance collect forcefully used and prepared data on a private cloud and sharable data on a public cloud | | | |
| | **Part C** | | | 42 |
| III. 1 | **Citrix Xen**<br>The hypervisor is a bare-metal solution and sits directly on the hardware.<br>The Xen model has a special guest called Domain 0, also referred to as Dom0. It also handles the hardware device driver support.<br>When additional guests make requests of the underlying hardware resources, those requests go through the hypervisor, up to the Dom0 guest, and then to the resource.<br>Key features of Citrix XenServer aim to ease virtualization infrastructure management.<br>VM templates are a significant aspect of this. For example, you can create VM templates from snapshots.<br>Another key feature of this platform is XenMotion, which allows you to live migrate VMs between hosts.<br>With the Enterprise version of XenServer 7.1, you can also live patch hosts with no downtime.<br>Centralized support for Open vSwitch is another important feature of the XenServer platform.<br>Having an operating system in the Dom0 guest can affect availability.<br>When OS patching needs to occur, a reboot of Dom0 will interrupt all of the other guests, even if the patches were not related to the virtualization functions.<br>Because Dom0 is also a guest, it consumes resources and contends for resources with the other guests in the system that | Any five points from each 3.5+3.5 | 7 | 7 |

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| | could lead to performance issues if Dom0 is either short of resources or using guest resources.<br>**Microsoft Hyper-V**<br>Microsoft Hyper-V was released in 2008 as an installable part of the Windows Server 2008 Operating System.<br>One point for Hyper-V is that a lot of companies already use Microsoft products and have familiarity with them.<br>Hyper-V is a Type 1 hypervisor because the hypervisor code lives directly on the hardware<br>The virtualized workloads are called partitions.<br>Similar to the Xen model, it requires a special parent partition that has direct access to the hardware resources. Like Dom0, the parent partition runs an operating system—in this case, Windows Server 2008.<br>This partition creates and manages the child partitions and handles the system management functions and device drivers.<br>Because it utilizes a model similar to XenServer, it is subject to the same availability vulnerabilities regarding patching and contention. | | | |
| III. 2 | a)<br>  <br><br>The structure of a VMM consists of a layer of software that lives in between the hardware, or host, and the virtual machines that it supports. Figure is a simple illustration of the Virtual Machine Monitor architecture. | (4)<br>Fig 2 Explanation 2 | 7 | 7 |

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| | b) Type 1<br>Type 1 hypervisors run directly on the server hardware without an operating system beneath it.<br>Without an intermediary, the Type 1 hypervisor can directly communicate with the hardware resources in the stack below it, making it much more efficient than the Type 2 hypervisor.<br>Type 1 hypervisors are more secure than Type 2 hypervisors<br>Less processing overhead is required for a Type 1 hypervisor<br>More virtual machines can be run on each host.<br>A Type 1 hypervisor would not require the cost of a host operating system<br>Type 2<br>A Type 2 hypervisor itself is an application that runs atop a traditional operating system.<br>Type 2 is a quickest Path to Market<br>The actual operating system already handled all of the hardware resources and the hypervisor would leverage that capability.<br>it can support a large range of hardware because that is inherited from the operating system it uses.<br>Type 2 hypervisors are easy to install and deploy because much of the hardware configuration work, such as networking and storage, has already been covered by the operating system.<br>Type 2 hypervisors are not as efficient as Type 1 hypervisors because of this extra layer between the hypervisor itself and the hardware. | 3<br>(3 Point from each)<br>1.5+1.5 | | | |

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| | Type 2 hypervisors are also less reliable because there are more points of failure: anything that affects the availability of the underlying operating system also can impact the hypervisor and the guests it supports | | | |
| III. 3 | Virtual NIC : Virtual NICs permits VMs to link to the VM networks. They remit and get VM traffic to and from the VM network<br>Virtual Switches : Virtual Switch is like a logical switching built into VMWare so that a virtual machine network can be managed as per the requirement<br>Virtual switches act as an interface between virtual ethernet and the physical ethernet<br>Virtual Switch offer association to virtual NIC and send VM traffic.<br>They also manage storage, administration, and VM migration traffic to and from the hypervisor kernel.<br>Two type of virtual switches are Internal and External<br>Virtual LAN :<br>A VLAN is a rational network constructed on a LAN or across multiple LANs constituting of virtual or Physical switches<br>A virtual LAN (VLAN) is a logical overlay network that groups together a subset of devices that share a physical LAN, isolating the traffic for each group<br>Virtual Lan permits you to have discrete LANs amongst ports on a similar switch | For listing 1 Explanation 2 x 3 | 7 | 7 |

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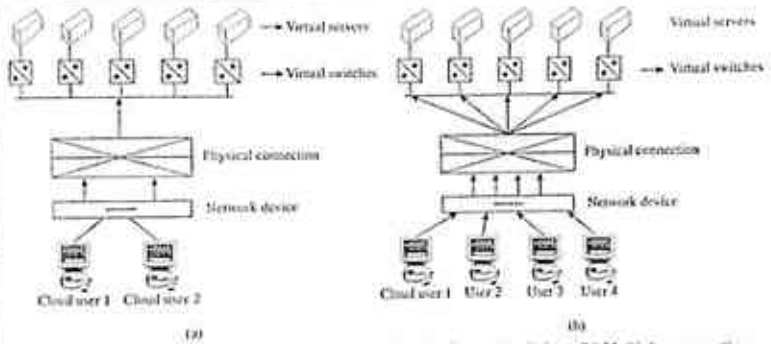
| | The VLAN may split a bulkley LAN into lesser virtual LANs or merge divided LANs into one or more virtual LANs | | | |
| III 4 | a) i) Linux<br>ii) Windows<br>iii) VirtualBox<br>b) Advantages of Application Virtualization<br>1. Improved workload management<br>2 Reduced hardware cost<br>3. Increased flexibility for working remotely<br>4. Simplified application deployment: Applications are never installed on to an operating System, hence the deployment of the applications is greatly simplified.<br>5.Simplified operating system image management: Since applications are completely different from the OS.- managing OS images is simpler<br>6 Elimination of resource conflicts. Since each application has its own virtual OS resources, resource and application conflict issues are eliminated. | 1x3<br>Any four<br>1 x4 | 7 | 7 |
| III. 5 |  <br><br>Fig. 3.10 (a) Single connection between network device and switches (b) Multiple connection between network device and switches<br>With the help of virtual switches, virtual resources are made available to the cloud user. A physical uplink acts as an interface for cloud consumers and virtual resources. Physical uplink monitors the traffic in the cloud network and all clients send | (7) | 7 | 7 |

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| | requests through this link. As the number of users and service requests increase after crossing a threshold value, performance of the network goes down causing sensitive packet loss and many other problems in the network.<br><br>To overcome the above problem, multiple uplinks are added for proper balancing. Multiple and redundant paths with multiple uplinks can casily handle network traffic and improve performance of the network. Traffic shaping policies are used to reconfigure virtual switches as per the muitiple physical links. | Fig 3 Explanation 4 | | |
| III. 6 | Reduced Cost<br>Scalability<br>Remote Access<br>Disaster relief<br>Ease of implementation<br>Response time<br>Easy to customize<br>Virtual provisioning<br>Skilled Vendors | 1 x 7<br>Any 7 pointes and explain briefly | 7 | 7 |
| III. 7 | Application – It is a computer Program which has the ability of computing operation. An application offers an interface between the host and the user and among multiple hosts. Classic Application contain a three-layered design-the application user interface in the front-end layer, the computer sense or application itself in the middle layer and the fundamental database in the back-end layer. The application transmits demand to the operating system to carry out read/write function on the storage.<br><br>DBMS- It offers planed means to save data in rationally prepared tables. The database assists to optimize the recovery | 2 Marks for Listing<br><br>5 marks for explanati | 7 | 7 |

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| | and the storage of data. A DBMS is a compilation of computer programs which manage the preservation, formation, and employment of database. The DBMS handle demands of an application for data and instruct the OS to access suitable data<br><br>Compute: It is a physical computing machine which controls application, database and operating system Storage and Network. It has three chief physical constitution memory, CPU and I/O tools. Despite physical constituents, it is posssess a set of regulation known as protocol and compilation of program as software. Compute system might be separate server/blad server, plain laptops. processor computers and many more.<br><br>Storage: It refers to a tool which constantly saves data for subsequent use. Data generated by companies or individuals should be saved so that it is effortlessly available when required. different storage options are Tape Drive, Optcal disk, Disk drives, Solid state drive.<br><br>RAID is a mean of the saving the same data on diverse sites. Since the same data is saved, it is referred to as redundant.<br><br>An intelligent storage system has been developed along with advances in technology. Intelligent storage system consist of four main elements -physical disk, cache, front-end and back-end.<br><br>Network: It is a communicating path which allows communication among compute systems and customers or among storage and computer system. In cloud computing TCp/IP protocol is used for wide area network and MAN and ethernet is used for LAN. Every compute system is associated with the network interface card. Routers and switches are used | on | | |

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| | interconnecting tools. Compute to storage communication is allowed by a variety of hardware constituents such as NIC, CAN, HBA router, Switch protocols and cables. | | | |
| III. 8 | a) The important features of PaaS for application developers<br>• A virtual development environment<br>• Application principles generally based on developers necessities<br>• An interface with tools 'virtual development'<br>• A ready to use tool for public application developers<br>• The PaaS model offers a minimum charge to application developers by supporting the entire software development life cycle of the Web application<br>b) The Compute Based : Replication is carried out using the resources of the CPU of the compute system through software which is working on the compute system. Compute based regional replication may be more classified as file system snapshots and LVM based mirroring<br>Storage Array -Based : Replication is carried out on the storage range by using the resources of the CPU of the range via the operating environment of range. This methods is classified as Pointer-based virtual machine, Pointer based Complete degree replication and Complete degree mirroring | 4<br><br>1.5 + 1.5 | 7 | 7 |
| III. 9 | a) The environment it creates for the VM is essentially identical to the original (hardware) physical machine.<br>The Hypervisor must have complete control of the system resources. | (4)<br>1 Marks for List | | |

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| | There should be little or no difference in performance between the VM and a physical equivalent.<br>The operating system in the guest should be able to use disk drives, access memory, make network calls, or at least believe that it can.<br>The hypervisor make the guest into believing that it can actually see and directly interact with the physical devices of the host. This is known as hardware abstraction<br>Each guest is presented only with a fraction of the resources of the physical host. A host may have 64 GB of physical memory installed in its frame, but a guest may believe that is has 4 GB. A guest may be writing files to a 250 GB D: drive, but actually be working with a portion of a file system on a much larger storage area network.<br>Processing and network resources work similarly: a guest may have two virtual CPUs and access to a single Network Interface Card (NIC), but the physical host will have many more of both.<br>b) The hypervisor abstracts the physical layer and presents this abstraction for virtualized servers or virtual machines to use. A hypervisor is installed directly onto a server, without any operating system between it and the physical devices. Virtual machines are then instantiated, or booted. From the virtual machine's view, it can see and work with a number of hardware resources. The hypervisor becomes the interface between the hardware devices on the physical server and the virtual devices of the virtual machines. | and 3 x 1 for explanation<br>3 | 7 | 7 |

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| III. 10 | a. As companies began to see the benefits of virtualization, they no longer purchased new hardware when their leases were over, or if they owned the equipment, when their hardware maintenance licenses expired. Instead, they virtualized those server workloads. This is called containment. Containment benefited corporations in multiple ways. They no longer had to refresh large amounts of hardware year after year; and all the costs of managing and maintaining those servers—power, cooling, etc.—were removed from their bottom line from that time on.<br>b) Microsoft Virtual PC, VMWare Player, VirtualBox, VMware Workstation (briefly explain each) | 3<br><br>4 | <br><br>7 | <br><br>7 |
| III. 11 | <u>Technological Influences</u><br><u>Universal Connectivity</u><br>Cloud computing needs global access and connectivity to the Internet in order to be successful. It assists associations and customers by providing connectivity anywhere among consumers, government com- panies, and enterprises via ways like peer-to-peer exchanges, Web 2.0, and web services. Such global connectivity must be achieved via high-speed, broadband networks. A vital matter regarding global connectivity is net impartiality. Net impartiality maintains the position of the Internet, whereby users are under the influence of the content | 7 | 7 | |

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| | and applications, and the whole network trafic is handled uniformly.<br>Commoditization<br>After 1980, with advancement in personal computers (PCs), several hardware and software elements became compatible and consistent among platforms. Later, emphasis on wide area networks (WANS) and local area networks (LANS) led to consistency in conversion rules and ultimately the Internet, which further speeded up commoditization.<br>Matters of such commoditization are relevant to cloud computing as well.. Cloud services have five basic features such as on-demand self-service, broadband network access, resource pooling, elasticity, and the ability to monitor services. As part of the approach to cloud computing, businesses will merge one or two measures which support exchange and interoperability of services among cloud dealers.<br>Open-source Software<br>Open-source software in cloud computing may draw distinct Views. The open-source software used in cloud computing may offer the following benefits:<br>1. Access and availability to source code<br>2. Easy amalgamation and growth of latest applications<br>3. Capability to expand, alter, and reallocate software<br>4. Easily available upgrades and patches<br>5. Open file arrangements<br>6. Minimal obstacles for new users to test the software<br>7. Avoidance of vendor lock-in<br>8. Low barriers for new users to try the software<br>Open-source software like Linux is used by several cloud suppliers so as to access and occasionally alter the code of source in order to offer customized services. | | | 7 |

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| | Virtualization<br>Conventionally, virtualization of server was observed as a price-saving process. The chief advantages of virtualization, which are intrinsic to cloud computing, are as follows:<br>1. Invoicing based on usage<br>2. Quick installation of extra servers<br>3. Support of economies of scale<br>4. Division of the consumer from physical server sites<br>5. Usage according to the service-level arrangements<br>6. Optional sourcing support<br>7. Application mobility among data centers and servers<br>Various cloud services, operational tools, and cloud resources are available for cloud users and the service management system handles the requirement of various resources in the network. Various types of devices can be used to take services from the cloud network, such as computer, laptop, and mobile | | | |
| III.<br>12 | Characteristic of cloud computing<br>On Demand Self Services<br>This implies that the customers, comprising non-IT persons, may unilaterally provision the service and scale it up or down by them.. Computer services such as applications, email, server, or network service may be offered without the requirement of any human interface with every service supplier. Cloud service suppliers offering on-demand self-services comprise Salesforce.com, Microsoft, Amazon Web Services (AWS), IBM, and Google.<br>Broad Network Access<br>This implies the service is uninterruptedly accessible by using the standard selection of tools comprising conventional mobile tools, PCs, and portable computers.. Cloud applications and facilities are available over the network and | 7 | 7 | 7 |

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| | can be used by means of standard procedures which encourage use by various thick or thin customer platforms such as PDAs, laptops, and mobile phones.<br>Resource pooling: This implies customers share a universal multi-occupant situation where virtual and physical resources can be dynamically allotted. The computing resources of the supplier are grouped together to cater to numerous Customers using a multiple-renter module, along with distinct virtual and physical resources vigorously allocated a reallocated in accordance with the requirement. The resources include memory, storage, processing network bandwidth, various mail services, and virtual machines. The joint grouping of the resource makes scale economies.<br>Quick elasticity: This implies the service may be swiftly scaled and frequently mechanically, such that to the customer, the facility seems infinite. The facilities accessible for provisioning to the customer frequently seem to be infinite and may be bought in any amount at any time.<br>Calculated Service<br>Usage of cloud computing resource may be controlled and reported while providing transparency to both the customer and provider of the used service. Cloud computing services use a metering facility. which allows optimizing and managing resource use. This means as for electricity. IT services are also charged for each usage metrics, that is, pay for every use.<br>Multi-persistence: It refers to the desire for strategy-focused segmentation, enforcement, control, separation, invoicing modules, and service levels for distinct customer areas. Customers could consume public cloud service offerings of supplier or in fact be from the similar company, like discrete | | | |

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| | business entities instead of different managerial units, but would yet share infrastructure.<br>Dynamic Computing Infrastructure: Cloud computing needs a dynamic computing infrastructure, The basis for the vibrant infrastructure is a scalable, safe, and consistent physical infrastructure. There must be unemployment levels to guarantee which level of accessibility, but mainly it should be simple to expand as demand by usage growth, with no requirement of design reworking. Subsequently, it should be virtualized. | | | |