**ASSESSMENT 21**

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| **Date:** | 10-06-2020 | **Name:** | Sheela Golasangi |
| **Course:** | VLSI | **USN:** | 4AL16EC068 |
| **Topic:** | MOS transistor basics-I | **Semester & Section:** | VIII  ‘B’ |
| **Github Repository:** | Sheela-Course |  |  |

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| **FORENOON SESSION DETAILS** |
| **Report**      The MOSFET (Metal Oxide Semiconductor Field Effect Transistor) transistor is a semiconductor device which is widely used for switching and amplifying electronic signals in the electronic devices.  The MOSFET is a core of integrated circuit and it can be designed and fabricated in a single chip because of these very small sizes.  The MOSFET is a four terminal device with source(S), gate (G), drain (D) and body (B) terminals. The body of the MOSFET is frequently connected to the source terminal so making it a three terminal device like field effect transistor. The MOSFET is very far the most common transistor and can be used in both analog and digital circuits.  We saw previously, that the N-channel, Enhancement-mode MOSFET (e-MOSFET) operates using a positive input voltage and has an extremely high input resistance (almost infinite) making it possible to interface with nearly any logic gate or driver capable of producing a positive output.  We also saw that due to this very high input (Gate) resistance we can safely parallel together many different MOSFETS until we achieve the current handling capacity that we required.  While connecting together various MOSFETS in parallel may enable us to switch high currents or high voltage loads, doing so becomes expensive and impractical in both components and circuit board space. To overcome this problem Power Field Effect Transistors or Power FET’s where developed.V  We now know that there are two main differences between field effect transistors, depletion-mode only for JFET’s and both enhancement-mode and depletion-mode for MOSFETs. In this tutorial we will look at using the Enhancement-mode MOSFET as a Switch as these transistors require a positive gate voltage to turn “ON” and a zero voltage to turn “OFF” making them easily understood as switches and also easy to interface with logic gates.  The operation of the enhancement-mode MOSFET, or e-MOSFET, can best be described using its I-V characteristics curves shown below. When the input voltage, ( VIN ) to the gate of the transistor is zero, the MOSFET conducts virtually no current and the output voltage ( VOUT ) is equal to the supply voltage VDD. So the MOSFET is “OFF” operating within its “cut-off” region.  The metal–oxide–semiconductor field-effect transistor (MOSFET, MOS-FET, or MOS FET), also known as the metal–oxide–silicon transistor (MOS transistor, or MOS), is a type of insulated-gate [field-effect transistor](https://en.wikipedia.org/wiki/Field-effect_transistor) (IGFET) that is fabricated by the [controlled oxidation](https://en.wikipedia.org/wiki/Thermal_oxidation) of a [semiconductor](https://en.wikipedia.org/wiki/Semiconductor), typically silicon. The voltage of the [covered gate](https://en.wikipedia.org/wiki/Gate_oxide) determines the [electrical conductivity](https://en.wikipedia.org/wiki/Electrical_conductivity) of the device; this ability to change conductivity with the amount of applied voltage can be used for [amplifying](https://en.wikipedia.org/wiki/Amplifier) or switching [electronic signals](https://en.wikipedia.org/wiki/Signal_(electrical_engineering)).  The MOSFET was invented by [Mohamed M. Atalla](https://en.wikipedia.org/wiki/Mohamed_M._Atalla) and [DawonKahng](https://en.wikipedia.org/wiki/Dawon_Kahng" \o "Dawon Kahng) at [Bell Labs](https://en.wikipedia.org/wiki/Bell_Labs) in 1959. It is the basic building block of modern electronics, and the [most frequently manufactured device](https://en.wikipedia.org/wiki/List_of_best-selling_electronic_devices) in history, with an estimated total of 13 sextillion (1.3×1022) MOSFETs manufactured between 1960 and 2018. It is the dominant [semiconductor device](https://en.wikipedia.org/wiki/Semiconductor_device) in [digital](https://en.wikipedia.org/wiki/Digital_electronics) and [analog](https://en.wikipedia.org/wiki/Analogue_electronics" \o "Analogue electronics) [integrated circuits](https://en.wikipedia.org/wiki/Integrated_circuits) (ICs),and the most common [power device](https://en.wikipedia.org/wiki/Power_device). It is a compact [transistor](https://en.wikipedia.org/wiki/Transistor) that has been miniaturised and mass-produced for a [wide range of applications](https://en.wikipedia.org/wiki/List_of_MOSFET_applications), revolutionizing the [electronics industry](https://en.wikipedia.org/wiki/Electronics_industry) and the world economy, and being central to the [digital revolution](https://en.wikipedia.org/wiki/Digital_revolution), [silicon age](https://en.wikipedia.org/wiki/Silicon_age) and [information age](https://en.wikipedia.org/wiki/Information_age). MOSFET scaling and miniaturization has been driving the rapid exponential growth of electronic semiconductor technology since the 1960s, and enables [high-density ICs](https://en.wikipedia.org/wiki/Very_Large_Scale_Integration) such as [memory chips](https://en.wikipedia.org/wiki/Memory_chip) and [microprocessors](https://en.wikipedia.org/wiki/Microprocessors). The MOSFET is considered the "workhorse" of the electronics industry. Types of MOSFET  * Enhancement Type MOSFETs * Depletion Type MOSFETs     **Fig. – Types of MOSFET** Enhancement Type MOSFET In this mode, there is no conduction at zero voltage which implies it is closed or “OFF” by default as there is no existing channel. When the gate voltage is increased more than the source voltage, the charge carriers (holes) shifts away leaving behind the electrons and thus a wider channel is established.  The gate voltage is directly proportional to the current i.e. as the gate voltage increases the current increases and vice versa. Types of Enhancement MOSFETs The Enhancement MOSFETs can be classified into two types depending upon the type of doped substrate (n-type or p-type) used.   * N Channel Enhancement Type MOSFETs * P Channel Enhancement Type MOSFETs  N Channel Enhancement Type MOSFETs   **Fig. – N Channel Enhancement Type MOSFET**   * A lightly doped P-type substrate forms the body of the device and the source and drain are heavily doped with N-type impurities. * N-channel have electrons as majority carriers. * The applied gate voltage is positive to turn “ON” the device. * It has lower inherent capacitance and smaller junction areas due to the high mobility of electrons which makes it to operate at high switching speeds. * It contains positively charged contaminants which makes the N-channel MOSFETs to turn on prematurely. * Drain resistance is low compared to P-type.  P Channel Enhancement Type MOSFETs  Depletion Type MOSFET In this type, the channel is already established and it is evident that the conduction occurs even at zero voltage and it is open or “ON” by default. Unlike Enhancement type, here the channel is depleted of charge carriers to reduce the width of the channel.  Fig.5 – Gate Voltage verses drain characteristics of MOSFET  The gate voltage is inversely proportional to the current i.e. as the gate voltage increases the current decreases. Types of Depletion MOSFETs The Depletion MOSFETs can be classified into two types depending upon the type of doped substrate (n-type or p-type) used.   * N Channel Depletion Type MOSFET * P Channel Depletion Type MOSFET  N Channel Depletion Type MOSFETs   Fig. – N Channel Depletion Type MOSFETs   * The P-type semiconductor forms the substrate and the source and drain are heavily doped with N-type impurities. * The applied gate voltage is negative. * The channel is depleted of its free electrons.  P Channel Depletion Type MOSFETs   The formation of p channel depletion is just in reverse as compared with the n channel depletion MOSFET. Here the channel is pre-build due to the impurities of the p-type present in it. When the negative value of the voltage is applied at the terminal gate the free holes that represent the minority carriers at the n-type gets attracted towards the channel of the impurity ions of positive type. Under this condition when a drain terminal is reverse biased the device starts conducting but as the negative voltage in the drain terminal is increased it results in the formation of the depletion layer. |

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| **Date:** | 10-06-2020 | **Name:** | Sheela Golasangi |
| **Course:** | Java Tutorial for Complete Beginners | **USN:** | 4AL16EC068 |
| **Topic:** | Programming core java   1. Arrays of Strings 2. Multi-Dimensional Arrays 3. Classes and Objects 4. Methods 5. Getters and Return Values 6. Method Parameters 7. Setters and "this" 8. Constructors 9. Static (and Final) 10. String Builder and String Formatting | **Semester & Section:** | VIII  ‘B’ |
| **Github Repository:** | Sheela-Course |  |  |
| **AFTERNOON SESSION DETAILS** | | | |
| Java String array is used to hold fixed number of Strings. [String](https://www.journaldev.com/16928/java-string) [array](https://www.journaldev.com/16851/java-array) is very common in [simple java programs](https://www.journaldev.com/17757/simple-java-programs), specially among beginners to java and to test some specific scenarios. Even [java main method](https://www.journaldev.com/12552/public-static-void-main-string-args-java-main-method) argument is string array – public static void main(String[] args). So today we will look into different aspects of java string array with example programs.   * Java String array is basically an array of objects. * There are two ways to declare string array – declaration without size and declare with size. * There are two ways to initialize string array – at the time of declaration, populating values after declaration. * We can do different kind of processing on string array such as iteration, sorting, searching etc.  Java String Array Declaration Below code snippet shows different ways for string array declaration in java.  String[] strArray; //declarewithoutsize  String[] strArray1 = newString[3]; //declarewithsize  Note that we can also write string array as String strArray[] but above shows way is the standard and recommended way. Also in the above code, strArray is null whereas strArray1 value is [null, null, null]. Java String Array Initialization Let’s look at different ways to initialize string array in java.  //inline initialization  String[] strArray1 = newString[] {"A","B","C"};  String[] strArray2 = {"A","B","C"};  //initialization after declaration  String[] strArray3 = newString[3];  strArray3[0] = "A";  strArray3[1] = "B";  strArray3[2] = "C"; Multidimensional Arrays in Java [Array-Basics in Java](https://www.geeksforgeeks.org/arrays-in-java/) Multidimensional Arrays can be defined in simple words as array of arrays. Data in multidimensional arrays are stored in tabular form (in row major order).  Syntax:  **data\_type**[1st dimension][2nd dimension][]..[Nth dimension] **array\_name** = **new data\_type**[size1][size2]….[sizeN];  where:   * data\_type: Type of data to be stored in the array. For example: int, char, etc. * dimension: The dimension of the array created. For example: 1D, 2D, etc. * array\_name: Name of the array * size1, size2, …,sizeN: Sizes of the dimensions respectively.   Examples:  Two dimensional array:  int[][] twoD\_arr = new int[10][20];  Three dimensional array:  int[][][] threeD\_arr = new int[10][20][30]; Classes and Objects in Java Classes and Objects are basic concepts of Object Oriented Programming which revolve around the real life entities.  **Class**  A class is a user defined blueprint or prototype from which objects are created.  It represents the set of properties or methods that are common to all objects of one type. In general, class declarations can include these components, in order:   1. **Modifiers** : A class can be public or has default access (Refer [this](https://www.geeksforgeeks.org/access-specifiers-for-classes-or-interfaces-in-java/) for details). 2. **Class name:** The name should begin with a initial letter (capitalized by convention). 3. **Superclass(if any):** The name of the class’s parent (superclass), if any, preceded by the keyword extends. A class can only extend (subclass) one parent. 4. **Interfaces(if any):** A comma-separated list of interfaces implemented by the class, if any, preceded by the keyword implements. A class can implement more than one interface. 5. **Body:** The class body surrounded by braces, { }.   **Object**  It is a basic unit of Object Oriented Programming and represents the real life entities.  A typical Java program creates many objects, which as you know, interact by invoking methods. An object consists of :   1. State : It is represented by attributes of an object. It also reflects the properties of an object. 2. Behavior : It is represented by methods of an object. It also reflects the response of an object with other objects. 3. Identity : It gives a unique name to an object and enables one object to interact with other objects.   Example of an object : dog String Formatting The most common way of formatting a string in java is using [String.format()](https://docs.oracle.com/javase/8/docs/api/java/lang/String.html" \l "format-java.lang.String-java.lang.Object...-" \t "_blank). If there were a “java sprintf” then this would be it.  Stringoutput=String.format("%s = %d", "joe", 35);  For formatted console output, you can use [printf()](https://docs.oracle.com/javase/8/docs/api/java/io/PrintStream.html" \l "printf-java.lang.String-java.lang.Object...-" \t "_blank) or the [format()](https://docs.oracle.com/javase/8/docs/api/java/io/PrintStream.html#format-java.lang.String-java.lang.Object...-) method of [System.out](https://docs.oracle.com/javase/8/docs/api/java/lang/System.html" \l "out" \t "_blank) and [System.err](https://docs.oracle.com/javase/8/docs/api/java/lang/System.html#err) PrintStreams.  System.out.printf("My name is: %s%n", "joe");  Create a [Formatter](https://docs.oracle.com/javase/8/docs/api/java/util/Formatter.html)and link it to a [StringBuilder](https://docs.oracle.com/javase/8/docs/api/java/lang/StringBuilder.html" \t "_blank). Output formatted using the [format()](https://docs.oracle.com/javase/8/docs/api/java/util/Formatter.html#format-java.lang.String-java.lang.Object...-) method will be appended to the StringBuilder.  StringBuildersbuf=newStringBuilder();  Formatterfmt=newFormatter(sbuf);  fmt.format("PI = %f%n", Math.PI);  System.out.print(sbuf.toString());  // you can continue to append data to sbuf here | | | |