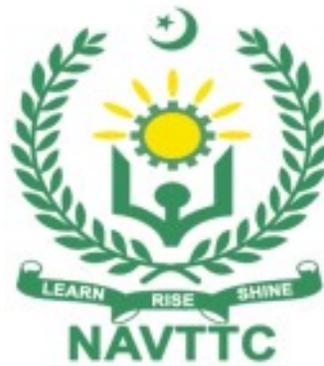


Government of Pakistan
National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skill for All"



Course Contents / Lesson Plan

Course Title: Internet of Things (IoT) System Development & Applications

Duration: 6 Months

Course Details / Description & Preliminaries

Course Title	Internet of Things(IoT) System Development & Applications
Objectives and Expectations	<p>Employable skills through an intensive course on Internet of Things (IoT)</p> <p>This is a special course designed to address unemployment in the youth. The course aims to achieve the above objective through hands on practical training delivery by a team of dedicated professionals having rich market/work experience. This course is therefore not just for developing a theoretical understanding/back ground of the trainees. Contrary to that it is primarily aimed at equipping the trainees to perform commercially in a market space in independent capacity or as a member of a team.</p> <p>The course therefore is designed to impart not only technical skills but also soft skills (i.e. interpersonal/communication skills; personal grooming of the trainees etc) as well as entrepreneurial skills (i.e marketing skills; free lancing etc). The course also seeks to inculcate work ethics to foster better citizenship in general and improve the image of Pakistani work force in particular.</p> <p><u>Main Expectations:</u></p> <p>In short, the course under reference should be delivered by professional instructors in such a robust hands- on manner that the trainees are comfortably able to employ their skills for earning money (through wage/self-employment) at its conclusion.</p> <p>This course thus clearly goes beyond the domain of the traditional training practices in vogue and underscores an expectation that a market centric approach will be adopted as the main driving force while</p>

<p>Key Features of Training & Special Modules</p>	<p>delivering it. The instructors should therefore be experienced enough to be able to identify the training needs for the possible market roles available out there. Moreover, they should also know the strengths and weaknesses of each individual trainee to prepare them for such market roles during/after the training.</p> <ol style="list-style-type: none"> <li data-bbox="573 562 1565 1060">i. Specially designed practical tasks to be performed by the trainees have been included in the Annexure-I to this document. The record of all tasks performed individually or in groups must be preserved by the management of the training Institute clearly labeling name, trade, session etc so that these are ready to be physically inspected/verified through monitoring visits from time to time. The weekly distribution of tasks has also been indicated in the weekly lesson plan given in this document. <li data-bbox="573 1081 1565 1816">ii. In order to materialize the main expectations, a special module on Job Search & Entrepreneurial Skills has been included in the later part of this course (5th & 6th month) through which, the trainees will be made aware of the Job search techniques in the local as well as international job markets (Gulf countries). Awareness around the visa process and immigration laws of the most favoured labour destination countries also forms a part of this module. Moreover, the trainees would also be encouraged to venture into self-employment and exposed to the main requirements in this regard. It is also expected that a sense of civic duties/roles and responsibilities will also be inculcated in the trainees to make them responsible citizens of the country. <li data-bbox="573 1837 1565 1871">iii. A module on Work Place Ethics has also been included to
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highlight the importance of good and positive behavior at work place in the line with the best practices elsewhere in the world. An outline of such qualities has been given in the Appendix to this document. Its importance should be conveyed in a format that is attractive and interesting for the trainees such as through PPT slides +short video documentaries. Needless to say that if the training provider puts his heart and soul into these otherwise non-technical components, the image of Pakistani workforce would undergo a positive transformation in the local as well as international job markets.

In order to maintain interest and motivation of the trainees throughout the course, modern techniques such as:

- Success Stories,
- Motivational Lectures
- Case Studies

These techniques would be employed as an additional training tool wherever possible (these are explained in the subsequent section on Training Methodology).

Lastly, evaluation of the competencies acquired by the trainees will be done objectively at various stages of the training and proper record of the same will be maintained. Suffice to say that for such evaluations, practical tasks would be designed by the training providers to gauge the problem solving abilities of the trainees.

(i) Motivational Lectures

<p>Training Tools/ Methodology</p>	<p>The proposed methodology for the training under reference employs motivation as a tool. Hence besides the purely technical content, a trainer is required to include elements of motivation in his/her lecture to inspire the trainees to utilize the training opportunity to the full and strive towards professional excellence. Motivational lectures may also include general topics such as the importance of moral values and civic role & responsibilities as a Pakistani. A motivational lecture should be delivered with enough zeal to produce a deep impact on the trainees. It may comprise of the following:</p> <ul style="list-style-type: none"> • Clear Purpose to convey message to trainees effectively. • Personal Story to quote as an example to follow. • Trainees Fit so that the situation is actionable by trainees and not represent a just idealism. • Ending Points to persuade the trainees on changing themselves. <p>A good motivational lecture should help drive creativity, curiosity and spark the desire needed for trainees to want to learn more.</p> <p>Impact of a successful motivational strategy is amongst others commonly visible in increased class participation ratios. It increases the trainees' willingness to be engaged on the practical tasks for longer time without boredom and loss of interest because they can clearly see in their mind's eye where their hard work would take them in short (1-3 years); medium (3 -10 years) and long term (more than 10 years).</p> <p>As this tool is expected that the training providers would make arrangements for regular well planned motivational lectures as part of a coordinated strategy interspersed throughout the training period as suggested in the weekly lesson plans in this document.</p> <p>(ii) Success Stories</p>
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Another effective way of motivating the trainees is by means of Success Stories. Its inclusion in the weekly lesson plan at regular intervals has been recommended till the end of the training.

A success story may be disseminated orally, through a presentation or by means of a video/documentary of someone that has risen to fortune, acclaim, or brilliant achievement. A success story shows how a person achieved his goal through hard work, dedication and devotion. An inspiring success story contains compelling and significant facts articulated clearly and easily comprehensible words. Moreover, it is helpful if it is assumed that the reader/listener knows nothing of what is being revealed. Optimum impact is created when the story is revealed in the form of:-

- Directly in person (At least 2-3 cases must be arranged by the training institute)
- Through an audio/ videotaped message (2-3 high quality videos must be arranged by the training institute)

It is expected that the training provider would collect relevant high quality success stories for inclusion in the training as suggested in the weekly lesson plan given in this document.

Suggestive structure and sequence of a sample success story and its various shapes can be seen at annexure III.

(iii) Case Studies

Where a situation allows, case studies can also be presented to the trainees to widen their understanding of the real life specific problem/situation and to explore the solutions.

In simple terms, the case study method of teaching uses a real life case example/a typical case to demonstrate a phenomenon in action and explain theoretical as well as practical aspects of the knowledge related to the same. It is an effective way to help the trainees comprehend in depth both the theoretical and practical aspects of the

	<p>complex phenomenon in depth with ease. Case teaching can also stimulate the trainees to participate in discussions and thereby boost their confidence. It also makes class room atmosphere interesting thus maintaining the trainee interest in training till the end of the course.</p> <p>Depending on suitability to the trade, the weekly lesson plan in this document may suggest case studies to be presented to the trainees. The trainer may adopt a power point presentation or video format for such case studies whichever is deemed suitable but it's important that only those cases are selected that are relevant and of a learning value. The Trainees should be required and supervised to carefully analyze the cases.</p> <p>For the purpose they must be encouraged to inquire and collect specific information / data, actively participate in the discussions and intended solutions of the problem / situation.</p> <p>Case studies can be implemented in the following ways: -</p> <ol style="list-style-type: none"> i. A good quality trade specific documentary (At least 2-3 documentaries must be arranged by the training institute) ii. Health & Safety case studies (2 cases regarding safety and industrial accidents must be arranged by the training institute) iii. Field visits(At least one visit to a trade specific major industry/ site must be arranged by the training institute)
<p>Learning Outcome of the Course</p>	<p>After completion of this course, the trainees must be able to do:</p> <ul style="list-style-type: none"> • Planning, coding and designing alternative solutions in the field. • Finding problems with secure, robust and even cost effective IoT Solutions. • Understand key concepts and components that make IoT system. • Enabling key technologies and protocols that enable IoT system. • Working on different devices such as Raspberry Pi, Arduino and sensory data acquisition to make a complete IoT system.

	<ul style="list-style-type: none"> • Understand where IoT fits in international and local ICT industry and its future trends.
Entry level of trainees	<p>Since intake level is Bachelor of Computer Science (BCS) / B.Sc (Computer Science) so expectations of the trainees are:</p> <ul style="list-style-type: none"> • Have knowledge of Programming Concepts • Have studied languages such as C, C++, JAVA,C#.net • Have concept of Computer system
Course Execution Plan	Total Duration of Course: 6 Months (26 Weeks)
	Class Hours: 4 Hours per day (06 Days/Week)
	Theory: 20% Practical: 80%
	Weekly Hours: 24 Hours Per week
	Total Contact Hours: 600 Hours
Companies Offering Jobs in the respective trade	<ul style="list-style-type: none"> • Free Lancing <p>International Companies:-</p> <ul style="list-style-type: none"> • Google • Intel • Microsoft • Cisco • Apple • Samsung • Sky bell • Mymdband • Deaco • Many more <p>Besides overseas employment, the following Pakistani companies/firms/Organizations are also offering jobs as well, with details as under:-</p>

	<ul style="list-style-type: none"> • CISNR • NCAI • NCRC • NIDA • EWall • Arduino Pak • PLC • SDSol Technologies • IoT developers systems Limited, Lahore • DPL Islamabad • Sync & Secure, Lahore • Cross Analytics, Islamabad • SDSol Technologies • Digital Dividend • Technosoft Solutions • Datum Brain • Internet of Things and Automation Pakistan Pvt. Ltd
Job Opportunities	<p>The participants may be able to:-</p> <ul style="list-style-type: none"> • Develop their own IoT based solutions. • Transform daily life applications to IoT solutions. • Produce research ideas to develop systems for automation, security and surveillance. • Find employability in international market/ research centers. • Produce industrial grade IoT products and increase entrepreneurship.
No of Students	25
Learning Place	Classroom / Lab / Site

WEEKLY SCHEDULE OF TRAINING

Scheduled Week	Module Title	Learning Units	Remarks
Week 1	Introduction	<ul style="list-style-type: none"> • Course Introduction • Motivational Lecture(<i>For further detail please see Page No: 4</i>) • Applications of the course • Institute/Work ethics (<i>For further detail please see Annexure-II at the end</i>) • Job market overview • Recognizing IoT Instruments • IoT Measuring instruments • IoT smart applications • IoT power system Appliances • IoT power conditioning • IOT Job market at a glance 	<p style="text-align: center;">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p> <p style="text-align: center;">•Task – 1 •Task – 2</p> <p style="text-align: center;"><i>Details may be seen at <u>Annexure-I</u></i></p>
Week 2	IoT Devices	<ul style="list-style-type: none"> • Different Testing Benches for IoT • IoT devices debugging • IoT data processing using Microcontroller • 8 bit microcontroller • Arduino Uno Development Board • Success story (<i>For further detail please see Page No: 5 and Annexure-III at the end</i>) • Institute/Work ethics (<i>For further detail please see Annexure-II at the end</i>) 	<p style="text-align: center;">•Tasks – 3 to 7 <i>Details may be seen at <u>Annexure-I</u></i></p> <p style="text-align: center;">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p>
Week 3	Programming Architecture	<ul style="list-style-type: none"> • Motivational Lecture(<i>For further detail please see Page No: 4</i>) • Types of Microcontroller and introduction to MCU Programming 	<p style="text-align: center;">•Task – 8 to 10 <i>Details may be seen at <u>Annexure-I</u></i></p>

		<ul style="list-style-type: none"> • Arduino flavours, architecture, Coding and debugging • Digital input and output applications • Arduino decision making applications • Multiple repetitions and looping • Motivational Lecture(For further detail please see Page No: 4) 	<p align="center">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p>
Week 4	Arduino Applications	<ul style="list-style-type: none"> • Arduino latching applications • Arrays and its applications • Arduino application using arrays • Arduino Multiple inputs and outputs • Dynamic LED array Application • Institute/Work ethics (For further detail please see Annexure-II at the end) 	<ul style="list-style-type: none"> • Task – 11 • Task – 12 • Task – 13 • Task – 14 <p align="center"><i>Details may be seen at <u>Annexure-I</u></i></p> <ul style="list-style-type: none"> • Monthly Test 1
Week 5	Communication	<ul style="list-style-type: none"> • Establishing IoT auto communication platform • Establishing IoT auto communication to LED Array • Actuators and Control devices • H Bridge applications • LORA and its applications • Success story (For further detail please see Page No: 5 and Annexure-III at the end) 	<ul style="list-style-type: none"> • Task – 15 • Task – 16 • Task – 17 • Task – 18 • Task – 19 <p align="center"><i>Details may be seen at <u>Annexure-I</u></i></p>
Week 6	Control Architecture	<ul style="list-style-type: none"> • Motivational Lecture(For further detail please see Page No: 4) • Solid State control devices • Automatic control and switching 	<ul style="list-style-type: none"> • Task – 20 • Task – 21 • Task – 22 <p align="center"><i>Details may be seen at <u>Annexure-I</u></i></p>

		<ul style="list-style-type: none"> • LCD Displays types and applications • LCD Interfacing • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> 	<p align="center">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p>
Week 7	Display and Output	<ul style="list-style-type: none"> • Seven Segment LCD Interfacing • TFT LCD types and applications • TFT LCD Interfacing • TFT LCD Interfacing • Passive Circuit Element • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> 	<p>Task – 23 to 26 <i>Details may be seen at <u>Annexure-I</u></i></p> <p align="center">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p>
Week 8	Sensory Data Acquisition	<ul style="list-style-type: none"> • Motivational Lecture • Current Sensing <i>(For further detail please see Page No: 4)Methods</i> • Temperature Sensing and applications • Serial data array on digital stream • Light intensity sensing and applications • Touch Sensor applications • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> • Start Freelancing 	<p>• Task – 27 to 31 <i>Details may be seen at <u>Annexure-I</u></i></p> <p align="center">Home Assignment <i>Details may be seen at <u>Annexure-IV</u></i></p> <p>• Monthly Test 2</p>
Week 9	Serial Data Communication	<ul style="list-style-type: none"> • Motivational Lecture <i>(For further detail please see Page No: 4)</i> • Introduction to NodeMCU • Serial Data communication • IoT Communication Devices (IR) • Radio Frequency Communication • RF Communication Application 	<p>• Task – 32 to 36 <i>Details may be seen at <u>Annexure-I</u></i></p>

		<ul style="list-style-type: none"> • RFID Applications • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> 	Home Assignment <u>Details may be seen at Annexure-IV</u>
Week 10	Priority criteria-based Applications	<ul style="list-style-type: none"> • Timers and interrupts Applications • Actuators types and Applications • Actuators control • IoT Design Constraints • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> 	<ul style="list-style-type: none"> • Task – 37 • Task – 38 • Task – 39 • Task – 40 <u>Details may be seen at Annexure-I</u>
Week 11	Sensory Data Acquisition	<ul style="list-style-type: none"> • Motivational Lecture<i>(For further detail please see Page No: 4)</i> • Level Sensors types and Applications • Ultraviolet sensors • Vibration Sensor Applications • Humidity sensor • Pressure Sensor 	<ul style="list-style-type: none"> • Task – 41 • Task – 42 • Task – 43 • Task – 44 • Task – 45 <u>Details may be seen at Annexure-I</u>
Week 12	Standardization and Security	<ul style="list-style-type: none"> • IoT Design Standardization • IoT Design Standardization • IoT Standardization Applications • Security Mechanism • Security Mechanism Constraints • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> 	<ul style="list-style-type: none"> • Task – 46 • Task – 47 • Task – 48 • Task – 49 <u>Details may be seen at Annexure-I</u> <ul style="list-style-type: none"> • Monthly Test 3
Week 13	Overview of the Previous Weeks & Mid Term Examination		

Week 14	Python Programming	<ul style="list-style-type: none"> • Introduction to Python programming • Python programming • Python Looping • Python Data Structure • Python Functions • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> 	Task –50 to 57 <i><u>Details may be seen at Annexure-I</u></i>
Week 15	Raspberry Pi	<ul style="list-style-type: none"> • Motivational Lecture<i>(For further detail please see Page No: 4)</i> • Introduction to Raspberry pi • Raspberry pi interfaces • Raspberry pi Applications • Block Chain Based Security Solutions for IoT • Security system application 	<ul style="list-style-type: none"> • Task – 58 • Task – 59 <i><u>Details may be seen at Annexure-I</u></i>
Week 16	Raspberry Pi	<ul style="list-style-type: none"> • Raspberry Pi software (Rasbian) • Basic Raspberry Pi Applications • Remote Access Using Raspberry Pi • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> 	Task –60 to 64 <i><u>Details may be seen at Annexure-I</u></i>
Week 17	Cloud and Fog Computing	<ul style="list-style-type: none"> • Motivational Lecture<i>(For further detail please see Page No: 4)</i> • Cloud Computing • FoG Computing 	Task –65 to 69 <i><u>Details may be seen at Annexure-I</u></i>

	Job Search	<ul style="list-style-type: none"> • Protocols • Communication Protocols • Job market & job search • Job related skills. • Interpersonal skills • Communication skills 	Monthly Test 4
Week 18	Hardware Basics CV Building	<ul style="list-style-type: none"> • Finding Your Way Around the GPIO • Setting Up SPI on Raspberry Pi • Powering Raspberry Pi • Python on Raspberry Pi • Sensory data Acquisition with Python • Session on CV Building. • How to make notable CV. • Dos and Don'ts of CV making. • Success story <i>(For further detail please see Page No: 5 and Annexure-III at the end)</i> • Institute/Work ethics <i>(For further detail please see Annexure-II at the end)</i> 	<ul style="list-style-type: none"> • Task – 70 • Task – 71 • Task – 72 • Task – 73 • Task – 74 <i><u>Details may be seen at Annexure-I</u></i>
Week 19	Sensory Data Acquisition using Raspberry Pi	<ul style="list-style-type: none"> • Sensory data Acquisition • Motivational Lecture<i>(For further detail please see Page No: 4)</i> • Freelancing concepts, how to start, step by step process from account opening to taking orders and contract signing • Freelancing platforms • Tips for how to increase earning 	Task –75 to 79 <i><u>Details may be seen at Annexure-I</u></i>
Week 20	Control and monitoring Applications	<ul style="list-style-type: none"> • IoT application for Home Automation • IoT application for Smart Cities • Institute/Work ethics <i>(For further detail</i> 	Task –80 to 81 <i><u>Details may be seen at Annexure-I</u></i>

		<p><i>please see Annexure-II at the end)</i></p> <ul style="list-style-type: none"> • Success story (<i>For further detail please see Page No: 5 and Annexure-III at the end)</i>) 	
Week 21	Communication Applications Business Development & Entrepreneurship	<ul style="list-style-type: none"> • Motivational Lecture(<i>For further detail please see Page No: 4)</i>) • Communication using Raspberry Pi • Smart Connected Homes Application • IoT Energy application • Session on Self-Employment • How to start a Business. • Requirements (Capital, Physical etc) • Benefits/Advantages of self-employment 	Task–82 to 86 <u><i>Details may be seen at Annexure-I</i></u>
Week 22	Security Applications	<ul style="list-style-type: none"> • Motivational Lecture(<i>For further detail please see Page No: 4)</i>) • Using Camera with Raspberry Pi • Remote Access of Camera • Surveillance camera Application using Raspberry Pi • QR Code Identification • Finger Print Reader application for biometric attendance system • Institute/Work ethics (<i>For further detail please see Annexure-II at the end)</i>) 	Task –87 to 90 <u><i>Details may be seen at Annexure-I</i></u>
Week 23	Project Selection and Proposal/ Report Writing 23 to 26 Weeks	<ul style="list-style-type: none"> • Project Selection • Project Proposal Formation • Proposal / Report Writing • Project Proto-typing 	

		<ul style="list-style-type: none"> • Project Implementation 	
Week 24	General Overseas Employment	<ul style="list-style-type: none"> • Session on General Overseas Employment opportunities. • Job search Avenues. • Visa Processes and other necessary requirements. • Immigration Information (Legal age requirements, Health Certificate, Police Clearance & Travel Insurance) 	
Week 25		<ul style="list-style-type: none"> • Selection of two countries of destination (Gulf Countries, Malaysia, South Korea etc) focusing on:- <ul style="list-style-type: none"> I. Trade specific Job Prospects and Earning levels in that country. II. Country Specific Labor laws, entry and exit requirements (Legal age requirements, Health Certificate, Police Clearance & Travel Insurance etc.). 	
Week 26		<ul style="list-style-type: none"> • Final Project Demonstration/Examination • Final Assessment 	Final Assessment

Annexure-I

Tasks For IoT System Development & Applications

Task No.	Task	Description	Week No
1.	Vernier Caliper and Screw Gauge measurement	Use vernier caliper to find the inner and outer breadth of a rod and also find its diameter using screw guage.	Week-1
2.	Using transformer, potentiometer, voltage regulators	Using transformer, potentiometer, voltage regulators to control the voltage.	
3.	Blinking LED using Breadboard and circuit boards	Use Breadboard to make flashing (Blinking) LED. You have to add the Transistors, Capacitors, 100K Resistors and LEDs. Place all these circuits on Breadboard and Supply Power and Watch the LEDs Blink.	Week-2
4.	Fault diagnosis / testing a Device	Collecting evidence, analyzing evidence, locating faults, determining and removing causes, rectifying faults and running a systems check.	
5.	Identifying and using a AVR atmega8 microcontroller MCU	Use atmega8 Microcontroller to control the water level in the tank.	
6.	Arduino Uno board testing	<p>To verify that you are receiving correct data, you need a wire wire to connect between the input connectors and power connectors on the Arduino Uno board.</p> <ul style="list-style-type: none"> • Connect one end of the wire to A0 port • Connect the other end to GND port • Analog0 in the Serial Monitor should now read 0.0 volts • Remove the wire from GND and connect it to 5V • Analog0 should now read approximately 5.0 volts • Remove the wire from 5V and connect it to 3.3V • Analog0 should now read approximately 3.3 volts • Repeat the same procedure with A1, D2 and D3 • Do you get the same value from the digital port in both 3.3V and 5V? 	

7.	Conditional Statement in Aurdino	Turns on an LED on pin 13 (<i>the built-in LED on many Arduino boards</i>) if the value read on an analog input goes above a certain threshold.	Week-3
8.	Arduino conditional input and output with alerts/alarms	<p>The alarm Buzzer will start once motion is detected. Things Needed:</p> <ul style="list-style-type: none"> • Buzzer • LED • Motion Detector • Button • Arduino Uno <p>Connect the +5V and GND of Arduino UNO to the breadboard. For LED: Connect the cathode (Shorter pin of LED) to ground and the Anode (longer pin of LED) with a 330 or 220 ohm resisitor. Connect the second pin of resistor with pin 6 of the Arduino as shows in schematics. For Buzzer: Connect the Positive terminal with pin 5 of Arduino and negative terminal to GND. For Button: Connect the button with a 1Kohm resistor to GND and to Positive terminal. Connect the other end with pin 12 as shown in schematics. For Motion Sensor: Connect the +Vcc pin with positive, GND with Ground terminal and Sensor pin with pin 7 of Arduino. Try moving your hands in front of the sensor and the buzzer should ring.</p>	
9.	Looping in C language	<p>Write a C Language Program to display count, from 5 to 15 (as shown below) using following:</p> <ul style="list-style-type: none"> • For Loop • While Loop • Do...while Loop <pre>5 6 7 : : 15</pre>	
10.	Arduino LED blinking	<p>Hardware Required: Arduino or Genuino Board Optional, LED, 220 ohm resistor Use built-in LED that most Arduino and Genuino boards have. This LED is connected to a digital pin. To make your life easier, we have a constant that is specified in every board descriptor file. This</p>	Week-4

		constant is <i>LED_BUILTIN</i> and allows you to control the built-in LED easily. Here is the correspondence between the constant and the digital pin.	
11.	Array in C language	Insert 1,2,3,4, 5 in an array and then read the elements of the array.	
12.	Controlling different devices from single Arduino	Control volume of the speaker and power outlet using a single Arduino	
13.	Displaying information on LED array	To display the entire matrix you need to multiplex the columns or the rows. That is, display each column or row one at a time and do it so quickly that all of the columns or rows appear to be visible at the same time. The circuit diagram in Figure 5 shows a 5x7 LED matrix display connected to an Arduino Uno SBC.	
14.	Sending SMS using GSM module	When the pushbutton is pressed, the Arduino sends the AT commands to the GSM module, for a text SMS; the GSM module works with the "AT commands". Connect the TX, RX and GND pins from the Arduino to the GSM as labelled in the diagram. Then connect the push switch between the 5V and pin2.	
15.	Sending data using Wifi module (ESP)	<p>The ESP8266 WiFi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your WiFi network. It offers a complete and self-contained Wi-Fi networking solution, allowing it to either host the application or to offload all Wi-Fi networking functions from another application processor. When ESP8266 hosts the application, and when it is the only application processor in the device, it is able to boot up directly from an external flash. It has integrated cache to improve the performance of the system in such applications, and to minimize the memory requirements.</p> <p>Things Required</p> <ul style="list-style-type: none"> • Esp8266 Module • Arduino Uno • DHT11 Temperature Humidity Sensor Module • 3X 220 Ohm resistors • A few Male to Female jumper Wires • A website 	Week-5
16.	Relay control and switching	A relay is an electrically operated switch that can be turned on or off, letting the current go through or not, and can be controlled with low voltages, like the 5V provided by the Arduino pins. Controlling a relay module with the Arduino is as simple as	

		controlling any other output as we'll see later on.	
17.	Motor Control using H bridge	DC Motor Driving using H Bridge. H Bridge is a simple electronic circuit which enables us to apply voltage to load in either direction. It is commonly used in robotics application to control DC Motors. By using H Bridge we can run DC Motor in clockwise or anticlockwise directions.	
18.	Making a small network for information transfer using LORA	<ul style="list-style-type: none"> • Register the LoRa gateway to the TTN network • Log into thethingsnetwork.org Console. • Click on Gateways -> register gateway. • Select the packet forwarder protocol. • Enter your Gateway EUI (if is printed on start and end of the installer) • Enter any description. 	
19.	Making a voltage sensitive circuit for automatic tripping of supply	Use ACS 712 Current Sensor. Switch ON the motor and When device is powered on and a "HIGH" signal is sent to the arduino pin, the motor stops.	
20.	Connecting 20x4 LCD with Arduino and Testing	<p>Things required: Arduino, 20x4 LCD, Breadboard, 1k, 220R Resistors & Connecting wires.</p> <p>Method:</p> <ol style="list-style-type: none"> 1. Study the schematic carefully. 2. Place your LCD on the bread board. 3. Make connections as per the schematic. 4. Instead of the potentiometer, you can use a 1k resistor and connect Pin 3 of LCD to Vcc via the resistor. 5. Carefully check whether all the connections are tight and correct. 6. Power up your Arduino via USB and check whether the LCD lights up. If yes, proceed. <p>Code for the above practical Insert your LCD screen into your breadboard vertically such that each pin has its own separate line on the board. Insert your potentiometer in the same way. Connect 5v and GND from Arduino to the + / - rails on your breadboard. ... Connect Pins 1 and 16 from the LCD screen to the negative power rail.</p>	Week-6
21.	Connecting 128x64 LCD with Arduino and Testing	<p>Things required: 128x64 LCD, Arduino, Bread Board, 10 k, 220 k, 22 Ohm Resistors, Connecting Wires, Power Adapter</p>	

		<p>Method:</p> <ol style="list-style-type: none"> 1. Study the LCD architecture and working from data sheet. 2. Place your LCD on the bread board. 3. Make connections as per the schematic. 4. Instead of the potentiometer, you can use a 1k resistor and connect Pin 3 of LCD to Vcc via the resistor to control the brightness. 5. Carefully check whether all the connections are tight and correct. 6. Power up your Arduino via USB and check whether the LCD lights up properly.. 7. Code for the above practical 8. Make necessary changes to the code for the respective desired output. 	
22.	Seven segment LCD	<p>Things required: Seven Segment LCD, Arduino, Bread Board, 10 k, 220 k, 22 Ohm Resistors, Connecting Wires, Power Adapter</p> <p>Method:</p> <ol style="list-style-type: none"> 2. Study the LCD architecture and working from data sheet. 2. Place your LCD on the bread board. 3. Make connections as per the schematic. 4. Instead of the potentiometer, you can use a 1k resistor and connect Pin 3 of LCD to Vcc via the resistor to control the brightness. 5. Carefully check whether all the connections are tight and correct. 6. Power up your Arduino via USB and check whether the LCD lights up properly.. 7. Code for the above practical 8. Make necessary changes to the code for the respective desired output. 	Week-7
23.	TFT LCD Connections with Arduino	<p>Things required: TFT LCD, Arduino, Bread Board, 10 k, 220 k, 22 Ohm Resistors, Connecting Wires, Power Adapter</p> <p>Method:</p> <ol style="list-style-type: none"> 3. Study the LCD architecture and working from data sheet. 2. Place your LCD on the bread board. 3. Make connections as per the schematic. 4. Instead of the potentiometer, you can use a 1k resistor and connect Pin 3 of LCD to Vcc via the resistor to control the brightness. 5. Carefully check whether all the connections are 	
24.		<ol style="list-style-type: none"> 5. Carefully check whether all the connections are 	

		<p>tight and correct.</p> <p>6. Power up your Arduino via USB and check whether the LCD lights up properly..</p> <p>7. Code for the above practical</p> <p>8. Make necessary changes to the code for the respective desired output.</p>	
25.	Testing Resistor, Inductor Capacitor	<p>Connect the probes to two ends of the unknown component (ignore polarity). If reading shows zero, it is an inductor. If reading shows some constant value other than “1” then it is a resistor. If reading keeps increasing and finally settles on “1” then it is a capacitor.</p>	
26.	Current Measurement with CTs and Shunt using Arduino	<p>Components Required: CT`s, Shunts, Multimeter, Bread Board, Resistors, Voltage Regulators, Power Supply</p>	
27.	Interfacing different Temperature Sensor	<p>The LM35 series are precision integrated-circuit temperature devices with an output voltage linearly proportional to the Centigrade temperature. The LM35 device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from the output to obtain convenient Centigrade scaling.</p> <p>To build our circuit with Arduino Uno, follow the steps below: Connect Arduino Uno GND to LM35 GND Connect Arduino 5V pin to LM35 pin 1 Connect Arduino Uno Analog Pin 1 to LM35 pin OUT</p> <p>Execute code on Arduino IDE. Upload the sketch and read the sensor output on Serial Monitor</p>	Week-8
28.	Arduino Digital pin to receive array of bits	<p>Making a digital pin to enable to receive an array of data and process the data accordingly in Arduino controller for data processing.</p>	
29.	Interfacing flame sensor using Arduino	<p>Use an IR based flame sensor. It is based on the YG1006 sensor which is a high speed and high sensitive NPN silicon phototransistor. It can detect infrared light with a wavelength ranging from 700nm to 1000nm and its detection angle is about 60°. Flame sensor module consists of a photodiode (IR receiver), resistor, and capacitor, potentiometer, and LM393 comparator in an integrated circuit. The sensitivity can be adjusted by varying the on board potentiometer. Working voltage is between 3.3v and 5v DC, with a digital</p>	

		<p>output. Logic high on the output indicates presence of flame or fire. Logic low on output indicates absence of flame or fire.</p> <p>Components Required</p> <ul style="list-style-type: none"> ▪ Arduino Uno (any Arduino board can be used) ▪ Flame sensor ▪ LED ▪ Buzzer ▪ Resistor ▪ Jumper wires 	
30.	Interfacing Touch Sensor with Arduino	Connect Vcc pin of Sensor breakout board to Arduino's +5V pin and Gnd to Gnd. Connect Signal (SIG) pin to Arduino Digital pin D1 and Upload the following code to get response when you touch the Capacitive sensor. Arduino Code for on board LED and Serial monitor observation	
31.	NodeMCU Serial data input and output	Making Serial Data Communication using NodeMCU serial port	Week-9
32.	IR communication using NodeMCU	Communicating information and signals through IR transceivers using NodeMCU.	
33.	RF communication using NodeMCU	Communicating information and signals through RF transceivers using NodeMCU.	
34.	RF remote wireless data logging	information transmission and processing over long range.	
35.	RFID interfacing with NodeMCU	Making security application for identification and attendance system using RFID.	
36.	NodeMCU WDT application	Using Watch Dog Timer to wait and respond after a specific time interval.	Week-10
37.	DC motor control using NodeMCU	Controlling a DC motor speed and direction using NodeMCU.	
38.	Servo motor control using NodeMCU	Controlling a Servo motor speed and rotation using NodeMCU.	
39.	IoT prototype Design and security requirements	Understanding prototype commercial requirements and standardization of the proto type.	Week-11
40.	Water Level Sensor interfacing with NodeMCU	Using a UV water level sensor for water tanks level monitoring.	
41.	Interfacing Ultraviolet sensor with NodeMCU	Making communication using UV sensors and designing an application for security and surveillance using UV.	
42.	Interfacing Vibration Sensors	Proximity and Vibration Sensor control	
43.	Interfacing Humidity sensor with NodeMCU	Testing humidity of environment and surfaces using humidity sensors	
44.	Interfacing Pressure sensor with NodeMCU	Measuring pressure of environment and inside an enclosure.	Week-12
45.	IoT Prototype Standardization	Learning the standards requirement as laid by certification bodies globally	

46.	GPIO Input / Output	Using general purpose input and output commands for python	
47.	Creating Shell Scripts	A shell script is simply a text file containing a series of shell (command line) commands that are executed one by one, as if they were input directly on the command line. They can save time if you need to execute lots of commands at once, or if you want to execute commands automatically, like when the Pi boots up.	
48.	Commercial product development	Commercialization constraints and key aspects to cover for prototype development for market.	
49.	Creating Strings Concatenating (Joining) Strings Converting Numbers to Strings Converting Strings to Numbers Finding the Length of a String Finding the Position of One String Inside Another Extracting Part of a String Replacing One String of Characters with Another Inside a String Converting a String to Upper- or Lowercase	Design and develop and practical IoT devices while learning programming and computer hardware. In addition, you will learn how to set up the Raspberry Pi environment, get a Linux operating system running, and write and execute some basic Python code on the Raspberry Pi. You will also learn how to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.	Week-14
50.	What are Conditional Statements? The if Statement	First of all define two variables x=2 and y = 4. Now use if Statement to checks for condition x<y. If condition is true then print "x is less than y" on the screen.	
51.	The if-else Statement	First of all define to variables x=8 and y = 4. Now use The if-else Statement checks for condition x<y. If condition is true then print "x is less than y" on the screen (which is false in this case) therefore the flow of program control goes to else statement and print "x is greater than y" on the screen.	
52.	The nested if Statement	Write a Python Program to display control conditions, from 5 to 15 (as shown below) using following: <ul style="list-style-type: none"> • Multiple if statements • Nested if statements 	
53.	The for Loop The while Loop	Write a Python Program to display count, from 5 to 15 (as shown below) using following: <ul style="list-style-type: none"> • For Loop 	

		<ul style="list-style-type: none"> • While Loop 	
54.	Nested for Loops	<p>Write a Python Program to display the following pattern using following:</p> <ul style="list-style-type: none"> • Nested For Loop • Nested While Loop 	
55.	What are Data Structures? Lists Tuples Dictionaries Dictionary Operations Sets Set Theory Operations	<p>Things Required: Raspberry Pi 3 Model B, mini breadboard, magnetic switch door sensor, terminal block, 3 meters of bell wire, 2 resistors(10K and 1K), and 3x IDC connection wires to the Pi.</p> <p>Method: After making all the connections, the next step is coding, creating a List that would monitor the attendance status and send a notification. The listing can be done in python too. This practice solves power loss failure and keeps the Pi running in case of electricity loss which allows us to check the door status log file when the Pi cannot send email notifications.</p>	
56.	What are Functions? Function Creation Function Scope Built-In Functions User defined function Python exceptions	<p>Design and develop fun and practical IoT devices while learning programming and computer hardware. In addition, you will learn how to set up the Raspberry Pi environment, get a Linux operating system running, and write and execute some basic Python code on the Raspberry Pi. You will also learn how to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.</p>	
57.	Interfacing Camera with Raspberry pi	<p>Pi Camera module is a camera which can be used to take pictures and high definition video. Raspberry Pi Board has CSI (Camera Serial Interface) interface to which we can attach PiCamera module directly. This Pi Camera module can attach to the Raspberry Pi's CSI port using 15-pin ribbon cable</p>	
58.	Motion Detection System using Raspberry pi	<p>Things you need:</p> <ul style="list-style-type: none"> • Raspberry Pi • camera board. • Open CV installed on your Raspberry Pi and be able to access your Raspberry Pi video stream. <p>Install a camera and whenever a motion is detected, the camera start recording the video.</p>	Week-15
59.	Download Rasbian for Raspberry Pi	<p>Download software for SD-card formatting and giving instruction how format SD-card.</p>	Week-16

		Download Rufus software for SD-Card Booting and provide training how to boot Rasbian in SD-card Installing Rasbian into SD-card.	
60.	Adjusting the Picture Size on Your Monitor Changing Your Password Adjust temperature icon on taskbar Setting time and date Connecting with simple Wi-Fi Connecting with smart university Wi-Fi. Terminal usage Finding Your IP Address Setting a Static IP Address Setting the Network Name of a Raspberry Pi Setting Up a Wireless Connection Shutting Down Your Raspberry Pi	Exploring Raspberry pi depth of applications for on build module software oriented control and operations	
61.	Controlling the Pi Remotely with SSH Controlling the Pi Remotely with VNC Moving Files Around Graphically Starting a Terminal Session Navigating the File system Using a Terminal Copying a File or Folder Renaming a File or Folder Editing a File	Design and develop fun and practical IoT devices while learning programming and computer hardware. In addition, you will learn how to set up the Raspberry Pi environment, get a Linux operating system running, and write and execute some basic Python code on the Raspberry Pi. You will also learn how to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.	
62.	Viewing the Contents of a File Creating a File without Using an Editor Creating a Directory Deleting a File or Directory Performing Tasks with Super user Privileges Understanding File Permissions Changing File Permissions Changing File Ownership Making a Screen Capture	Editing a file or directory and apply limitations to a file using raspberry Pi.	

63.	Installing Software with apt-get Removing Software Installed with apt-get Installing Python Packages with Pip Fetching Files from the Command Line Running a Program or Script Automatically on Startup	Installing different software on Raspberry Pi and application of these software.	
64.	Sending Data to Cloud Server	Using Raspberry Pi sending data to a remote cloud server	
65.	Retrieving Data from Cloud Server	Using Raspberry Pi receiving data from a remote cloud server	
66.	Installing and Setting up the Raspberry Pi development environment How to access GPIO Pins of Raspberry Pi Hands on working with GPIOs IoT Communication Models and Protocols Request-Response, Publish-Subscribe, Push-Pull, Exclusive Pair Application Protocols: HTTP	<p>The Raspberry Pi has a 40-pin GPIO (General Purpose Input/output) connection, which makes it very easy to connect to the outside world. To connect the GPIO to external sensors, you can:</p> <ul style="list-style-type: none"> • Connect the sensors directly to the GPIO pins using jumper wires • Connect the GPIO pins to a ribbon cable, which in turn connects it to a breadboard. The Adafruit Pi T-Cobbler Plus - Breakout + Cable for Raspberry Pi A+/B+/Pi 2/Pi 3 is one such product. This option is ideal during the prototyping phase. 	Week-17
67.	CoAP, MQTT, AMQP	Using and adopting the protocols CoAp, MQTT, AMQP	
68.	Communication protocols I - UART, SPI, I2C, CAN, Interfacings Communication APIs: REST-based, Web Socket-based	Using and adopting communication protocols using Raspberry Pi	
69.	GPIO Connector Keeping Your Raspberry Pi Safe When Using the GPIO Connector Setting Up I2C Using I2C Tools	Setting up and sending /receiving data using UART port of Raspberry Pi	
70.	Installing PySerial for Access to the Serial Port from Python Using a Breadboard with Jumper Leads Using a Breadboard with a Pi	<p>Once you have completed the initial network configuration, you can connect to your Raspberry Pi via SSH using Putty (default login for the Raspberry Pi is pi and raspberry).</p> <p>So, you've got your Pi plugged in, and you've installed the latest version of Rasperian OS (if</p>	Week-18

	Cobbler Using a Raspberry Squid Using a Raspberry Squid Button	you're new to Linux and the Pi family, download the NOOBs installer!),	
71.	Making battery for Raspberry pi Powering a Raspberry Pi with a LiPo Battery	Making a backup battery bank with allied circuitry to power Raspberry pi remotely	
72.	How to connect TTL using connector for sharing data How to start python on Raspberry pi How to install python libraries in Raspberry pi	Searching and installing python libraries on Raspberry pi for different applications of use.	
73.	Dual color Led Laser Button Reed Switch Relay Thermistor	Interfacing hardware components with Raspberry Pi	
74.	Rain detection Flame sensor Gas sensor	Interfacing IoT sensors with Raspberry Pi	
75.	Photoresistor Joystick_ps2	Interfacing IoT sensors with Raspberry Pi	
76.	Touch sensor Ultrasonic sensor	Interfacing IoT sensors with Raspberry Pi	Week-19
77.	IR-obstacle sensor Barometer	Interfacing IoT sensors with Raspberry Pi	
78.	Controlling stepper motor Controlling servo motor	Using raspberry Pi control speed and direction of dc motors.	
79.	Home Automation System	Developing Home automation system covering the household appliances, remotely	
79a	Create an account profile on Fiverr (at least two gigs) and Upwork	Create an account by following these steps: Step 1: Personal Info Step 2: Professional Info Step 3: Linked Accounts Step 4: Account Security Step 5: Sort out top freelancers and study their profile. Step 6: Update your profile following the style of shortlisted profiles.	Week-20
80.	Smart City Application	Developing smart city security and surveillance system.	
81.	Sending Email and Other	Sending alerts and automated emails over internet	Week-21

	Notifications from Raspberri Pi	using Raspberry Pi.	
82.	Sending mobile massages from Raspberry Pi	Interfacing GSM with Raspberry Pi and sending messages.	
83.	Smart Connected Homes	Making a small intra-network linking buildings without internet.	
84.	Energy Management System	Design applications for energy measurement and alerts generation	
85.	Energy Automation System	Making prepaid energy audit system	
86.	How to install raspberri Pi Camera	Installing camera on Raspberry Pi	Week-22
87.	How to access Raspberri pi Camera in python	Security camera application using Raspberry Pi	
88.	How to access online streaming from Raspberri pi camera through smart phone or PC	Remote access of camera surveillance system	
89.	Introduction of QR Code reader Integration of QR Code reader with Raspberri PI Generation of QR Code using python programming language	QR code application for stock management	
90.	Interfacing Finger print reader with Raspberri Pi	Biometric Attendance system	

Workplace/Institute Ethics Guide

Work ethic is a standard of conduct and values for job performance. The modern definition of what constitutes good work ethics often varies. Different businesses have different expectations. Work ethic is a belief that hard work and diligence have a moral benefit and an inherent ability, virtue or value to strengthen character and individual abilities. It is a set of values centered on importance of work and manifested by determination or desire to work hard.

The following ten work ethic are defined as essential for student success:

1. Attendance:

Be at work every day possible, plan your absences don't abuse leave time. Be punctual every day.

2. Character:

Honesty is the single most important factor having a direct bearing on the final success of an individual, corporation, or product. Complete assigned tasks correctly and promptly. Look to improve your skills.

3. Team Work:

The ability to get along with others including those you don't necessarily like. The ability to carry your own weight and help others who are struggling. Recognize when to speak up with an ideas and when to compromise by blend ideas together.

4. Appearance:

Dress for success, set your best foot forward, personal hygiene, good manner, remember that the first impression of who you are can last a life time

5. Attitude:

Listen to suggestions and be positive, accept responsibility. If you make a mistake, admit it. Values workplace safety rules and precautions for personal and co-worker safety. Avoids unnecessary risks. Willing to learn new processes, systems and procedures in light of changing responsibilities.

6. Productivity:

Do the work correctly, quality and timelines are prized. Get along with fellows, cooperation is the key to productivity. Help out whenever asked, do extra without being asked. Take pride in your work, do things the best you know how. Eagerly focuses energy on accomplishing tasks, also referred to as demonstrating ownership. Takes pride in work.

7. Organizational Skills:

Make an effort to improve, learn ways to better yourself. Time management, utilize time and resources to get the most out of both. Takes an appropriate approach to social interactions at work. Maintains focus on work responsibilities.

8. Communication:

Written communication, being able to correctly write reports and memos.
Verbal communications, being able to communicate one on one or to a group.

9. Cooperation:

Follow institute rules and regulations, learn and follow expectations. Get along with fellows, cooperation is the key to productivity. Able to welcome and adapt to changing workplace situations and the application of new or different skills.

10. Respect:

Work hard, work to best of your ability. Carry out orders, do what's asked the first time. Show respect, accept and acknowledge an individual's talents and knowledge. Respects diversity in the workplace, including showing due respect for different perspectives, opinions and suggestions.

Annexure-III

Suggestive Format and Sequence Order of Success Story

S. No	Key Information	Detail/Description
1.	Self & Family background	<ul style="list-style-type: none">• Self-introduction• Family background and socio economic status,• Education level and activities involved in• Financial hardships etc
2.	How he came on board NAVTTC Training/ or got trained through any other source	<ul style="list-style-type: none">• Information about course, apply and selection• Course duration, trade selection• Attendance, active participation, monthly tests, interest in lab work
3.	Post training activities	<ul style="list-style-type: none">• How job / business (self-employment) was set up• How capital was managed (loan (if any) etc).• Detail of work to share i.e. where is job or business being done; how many people employed (in case of self-employment/ business)• Monthly income or earnings and support to family• Earning a happy life than before
4.	Message to others (under training)	<ul style="list-style-type: none">• Take the training opportunity seriously• Impose self-discipline and ensure regularity• Make Hard work pays in the end so be always ready for the same.

Note: Success story is a source of motivation for the trainees and can be presented in a number of ways/forms in a NAVTTC skill development course as under:-

1. To call a passed out successful person of institute. He/she will narrate his/her success story to the trainees in his/her own words and meet trainees as well.
2. To see and listen to a recorded video/clip (5 to 7 minutes) showing a successful person Audio video recording that has to cover the above mentioned points.
3. The teacher displays the picture of a successful trainee (name, trade, institute, organization, job, earning per month etc) and narrates his/her story in teacher's own motivational words.

Home Assignment

Designing Effective Homework

To achieve a positive impact on student learning, homework assignments must be well-designed and carefully constructed. Some specific research findings include:

- ▶ Homework is most effective when it covers material already taught.
- ▶ Homework is most effective when it is used to reinforce skills learned in previous weeks or months.
- ▶ Homework is less effective if it is used to teach complex skills.

Characteristics of Good Assignments

When teachers plan homework, they should consider the characteristics listed below:

- ▶ Provide clear instructions for students;
- ▶ Can be completed successfully;
- ▶ Are not too long;
- ▶ Can be completed within a flexible time frame;
- ▶ Use information and materials that are readily available;
- ▶ Reinforce and allow practice of previously taught skills;
- ▶ Must not be unfinished class work;
- ▶ Are interesting to students and lead to further exploration and study;
- ▶ Stimulate creativity and imagination in the application of skills;
- ▶ Stimulate home and class discussion

Homework Don'ts

Do not assign homework that:

- ▶ Is unfamiliar, boring or impossible to do
- ▶ Requires complex skills or requires unreasonable time frames
- ▶ Is a “time filler” to keep students busy or a punishment for not doing class work
- ▶ Do not wait until the last minute to organize and assign the *homework (You may give useless or impossible tasks and/or giving inadequate directions)*
- ▶ Do not assume that all homes have equal resources, that all parents have equal skills and talents to support their children as learners
- ▶ Do not collect any homework you do not intend to check, review or grade.
- ▶ Do not assign homework that is so difficult and unfamiliar to students that their parents are tempted to:
 - Do the work for them;
 - Accuse their children of being inattentive in class; or
 - Accuse their children of failing.

References

1. A Union of Professionals, Classroom Tips, Assigning Effective Homework
<https://files.eric.ed.gov/fulltext/ED516934.pdf> visited on 7th June, 2020