Government of Pakistan

National Vocational and Technical Training Commission

Prime Minister's Hunarmand Pakistan Program

"Skills for All"

Course Contents / Lesson Plan
Course Title: Advanced Electronics & PCB Design
Duration: 6 Months

Revised Edition

Trainer Name	
Course Title	**Advanced Electronics & PCB Design**
Objectives and Expectations	**Employable skills and hands-on practice for Advanced Electronics& PCB Design** 1. To enable students to gain an in-depth understanding of advanced electronic circuits and systems. Students will learn complex circuit analysis techniques, explore advanced electronic components, and understand the theory behind various electronic systems such as amplifiers, oscillators, filters, and feedback control systems. 2. To develop skills in designing and simulating complex electronic systems using hardware and industry-standard software tools. They will learn how to apply advanced circuit analysis and design techniques to create functional and optimized electronic circuits. Through practical exercises and projects, students will gain hands-on experience in designing electronic systems and analyzing their performance through simulation. 3. To provide students with insights into the latest trends and emerging technologies in the field of electronics. They will also learn about the applications of advanced electronics in various industries, such as healthcare, automotive, aerospace, and renewable energy. 4. To enhance students' practical skills by engaging them in hands-on projects and PCB designing. Students will work on real-world applications and design challenges to reinforce their understanding of advanced electronic concepts. They will be exposed to prototyping, soldering, circuit assembly, and troubleshooting techniques. By completing projects, students will gain confidence in applying their knowledge to solve practical electronic problems. **Main Expectations:** 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. 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 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 trainee to prepare them for such market roles during/after the training. **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.

ii. To materialize the main expectations, a special module on **Job Search & Entrepreneurial Skills** has been included in the latter 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 favored labor destination countries also form 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.

iii. A module on **Workplace Ethics** has also been included to highlight the importance of good and positive behavior in the workplace 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 the Pakistani workforce would undergo a positive transformation in the local as well as international job markets.

To maintain interest and motivation of the trainees throughout the course, modern techniques such as:
• Motivational Lectures
• Success Stories
• 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 a 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

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:

1. Clear Purpose to convey the message to trainees effectively.

	2. Personal Story to quote as an example to follow. 3. Trainees Fit so that the situation is actionable by trainees and not represent a just idealism. 4. Ending Points to persuade the trainees on changing themselves. A good motivational lecture should help drive creativity, curiosity, and spark the desire needed for trainees to want to learn more. The 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 a longer time without boredom and loss of interest because they can 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). 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. Course-related motivational lectures online link is available in **Annexure-II**. **(ii) Success Stories** Another effective way of motivating the trainees is using 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 using 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 comprehendible words. Moreover, it is helpful if it is assumed that the reader/listener knows nothing of what is being revealed. The optimum impact is created when the story is revealed in the form of: 1. Directly in person (At least 2-3 cases must be arranged by the training institute) 2. 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 in **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 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 the classroom atmosphere interesting thus maintaining the trainee interest in training till the end of the course. Depending on suitability to the trade, the weekly lesson plan in this document may suggest case studies be presented to the trainees. The trainer may adopt a PowerPoint presentation or video format for such case studies whichever is deemed suitable but only those cases must be selected that are relevant and The Trainees should be required and supervised to carefully analyze the cases. For this purpose, they must be encouraged to inquire and collect specific information/data, actively participate in the discussions, and intended solutions to the problem/situation. Case studies can be implemented in the following ways: - 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) of a learning value.
Entry-level of trainees	Intermediate / Matric Science
Learning Outcomes of the course	By the end of this course, students will be able to: 1. Apply complex circuit analysis techniques to analyze and evaluate electronic circuits. 2. Identify and analyze the theory behind various electronic systems, including amplifiers, oscillators, filters, and feedback control systems. 3. Develop skills in designing and simulating complex electronic systems using hardware and industry-standard software tools. 4. Demonstrate proficiency in using simulation software to analyze the performance of electronic systems. 5. Gain hands-on experience in designing electronic systems through practical exercises and projects. 6. Understand the applications of advanced electronics in various industries such as healthcare, automotive, aerospace, and renewable energy. 7. Enhance practical skills through hands-on projects and PCB designing. 8. Demonstrate proficiency in prototyping, soldering, circuit assembly, and troubleshooting techniques. 9. Develop confidence in solving practical electronic problems by completing projects and gaining practical experience.
Course Execution Plan	The total duration of the course: **6 months (26 Weeks)** Class hours: **4 hours per day** Theory: **20%** Practical: **80%** Weekly hours: **20 hours per week** Total contact hours: **520 hours**

Companies offering jobs in the respective trade	1. Companies in the telecommunications sector require skilled professionals for the design, development, and maintenance of advanced electronic systems used in telecommunications networks, wireless communication technologies, and infrastructure. 2. Consumer electronics companies, including manufacturers of smartphones, tablets, laptops, gaming consoles, and home entertainment systems, seek professionals with expertise in Advanced Electronics for product development, testing, and quality control. 3. With the increasing integration of electronics in vehicles, the automotive industry requires professionals skilled in Advanced Electronics for designing and developing systems related to electric vehicle, advanced driver-assistance systems, infotainment systems, and automotive sensors. 4. The renewable energy sector, particularly in solar and wind power, relies on advanced electronic technologies for power conversion, control systems, and grid integration. Professionals in Advanced Electronics can find employment in the design, installation, and maintenance of renewable energy systems. 5. Industries implementing advanced automation technologies such as robotics and industrial control systems rely on professionals skilled in Advanced Electronics for system design and maintenance.
Job Opportunities	1. PCB Design Technician 2. Product Development Technician 3. Electronics Technician 4. Quality Assurance Technician 5. Manufacturing Technician 6. Production Supervisor 7. Telecommunications Technician 8. Power Electronics Technician 9. Solar Power System Technician 10. Power Systems Technician 11. Consumer Electronics Technician 12. Home Appliances Engineer 13. Automation Technician 14. Service Technician 15. Electronics Lab Technician 16. Hardware Technician 17. Medical Equipment Service Technician
No of Students	25
Learning Place	Classroom / Lab
Instructional Resources	1. J D Irwin and R M Nelms, "Basic Engineering Circuit Analysis", Wiley, 9th Edition, 2008 2. "University Physics" by Hugh D. Young and Roger A. Freedman, 14th Edition. 3. Electronic Devices and Circuit Theory, H. Boylestad and L. Nashelsky, ISBN-10: 0135026490

4. S. Franco, "Electric Circuits Fundamentals", Oxford University Press, (Latest Edition).
5. Morris Mano and Charles R. Kime, "*Logic and Computer Design Fundamentals*", Prentice Hall; 5th edition (2015).
6. S. M. Rashid's book "Power Electronics: Circuits, Devices, and Applications"
7. "Printed Circuit Board Designer's Reference: Basics" by Chris Robertson

Modules

Scheduled Weeks	Module Title	Days	Learning Units	Remarks*
Week 1	Introduction to Electronics & PCB Design	Day 1	Motivational Lecture	
		Day 2	Course Introduction	
		Day 3	Job market	Task-1
		Day 4	Course Applications	Task-2
		Day 5	Institute/work ethics	Task-3
Week 2	Electric Charge	Day 1	Introduction to electric charge	Task-4
		Day 2	Conductors and Insulators	Task-5
		Day 3	Coulomb's Law	Task-6
		Day 4	Quantization and Conservation of Charge.	Task-7
		Day 5	Presentations	
Week 3	Electric Fields	Day 1	Introduction to Electric Field	
		Day 2	A point charge in electric field	Task-8
		Day 3	A dipole in electric field	
		Day 4	Electric Flux	
		Day 5	Gauss' Law and its Applications	Task-9
Week 4	Electric Potential	Day 1	Electric potential and Electric potential energy	Task-10
		Day 2	Potential due to a point charge	Task-11
		Day 3	Potential due to group of charges	Task-12
		Day 4	Potential due to an electric dipole	Task-13
		Day 5	Potential due to continuous charge distribution	Task-14
Week 5	Current and Resistance	Day 1	Introduction to electric current	
		Day 2	Effects of Electric Current	
		Day 3	Sources of Electricity	Task-15
		Day 4	Resistance and Resistivity	Task-16
		Day 5	Ohm's Law	Task-17
Week 6	Capacitance & Inductance	Day 1	Introduction to capacitance	Task-18
		Day 2	Introduction to magnetic fields	Task-19
		Day 3	Inductors	Task-20
		Day 4	Electromagnetic Induction	Task-21
		Day 5	Quiz Week2-Week6	
Week 7	Circuits	Day 1	Introduction to electric circuits	Task-22
		Day 2	Pumping charges	
		Day 3	Work, energy and EMF	Task-23
		Day 4	Single and Multi-loop circuits	
		Day 5	The ammeter and voltmeter	Task-24
Week 8		Day 1	Kirchhoff's laws, circuit elements	

		Day 2	Resistance in series combination	Task-25
	Circuit Reduction	Day 3	Resistance in parallel combination	Task-26
		Day 4	Voltage and current dividers	Task-27
		Day 5	Resistive bridges	Task-28
Week 9	**Circuit Analysis**	Day 1	Nodal analysis	Task-29
		Day 2	Loop analysis	Task-30
		Day 3	Linearity and superposition	Task-31
		Day 4	Source transformation	
		Day 5	Power calculations	Task-32
Week 10	**RLC Circuits**	Day 1	Circuits with Capacitors	Task-33
		Day 2	Circuits with Inductors	Task-34
		Day 3	Circuits with Resistors, Capacitors, Inductors	Task-35
		Day 4	Motivational Lecture	
		Day 5	Quiz Week7-Week10	
Week 11	**Semiconductor Devices**	Day 1	Introduction to Semiconductors	
		Day 2	N-type and P-type materials	Task-36
		Day 3	Semiconductor Diodes	Task-37
		Day 4	Characteristics of Diodes	Task-38
		Day 5	Diode equivalent circuits	Task-39
Week 12	**Diode Applications**	Day 1	Half wave/Full wave rectifiers	Task-40
		Day 2	Clipper and Clamper circuits	Task-41
		Day 3	Zener Diodes	Task-42
		Day 4	Voltage-multiplier circuits and applications	Task-43
		Day 5	Photodiodes	Task-44
Week 13	**Bipolar Junction Transistors**	Day 1	Introduction Bipolar Junction Transistors	Task-45
		Day 2	Construction and operation	Task-46
		Day 3	Amplification analysis	Task-47
		Day 4	Common-Emitter	Task-48
		Day 5	Common-Base and Common Collector configurations of BJT	Task-49
Week 14	**Field Effect Transistors**	Day 1	Introduction to FETs	Task-50
		Day 2	JFETs	Task-51
		Day 3	MOSFETs	Task-52
		Day 4	Applications of MOSFETs	Task-53
		Day 5	Mid Term Exam	
Week 15	**Differential Amplifiers**	Day 1	Introduction to Differential Amplifiers	Task-54
		Day 2	DC and AC analysis of differential amplifier	Task-55
		Day 3	Design of simple differential amplifier	Task-56

		Day 4	Level translator	
		Day 5	Applications of Differential Amplifiers	Task-57
Week 16	**Classification of Amplifiers**	Day 1	Class A amplifier	Task-58
		Day 2	Class B amplifier	Task-59
		Day 3	Class AB amplifier	Task-60
		Day 4	Class C amplifier	Task-61
		Day 5	Push-pull amplifier	Task-62
Week 17	**Digital Systems**	Day 1	Digital Systems	
		Day 2	Binary and Decimal Number-Base Conversion	Task-63
		Day 3	Binary and Hexadecimal Numbers	Task-64
		Day 4	Complements, Signed Binary Numbers	Task-65
		Day 5	Binary logic	Task-66
Week 18	**Digital Circuits**	Day 1	Introduction to Boolean Algebra	Task-67
		Day 2	Basic Theorems and Properties of Boolean Algebra	Task-68
		Day 3	Boolean Functions, Canonical and Standard Forms	Task-69
		Day 4	Digital Logic Gates	Task-70
		Day 5	Integrated Circuits	
Week 19	**Combinational Logic**	Day 1	Adders & Multipliers	Task-71
		Day 2	Comparator	Task-72
		Day 3	Decoders	Task-73
		Day 4	Encoders	Task-74
		Day 5	Multiplexers	Task-75
Week 20	**Synchronous Sequential Logic**	Day 1	Introduction, Sequential Circuits	Task-76
		Day 2	Storage Elements: Latches,	Task-77
		Day 3	Storage Elements: Flip Flops	Task-78
		Day 4	Analysis of Clocked Sequential Circuits	Task-79
		Day 5	Design Procedure	Task-80
Week 21	**Registers and Counters**	Day 1	Registers	Task-81
		Day 2	Shift Register	Task-82
		Day 3	Ripple Counter	Task-83
		Day 4	Synchronous Counters	Task-84
		Day 5	Quiz Week14-Week20	
Week 22	**Power Electronic Devices**	Day 1	Power diodes	Task-85
		Day 2	Power transistors	Task-86
		Day 3	Thyristors	Task-87
		Day 4	Rectifiers (Uncontrolled, Semi-controlled & Fully controlled)	Task-88

		Day 5	Applications of Power Electronic Devices	Task-89
Week 23	**Introduction to PCB Design and Design Software**	Day 1	Introduction to printed circuit boards (PCBs) and their importance	Task-90
		Day 2	Overview of the PCB design process	Task-91
		Day 3	Introduction to PCB design software	Task-92
		Day 4	Understanding the PCB design environment and interface	Task-93
		Day 5	Basic tools and commands for schematic capture and PCB layout	Task-94
Week 24	**Schematic Design and Component Placement**	Day 1	Creating schematic symbols and libraries	Task-95
		Day 2	Schematic capture techniques and best practices	Task-96
		Day 3	Understanding and applying design constraints and specifications	Task-97
		Day 4	Component selection and datasheet analysis	Task-98
		Day 5	Effective component placement strategies for optimal performance and manufacturability	Task-99
Week 25	**PCB Layout and Routing**	Day 1	PCB stack-up and layer management	Task-100
		Day 2	Placement and routing guidelines for different types of components (passive, active, connectors, etc.)	Task-101
		Day 3	Routing techniques and considerations for signal integrity and EMI/EMC compliance	Task-102
		Day 4	Grounding and power plane design	Task-103
		Day 5	Utilizing design rules and constraints for efficient routing and error checking	
Week 26	**Design Validation, Manufacturing, and Assembly**	Day 1	Design rule checking and electrical rule checking	Task-104
		Day 2	Generating manufacturing files	Task-105
		Day 3	Understanding the fabrication and assembly processes	Task-106
		Day 4	Design considerations for soldering, assembly, and testing	Task-107
		Day 5	Final Term Exam	

*See Annexure I

Annexure - I

Tasks For Certificate in Advanced Electronics & PCB Design

Task No.	Task	Remarks	Week
1	**Introduction to Electronics & PCB Design**	Search any three freelancing sites (Fiverr, Upwork, Guru, etc.) and list down the top 5 profiles related to your course	**Week 1**
2		Prepare a career path related to your course and also highlight the emerging trends in the local as well as international market	
3		Generate a report on Institute work ethics and professionalism related to your course	
4	**Electric Charge**	Introduction to hardware setup and tools	**Week 2**
5		Observe conductors and insulators used in household	
6		Explore applications of Columb's Law	
7		Perform experiment to observe the electric charges	
8	**Electric Fields**	Conduct experiment to observe the electric field	**Week 3**
9		Explore applications of Gauss' Law	
10	**Electric Potential**	Explore various sources of electric potential energy	**Week 4**
11		Determine the electric potential at a distance from a point charge.	
12		Find the total electric potential at a point P, located equidistant from group of charges.	
13		Calculate the electric potential at a point on the axial line of an electric dipole, located at a distance from the dipole.	
14		Determine the electric potential at a distance from an infinite line of charge with a linear charge density.	
15	**Current and Resistance**	Explore sources of electricity	**Week 5**
16		Perform hardware and software experiments to understand resistance	
17		Perform hardware and software experiments to verify Ohm's Law	

		Conduct experiments to understand concept of capacitance	
18	**Capacitance & Inductance**		**Week 6**
19		Explore magnetc fields and highlight methods to measure magnetic fields	
20		Perform experiments to understand construction of Inductors	
21		Explore applications of Electronmagnetic Induction	
22	**Circuits**	Perform experiments to connect basic circuits.	**Week 7**
23		Explore concept of Work, energy and EMF by observing the surroundings	
24		Measure current and voltages using ammeter and voltmeters	
25	**Circuit Reduction**	Connect resistance in seriers on hardware and software.	**Week 8**
26		Connect resistance in parallel on hardware and software.	
27		Implement voltage and current dvider circuits	
28		Explore different types of resistive bridges with the help experimentation	
29	**Circuit Analysis**	Apply nodal analysis on various circuits and verify with experimentation	**Week 9**
30		Apply loop analysis on various circuits and verify with experimentation	
31		Explore concepts of linearuty and source transformation	
32		Calculate power of different elements in a circuit and perform experiment	
33	**RLC Circuits**	Construct circuits having capacitors and observe waveforms	**Week 10**
34		Construct circuits with inductors and observe waveforms	
35		Implement RLC circuits and observe the waveforms	
36	**Semiconductor Devices**	Explore N and P type materials used in electronic devices	**Week 11**
37		Conduct experiments to understand working of diode	
38		Observe characteristics of diodes by experimentation	

39		Construct diode equivalent circuits with the help of passive devices	
40	**Diode Applications**	Implement Half and Full wave rectifier circuits	**Week 12**
41		Conduct experiments to understand working of Clipper and Clamper Circuits	
42		Explore working of Zener diodes	
43		Implement voltage multiplier circuits	
44		Design circuit using various types of photodiodes	
45	**Bipolar Junction Transistors**	Explore construction of transistors with the help of diode model	**Week 13**
46		Implement circuits to explore basic transistor operations	
47		Perform amplification analysis of transistors	
48		Observe characteristics of common emitter configuration	
49		Observe characteristics of common base and common collector configuration	
50	**Field Effect Transistors**	Explore basics of Field effect transistors	**Week 14**
51		Implement circuits to understand operations of JFETs	
52		Implement circuits to understand operations of MOFETs	
53		Explore applications of MOSFETs	
54	**Differential Amplifiers**	Conduct experiments to understand working of Differential Amplifiers	**Week 15**
55		Perform experiment to explore DC and AC differential amplifiers	
56		Design differential amplifiers having the desired characteristics	
57		Explore applications of differential amplifiers in electronic devices	
58	**Classification of Amplifiers**	Understand construction and working of Class A amplifier with the help of hardware and software	**Week 16**
59		Explore construction and working of Class B amplifier with the help of hardware and software	

60		Understand construction and working of Class AB amplifier with the help of hardware and software	
61		Understand construction and working of Class Amplifier with the help of hardware and software	
62		Explore applications of amplifiers in electronic devices	
63	**Digital Systems**	Convert the decimal numbers to binary and vise versa. Show the step-by-step conversion process	**Week 17**
64		Convert the hexadecimal numbers to binary and vise versa. Show the step-by-step conversion process	
65		Explore complements of numbers and signed binary number operations	
66		Perform the AND, OR, XOR, and NOT logic operations. Provide the results for each operation and explain the logic behind the outcomes.	
67	**Digital Circuits**	Design a truth table for a simple logic circuit that has two inputs (A and B) and one output (Y).	**Week 18**
68		Prove De Morgan's theorem using Boolean algebraic manipulations. Show step-by-step how the theorem can be applied to simplify a complex Boolean expression.	
69		Given a Boolean function in truth table form, determine its canonical sum-of-products form and its canonical product-of-sums form. Simplify the Boolean function using each form and compare the results.	
70		Build logic circuits using basic logic gates (AND, OR NOT) to implement a given Boolean expression. Draw the logic diagram and verify its functionality by comparing the truth table of the circuit with the desired output.	
71	**Combinational Logic**	Design a 4-bit binary adder circuit using basic logic gates (AND, OR, XOR) and test it with different input combinations.	**Week 19**
72		Construct a 2-bit magnitude comparator circuit using logic gates. Verify its operation by comparing different pairs of 2-bit binary numbers and observing the output.	
73		Design a 3-to-8-line decoder circuit using basic logic gates.	
74		Build a priority encoder circuit that can encode four inputs into a 2-bit binary code.	
75		Design a 4-to-1 multiplexer circuit using basic logic gates.	
76	**Synchronous Sequential Logic**	Construct a circuit using logic gates to implement a 2-bit binary counter.	**Week 20**

77		Design and build a latch circuit using NAND gates.	
78		Construct a D flip-flop circuit using logic gates.	
79		Analyze a given clocked sequential circuit and draw the state transition diagram.	
80		Design a 3-bit binary counter using JK flip-flops. Follow the design procedure and draw the circuit diagram.	
81	**Registers and Counters**	Design and construct a 4-bit parallel-in-parallel-out (PIPO) register using D flip-flops.	**Week 21**
82		Implement a 3-bit serial-in, serial-out (SISO) shift register using D flip-flops.	
83		Design and build a 3-bit asynchronous ripple counter using T flip-flops.	
84		Construct a 2-bit synchronous counter using JK flip-flops.	
85	**Power Electronic Devices**	Design a half-wave rectifier circuit using a power diode to convert an AC voltage into a pulsating DC voltage.	**Week 22**
86		Build a simple amplifier circuit using a power transistor to amplify an audio signal.	
87		Construct a basic light dimming circuit using a thyristor. Control the brightness of a lamp by varying the firing angle of the thyristor and observe the effect.	
88		Design a full-wave bridge rectifier circuit using uncontrolled diodes. Measure the output DC voltage and ripple voltage.	
89		Construct a motor control circuit using power transistors or thyristors. Control the speed and direction of a DC motor using appropriate power electronic devices.	
90	**Introduction to PCB Design and Design Software**	Research and present a brief report on the history of PCBs, their evolution, and their significance in modern electronic devices.	**Week 23**
91		Develop a flowchart illustrating the step-by-step process of designing a PCB.	
92		Explore PCB design software and create a document highlighting the software's main capabilities, user interface, and available tools for schematic capture and PCB layout.	
93		Create a simple schematic diagram consisting of common electronic components and save it as a project file.	

94		Using a PCB design software, create a schematic diagram of a basic circuit	
95	**Schematic Design and Component Placement**	Create a custom schematic symbol for a commonly used component (e.g., resistor, capacitor) and add it to a library in the PCB design software.	**Week 24**
96		Design a simple circuit schematic that includes multiple components, such as resistors, capacitors, and an integrated circuit.	
97		Design a PCB layout with specific design constraints, such as a maximum board size, minimum trace width, and clearance requirements.	
98		Select components for a given circuit design by researching their specifications and datasheets. Consider factors such as voltage ratings, capacitance values, and package types.	
99		Design a PCB layout for a simple circuit and focus on optimizing component placement.	
100	**PCB Layout and Routing**	Design a PCB stack-up for a two-layer board considering the requirements.	**Week 25**
101		Design a PCB layout for a simple circuit with various components and consider signal flow and minimize trace lengths for better performance.	
102		Route a high-speed digital signal on a PCB layout while considering signal integrity and EMI/EMC compliance.	
103		Design a PCB with a proper grounding and power plane arrangement.	
104	**Design Validation, Manufacturing, and Assembly**	Apply DRC to check for proper spacing between components, appropriate trace widths, and clearance requirements.	**Week 26**
105		Generate manufacturing files, specifically Gerber files, required for PCB fabrication.	
106		Understand the significance of processes like solder mask application and silkscreen printing.	
107		Design a circuit that includes through-hole components (e.g., resistors, capacitors, ICs) on a PCB.	

Annexure - II

1. What is freelancing and how you can make money online - BBCURDU
   https://www.youtube.com/watch?v=9jCJN3Ff0kA

2. What Is the Role of Good Manners in the Workplace? By Qasim Ali Shah | In Urdu
   https://www.youtube.com/watch?v=Qi6Xn7yKIlQ

3. Hisham Sarwar Motivational Story | Pakistani Freelancer
   https://www.youtube.com/watch?v=CHm_BH7xAXk

4. 21 Yr Old Pakistani Fiverr Millionaire | 25-35 Lakhs a Month Income | Interview
   https://www.youtube.com/watch?v=9WrmYYhr7S0

5. Failure to Millionaire - How to Make Money Online | Fiverr Superhero Aaliyaan
   Success Story
   https://www.youtube.com/watch?v=d1hocXWSpus

<u>**SUGGESTIVE FORMAT AND SEQUENCE ORDER OF MOTIVATIONAL LECTURE**</u>

Mentor

Mentors are provided an observation checklist form to evaluate and share their observational feedback on how students within each team engage and collaborate in a learning environment. The checklist is provided at two different points: Once towards the end of the course. The checklists are an opportunity for mentors to share their unique perspective on group dynamics based on various team activities, gameplay sessions, pitch preparation, and other sessions, giving insights on the nature of communication and teamwork taking place and how both learning outcomes and the student experience can be improved in the future.

Session- 1 (Communication):

Please find below an overview of the activities taking place Session plan that will support your delivery and an overview of this session's activity.

Session- 1 OVERVIEW
Aims and Objectives:
• To introduce the communication skills and how it will work   • Get to know mentor and team - build rapport and develop a strong sense of a team   • Provide an introduction to communication skills   • Team to collaborate on an activity sheet developing their communication, teamwork, and problem-solving   • Gain an understanding of participants' own communication skills rating at the start of the program

Activity:	Participant Time	Teacher Time	Mentor Time
Intro Attend and contribute to the scheduled.			
Understand good communication skills and how it works.			
Understand what good communication skills mean			
Understand what skills are important for good communication skills			

Key learning outcomes	Resources	Enterprise skills developed
• Understand the communication. skills and how it works. • Understand what communication skills mean. • Understand what skills are important for communication skills	1. Podium 2. Projector 3. Computer 4. Flip Chart 5. Marker	• Communication • Self Confidence • Teamwork

Schedule	Mentor Should do
Welcome: 5 min	Short welcome and ask the **Mentor** to introduce him/herself. Provide a brief welcome to the qualification for the class. Note for Instructor: Throughout this session, please monitor the session to ensure nothing inappropriate is being happened.
Icebreaker: 10 min	Start your session by delivering an icebreaker, this will enable you and your team to start to build rapport and create a team presentation for the tasks ahead. The icebreaker below should work well at introductions and encouraging communication, but feel free to use others if you think they are more appropriate. It is important to encourage young people to get to know each other and build strong team links during the first hour; this will help to increase their motivation and communication throughout the sessions.
Introduction & Onboarding: 20mins	Provide a brief introduction of the qualification to the class and play the "Onboarding Video or Presentation". In your introduction cover the following: 1. Explanation of the program and structure. (Kamyab jawan Program) 2. How you will use your communication skills in your professional life. 3. Key contacts and key information – e.g. role of teacher, mentor, and SEED. Policies and procedures (user agreements and "contact us" section). Everyone to go to the Group Rules tab at the top of their screen, read out the rules, and ask everyone to verbally agree. Ensure that the consequences are clear for using the platform outside of hours. (9am-8pm) 4. What is up next for the next 2 weeks ahead so young people know what to expect (see pages 5-7 for an overview of the challenge). Allow young people to ask any questions about the session topic.
Team Activity Planning: 30 minutes	MENTOR: Explain to the whole team that you will now be planning how to collaborate for the first and second collaborative Team Activities that will take place outside

	of the session. There will not be another session until the next session so this step is required because communicating and making decisions outside of a session requires a different strategy that must be agreed upon so that everyone knows what they are doing for this activity and how. • "IDENTIFY ENTREPRENEURS" TEAM ACTIVITY • "BRAINSTORMING SOCIAL PROBLEMS" TEAM ACTIVITY" *As a team, collaborate on a creative brainstorm on social problems in your community. Vote on the areas you feel most passionate about as a team, then write down what change you would like to see happen.* Make sure the teams have the opportunity to talk about how they want to work as a team through the activities e.g. when they want to complete the activities, how to communicate, the role of the project manager, etc. Make sure you allocate each young person a specific week that they are the project manager for the weekly activities and make a note of this. Type up notes for their strategy if this is helpful - it can be included underneath the Team Contract.
Session Close: 5 minutes	**MENTOR:** Close the session with the opportunity for anyone to ask any remaining questions. **Instructor:** Facilitate the wrap-up of the session. A quick reminder of what is coming up next and when the next session will be.

MOTIVATIONAL LECTURES LINKS

TOPIC	SPEAKER	LINK
How to Face Problems In Life	Qasim Ali Shah	https://www.youtube.com/watch?v=OrQte08Ml90
Just Control Your Emotions	Qasim Ali Shah	https://www.youtube.com/watch?v=JzFs__yJt-w
How to Communicate Effectively	Qasim Ali Shah	https://www.youtube.com/watch?v=PhHAQEGehKc
Your ATTITUDE is Everything	Tony Robbins Les Brown David Goggins Jocko Willink Wayne Dyer Eckart Tolle	https://www.youtube.com/watch?v=5fS3rj6eIFg
Control Your EMOTIONS	Jim Rohn Les Brown TD Jakes Tony Robbins	https://www.youtube.com/watch?v=chn86sH0O5U
Defeat Fear, Build Confidence	Shaykh Atif Ahmed	https://www.youtube.com/watch?v=s10dzfbozd4
Wisdom of the Eagle	Learn Kurooji	https://www.youtube.com/watch?v=bEU7V5rJTtw
The Power of ATTITUDE	Titan Man	https://www.youtube.com/watch?v=r8LJ5X2ejqU
STOP WASTING TIME	Arnold Schwarzenegger	https://www.youtube.com/watch?v=kzSBrJmXqdg
Risk of Success	Denzel Washington	https://www.youtube.com/watch?v=tbnzAVRZ9Xc

Annexure - III

SUCCESS STORY

S. No	Key Information	Detail/Description
1.	**Self & Family background**	
2.	**How he came on board NAVTTC Training/ or got trained through any other source**	
3.	**Post-training activities**	
4.	**Message to others** **(under training)**	

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

1. To call a passed out successful trainee of the institute. He will narrate his success story to the trainees in his own words and meet trainees as well.
2. To see and listen to a recorded video/clip (5 to 7 minutes) showing a successful trainee 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, etc) and narrates his/her story in the teacher's own motivational words.

** The online success stories of renowned professional can also be obtained from **Annex-II**

Annexure - IV

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 the importance of work and manifested by determination or desire to work hard.

The following ten work ethics 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. **Teamwork:**

   The ability to get along with others including those you don't necessarily like. The ability to carry your weight and help others who are struggling. Recognize when to speak up with an idea 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 lifetime.

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 your 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. Take 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 work situations and the application of new or different skills.

10. **Respect**

Work hard, work to the 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.