1. **Body language: Key to professional Success**

Course layout

**Week 1:** Defining Body Language, Scope and Relevance, Changing Contours, Classification, Defining Proxemics, Four Zones, Behavioral Connotations, Space and Designs, Haptics and its Role, Behavioral Significance **Week 2:** Shaking Hands and other tactile behavior. Cultural Variations, Occulesics, Right and Left Brain Associations, Different Types of Eye Contact, Individual and Group situations, Facial Expressions, Smiles and Nods, Head Tilts and Inclines **Week 3:** Facial Expressions, Cultural Interface, Kinesics: Types and Contexts, Negative and Positive Gestures, Hand Movements and Steepling, Understanding Finger Movements, Fidgeting and Ticks **Week 4:** Paralanguage and Voice Modulations, Chronemics, Chromatics, Cultural and Gender Based aspects, Stereotypes, Body Language: Online Presence and Video Interviews

1. **Interpersonal Skills**

Course layout

**Week 1 -** Introduction to Interpersonal skills with pronunciation and communicative skills **Week 2 -** Introduction to Body language as part of communicative skills **Week 3 -** Introduction to group dynamics and group effectiveness and leadership **Week 4 -** Various steps to give a successful oral presentation **Week 5 -** Time Management with Negotiation **Week6 -** Creativity and Problem Solving Skills **Week7 -** Stage Freight & Death by PowerPoint **Week8 -** Making Decision & Emotional Intelligence with Group Discussion

1. **Cognition, Transformation and Lives**

Course layout

**Week 1:** Why Do people do what they do?

**Week 2:**Where is the mind?

**Week 3:**Understanding Transformation

**Week 4:** Gandhi’s process of transformation.

1. Structural Analysis of Nanomaterials

Course layout

**Week 1** : Introduction: Fundamental concepts of atomic structure and interatomic bonding, Structure of materials, Defects in structure of materials, Phase diagram: Determination of phases, Transformation of phases.
**Week 2**: Basic properties: Metals, Basic properties: Ceramics , Basic properties: Polymers, Selection of nanomaterials, Structure property relationship of advanced nanomaterials.
**Week 3** :  Introduction to X-Ray Spectroscopy, Diffraction direction and methods of XRD, Determination of crystal structures by XRD Pattern, Precise parameter measurements, Orientation of single crystals.
**Week 4** :  Qualitative analysis by diffraction, Quantitative analysis by diffraction, Microscopic structural analysis of nanomaterials-I, Microscopic structural analysis of nanomaterials-II, Other characterization used.

1. **Business Analytics & Data Mining Modeling Using R Part II**

Course layout

**Week 1** : Unsupervised Learning Methods : Association Rules
**Week 2**: Unsupervised Learning Methods : Cluster Analysis
**Week 3** : Time Series Forecasting: Understanding Time Series and Regression-Based Forecasting Methods
**Week 4** : Time Series Forecasting: Smoothing Methods and Conclusion

1. **Product Design Using Value Engineering**

Course layout

**Week 1:** Introduction to Product Design and Development, Product Design Steps and Product Analysis, Profit Consideration, Value Engineering (History, Concept and Definitions), Value Engineering vs. Cost Cutting.

**Week 2:** Creative Thinking, Problem Identification and VEJP, Types of Product Functions, Functional Analysis, Functional Analysis System Technique.

**Week 3:** Function-Cost Relationship – I, Function-Cost Relationship - II, VE Applications in Product Design, Value Engineering:Case Study -I, Value Engineering: Case Study –II.

**Week 4:** VE Tools and Techniques – I, VE Tools and Techniques – II, , VE Success Stories –I, VE Success Stories -II .Behavioral Roadblocks

1. Organic Farming for Sustainable Agricultural Production

Course layout

**Week 1  :**  Organic Farming: Concepts and principles of organic farming

**Week 2  :**  Key indicators of sustainable agriculture, organic farming and climate change

**Week 3  :**  Input management; compost production, vermicomposting, Compost quality, Compost utilization and marketing

**Week 4  :**  Organic crop management: field crops, horticulture and plantation crops

**Week 5  :**  Plant protection measures, biopesticides, natural predators, cultural practice

**Week 6  :**  Rotation design for organic system,  Transition to organic agriculture, farming system

**Week 7  :**  Quality analysis of organic foods, Antioxidants and their natural source, organic food and human health

**Week 8  :**  Standards of organic food and marketing

1. Decision making using financial accounting

Course layout

**Week 1:** Conceptual Basis of Financial Accounting

**Week 2:** Concepts and Interactions of Financial Statements

**Week 3:** Financial Statements: Balance sheet

**Week 4:** Financial Statements: Income Statement

**Week 5:** Accounting Records and Systems Credit and debit Journal and Ledger

**Week 6:** Financial Statements: Cash flow Statement

**Week 7:** Financial Statement Analysis Reading financial statements Financial Ratios

**Week 8:** Accounting Fraud and Governance I

1. C Programming and Assembly Language

Course layout

**WEEK 1:** Introduction to Microprocessors and Assembly language Programming Microprocessor Architecture Machine Language Execution sequence in a MuP Memory in a microprocessor Instruction Set ADDRESSING SCHEMES MOV ARITHMETIC AND LOGICAL INSTRUCTIONS FLAG REGISTER STACK INSTRUCTIONS CALL and RET HARDWARE LOOPS **WEEK 2:** Introduction to C and Inline Assembly Data types and their sizes Simple examples of Inline assembly ALU operations String length Multiplication using repeated addition Swap two variables in C Swap two variables in inline Assembly Function to swap two variable in C Inline code to swap the two variables using a function **WEEK3:** Compiling C to Assembly Language Compiling a simple program to Assembly – first order Passing parameters Prologue Epilogue Local variables **WEEK4:** C++ and Some special Functions C and C++ at assembly language level Recursion vs Loops with factorial as example Special functions memcpy strlen

Books and references

1. “The C Programming Language” by BRIAN W. KERNIGHAN and DENNIS M. RITCHIE, Second Edition
2. “The INTEL Microprocessors – Architecture, Programming and Interfacing”, by Barry B. Brey 8th Edition
3. Programming, Data Structures And Algorithms Using Python

Course layout

**Week 1**
Informal introduction to programmin, algorithms and data structures viagcd
Downloading and installing Python
gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

**Week 2**
Python: types, expressions, strings, lists, tuples
Python memory model: names, mutable and immutable values
List operations: slices etc
Binary search
Inductive function denitions: numerical and structural induction
Elementary inductive sorting: selection and insertion sort
In-place sorting

**Week 3**
Basic algorithmic analysis: input size, asymptotic complexity, O() notation
Arrays vs lists
Merge sort
Quicksort
Stable sorting

**Week 4**
Dictionaries
More on Python functions: optional arguments, default values
Passing functions as arguments
Higher order functions on lists: map, lter, list comprehension

**Week 5**
Exception handling
Basic input/output
Handling files
String processing

**Week 6**
Backtracking: N Queens, recording all solutions
Scope in Python: local, global, nonlocal names
Nested functions
Data structures: stack, queue
Heaps

**Week 7**
Abstract datatypes
Classes and objects in Python
"Linked" lists: find, insert, delete
Binary search trees: find, insert, delete
Height-balanced binary search trees

**Week 8**
Effcient evaluation of recursive definitions: memoization
Dynamic programming: examples
Other programming languages: C and manual memory management
Other programming paradigms: functional programming

Books and references

NIL

11)Selection Of Nanomaterials For Energy Harvesting And Storage Application

Course layout

**Week 1:**Introduction, Criteria for choosing the nanomaterials for energy harvesting and storage applications, Brief discussion about all  types of energy harvesting and storage systems, Solar energy, Nanomaterials used for solar energy, Types of solar energy, Solar thermal and heat transfer fluids with example.

**Week 2:**Hydrogen energy: Introduction, Nanomaterials used for hydrogen energy generation, Methods to produce hydrogen energy,Hydrogen production from fossil fuels and biomass, thermo-chemical process, electrolysis, solar and biological, Key Challenges for hydrogen energy generation.

**Week 3:**
Nanogenerators: Introduction, Types of Nanogenerators: Piezoelectric, Thermoelectric, Pyro-electric, Electromagnetic, and  Triboelectric, Key challenges for choosing nanomaterials for nanogenerators, Other conventional energy generation techniques: Wind energy, Tidal, Thermal, hydro power generation, Nuclear and geothermal energy production.

**Week 4:**
Energy storage, Nanomaterials used for energy storage, key challenges for energy storage, Solution of key challenges, Type of energy storages: Electrochemical (Batteries), Supercapacitor, Hydrogen storage, Thermal energy storage.

1. Robotics

Course layout

**Week 1** : Introduction to Robots and Robotics
**Week 2**: Introduction to Robots and Robotics; Robot Kinematics
**Week 3** : Robot Kinematics
**Week 4** : Robot Kinematics; Trajectory Planning
**Week 5** : Robot Dynamics
**Week 6** : Control Scheme; Sensors; Robot Vision
**Week 7** : Robot Vision; Robot Motion Planning
**Week 8** : Intelligent Robot; Biped Walking; Summary

1. Fundamentals of electronic device fabrication

**Week 1:** Introduction and overview of semiconductor device fabrication

**Week 2:** Fabrication operations: Oxidation, doping, and lithography

**Week 3:** Fabrication processes: etching and growth. Process evaluation

**Week 4:** Process yield, clean room design, and IC logic and packaging

1. Demystifying networking

**Week 1:**  Layers of Computer Networks and Network Addressing

**Week 2:**  Routing

**Week 3:**  Transport and Application Layers

**Week 4:**  Introduction to Security and Troubleshooting

1. Introduction to Machine Learning-IIT Kharagpur

**Week 1:**Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation
**Week 2:**Linear regression, Decision trees, overfitting
**Week 3:** Instance based learning, Feature reduction, Collaborative filtering based recommendation
**Week 4:**Probability and Bayes learning
**Week 5:**Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM
**Week 6:**Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network
**Week 7:**Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning
**Week 8:**Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model

1. Manufacturing Automation

**Week 1 :**Definition; Discussion on Pros and Cons of Automation;
Benefits of Automation; Types of automation: Fixed automation, programmable automation, and Flexible automation- Typical Features and examples;
Reasons for automating; Automation strategies; Automated flow lines: the objectives of the use of flow line automation;
General forms of Work Flow – criteria for selection;
Methods of work part transport: Continuous, intermittent and asynchronous: types and their selection;
Transfer Mechanisms; Examples of transfer mechanisms for linear travel and rotary transfer mechanisms; Buffer Storage;

**Week 2 :**Flow line Performance Analysis: Average production time and production rate;
Mean time per cycle when machine breakdown occurs; Flow line
Performance Analysis:  Line efficiency; Cost per item produced;
Partial automation:Reasons for using, Advantages and drawbacks;
Production and Throughput: Examples; Effect of machine Jamming; Component Quality Control;
Choice of assembly methods: Cost, Production Rate, Availability of Labour, and Market Life of the Product;
Advantages of Automatic Assembly; Design for automated assembly; Components of automatic Assembly Machines;

**Week 3 :**Transfer systems; Assembly Machines: In-Line, Rotary; Continuous and Intermittent Transfer;
Indexing Machines:Factors affecting the choice; Various Indexing Mechanisms;
Vibratory bowl feeders: Mechanics of Vibratory Conveying - its analysis;
Effect of Frequency, Track Acceleration and Vibration Angle; Effect of Track Angle and Coefficient of Friction;
Summary of Bowl Feeder Design; Spiral Elevators; General Requirements of Part Feeders;
Non-vibratory feeders : Reciprocating Tube Hopper Feeder – its analysis;
General Features. Centerboard Hopper Feeder: Analysis: Maximum Track Inclination, Total Cycle Time, Mean Feed Rate;

**Week 4 :**
Reciprocating Tube Hopper Feeder: Principle of Operation;
External Gate Hopper Feeder: Its Analysis: Maximum Peripheral Velocity, Mean Feed rate;
Rotary Disk Feeder: Indexing and Rotary Disk Feeder with continuous drive and their analysis:
Load sensitivity, Efficiency and Mean Feed Rate;
Orientation of Parts in Automatic Assembly:In-Bowl and Out-of-Bowl Toolings;
Typical Orienting Systems: Wiper Blade, Pressure Break, slot in the track; Analysis of Part Orienting Systems;
Examples of Out-of-Bowl Toolings; Feed Tracks: Analysis of Horizontal Delivery Feed Track;
“ON-OFF” Sensors; Reliability of Feeding.

1. WildLife Conservation

Course layout

**Week 1**: Introduction, Importance, Threats

**Week 2**: Monitoring wild animals

**Week 3**: Monitoring & managing habitats

**Week 4**: Management of wildlife diseases

**Week 5**: Capturing and restraining wild animals

**Week 6**: Conservation genetics

**Week 7**: Ex-situ conservation

**Week 8**: Management of changes

1. Data Base Management System

Course layout

**Week 1:** Course Overview. Introduction to RDBMS
**Week 2:** Structured Query Language (SQL)
**Week 3:** Relational Algebra. Entity-Relationship Model
**Week 4:** Relational Database Design
**Week 5:** Application Development. Case Studies. Storage and File Structure
**Week 6:** Indexing and Hashing. Query Processing
**Week 7:**Query Optimization. Transactions (Serializability and Recoverability)
**Week 8:** Concurrency Control. Recovery Systems. Course Summarization.

1. Global Navigation Satellite Systems And Applications

COURSE PLAN :

WEEK-1: Introduction to Global Navigation Satellite System (GNSS) How position is determined by the GNSS? (Part-I) How position is determined by the GNSS? (Part-II) How position is determined by the GNSS? (Part-III) NAVSTAR - Global Positioning System

WEEK-2: Global Navigation Satellite System (GLONASS) BeiDou Navigation Satellite System (BDS) Indian Regional Navigation Satellite System (IRNSS) GALILEO Quasi-Zenith Satellite System (QZSS)

WEEK-3: Differential Global Navigation Satellite System (DGNSS) REAL-TIME KINEMATIC (RTK) Satellite Based Augmentation System (SBAS) GNSS Errors GNSS Correction Methods

WEEK-4: Why altitude estimated by GNSS receivers is not very accurate Global Navigation Satellite Systems (GNSS) Applications - I Global Navigation Satellite Systems (GNSS) Applications - II GNSS: Current Trends and Future GNSS: Opportunities in India

1. WildLife Conservation

Course layout

**Week 1**: Introduction, Importance, Threats

**Week 2**: Monitoring wild animals

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**Week 4**: Management of wildlife diseases

**Week 5**: Capturing and restraining wild animals

**Week 6**: Conservation genetics

**Week 7**: Ex-situ conservation

**Week 8**: Management of changes

1. Python for Data Science – Online

Course layout

**Week 1:**
•**BASICS OF PYTHON SPYDER (TOOL)**

• Introduction Spyder

• Setting working Directory

• Creating and saving a script file

• File execution, clearing console, removing variables from environment, clearing environment

• Commenting script files

• Variable creation

• Arithmetic and logical operators

• Data types and associated operations

 **Week 2:**

**Sequence data types and associated operations**

•        Strings
•        Lists
•        Arrays
•        Tuples
•        Dictionary
•        Sets
•        Range

**NumPy**
•        ndArray

**Week 3:**
•**Pandas dataframe and dataframe related operations on Toyota Corolla dataset**

1. Reading files
2. Exploratory data analysis
3. Data preparation and preprocessing

•**Data visualization on Toyoto Corolla dataset using matplotlib and seaborn libraries**

1. Scatter plot
2. Line plot
3. Bar plot
4. Histogram
5. Box plot
6. Pair plot

•**Control structures using Toyota Corolla dataset**

1. if-else family
2. for loop
3. for loop with if break
4. while loop

•**Functions**
 **Week 4: CASE STUDY**

•**Regression**

1. Predicting price of pre-owned cars

•**Classification**

1. Classifying personal income
2. **Cloud Computing – Online**

Course layout

**Week 1:** Introduction to Cloud Computing

**Week 2:** Cloud Computing Architecture

**Week 3:** Service Management in Cloud Computing

**Week 4:** Data Management in Cloud Computing

**Week 5:** Resource Management in Cloud

**Week 6:** Cloud Security

**Week 7:** Open Source and Commercial Clouds, Cloud Simulator

**Week 8:** Research trend in Cloud Computing, Fog Computing

1. Practical Machine Learning with Tensorflow – Online

Course layout

**Week 1:** Getting started with Tensorflow

**Week 2:** Overview of Machine Learning (Process and Techniques, Demonstration of ML concepts with Deep Playground)

**Week 3:** Data Input and Preprocessing with Tensorflow

**Week 4:** Machine Learning Model Building

**Week 5:** Prediction with Tensorflow

**Week 6:** Monitoring and evaluating models using Tensorboard

**Week 7:** Advance Tensorflow (Building custom models - CNNs, Scaling up for large datasets)

**Week 8:** Distributed training with hardware accelerators

1. Toyota Production System – Online

Course layout

**Week 1**:  (1)  Manufacturing Excellence

 (2)  Global Environment

 (3)  Production System

 (4)  Operations Strategy

 (5)  The Heart of the TPS: Eliminating Waste

**Week 2**:  (1)  Principles of Toyota Way

 (2)  Culture Behind Toyota Way

 (3)  Toyota Way in Action

 (4)  Long Term Philosophy

 (5)  Create Continuous Flow

**Week 3**:  (1)  Pull System

 (2)  Leveling Workload

 (3)  Get Quality Right the first time

 (4)  Standardization of Task

 (5)  Use of Visual Control

**Week 4**: (1)  Use of Reliable Technology

 (2)  Role of Leaders in Manufacturing Philosophy

 (3)  Developing Exceptional Teams

 (4)  Challenge & Respect Extended Networks

 (5)  See yourself to understand the situation

**Week 5**:  (1)  Developing decisions with Consensus

 (2)  Becoming Learning Organization

 (3)  Becoming a Learning Organization: Continuous Improvement

 (4)  Using Toyota Way for other Organization(Service & Technical)

 (5)  Lean Manufacturing

**Week 6**: (1)  Lean Vs Agile Manufacturing

 (2)  Sustainable Manufacturing-I

 (3)  Sustainable Manufacturing-II

 (4)  Flexible Manufacturing System

 (5)  Benchmarking

**Week 7**:  (1)   Cultural Issues in Lean

 (2)   Overview of Lean implementation

 (3)   Significance of Lead time

 (4)   Techniques to reduce LT

 (5)   Value Stream Mapping

**Week 8**:  (1)   KANBAN Approach

 (2)   KANBAN Calculation-I

 (3)   KANBAN Calculation-II

 (4)   Theory of Constraints

 (5)   Different Business Excellence Models

1. Human Resource Development – Online

Course layout

**Week 1:**Introduction to Human Resource Development: Emergent of HRD, Critical HRD roles, challenges for HRD

**Week 2:**   HRD in global perspective, HRD- Performance link, Strategic perspective of HRD

**Week 3:**   HRD Process Model: identification of HRD needs and Design and development of HRD programmes

**Week 4:**   HRD Process Model: Methods of Implantation, Evaluation of HRD programmes

**Week 5:**   Employee coaching and performance management: Coaching to improve poor performance, coachinganalysis, coaching discussion, coaching skills

**Week 6:**   HRD interventions: Mentoring for employee development: Role of mentoring in development,understanding the role and responsibilities of mentor, mentee, implementing the mentoring process,mentoring relationship,

**Week 7:**   Employee counseling for HRD: Overview of counseling programmess, employee assistance programme, stress management, employee wellness and health promotion

**Week 8:**   Competency framework of HRD: why competency mapping? Understanding the competency mapping framework, steps in competency mapping

**Week 9:**   Career Planning, management, and development: Career development stages and activities, role of individual and organization in career planning, Issues in career management

**Week 10:** Intellectual capital (IC), its measurement and management: Components of IC, measurement models  of IC, IC index and challenges for HR

**Week 11:** HRD, Organizational Learning, and learning organizations

**Week 12:** The future of HRD and HRD Ethics: Research, practice and education of HRD for innovation and talent  development and management, Role of HRD in developing ethical attitude and behavior and development,  Ethical problems with HRD roles

1. Deep Learning – Online

Course layout

**Week 1**:  Introduction to Deep Learning, Bayesian Learning, Decision Surfaces

**Week 2:**  Linear Classifiers, Linear Machines with Hinge Loss

**Week 3:**  Optimization Techniques, Gradient Descent, Batch Optimization

**Week 4:**  Introduction to Neural Network, Multilayer Perceptron, Back Propagation Learning

**Week 5:** Unsupervised Learning with Deep Network, Autoencoders

**Week 6:**  Convolutional Neural Network, Building blocks of CNN, Transfer Learning

**Week 7:**  Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

**Week 8:**  Effective training in Deep Net- early stopping, Dropout, Batch Normalization, Instance Normalization, Group Normalization

**Week 9:**  Recent Trends in Deep Learning Architectures, Residual Network, Skip Connection Network, Fully Connected CNN etc.

**Week 10**: Classical Supervised Tasks with Deep Learning, Image Denoising, Semanticd Segmentation, Object Detection etc.

**Week 11:** LSTM Networks

**Week 12:** Generative Modeling with DL, Variational Autoencoder, Generative Adversarial Network Revisiting Gradient Descent, Momentum Optimizer, RMSProp, Adam

* 1. Applied Thermodynamics For Engineers – Online

Course layout

**Week 1:** Review of Thermodynamic Principles

**Week 2:** Thermodynamic Property Relations

**Week 3:** Properties of Pure Substances

**Week 4:**  Air Standard Cycles

**Week 5:**  Real Cycles for Reciprocating Engines

**Week 6:** Gas Turbine Cycles

**Week 7:**  Vapor Power Cycles

**Week 8:**  Cogeneration & Combined Cycles

**Week 9:**  Refrigeration Cycles

**Week 10:** Gas Mixtures

**Week 11:** Gas-vapor Mixtures

**Week 12:** Chemical Reactions

* 1. Fluid Machines – Online

Course layout

**Week 1** :  Introduction and basic principles

**Week 2** :  Hydraulic Impulse Turbine

**Week 3** :  Hydraulic Reaction Turbine Part I

**Week 4** :  Hydraulic Reaction Turbine Part II and Hydraulic Pump Part I

**Week 5** :  Hydraulic Pump Part II

**Week 6** :  Hydraulic Pump Part III

**Week 7** :  Air  Compressor Part I

**Week 8** :  Air  Compressor Part II

* 1. Tissue engineering – Online

Course layout

**Week 1** : Introduction to tissue engineering

**Week 2** : Biomaterials: natural materials, polymers

**Week 3** : Biomaterials: hydrogels, ceramics, scaffold fabrication

**Week 4** : Immune response to biomaterials

**Week 5** : Cells: source, culture, and tissue dynamics

**Week 6** : Cells: differentiation, adhesion, and migration

**Week 7** : Cells and signals

**Week 8** : Applications

* 1. Ethical Hacking – Online

Course layout

**Week 1:**  Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.

**Week 2:**   IP addressing and routing. TCP and UDP. IP subnets.

**Week 3:**  Routing protocols. IP version 6.

**Week-4:**   Installation of attacker and victim system. Information gathering using advanced google search,
  archive.org, netcraft, whois, host, dig, dnsenum and NMAP tool**.**

**Week-5:** Vulnerability scanning using NMAP and Nessus. Creating a secure hacking environment.
 System Hacking: password cracking, privilege escalation, application execution. Malware and
 Virus. ARP spoofing and MAC attack.

**Week 6:**   Introduction to cryptography, private-key encryption, public-key encryption.

**Week 7:**   Cryptographic hash functions, digital signature and certificate, applications.

**Week 8:**   Steganography, biometric authentication, network-based attacks, DNS and Email security.

**Week-9:**Packet sniffing using wireshark and burpsuite, password attack using burp suite.
  Social engineering attacks and Denial of service attacks.

**Week 10:** Elements of hardware security: side-channel attacks, physical inclinable functions, hardware
  trojans.

**Week-11:**Different types of attacks using Metasploit framework: password cracking, privilege escalation,
  remote code execution, etc.Attack on web servers: password attack, SQL injection, cross site
  scripting.

**Week 12:** Case studies: various attacks scenarios and their remedies.