Finishing College Training Program for Engineers
National Institutes of Technology Meghalaya

The Program:

The course will be floated under SII-UKIERI program. The program is introduced jointly by universities UK International, UK and Ministry of Human Resource Development, Government of India through British council India and Study in India, to fund outward student mobility of around 300 students from the UK to India through study in India program. The aim is to support the employability of UK graduates, recognizing the positive correlation between international experience, academic performance and graduate employability. The program will also enhance and sharpen the required skills among the Indian engineering graduates and make them employable in industry.

The duration of the program is 6 weeks during June-July with minimum batch of 12 students and maximum of 20 students.

To meet the immediate trained human resource requirements of different industries, the course is proposed for graduates of Computer Science Engineering, Civil Engineering, Electrical Engineering, Electronics & Communication Engineering and Mechanical Engineering. The objective of the course is:

(i)   To offer suitable candidates to industry
(ii)   To help young UK, Non-UK and Indian graduates to find jobs through appropriate training.

The program will be delivered by the faculties of NIT Meghalaya with additional support from practicing executives from industry and other institutes.

FINISHING COLLEGE TRAINING PROGRAM FOR ENGINEERS

SYLLABUS

Table of Contents

* Course from only branch to be chosen.

MATHEMATICS
Syllabus
(Total Hours: 20)

Module I (7 hours)
Probability – Conditional Probability, Binomial and Normal Distributions, Correlation & Regression.

Module II (7 hours)
Numerical Method – Numerical Solution of Linear System by Gauss Elimination and Gauss Seidel Method, Numerical methods for ODEs & PDEs.

Module III (6 hours)
Mathematical Structure – Introduction to Graphs and Trees, Eulerian and Hamiltonian Graphs, Graph Traversals and Minimum spanning trees.

BASICS OF BUSINESS AND ACCOUNTANCY
Syllabus
(Total Hours: 20)

Module I (3 hours)
The Types of Business Organisations and the History of Corporations; Business Intelligence.

Module II (6 hours)
Economic Fundamentals – Demand and Supply, Price Elasticity of Demand; Market Structure; Basics of Production, Costing and Pricing.

Module III (4 hours)
The Concept of Marketing; The Marketing Mix; Segmentation, Targeting and Positioning.

Module IV (7 hours)
Understanding Financial Statements – Journal, Ledger, Trial Balance, Profit and Loss Account, Balance Sheet, Fund Flow Statement and cash Flow Statement; Basics of Capital Budgeting

SOFT SKILLS
Syllabus
(Total Hours: 30)

Module I **(**12 hours**)**
General Aptitude Tests- Numeracy/ Quantitative aptitude, Logical Reasoning, Data Interpretation.

Module II **(**6 hours**)**
Business writing & Reading – Business vocabulary and grammar review, Business writing, Reading Skill, Case analysis, Emcee: The language of meetings and meeting skills.

Module III **(**6 hours**)**
Communication Skills – Communication Foundation, Active Listening, Non verbal communication, Presentation skill, Decision making skills, Time management skills.

Module IV **(**6 hours**)**
Preparation for placement – Market Requirement/ Opportunities, Counseling for planning successful career, Employment strategies, Negotiation skill, Etiquette/Work Ethics/Values, Team Building/Interpersonal skills.

CIVIL ENGINEERING
Syllabus
(Total Hours: 60)

Module I **(**20 hours**)**
Comprehensive understanding of Soil Characteristics and Properties - practical insight into soil mechanics; Overview of Foundation systems- Introduction to bearing capacity theories, selection of type of foundation, Load transfer mechanism; Design of Isolated, Combined and Mat Footings- Using Codal provisions;

Module II **(**20 hours**)**
Layout and detailing of Reinforcement concrete and steel structures; Generation of Project reports; Seismic vulnerability assessment of Reinforced Concrete Structures; Non-destructive Testing Techniques of reinforced concrete structures.

Module III **(**20 hours**)**
Analysis and design of foundation and civil engineering structures using commercially available software packages.

COMPUTER SCIENCE & ENGINEERING
(Total Hours: 60)

Module I **(**20 hours**)**
Problem Analysis and Representation, Basic Problem Solving Methods

Structured Representation of Knowledge State Space Search, Uninformed and Informed Search

Constraint satisfaction problems

Propositional Logic and First Order Predicate Logic (FOPL), Production Systems, Semantic Nets, Resolution in Predicate Logic, Unification, Strategies for Resolution by Refutation

Probabilistic Inference, Bayes Networks, Reasoning of Uncertain Information Fuzzy Logic and Reasoning Planning algorithms, Rule based Systems

Data –Preprocessing, Data Quality Issues, Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization

Module II **(**20 hours**)**
Basic Concepts of Data warehousing, Data Warehouse Modeling, Data Warehouse Design Process and Implementation, Indexing OLAP Data, Efficient Processing of OLAP Queries, OLAP Server Architecture, Data Cube Computation

Basic Concepts of association rules, Apriori Algorithm, Frequent Pattern growth (FP-growth) Algorithm, Mining Closed and Max Patterns, Pattern Evaluation Methods, Constraint-Based Frequent Pattern Mining

Basic Concepts of classification, Decision Tree Classifier, Rule-Based Classifier, Nearest Neighbor Classifiers, Naive Bayes Classifier, Artificial Neural Network (ANN), Support Vector Machine (SVM), Model Over fitting, Model Evaluation and Selection

Overview of clustering techniques, Types of Clustering Methods, Partitioning Methods, Hierarchical Methods, Density-Based Methods, Grid-Based Methods, Performance Parameters, Clustering with Constraints

Basic of outlier detection, Outlier Detection Methods, Statistical Approaches, Proximity-Based Approaches, Clustering-Based Approaches, Classification-Based Approaches

Module III **(**20 hours**)**
Machine Learning-Characteristics and Applications of Soft Computing

Fuzzy Logic- Fuzzy Sets And Membership Function, Parameterized Member Functions, Set Operations on Fuzzy Sets, Fuzzy If-Then Rules, Fuzzy Reasoning, Fuzzification and Defuzzification, Mamdani Fuzzy Models, Sugeno Fuzzy Models, Tsukamoto Fuzzy Models,

Fuzzy Logic Controller, Applications of Fuzzy Logic.

Genetic Algorithm- Encoding, Selection, Crossover, Mutation, Fitness Function, Convergence, Multi Objective Genetic Algorithm.

Neural Networks- Backpropagation, Extended Backpropagation for Recurrent Networks, Mason's Gain Formula, Hybrid Learning Rules, Artificial Neural Networks, Different Artificial Neural Networks Architectures, Training Techniques for ANNs.

Hybrid Systems- Integration of Neural Networks, Fuzzy Logic and Genetic Algorithms, Genetic Algorithms Based Backpropagation Networks, Fuzzy Backpropagation Networks Fuzzy Logic Controlled Genetic Algorithms.

Optimization Techniques- Particle Swarm Optimization, Ant Colony Optimization, Random Search, Harmony Search, Cuckoo Search.

ELECTRICAL ENGINEERING
Syllabus
(Total Hours: 60)

Module I **(**15 hours**)**
Basic concepts of rotating electrical machines, DC generators and motors, Transformer – single and three phase, Poly-phase induction motor, Synchronous machine, Single phase induction motor, Special machines – hysteresis motor, stepper motor, reluctance motor, brushless motor.

Module II **(**15 hours**)**
Generation and distribution of electrical power, Overhead and Underground transmission system, Transmission line parameters, characteristics and performance, Fault analysis – Symmetrical and Unsymmetrical, load flow analysis, Economic load dispatch, unit commitment, Power system stability, Automatic generation and voltage control, Protection relays and circuit breake, Protection scheme – generator, transformer, bus-bar, transmission lines.

Module III **(**15 hours**)**
Introduction to power electronic devices, Phase controlled rectifiers, Choppers, Inverters, Cyclo-converters, Fundamentals and dynamics of electrical drives, Power electronic control of DC and AC drives, permanent magnet AC drives, Brushless DC drives.

Module IV **(**15 hours**)**
Basic concepts and mathematical modeling of physical system, Linear system performance in time and frequency domain, Stability analysis – Routh-Hurwitz criteria, root locus technique, bode plot, nyquist plot, Compensator design, State space analysis, Nonlinear control system, Digital control System.

Performance and characteristics of measurement system, Analog & Digital instruments, Transducers and sensors.

ELECTRONICS & COMMUNICATION ENGINEERING
Syllabus
(Total Hours: 60)

Module I   **(**10 hours**)**
CMOS circuit design and simulation: MOS transistor basic, MOS parasitic & SPICE model.

Module II   **(**15 hours**)**
Digital VLSI design & design of embedded systems: ASIC system design, CMOS inverter, combinational logic design, sequential logic design.

Module III   **(**10 hours**)**
Signal processing algorithms and filter, DFT and FFT architectures.

Module IV   **(**15 hours**)**
Baseband designing for advanced wireless communication systems. Antenna design and artificial surfaces: antenna design issues, metasurface and its application in antenna design.

Module V   **(**10 hours**)**
RF IC design and MEMS: RF front-end (Power Amplifier, low noise amplifier, mixer, oscillators), data acquisition circuits.

MECHANICAL ENGINEERING
Syllabus
(Total Hours: 60)

Module I   **(**20 hours**)**
Definition and properties of Fluids, Fluid as continuum, Langragian and Euleri description,Velocity and stress field, Fluid statics, Fluid kinematics.
Reynolds transport theorem, Integral and differential forms of governing equations: ma momentum and energy conservation equations, NavierStokes equations,Euler's equation,Bernoull Equation.
Couette flows,Poiseuille flows, Fully developed flows in noncircular cross-sections, Unstea flows, Creeping flows.
Boundary layer equations, Boundary layer thickness, Boundary layer on a flat plate, similar solutions, Integral form of boundary layer equations, Approximate Methods, Flow separation,En flow into a duct.
Introduction, Fluctuations and timeaveraging, General equations of turbulent flow, Turbule boundary layer equation, Flat plate turbulent boundary layer, Turbulent pipe flow, Prandtl mixi hypothesis, Turbulence modeling, Free turbulent flows.

Module II   **(**10 hours**)**
Hydraulic Impulse Turbine, Hydraulic Reaction Turbine, Hydraulic pumps and fan.

Module III   (30 hours)

Applications, Numerical vs Analytical vs Experimental, Modeling vs Experimentation, Fundamen
principles of conservation, Reynolds transport theorem, Conservation of mass, Conservation
linear momentum: Navier-Stokes equation, Conservation of Energy, General scalar transpo
equation.
Mathematical classification of Partial Differential Equation, Illustrative examples of ellipt
parabolic and hyperbolic equations,Physical examples of elliptic, parabolic and hyperbolic part
differential equations
Error Minimization Principles, Functional involving higher order derivatives,Approximate soluti
of differential equations through variational formulation,Boundary conditions in the variatio
form: Primary and secondary variables, Essential and natural boundary conditions,Err
Minimization Principles, Functional involving higher order derivatives,Approximate solution
differential equations through variational formulation,Boundary conditions in the variational for
Primary and secondary variables, Essential and natural boundary conditions,Approximate solutic
of differential equations
Discretization principles:Preprocessing,Solution,Postprocessing, Finite difference method, W
posed   boundary   value   problem,Possible   types   of   boundary   conditio
Conservativeness,Boundedness, Transportiveness, Finite volume method (FVM), Illustrati
examples: 1-D steady state heat conduction without and with constant source term.
FVM for 2-D unsteady state diffusion problems.
Finite volume discretization of convection-diffusion problem: Central difference scheme, Upwi
scheme,Exponential scheme and Hybrid scheme,Power law scheme, Generalized convectic
diffusion formulation, Finite volume discretization of two-dimensional convection-diffusi
problem, The concept of false diffusion, QUICK scheme.
Discretization of the Momentum Equation:Stream Function-Vorticity approach and Primiti
variable approach,Staggered grid and Collocated grid,SIMPLEAlgorithm, SIMPLER Algorithm.
The basic structure of a CFD code: Pre-processor,Solver and Postprocessor, Us
definedsubroutines,Solution to some basic problems in heat transfer and fluid flow