



**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
ANANTHAPURAMU- 515 002 (A.P) INDIA**

Metric No: 1.3.2.

Number of value-added courses for imparting transferable and life skills offered during last five years.

1.3.2.1. How many new value-added courses are added within the last five years.

HEI Inputs: 106

DVV Comment: Provide List of value added courses which are optional and offered outside the curriculum of the programs as endorsed by the appropriate authority. Provide Brochure and Course content or syllabus along with course outcome of Value added courses offered.

HEI Response: : Provided List of value added courses which are optional and offered outside the curriculum of the programs as endorsed by the appropriate authority. Provided Brochure and Course content or syllabus along with course outcome of Value added courses offered.


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ANANTHAPURAMU- 515 002 (A.P) INDIA**

1.3.2: Number of value-added courses for imparting transferable and life skills offered during last five years.

S.No	Title of the Course
1	DIGITAL LAND SURVEYING AND MAPPING(DLS&M)
2	SUSTAINABLE ENGINEERING CONCEPTS & LIFE CYCLE ANALYSIS
3	Introduction to Airplane Performance
4	Cloud computing
5	Computer Organization and Architecture
6	Programming, Data structures and Algorithms using Python
7	Introduction to Modern Application Development
8	Plastic Waste Management
9	Digital Land Surveying And Mapping
10	Infra Structure Planning And Management
11	Principles Of Construction Management
12	Natural Hazards Part-1
13	Joining Technology for Metals
14	Surface Engineering for Nano Materials
15	Principles Of Casting Technology
16	Introduction To Abrasive Machining And Finishing Process
17	Manufacturing of Composites
18	Air Craft Stability & Control
19	Introduction To Electro Magnetic Theory
20	Product Design And Manufacturing
21	Programming, Datastructures & Algorithms Using Python
22	Programming In C++
23	Cloud Computing
24	Hardware Modeling using Verilog
25	Consumer Psychology
26	Introduction To Machine Learning
27	Data Science For Engineers
28	Integrated Waste Management for a Smart City
29	Plastic Working of Metallic Materials
30	Micro electronics : Devices to Circuits
31	Synthesis of Digital Systems
32	Ethical Hacking
33	Blockchain Architecture Design and Use Cases
34	Sensors and actuators
35	linear system theory
36	Water Economics and Governance
37	Glass in buildings : Design and applications
38	Introduction to Composites
39	Aircraft Propulsion
40	Introduction to internet of things
41	Computer Integrated Manufacturing
42	Hardware modeling using verilog


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43	The Joy of Computing using Python
44	Introduction to Machine Learning
45	Programming, Data Structures And Algorithms Using Python
46	Natural Language Processing
47	Introduction to algorithms and analysis
48	Social Networks
49	Electric vehicles and Renewable energy
50	Fabrication Techniques for MEMs-based sensors : clinical perspective
51	Software Development Fundamentals
52	Database Fundamentals
53	Windows® Server Administration Fundamentals
54	Security Fundamentals
55	Mobility and Device Fundamentals
56	HTML5 Application Development Fundamentals
57	Introduction to Programming using Python
58	Introduction to Programming using Java
59	Introduction to Programming using HTML and CSS
60	Mechanical Operations
61	Mechanical Operations
62	EFFECTIVE WRITING
63	EFFECTIVE WRITING
64	MECHANICAL UNIT OPERATIONS
65	STRESS MANAGMENT
66	CHEMICAL ENGINEERING REACTION-1
67	ECOLOGY AND ENVIRONMENT
68	FLUID FLOW OPERATIONS
69	Mechanical Operations
70	MECHANICAL UNIT OPERATIONS
71	RENEWABLE ENERGY ENGINEERING
72	VISUAL COMMUNICATION DESIGN FOR DIGITAL MEDIA
73	Biology for engineer and Other Non Biologists
74	Developing Soft Skills and Personality
75	Better Spoken English
76	Gender Justice and Workshop Security
77	Innovation Business Models and Entrepreneurship
78	Technical English for Engineers
79	Patent Drafting for Beginners
80	Introduction to Airplane Performance
81	Cloud computing
82	Introduction to History of Architecture in India
83	Discrete Mathematics
84	Introduction to Probability and Statistics
85	Soft skills
86	Programming, Data Structures and Algorithms using Python
87	Advanced Aircraft Maintenance
88	Water Society and Sustainability
89	Leadership
90	Introduction to Smart Grid
91	Recent Advances in Transmission Insulators
92	Python Developer


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93	Consumer Psychology
94	Effective Writing
95	Consumer Behavior
96	Enhancing Soft Skills and Personality
97	Crash Course on Python
98	Leadership Emotional Intelligence
99	Electric Vehicles and Mobility
100	Cyber Security Fundamentals
101	Introduction to Programming using Python
102	Introduction to Programming using Java
103	Azure Fundamentals
104	Data Fundamentals
105	AI Fundamentals
106	Microsoft 365 Fundamentals



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DATA ANALYTICS WITH PYTHON

PROF. A RAMESH

Department of Management Studies
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

INTENDED AUDIENCE : Management, Industrial Engineering and Computer Science Engineering Students

INDUSTRIES APPLICABLE TO : Any analytics company

COURSE OUTLINE :

This course includes examples of analytics in a wide variety of industries, and we hope that students will learn how one can use analytics in their career and life. One of the most important aspects of this course is that hands-on experience creating analytics models will be shared.

ABOUT INSTRUCTOR :

Prof. Ramesh Anbanandam graduated in Production Engineering from Madras University, Chennai. He did his post-graduation from National Institute of Technology, Trichy. He later earned his Ph.D. in Supply Chain Management from Indian Institute of Technology Delhi. His professional interest includes Humanitarian Supply Chain Management, Operations Management, Operations Research, Healthcare Waste Management, Sustainable Multi-modal and Freight Transportation, Transportation Asset Management and Advanced Data Analytics using Python and R-programming. He has published various research articles in reputed journals. He was also awarded Emerald Literati Award for Excellence under "Highly Commended Research Paper in the Year 2011 and 2016" in the field of Supply Chain Management.

COURSE PLAN :

Week 1: Introduction to data analytics and Python fundamentals

Week 2: Introduction to probability

Week 3: Sampling and sampling distributions

Week 4: Hypothesis testing

Week 5: Two sample testing and introduction to ANOVA

Week 6: Two way ANOVA and linear regression

Week 7: Linear regression and multiple regression

Week 8: Concepts of MLE and Logistic regression

Week 9: ROC and Regression Analysis Model Building

Week 10: χ^2 Test and introduction to cluster analysis

Week 11: Clustering analysis

Week 12: Classification and Regression Trees (CART)

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COMPUTATIONAL GEOMETRY

PROF. AMIT KUMAR

Department of Computer Science and Engineering
IIT Delhi

TYPE OF COURSE : Rerun | Elective | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Data Structures and Algorithms

INTENDED AUDIENCE : 4 th year undergraduate or beginning graduate students

COURSE OUTLINE :

The course covers lessons in Introduction using Basic Visibility Problems , The Maximal Points Problem, The Plane Sweep Technique and applications ,Convex Hull Different Paradigms and Quickhull , Dual Transformation and Applications , Lower Bounds on Algebraic tree model , Point Location and Triangulation , Voronoi Diagram and Delaunay Triangulation , Randomized Incremental Construction and Random Sampling , Arrangements and Levels , Range Searching , Clustering Point Sets using Quadtrees and Applications , Epsilon-Nets VC Dimension and Applications , Shape Analysis and Shape Comparison.

ABOUT INSTRUCTOR :

Prof. Amit Kumar is Tarwinder and Jaswinder Chadha Chair Professor in the Dept. of Computer Science and Engineering at IIT Delhi. He obtained B.Tech. degree from IIT Kanpur in 1997 and Ph.D. from Cornell University in 2002. He works in the area of combinatorial optimization, with emphasis on problems arising in scheduling, graph theory and clustering. He received IBM Faculty Award in 2005, INAE (Indian National Academy of Engineering) Young Engineer Award in 2006 and INSA (Indian National Science Academy) Medal for Young Scientists in 2011. He was a Max Planck-India partner group research fellow during 2005-09. He received the prestigious Shanti Swarup Bhatnagar Award for Mathematical Sciences in 2018, and was elected Fellow of Indian Academy of Sciences in 2019.

COURSE PLAN :

Week 1: Introduction and Basic Problems

Week 2: Plane Sweep Technique

Week 3: Convex Hull and Algorithm

Week 4: Duality Transform and Application

Week 5: Lower Bound Techniques

Week 6: Point Location and Triangulation

Week 7: Voronoi Diagram and Delaunay Triangulation

Week 8: Arrangements and Levels

Week 9: Range Search

Week 10: Clustering Point sets using Quadtrees and Applications

Week 11: Epsilon-nets and VC Dimension

Week 12: Shape Analysis

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THE JOY OF COMPUTING USING PYTHON

PROF. SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

INTENDED AUDIENCE : Any interested audience

PREREQUISITES : 10th standard/high school

INDUSTRY SUPPORT : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

COURSE PLAN :

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!

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INTRODUCTION TO MACHINE LEARNING

PROF. BALARAMAN RAVINDRAN

Department of Computer Science and Engineering
IIT Madras

PRE-REQUISITES : We will assume that the students know programming for some of the assignments. If the students have done introductory courses on probability theory and linear algebra it would be helpful. We will review some of the basic topics in the first two weeks as well.

INTENDED AUDIENCE : This is an elective course. Intended for senior UG/PG students. BE/ME/MS/PhD

INDUSTRIES APPLICABLE TO : Any company in the data analytics/data science/big data domain would value this course

COURSE OUTLINE :

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

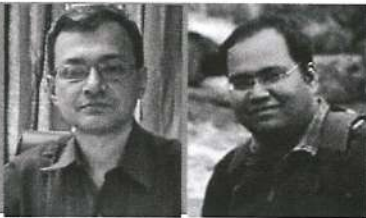
ABOUT INSTRUCTOR :

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

COURSE PLAN :

- Week 0:** Probability Theory, Linear Algebra, Convex Optimization - (Recap)
- Week 1:** Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance
- Week 2:** Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares
- Week 3:** Linear Classification, Logistic Regression, Linear Discriminant Analysis
- Week 4:** Perceptron, Support Vector Machines
- Week 5:** Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation
- Week 6:** Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures
- Week 7:** Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting
- Week 8:** Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks
- Week 9:** Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation
- Week 10:** Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering
- Week 11:** Gaussian Mixture Models, Expectation Maximization
- Week 12:** Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)


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COMPUTER NETWORKS AND INTERNET PROTOCOL

PROF. SOUMYA KANTI GHOSH

Department of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PROF. SANDIP CHAKRABORTY

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : CSE, ECE, EE students

INDUSTRIES APPLICABLE TO : IT industries

COURSE OUTLINE :

The domain of Internet has grown in a rapid pace from traditional circuit switched and packet switched small scale networks to modern high-speed mobile and wireless Internet. A large number of methods, architectures and designs came up at every protocol level to cope up with the demands for developing a secure and highly dependable information technology infrastructure. The broad objective of the course is to understand - (i) the architecture and principles of today's computer networks, (ii) the protocols and their functionalities, (iii) the requirements for the future Internet and its impact on the computer network architecture. In this course, we'll broadly cover the basic TCP/IP protocol stack and touch on the next generation computer networks. We'll take a top-down approach to cover different protocols at the TCP/IP protocol stack.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

Prof. Sandip Chakraborty received Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Guwahati. Presently, he is an Assistant Professor with Department of Computer Science and Engineering, IIT Kharagpur. He has around 100 research papers in reputed journals and conference proceedings. His research interests include computer systems, distributed systems and mobile computing.

COURSE PLAN :

Week 1 : Introduction to Computer Networks History, Circuit Switching and Packet Switching

Week 2 : TCP/IP Protocol Stack – Basic Overview

Week 3 : Application Layer Services (HTTP, FTP, Email, DNS)

Week 4 : Transport Layer Primitives – Connection Establishment and Closure

Week 5 : Flow Control and Congestion Control at the Transport Layer

Week 6 : Transmission Control Protocol – Basic Features, TCP Congestion Control

Week 7 : Network Layer Primitives – IP Addressing

Week 8 : IP Routing – Intra Domain Routing Protocols, Inter Domain Routing Protocols (BGP)

Week 9 : IP Services – SNMP, ARP

Week 10 : Data Link Layer Service Primitives – Forwarding, Flow Control, Error Control

Week 11 : Media Access Control - Channel Access Protocols, Framing

Week 12 : End to End Principles of Computer Networks


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PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development


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DIGITAL SYSTEM DESIGN

PROF. NEERAJ GOEL

Department of CSE
IIT Ropar

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 Weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 20222

INTENDED AUDIENCE : CSE, EE, ECE undergraduate students

INDUSTRIES APPLICABLE TO : Any VLSI related company: Intel, AMD, TI, nVIDIA, Qualcomm, etc.

COURSE OUTLINE :

Digital system design course focuses on design digital system from scratch. The course focuses on designing combinational and sequential building blocks, using these building blocks to design bigger digital systems. During this course we also learn how to use Verilog to design/model a digital system.

ABOUT INSTRUCTOR :

Prof. Neeraj Goel is an Assistant Professor in the Department of Computer Science and Engineering at IIT Ropar. His research interest includes processor architecture, SoC design, SoC modeling and low power design. He received B.Tech degree in Electronics and communication from NIT Kurukshetra, M.Tech degree in VLSI Design Tools and Technology from IIT Delhi and PhD in Computer Science and Engineering from IIT Delhi.

COURSE PLAN :

Week 1: Introduction of digital systems. Number system

Week 2: Number representation: BCD, floating point numbers

Week 3: Boolean algebra, application of Boolean algebra in minimization of Boolean expressions

Week 4: Boolean minimization using K-map and Quine McCluskey method. Introduction to Verilog

Week 5: MSI Logic: Multiplexer, encoder, decoder

Week 6: Arithmetic circuits: Adder, subtractor, multiplier, comparator

Week 7: Latches and flipflop (SR, JK, T, D), counters

Week 8: Sequential logic like Registers, introduction to behavior modeling in Verilog

Week 9: Finite state machine, state graphs and tables.

Week 10: Reduction of state table and state assignments. Arithmetic circuits using sequential design.

Week 11: Register transfer level (RTL) design, RTL design examples

Week 12: FPGA, VLSI design flow using HDL, introduction to behavior, logic and physical synthesis.


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FUNDAMENTALS OF SEMICONDUCTOR DEVICES

PROF. DIGBIJOY N. NATH

Centre for Nano Science and Engineering (CeNSE)
IISc Bangalore

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : High school physics & math, 10+2 physics

INTENDED AUDIENCE : Students pursuing B.E./B.Tech in ECE/EE, or M. Sc Physics

INDUSTRIES APPLICABLE TO : Semiconductor

COURSE OUTLINE :

This course seeks to cover the basics of semiconductor devices including the physics of energy bands, doping and carrier statistics and transport leading up to the understanding of common semiconductor devices including p-n junctions and their applications, BJTs and MOSFETs. The course will also give a flavour of the basics of compound semiconductors and their devices, and also touch base with opto-electronic devices such as solar cells, photodetectors and LEDs. The course will ensure that undergraduates, college teachers and other interested audience with no background in semiconductors are able to grasp the content. In parallel, the course will consistently seek to engage the audience by giving real-life examples pertaining to the content, and also seek to calibrate the content with respect to practical and commercial technologies which are all around us and which use semiconductor devices. There will be enough food for thought even for advanced learners such as PhD students and active researchers.

ABOUT INSTRUCTOR :

Prof. Digbijoy N. Nath completed his B.E. (Hons) in Electrical and Electronics Engineering from BITS, Pilani (Rajasthan) and PhD in Electrical Engineering from Ohio State University, Columbus specializing in gallium nitride based semiconductor devices. He has been as Assistant Professor at Centre for Nano Science and Engineering (CeNSE) at Indian Institute of Science (IISc), Bangalore since Aug 2014. His research interests lie in wide band gap semiconductor devices for high power & RF electronics/deep-UV opto-electronics. He has authored/co-authored 46 publications so far.

COURSE PLAN :

- Week 1:** Importance of semiconductor devices and their diverse applications. Introduction to semiconductors, concept of energy bands
- Week 2:** Equilibrium electron-hole concentration, temperature-dependence. Carrier scattering and mobility, velocity saturation, Drift-diffusion transport
- Week 3:** Excess carrier decay & recombination, charge injection, continuity equation, quasi-Fermi level
- Week 4:** p-n junction: static behaviour
- Week 5:** Zener and avalanche breakdown, Capacitance-voltage profiling, metal/semiconductor junction
- Week 6:** MOS capacitor, charge/field/energy bands, accumulation, inversion, C-V (high and low frequencies)
- Week 7:** MOSFET: structure and operating principle, derivation of I-V, gradual channel approximation, substrate bias effects
- Week 8:** Introduction to compound semiconductors & alloys, commonly used compound semiconductors
- Week 9:** BJT: working principle, DC parameters and current components, base transport factor, Early Effect, charge control equation & current gain
- Week 10:** (Basics of) - transistors for high-speed logic, transistors for high frequency (RF), transistors for high power switching
- Week 11:** Solar cells: principle, efficiency, Fill factor, Shockley-Quiesser limit, silicon solar cells, multi-junction solar cell
- Week 12:** LEDs: working principle, radiative/non-radiative recombination, various types of efficiencies

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PRINCIPLES OF INDUSTRIAL ENGINEERING

PROF. D K DWIVEDI

Department of Mechanical Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 24 Apr 2022

INTENDED AUDIENCE : UG/PG Students of Industrial Engineering & Practicing Engineers

COURSE OUTLINE :

The course content is designed to have systematic and comprehensive understanding on various aspects related with industrial engineering and its relevance in the industrial environment. It is proposed to include organizational structure, plant location and plant layout, production planning and control, scheduling, forecasting, statistical quality control, total quality management, work study, method study and work measurement, ergonomics. Presentations will be supported with case studies for effective communication of concepts and techniques.

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering), in 1993 from GEC Rewa, ME (welding engineering) from Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 14 years at IIT Roorkee in subjects related to manufacturing at UG level and Welding Engineering related subjects at PG level. He has published more than 120 research papers in SCI/SCIE indexed journals and undertaken 20 sponsored research and 50 industrial consultancy projects. He has authored two books entitled "Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013) and Surface Engineering with Springer, New Delhi (2018).

COURSE PLAN :

Week 1 : 1. Introduction 2. Introduction: Developments, Objectives, & Functions 3. Introduction: Functions and tools 4. Tool of IE and Organizational Structure 5. Organizational Structure\

Week 2 : 6. Organizational Structure: Roles 7. Organizational Structure: Types 8. Organizational Structure: Product Strategies 9. Organizational Structure: Process & Product Organization 10. Organizational Structure and culture

Week 3 : 11. Organizational Structure: Principles 12. Plant Location & Layout: Selection of Site 13. Plant Location & Layout: Factor Affecting Selection of Site 14. Plant Location & Layout: Methods for Selection of Site 15. Plant Location & Layout: Methods for Selection of Site II

Week 4 : 16. Plant Location & Layout: Methods for Selection of Site III 17. Plant Location & Layout: Methods for Selection of Site IV 18. Plant Layout: Purpose and Types of Layout 19. Plant Layout: Types of Layout 20. Plant Layout: Cellular and Process Layout

Week 5 : 21. Plant Layout: Process Layout Design 22. Plant Layout: Process Layout Design II 23. Plant Layout: Product Layout Design 24. Organization of Facility 25. Organization of Facility & Material Handling

Week 6 : 26. Material Handling 27. Production Planning and Control: Scope 28. Production Planning and Control: Scope II 29. Production Planning and Control: Capacity Planning 30. Production Planning and Control: Capacity Planning & Scheduling

Week 7 : 31. Production Planning and Control: MRP, Routing, Scheduling 32. Production Planning and Control: Scheduling 33. Production Planning and Control: Priority Sequencing 34. Production Planning and Control: Priority Sequencing II 35. Production Planning and Control: Relative Performance of Priority Sequencing Rules

Week 8 : 36. Inventory: Fundamentals 37. Inventory: Models 38. Inventory: Models II 39. Inventory: Wilson Model 40. Inventory: Gradual Replenishment Model

Week 9 : 41. Project Management & Network Modelling: Introduction 42. Network Modelling: PERT 43. Network Analysis: PERT 44. Network Analysis: PERT II 45. Network Analysis: Crashing Network and CPM

Week 10: 46. Network Analysis: Critical Path Method 47. Forecasting: Introduction 48. Forecasting: Methods 49. Forecasting: Methods II 50. Forecasting: Methods III

Week 11: 51. Forecasting: Methods IV 52. Forecasting: Methods V 53. Quality Control: Introduction 54. Quality Control: Fundamentals 55. Quality Control: SPC

Week 12: 56. Quality Control: SPC II 57. Quality Control: Control Charts 58. Quality Control: Control Charts II 59. Quality Control: Control Charts for Attributes 60. Productivity & Work Study



ELEMENTS OF SOLAR ENERGY CONVERSION

PROF. JISHNU BHATTACHARYA

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Basic UG thermodynamics, UG heat transfer, basic electronics, basic engineering mathematics

INTENDED AUDIENCE : Any Interested Learners

INDUSTRIES APPLICABLE TO : Any solar energy based company. Such a course is non-existent in most curricula in India and it was the industry persons whose suggestions initiated the course.

COURSE OUTLINE :

This course intends to introduce the basic concepts required for the engineers to work in the field of solar energy technology, both industrial installations and research endeavours. The major focus is on the following topics: the apparent movement of the sun, irradiation prediction, intensity estimation on tilted plane, flat plate collectors, concentrating collectors of various kinds, thermal and photovoltaic routes of solar energy conversion. The course assumes basic knowledge in UG level thermodynamics, optics, semiconductor physics, heat transfer and engineering mathematics. The advanced UG ME students and the PG ME students intending to work in the solar energy field should opt for this course.

ABOUT INSTRUCTOR :

Prof. Jishnu Bhattacharya is an associate professor in Mech. Engg. in IIT, Kanpur. He works in the field of energy storage and conversion through sustainable routes. He teaches courses related to thermodynamics, heat transfer, air-conditioning, atomistic simulations for energy materials, electrochemical energy storage, solar energy conversion etc. Prior to IIT Kanpur, he was associated with IIT Kharagpur, Northwestern University, University of Michigan, Indian Institute of Science and Bengal Engineering College, Shibpur in reverse chronological order.

COURSE PLAN :

Week 1: Basic concepts related to solar radiation, the sun, spectral distribution, sun- earth relationship, extraterrestrial radiation, revolution of earth, seasons, position of sun in the sky, position of sun with respect to the center of the earth

Week 2: Concept of time, equation of time, solar time, standard time, Role of atmosphere on solar radiation, air mass, terrestrial spectrum, prediction of solar radiation

Week 3: Diffuse and direct radiation, derivation of the relationships between angles

Week 4: Sign conventions, angle of incidence on a tilted plane, shading, sun-path diagram, overhangs, parallel rows of solar collectors, measurement of radiation

Week 5: Estimation of total irradiance on a tilted surface, radiation augmentation

Week 6: Flat plate collector, thermal analysis, heat removal factor

Week 7: Air heaters, thermal analysis of air heaters, overview of other thermal collectors, testing procedure

Week 8: Single axis tracking, concentrating collectors, theoretical limit, classifications of concentrators

Week 9: Parabolic trough collector, thermal analysis, compound parabolic concentrators, parabolic dish collector, central receiver tower

Week 10: Non-thermal routes for solar energy conversion, Basics of photovoltaic effect, Electron-hole carrier formation and motion

Week 11: Band bending, photovoltaic generation, P-N junction diode, forward Bias, reverse bias

Week 12: Dark current, light-generated current, IV characteristic curve for P-N junction diodes, efficiency, effect of temperature intensity and spectrum, Comparative discussion on different solar conversion technologies in the state of the art form and the future directions


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



WELDING PROCESSES

PROF. MURUGAIYAN AMIRTHALINGAM

Department of Metallurgy and Material Science
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Graduates of Metallurgical/Mechanical/Automobile/Production Engineering

INTENDED AUDIENCE : Masters students in Metallurgical, Mechanical, Automobile and Production Engineering. Practicing welding engineers, welders, R&D personnel in academia and national laboratories, quality management personnel from welding and manufacturing industries and research scholars who are working in welding and joining.

INDUSTRIES APPLICABLE TO : Construction, Fabrication, Automobile and Power generation industries and research labs

COURSE OUTLINE :

The modern material assemblies require the combined use of alloys for a given commercial application. Welding technologies are of critical importance for the construction of virtually all components of the assemblies. This course aims to elaborate the physical principles of arc, plasma, laser, resistance spot, electron beam and solid state welding processes. This includes, physics of electric arc-plasma, engineering the arc-plasma for welding, metal transfer and mass flow in the weld pool, laser/electron beam - material interactions, pressure and force balance in keyhole mode power beam welding, fundamentals of heat generation by Joule heating and process principles and overview on types of resistance and solid state welding processes.

ABOUT INSTRUCTOR :

Prof. Murugaiyan Amirthalingam is currently working as an Assistant Professor in IIT-Madras. His research and teaching interests include welding metallurgy, welding processes development, steel product development and additive manufacturing.

COURSE PLAN :

Week 1: Introduction to the course

Week 2: Physics of welding arc – Part I

Week 3: Physics of welding arc – Part II

Week 4: Introduction to arc welding processes – Part I

Week 5: Electrical power sources for welding

Week 6: Introduction to arc welding processes – Part II

Week 7: Fundamentals of resistance welding – Part I

Week 8: Fundamentals of resistance welding – Part II

Week 9: Introduction to power beam welding processes Plasma, laser and electron beam welding processes

Week 10: Principles of power beam welding processes

Week 11: Introduction to pressure welding processes

Week 12: Principles and operational considerations of pressure welding processes


REGISTRAR
J.N.T.U. Anantapur
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FUNDAMENTALS OF COMBUSTION

PROF. V. RAGHAVAN

Department of Mechanical Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 Weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

INTENDED AUDIENCE : UG, PG, MS and PhD students doing research in Combustion and related areas

INDUSTRIES APPLICABLE TO : TATA steels, Thermax, BHEL

COURSE OUTLINE :

To enable students to apply the knowledge of thermodynamics to combustion. To emphasize the basics of fuels, stoichiometry, chemical kinetics and equilibrium, mass transfer, and different types of combustion process. To explain the mathematics involved in transport processes of a reactive flow, simplifications involved and the parameters affecting different types of combustion processes.

ABOUT INSTRUCTOR :

Prof. Vasudevan Raghavan is currently working as Professor in the Department of Mechanical Engineering, Indian Institute of Technology Madras (IITM), India. He obtained his PhD degree from IITM and has carried out his post-doctoral research in the University of Nebraska-Lincoln, USA, microgravity droplet combustion simulations. His areas of research include Computational Fluid Dynamics applied to reacting flows, laminar flames, fire modelling, evaporation and combustion of liquid fuel droplets, flame spread and liquid fuel pool combustion, gasification and combustion of coal and biomass. Prof. Raghavan has graduated 10 PhD students and 18 MS students till July 2020. He has authored about 112 international peer reviewed journal articles, 60 international conference articles and a book on Combustion Technology, 'Essentials of Flames and Burners', published by ANE Publishers and John Wiley & Sons Ltd., UK, 2016. He teaches graduate courses such as Theory of Fire Propagation, Fundamentals of Combustion, Combustion Technology and Applied Thermodynamics at the Department of Mechanical Engineering in IITM.

COURSE PLAN :

Week 1: Fuels and their properties

Week 2: Review of basic thermodynamics of ideal gas mixtures

Week 3: Stoichiometry

Week 4: First and Second Laws of Thermodynamics applied to combustion; Heat, temperature and composition of products in equilibrium

Week 5: Mass transfer basics

Week 6: Fundamentals of combustion kinetics

Week 7: Governing equations for a reacting flow

Week 8: General characteristics of combustion flame and detonation

Week 9: Laminar flame propagation-Flammability limits and quenching of laminar flames-Ignition-Flame stabilization

Week 10: Gas jets and combustion of gaseous fuel jets

Week 11: Turbulent premixed and non-premixed flames

Week 12: Droplet evaporation and combustion; Combustion of a carbon particle


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



SIX SIGMA

PROF. JITESH J. THAKKAR
Department of Management Studies
IIT Kharagpur

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)
EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Statistics

INTENDED AUDIENCE : Mechanical Engineering, MBA, Industrial Engineering

INDUSTRIES APPLICABLE TO : Manufacturing and Service Industry

COURSE OUTLINE :

The course on Six-Sigma will focus on detailed strategic and operational issues of process improvement and variation reduction. Six-sigma is a measure of quality that strives for near perfection. It is a disciplined, data-driven approach for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process-from manufacturing to transactional and from product to service. A Six-sigma defect is anything outside of customer specifications. To be tagged Six Sigma, a process must not produce more than 3.4 defects per million opportunities. Six-sigma employs a systematic approach of DMAIC (Define, Measure, Analyze, Improve and Control) for the process improvement. This course will provide a detailed understanding on various issues specific to each phase of DMAIC.

ABOUT INSTRUCTOR :

Prof. Jitesh J. Thakkar is a Professor at National Rail and Transportation Institute (NRTI), Vadodara – India's first University dedicated in the field of Rail and Transportation education. He has served as a faculty at Department of Industrial and Systems Engineering, IIT Kharagpur for 10 years. He has professional experience of more than 20 years. He holds a Ph.D in Supply Chain Management from IIT Delhi, M.Tech. in Industrial Engineering from IIT Delhi and Bachelors of Engineering in Mechanical Engineering conferred with Gold Medal from one of the oldest Government Engineering College - Birla Vishvakarma Mahavidyalaya Engineering College, Sardar Patel University. His areas of interests include Transportation Management, Logistics and Supply Chain Management, Project Management, Service Operations Management, Six Sigma, Lean Manufacturing, Optimization, Statistical Modeling and System Dynamics. He has supervised 14 Ph.D and 80 B.Tech./M.Tech. projects at IIT Kharagpur. He is a productive researcher with H-index 24 and 70 research papers published in SCI/SCOPUS listed journals. He has extensively published in the high impact factor international journals such as International Journal of Production Economics, Transportation Research (Part- E), International Journal of Production Research, Computers and Industrial Engineering, Production Planning and Control, Expert Systems with Applications, Journal of Cleaner Production. He has published two books – Structural Equation Modeling and Project Management with Springer. He has executed more than 5.0 crore rupees of research and consultancy projects. He has extended training/consulting to various organizations such as L&T, DRDO, Food Corporation of India, Neyveli Lignite Corporation, Tata Steel, Tata Hitachi, Essar Steel, Ordnance Factory, Lakshmi Machine Works Ltd., Godrej, Qatar Chemical. His online course on "Six Sigma" offered by NPTEL has been attended by more than 20,000 University students and Industry professionals in last five years. He has delivered more than 100 invited sessions at various reputed platforms. He has been invited as a faculty expert by IIT Kanpur, IIT Madras, IIM Indore, NITIE Mumbai, NIT Surat, NIT Trichy, IRMA, AMA, BCCI Kolkata, L&T-PMI.

COURSEPLAN:

Week 1 : Quality: Fundamentals And Key Concepts

Week 2 : Quality: Fundamentals And Key Concepts

Week 3 : Define

Week 4 : Measure

Week 5 : Measure,cont'd

Week 6 : Analyze

Week 7 : Analyze,cont'd

Week 8 : Improve

Week 9 : Improve,cont'd

Week 10 : Control

Week 11 : Control,cont'd

Week 12 : Six Sigma Implementation Challenges


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



MAINTENANCE AND REPAIR OF CONCRETE STRUCTURES

PROF. RADHAKRISHNA G. PILLAI

Department of Civil Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Completed 3rd year of a Bachelor program in civil engineering

INTENDED AUDIENCE : Undergraduate Students, Graduate students, research scholars, practicing engineers, repair experts, and scientists, working in the areas of concrete science and technology

INDUSTRIES APPLICABLE TO : Govt. agencies and public/private companies involved in the design, construction, and maintenance of concrete structures: • Govt agencies: National Highway Authority (NHAI), Central Public Works Department (CPWD) and PWD/Housing departments of various states • Chemical manufacturers: BASF, SIKA corporation, Euclid chemicals, and other chemical admixture companies • Cement companies: ACC Ltd., Ambuja cement, JSW cement Ltd, JK Cement Ltd, Penna Cement Industries Ltd, Ultratech cement Ltd.

COURSE OUTLINE :

This course will help students learn how to identify various deterioration mechanisms or damage mechanisms in concrete structures (say, deterioration of metallic reinforcement and cementitious materials). The course will discuss the scientific aspects and its use while practicing repair works at site. Use of various non-destructive, partially-destructive tools to assess the condition of the structure will be discussed. Also, tips on selecting measurable parameters that are useful in deciding the further repair and maintenance practices will be provided.

ABOUT INSTRUCTOR :

Prof. Radhakrishna G. Pillai is an Associate professor at the Department of Civil Engineering at the Indian Institute of Technology Madras, Chennai, India, where he is working since 2010. He earned his M.S. and Ph.D. in Civil Engineering from Texas A and M University (TAMU), College Station, Texas, USA. He has co-authored more than 70 publications in the areas of structural and materials performance, concrete technology, and corrosion mechanisms and service life estimation in concrete structures. In addition, he is a lead investigator for various research projects funded by public and private agencies involving corrosion, condition assessment and restoration of concrete structures.

COURSE PLAN :

Week 1: Introduction, significance of corrosion, and corrosion mechanisms

Week 2: Embedded metal corrosion

Week 3: Deterioration of cementitious systems – Sulphate and Acid attack

Week 4: Deterioration of cementitious systems – Alkali Silica Reaction (ASR), Shrinkage, and others

Week 5: Concrete assessment using non-destructive tests (NDT)

Week 6: Concrete assessment and load effects

Week 7: Surface repair – Condition assessment

Week 8: Surface repair – Analysis, strategy, and design

Week 9: Surface repair – Material requirement, surface preparation, placement of repair material

Week 10: Strengthening and stabilization – Introduction and beam shear capacity strengthening

Week 11: Strengthening and stabilization – Column strengthening

Week 12: Strengthening and stabilization – Flexural strengthening

REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



SENSORS AND ACTUATORS

PROF HARDIK J PANDYA

Department of Electronic Systems Engineering
IISc Bangalore

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan'22 - 15 Apr'22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Basic Electronics

INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges

COURSE OUTLINE :

This course is designed with an aim of educating students in microtechnology and its use to fabricate sensors and systems. The students will have an exposure to sensors and its importance in the real world. The students will also be able to understand how to fabricate some of those sensors. They will have an exposure towards how to fabricate the sensors and its application in real world and understand and also learn modern day microsensors and micro actuators, how to simulate some of those sensors and characterise before fabricating it.

ABOUT INSTRUCTOR :

Prof. Hardik J. Pandya is an Assistant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is heading an Advanced Microsystems and Biomedical Devices Facility for Clinical Research as well as Biomedical and Electronic Engineering Systems Laboratory which focuses on the cutting-edge research on novel devices for solving unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc.

COURSE PLAN :

Week1: Basics of Energy Transformation: Transducers, Sensors and Actuators

Week2: Understanding of thin film physics: Application in MOSFET and its variants

Week3: Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)

Week 4: Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)

Week 5: Basic understanding of Photolithography for patterning layer. Detailed overview of Etching methods.

Week 6: Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors

Week 7: Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications

Week 8: Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications

Week 9: Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques.

Week 10: Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics

Week11: Understanding of Sensor Interfacing with Microprocessor to build electronic system

Week12: Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



LINEAR SYSTEMS THEORY

PROF. RAMKRISHNA PASUMARTHY

Department of Electrical Engineering
IIT Madras

PRE-REQUISITES : Linear Algebra, Differential Equations, Control Systems Engineering

INTENDED AUDIENCE : Graduate Students from Electrical / Mechanical/ Aerospace/ Chemical Engineering

COURSE OUTLINE :

This course will provide a thorough introduction to the theory of Linear Systems with emphasis on Control related concepts. First, mathematical models describing the fundamental properties that govern the behavior of systems will be developed. We will cover time invariant, time varying, continuous and discrete time systems. This course will cover concepts of stability, controllability, observability, and design and serve as necessary foundation for further study in the area of systems and control.

ABOUT INSTRUCTOR :

Prof. Ramkrishna Pasumarthi is currently an Assistant Professor at Department of Electrical Engineering, IIT Madras. He obtained his PhD in systems and control from University of Twente, The Netherlands and held post doc positions at University of Melbourne and UCLA. His research interests are in the areas of network science with applications to power, traffic cloud and brain networks. also associated with the Robert Bosch Center for Data Sciences and Artificial Intelligence at IIT Madras. He also has interests in medical wearable devices and is a co funder of a start up iMov Motion Tech pvt. ltd. incubated at IITM Research Park

COURSE PLAN :

- Week 1:** Introduction to Linear systems with Examples
- Week 2:** Math Preliminaries I - Vector Spaces, Bases, Coordinate Transformation, Invariant Subspaces, Inner product, Norms
- Week 3:** Math Preliminaries II - Rank, Types of Matrices, Eigen values, Eigen vectors, Diagonalization, Matrix Factorization
- Week 4:** State Transition Matrix, Solutions to LTI Systems, Solutions to LTV Systems
- Week 5:** Equilibrium points, Linearization, Types of Linearization with Examples
- Week 6:** Stability, Types of Stability, Lyapunov Equation
- Week 7:** Controllability, Reachability, Stabilizability, Tests, Controllable and Reachable Subspaces, Grammians, Controllable Decomposition
- Week 8:** Observability, Constructibility, Detectability, Tests, Subspaces, Grammians, State Estimation, Observable Decomposition
- Week 9:** Kalman Decomposition, Pole Placement, Controller Design
- Week 10:** Observer Design, Duality, Minimal Realization
- Week 11:** Basics of Optimal Control, LQR, Ricatti Equation
- Week 12:** LMIs in Control


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J.N.T.U. Anantapur
ANANTAPURAMU-515002



SENSORS AND ACTUATORS

PROF HARDIK J PANDYA

Department of Electronic Systems Engineering
IISc Bangalore

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan'22 - 15 Apr'22)

EXAM DATE : 24 Apr 2022

PRE-REQUISITES : Basic Electronics

INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges

COURSE OUTLINE :

This course is designed with an aim of educating students in microtechnology and its use to fabricate sensors and systems. The students will have an exposure to sensors and its importance in the real world. The students will also be able to understand how to fabricate some of those sensors. They will have an exposure towards how to fabricate the sensors and its application in real world and understand and also learn modern day microsensors and micro actuators, how to simulate some of those sensors and characterise before fabricating it.

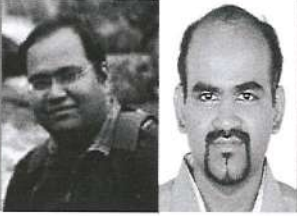
ABOUT INSTRUCTOR :

Prof. Hardik J. Pandya is an Assistant Professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is heading an Advanced Microsystems and Biomedical Devices Facility for Clinical Research as well as Biomedical and Electronic Engineering Systems Laboratory which focuses on the cutting-edge research on novel devices for solving unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc.

COURSE PLAN :

- Week1:** Basics of Energy Transformation: Transducers, Sensors and Actuators
- Week2:** Understanding of thin film physics: Application in MOSFET and its variants
- Week3:** Thin Film Deposition Techniques: Chemical Vapor Deposition (APCVD, LPCVD, UHVCVD, PECVD, ALCVD, HPCVD, MOCVD)
- Week 4:** Thin Film Deposition Techniques: Physical Vapor Deposition (Thermal Deposition, E-beam Evaporation, Sputtering, Pulsed Laser Deposition)
- Week 5:** Basic understanding of Photolithography for patterning layer. Detailed overview of Etching methods.
- Week 6:** Understanding various gas sensors: Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors
- Week 7:** Design and fabrication process of Microsensors: Force Sensors, Pressure Sensors, Strain gauges and practical applications
- Week 8:** Explain working principles of Actuators. Piezoelectric and Piezoresistive actuators, micropumps and micro actuators with practical applications
- Week 9:** Understanding basics of microfluidics to assist Photomask design using Clewin Software, pattern transfer techniques, PDMS moulding and degassing, device bonding techniques.
- Week 10:** Simulation, Optimization and characterization of various sensors using COMSOL Multiphysics
- Week11:** Understanding of Sensor Interfacing with Microprocessor to build electronic system
- Week12:** Static and Dynamic Characteristic Parameters for Sensors and Actuators, Calibration of Sensor based electronics systems


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BLOCKCHAIN ARCHITECTURE DESIGN AND USE CASES

PROF. SANDIP CHAKRABORTY

Dept. of Computer Science and Engineering
IIT Kharagpur

Dr. PRAVEEN JAYACHANDRAN

Research Staff Member
IBM

Technical Partner



TYPE OF COURSE	: Rerun Elective UG/	COURSE DURATION	: 12 weeks (29 Jul'19 - 18 Oct'19)
INTENDED AUDIENCE	: PG CSE, ECE, EE, Maths	EXAM DATE	: 17 Nov 2019
INDUSTRIES APPLICABLE TO	: IT Industries		

COURSE OUTLINE :

The widespread popularity of digital cryptocurrencies has led the foundation of Blockchain, which is fundamentally a public digital ledger to share information in a trustworthy and secure way. The concept and applications of Blockchain have now spread from cryptocurrencies to various other domains, including business process management, smart contracts, IoT and so on. This course is a joint venture from academia and industry, where the target is to cover both the conceptual as well as application aspects of Blockchain. This includes the fundamental design and architectural primitives of Blockchain, the system and the security aspects, along with various use cases from different application domains.

ABOUT INSTRUCTOR :

Prof. Sandip Chakraborty received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Guwahati, India. Presently, he is an Assistant Professor with Department of Computer Science and Engineering, IIT Kharagpur.

Dr. Praveen Jayachandran is a research staff member, master inventor and manager of the Blockchain and Smart Contracts team at IBM Research, India. His work spans different aspects of blockchain technology, including developing an enterprise-grade blockchain platform, development of smart contracts, and reimagining industry use cases in a blockchain world.

COURSE PLAN :

- Week 01** : Introduction to Blockchain
- Week 02** : Crypto Primitives and Bitcoin
- Week 03** : Consensus
- Week 04** : Permissioned Blockchain
- Week 05** : Hyperledger Fabric
- Week 06** : Fabric Demo
- Week 07** : Blockchain Use Cases - Finance
- Week 08** : Blockchain Use Cases - Industry
- Week 09** : Blockchain in Government and Blockchain Security
- Week 10** : Security and Research Aspects
- Week 11** : Research Aspects in Blockchain
- Week 12** : AI, Blockchain and Big Data


REGISTRAR
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ETHICAL HACKING

PROF. INDRANIL SENGUPTA

Dept. of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : Computer Science and Engineering / Information Technology / Electronics and Communication Engineering / Electrical Engineering

PREREQUISITES : Basic concepts in programming and networking

INDUSTRIES APPLICABLE TO : TCS, Wipro, CTS, Google, Microsoft, Qualcomm

COURSE OUTLINE

Ethical hacking is a subject that has become very important in present-day context, and can help individuals and organizations to adopt safe practices and usage of their IT infrastructure. Starting from the basic topics like networking, network security and cryptography, the course will cover various attacks and vulnerabilities and ways to secure them. There will be hands-on demonstrations that will be helpful to the participants. The participants are encouraged to try and replicate the demonstration experiments that will be discussed as part of the course.

ABOUT INSTRUCTOR

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 years of teaching and research experience. He has guided 22 PhD students, and has more than 200 publications to his credit in international journals and conferences. His research interests include cryptography and network security, VLSI design and testing, and mobile computing.

He is a Senior Member of IEEE. He had been the General Chairs of Asian Test Symposium (ATS-2005), International Conference on Cryptology in India (INDOCRYPT-2008), International Symposium on VLSI Design and Test (VDAT-2012), International Symposium on Electronic System Design (ISED-2012), and the upcoming Conference on reversible Computation (RC-2017). He had delivered invited and tutorial talks in several conferences in the areas of VLSI design and testing, and network security.

COURSE PLAN

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 Burp Suite, password attack using Burp Suite. Social engineering attacks and Denial of service attacks.

Week 10: Elements of hardware security: side-channel attacks, physical in-lab 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.



REGISTRAR
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COMPUTATIONAL ELECTROMAGNETICS

PROF. UDAY KHANKHOJE

Department of Electrical Engineering
IIT Madras

PRE-REQUISITES : Engineering Electromagnetics

INTENDED AUDIENCE : UG and PG students

INDUSTRIES APPLICABLE TO : ISRO, DRDO

COURSE OUTLINE :

This course on Computational Electromagnetics is targeted at senior undergraduate students and beginning graduate students who have taken a first course in Engineering Electromagnetics. The course covers the mathematical formulation of the main methods currently in use by the community, namely: Integral Equations Methods (and their solution by the Method of Moments), the Finite Element Method, and the Finite Difference Time Domain method. These methods are illustrated by their use in solving scattering problems and antenna radiation/impedance calculation problems. Additional topics include introduction to inverse problems, calculating the mutual coupling between antennas, finding the electromagnetic modes of a waveguide, and techniques to hybridize the Finite Element Method with the Integral Equation Method. Programming issues faced in the implementation of these methods will also be highlighted.

ABOUT INSTRUCTOR :

Prof. Uday Khankhoje is an Assistant Professor of Electrical Engineering at the Indian Institute of Technology Madras, Chennai, India, since 2016. He received a B.Tech. degree from the Indian Institute of Technology Bombay, Mumbai, India, in 2005, an M.S. and PhD. degrees from the California Institute of Technology (Caltech), Pasadena, USA, in 2010, all in Electrical Engineering. He was a Caltech Postdoctoral Scholar at the Jet Propulsion Laboratory (NASA/Caltech) from 2011-2012, a Postdoctoral Research Associate in the Department of Electrical Engineering at the University of Southern California, Los Angeles, USA, from 2012-2013, and an Assistant Professor of Electrical Engineering at the Indian Institute of Technology Delhi from 2013-2016. His research interests are in the area of computational electromagnetics and its applications to remote sensing and inverse imaging. He received an Institute award for teaching excellence at IIT Delhi in 2015 for an undergraduate course on electromagnetism.

COURSE PLAN :

Week 1: Review of vector calculus, electromagnetic fields, and an overview of computational electromagnetics

Week 2: Numerical integration, Introduction to integral equations, and the Helmholtz equation

Week 3: Surface integral equations in 2D, Green's functions

Week 4: Solving surface integral equations by method of moments

Week 5: Solving volume integral equations by method of moments, Introduction to finite element methods

Week 6: Finite element method in 1D

Week 7: Finite element method in 2D

Week 8: Finite difference time domain method - introduction

Week 9: Finite difference time domain method - materials and boundary conditions

Week 10: Finite difference time domain method - perfectly matched layers

Week 11: Applications of CEM -- inverse problems and antenna radiation problems

Week 12: Applications of CEM -- antenna radiation problems and hybrid methods


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



SYNTHESIS OF DIGITAL SYSTEMS

PROF. PREETI RANJAN PANDA

Dept. of Computer Science and Engineering
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG
COURSE DURATION : 12 weeks (29 Jul'19 - 18 Oct'19)
EXAM DATE : 17 Nov 2019

PRE-REQUISITES : Digital Design (or Logic Design), Data Structures

INDUSTRY SUPPORT : Synopsys, Cadence Design Systems, Mentor Graphics, Intel, NXP, IBM

COURSE OUTLINE

This course is about the automatic generation of digital circuits from high-level descriptions. Modern electronic systems are specified in Hardware Description Languages and are converted automatically into digital circuits. We will introduce the VHDL Hardware Description Language, and follow it up with a discussion of the basics of synthesis topics including High-level Synthesis, FSM Synthesis, Retiming, and Logic Synthesis.

ABOUT INSTRUCTOR

Prof. Preeti Ranjan Panda received his B. Tech. degree in Computer Science and Engineering from the Indian Institute of Technology Madras and his M. S. and Ph.D. degrees in Information and Computer Science from the University of California at Irvine. He is currently a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Delhi. He has previously worked at Texas Instruments, Bangalore, India, and the Advanced Technology Group at Synopsys Inc., Mountain View, USA, and has been a visiting scholar at Stanford University. His research interests are: Embedded Systems Design, CAD/VLSI, Post-silicon Debug/Validation, System Specification and Synthesis, Memory Architectures and Optimisations, Hardware/Software Codesign, and Low Power Design.

COURSE PLAN

- Week 1** : Course Outline and Introduction to VLSI Design Automation
- Week 2** : Hardware Description Languages and VHDL
- Week 3** : Specifying Behaviour and Structure in HDL
- Week 4** : Introduction to High-level Synthesis
- Week 5** : Compiler Transformations in High-level Synthesis
- Week 6** : Scheduling
- Week 7** : Register Allocation and Timing Issues
- Week 8** : Finite State Machine Synthesis
- Week 9** : The Retiming Problem
- Week 10** : Introduction to Logic Synthesis and Binary Decision Diagrams
- Week 11** : Two-level and Multi-level Logic Optimisation
- Week 12** : Technology Mapping, Timing Analysis, and Physical Synthesis

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MICROELECTRONICS: DEVICES TO CIRCUITS

PROF. SUDEB DASGUPTA

Department of Electronics & Communication Engineering
IIT Roorkee

INTENDED AUDIENCE : Any Interested Learners

PRE-REQUISITES : First course on linear circuit analysis, A basic course on Semiconductor Devices and Digital Electronics. A course on Computer Organization will be also helpful (though not strictly required).

INDUSTRIES APPLICABLE TO : Cadence; Synopsys; ST Microelectronics; NXP Semiconductors; Semiconductor Complex Limited; Design House in general

COURSE OUTLINE :

This course is intended for the core courses in Electronics Circuits taught to undergraduates in Electrical and Computer Engineering. The objective of this course is to develop the ability to analyse and design electronic circuits both analog and digital, discrete and integrated. The course starts with the basics of the device most seldom encountered in mixed designs and then go on to do circuit analysis in the later parts.

ABOUT INSTRUCTOR :

Prof. S. Dasgupta, is presently working as an Associate Professor, in Microelectronics and VLSI Group of the Department of Electronics and Communication Engineering at Indian Institute of Technology, Roorkee. He received his PhD degree in Electronics Engineering from Institute of Technology-Banaras Hindu University (currently IIT-BHU), Varanasi in 2000. During his PhD work, he carried out research in the area of effects of ionizing radiation on MOSFET. Subsequently, he was member of faculty of Department of Electronics Engg., at Indian School of Mines, Dhanbad (currently IIT-Dhanbad). In 2006, he joined as an Assistant Professor in the Department of Electronics and Communication Engineering at Indian Institute of Technology, Roorkee. He is currently the Chairman, Faculty Search Committee of the Department. He has authored/co-authored more than 200 research papers in peer reviewed international journals and conferences. His citations are around 2400 (after 2006) and h-index and i-index are 25 and 65 respectively. He is a member of IEEE, EDS, ISTE and associate member of Institute of Nanotechnology, UK. He has been a technical committee member International Conference on Micro-to-Nano, 2006; VDAT-2012, 13, 14, 15, 16, 17 and 18. He worked as the Organising Chair and Program Co-Chair for VDAT-2017 held at IIT Roorkee. He is also heading the Technical Program Group for Emerging Devices at VLSI Design Conference. He has presented tutorial in VDAT-2014 and VLSI Design Conference, Bangalore 2015 amongst many others. He has also been member of technical committees of various international conferences. He has presented large number of invited and keynote talk at various technical forum. He was awarded with Erasmus Mundus Fellowship of European Union in the year 2010 to work in the area of RDF at Politecnico Di Torino, Italy. He is the recipient of prestigious IUSSTF to work in the area of SRAM testing at University of Wisconsin at Madison, USA in the year 2011-12. He was also awarded with DAAD Fellowship to work on Analog Design using Reconfigurable Logic at TU, Dresden, Germany in the year 2013. He is the Principal Coordinator for SMDP-C2SD at IIT Roorkee. His areas of interest are Nanoelectronics, Nanoscale MOSFET modeling and simulation, Design and Development of low power novel devices, FinFET based Memory Design, Emerging Devices in Analog Design and Design and development of reconfigurable logic. He has guided/co-guided 15 Ph.D scholars. Currently he is supervising 7 candidates leading to their Ph.D degree. He has been awarded INAE Young Engineer Award. Dr. Dasgupta acted as a reviewer for IEEE Transactions on Electron Devices, IEEE Electron Device Letters, IEEE Transactions on Nanotechnology, Superlattice and Microstructures, International Journal of Electronics, Semiconductor Science and Technology, Nanotechnology, IEEE Transactions on VLSI Systems, Microelectronic Engineering, and Microelectronic Reliability amongst other.


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COURSE PLAN :

Week 1:

- Bipolar Junction Transistor; Physical Structure and Modes of operation,
- Operation in Active Mode, circuit symbols and conventions,
- BJT as an Amplifier, small circuit model,
- BJT as a switch and Ebers Moll Model,
- Simple BJT inverter and Second Order Effects.

Week 2:

- MOS Transistor Basic,
- MOS Parasitic & SPICE Model;
- CMOS Inverter Basics-I

Week 3:

- CMOS Inverter Basics(contd)
- Power Analysis
- SPICE Simulation-I

Week 4:

- Biasing of MOS Amplifier and its behavior as an analog switch,
- CMOS CS/CG/SF Amplifier Configuration,
- Internal cap models and high frequency modelling,
- JFET, structure and operation.

Week 5:

- Multistage and Differential Amplifier,
- Small Signal Operation and Differential Amplifier,
- MOS Differential Amplifier,
- BiCMOS Amplifier with Active Load,
- Multistage Amplifier with SPICE Simulation

Week 6:

- s-domain analysis, transfer function, poles and zeros,
- High Frequency Response of CS and CE Amplifier,
- Frequency Response of CC and SF Configuration,
- Frequency Response of the Differential Amplifier,
- Cascode Connection and its Operation

Week 7:

- General Feedback structure and properties of negative feedback,
- Basic Feedback Topologies,
- Design of Feedback Amplifier for all configuration,
- Stability and Amplifier poles,
- Bode Plots and Frequency Compensation

Week 8:

- Ideal Operational Amplifier and its terminals,
- Inverting and Non- Inverting Configuration,
- As an integrator and Differentiator,
- Introduction to Analog Computer,
- Large Signal Operation of Op-Amp and Second order offsets.

Week 9:

- Butterworth and Chebyshev Filters,
- First and Second Order Filter Functions,
- Switched Capacitor based filters,
- Single-Amplifier Biquadratic Filters,
- Second Order LCR Resonator.

Week 10: Combinational Logic Design

Week 11: Sequential Logic Design

Week 12: Clock Strategies for Sequential Design, Concept of Memory & its Designing-I


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PLASTIC WORKING OF METALLIC MATERIALS

PROF. P.S. ROBI

Department of Mechanical Engineering
IIT Guwahati

TYPE OF COURSE : New | Core_Elective | UG/PG

COURSE DURATION : 12 weeks (29 Jul'19 - 18 Oct'19)

EXAM DATE : 16 Nov 2019

INTENDED AUDIENCE : Mechanical Engineering /Manufacturing Engineering/ Metallurgical Engineering students

COURSE OUTLINE :

Plastic working of metallic materials is an important subject area for applications like automobiles, aircraft, defense, construction, domestic use, etc. This course is developed for a variety of audience viz., undergraduate as well as post graduate students of Mechanical Engineering and Metallurgical Engineering, practicing engineers and technocrats. The course begins with the fundamentals of metal working and slowly moves to advanced analysis of metalworking. Most of the conventional metal working processes has been discussed highlighting the equipments used , the industrial processes and detailed analysis of the particular processes. After attending this course, the participant will be fully conversant with the conventional deformation processing techniques practiced by the present day metal industries.

ABOUT INSTRUCTOR :

Dr. P. S Robi did his B.Tech degree in Mechanical Engineering from Kerala University in 1986, M.Tech in Foundry –Forge Technology from NFFT Ranchi and subsequently earned his Ph.D degree from the Department of Metallurgical Engineering and Materials Science in 1995. He joined IIT Guwahati as an Assistant Professor in the department of Mechanical Engineering in 1997 and was promoted to Associate Professor, and later Full Professor. He served IIT Guwahati under various capacities, viz., Head, Department of Mechanical Engineering, Dean (Research and Development) and presently serving as Deputy Director. He is actively involved in teaching undergraduate and post graduate courses related to Materials and Manufacturing. His research interest is Materials development and Manufacturing. He has successfully completed 13 research projects. He has supervised 6 PhD thesis and around 32 M.Tech thesis and is presently supervising 7 PhD thesis.

COURSE PLAN :

Week 1: Fundamentals of metal working

Week 2: Flow curve determination

Week 3: Mechanics of Metal working

Week 4: Forging process

Week 5: Drawing Operations

Week 6: Extrusion of metals

Week 7: Rolling of Metals

Week 8: Sheet metal forming

Week 9: Drawing Operations (contd)

Week 10: Extrusion of metals (contd)

Week 11: Rolling of Metals (contd)

Week 12: Sheet metal forming (contd)


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INTEGRATED WASTE MANAGEMENT FOR A SMART CITY

PROF. BRAJESH KUMAR DUBEY

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : The course will be beneficial for B.Tech/M.Tech/B.Sc/M.Sc/Research Scholars/ Faculty members from different institutions. In addition, we will strongly encourage engineers/professionals working in any area related to waste management should consider taking advantage from this unique application orientated course. Regulators (SPCB, CPCB and MOEF professionals) and policy makers will also benefit from this course.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : Larsen and Turbo, Tata Group of Industries, Ramky Group of Industries, IF&LS Environment

COURSE OUTLINE :

This course has emphasises on Integrated Solid Waste Management aspects within the broad subject area of Integrated Waste Management for a Smart City. The issues of Municipal Solid Waste (MSW) management, Construction and Demolition (C&D) Waste and Electronic Waste Management will be covered in this course. The topics will include: generation rates and waste composition; Integrated waste management issues, collection, recovery, reuse, recycling, energy-from-waste, and landfilling; Biological treatment of the organic waste fraction - diet I and application, composting, and anaerobic digestion. The environmental impact of waste management and its relationship on the big picture sustainable development and smart city development will be discussed. A major focus of this course will be the role of MSW management within the various initiatives of the Govt. of India including: Swachh Bharat Mission, Smart Cities as well as Make in India. The challenges of waste management for smart cities will also be discussed taking case studies from the first list of 20 smart cities identified in the first phase for this program. This will be followed by overview of the Construction and Demolition (C&D) Waste and Electronic Waste (E-Waste) management issues in India in general and for the smart cities in particular. The new rules with respect of C&D Waste and E-Waste Management will be covered. The challenges of managing these waste streams effectively will be discussed.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management, Life Cycle Analysis and Environmental Risk Assessment among other courses for nearly a decade. He has taught at several universities in USA, Canada, New Zealand, China and India. He has also conducted training programs in the Integrated Waste Management areas including that for Electronics Waste. Dr. Dubey has authored/co- authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

- Week 01 :** Introduction to Solid Waste Management
- Week 02 :** Municipal Solid Waste Characteristics and Quantities
- Week 03 :** MSW Rules 2016, Swachh Bharat Mission and Smart Cities Program
- Week 04 :** Municipal Solid Waste Collection, Transportation, Segregation and Processing
- Week 05 :** Disposal of Municipal Solid Waste
- Week 06 :** Biochemical Processes and Composting


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- Week 07 :** Energy Recovery from Municipal Solid Waste
- Week 08 :** Current Issues in Solid Waste Management and Review of MSW Management Status in First List of 20 Smart Cities in the Country
- Week 09 :** Construction and Demolition (C&D) Waste Management - Overview
- Week 10 :** C&D Waste – Regulation, Beneficial Reuse of C&D Waste Materials
- Week 11 :** Electronic Waste (E-Waste) Management – Issues and Status in India and Globally
- Week 12 :** E-Waste Management Rules 2016 and Management Challenges


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INTRODUCTION TO MACHINE LEARNING

PROF. BALARAMAN RAVINDRAN

Department of Computer Science and Engineering
IIT Madras

PRE-REQUISITES : We will assume that the students know programming for some of the assignments. If the students have done introductory courses on probability theory and linear algebra it would be helpful. We will review some of the basic topics in the first two weeks as well.

INTENDED AUDIENCE : This is an elective course. Intended for senior UG/PG students. BE/ME/MS/PhD

INDUSTRIES APPLICABLE TO : Any company in the data analytics/data science/big data domain would value this course

COURSE OUTLINE :

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

ABOUT INSTRUCTOR :

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

COURSE PLAN :

- Week 0:** Probability Theory, Linear Algebra, Convex Optimization - (Recap)
- Week 1:** Introduction; Statistical Decision Theory - Regression, Classification, Bias Variance
- Week 2:** Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares
- Week 3:** Linear Classification, Logistic Regression, Linear Discriminant Analysis
- Week 4:** Perceptron, Support Vector Machines
- Week 5:** Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation
- Week 6:** Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures
- Week 7:** Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting
- Week 8:** Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks
- Week 9:** Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation
- Week 10:** Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering
- Week 11:** Gaussian Mixture Models, Expectation Maximization
- Week 12:** Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)


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DATA SCIENCE FOR ENGINEERS

PROF. RAGHUNATHAN RENGASAMY

Department of Chemical Engineering
IIT Madras

PROF. SHANKAR NARASIMHAN

Department of Chemical Engineering
IIT Madras

PRE-REQUISITES : 10 hrs of pre-course material will be provided, learners need to practice this to be ready to take the course.

INTENDED AUDIENCE : Any interested learner

INDUSTRIES APPLICABLE TO : HONEYWELL, ABB, FORD, GYAN DATA PVT. LTD.

COURSE OUTLINE :

Learning Objectives :

- Introduce R as a programming language
- Introduce the mathematical foundations required for data science
- Introduce the first level data science algorithms
- Introduce a data analytics problem solving framework
- Introduce a practical capstone case study

Learning Outcomes:

- Describe a flow process for data science problems (Remembering)
- Classify data science problems into standard typology (Comprehension)
- Develop R codes for data science solutions (Application)
- Correlate results to the solution approach followed (Analysis)
- Assess the solution approach (Evaluation)
- Construct use cases to validate approach and identify modifications required (Creating)

ABOUT INSTRUCTOR :

Prof.Rengaswamy was a professor of Chemical Engineering and Co-Director of the Process Control and Optimization Consortium at Texas Tech University, Lubbock, USA. He was also a professor and associate professor at Clarkson University, USA and an assistant professor at IIT Bombay. His major research interests are in the areas of fault detection and diagnosis and development of data science algorithms for manufacturing industries.

Prof.Shankar Narasimhan is currently a professor in the department of Chemical Engineering at IIT Madras. His major research interests are in the areas of data mining, process design and optimization, fault detection and diagnosis and fault tolerant control. He has co-authored several important papers and a book titled Data Reconciliation and Gross Error Detection: An Intelligent Use of Process Data which has received critical appreciation in India and abroad.

COURSE PLAN :

Week 1: Course philosophy and introduction to R

Week 2: Linear algebra for data science

1. Algebraic view - vectors, matrices, product of matrix & vector, rank, null space, solution of over-determined set of equations and pseudo-inverse)
2. Geometric view - vectors, distance, projections, eigenvalue decomposition

Week 3: Statistics (descriptive statistics, notion of probability, distributions, mean, variance, covariance, covariance matrix, understanding univariate and multivariate normal distributions, introduction to hypothesis testing, confidence interval for estimates)

Week 4: Optimization

Week 5: 1. Optimization

2. Typology of data science problems and a solution framework

Week 6: 1. Simple linear regression and verifying assumptions used in linear regression

2. Multivariate linear regression, model assessment, assessing importance of different variables, subset selection.

Week 7: Classification using logistic regression

Week 8: Classification using kNN and k-means clustering


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CONSUMER PSYCHOLOGY

PROF. NAVEEN KASHYAP

Department of Humanities and Social Sciences
IIT Guwahati

INTENDED AUDIENCE : UG / PG / PhD

COURSE OUTLINE :

Human beings have basic needs that they fulfill by making transactions in the market. Transactions mostly in the form of monetary exchange for goods and services are very basic for the survival of the human race. The present course is designed to study how consumers behave on the market and what the consequences of various behavior patterns. Additionally, the present course also looks at various psychological factors that shape the behavior and actions of the consumer in the global market.

ABOUT INSTRUCTOR :

Prof. Naveen Kashyap, Ph.D is an Associate Professor of Psychology at the Indian Institute of Technology Guwahati. His research interests are sleep and human cognitive processes. Dr Kashyap has been teaching courses like cognitive psychology, introduction to psychology, consumer psychology, advanced cognitive process and research methodology to UG and PG students of IITG for the past 10 years.

COURSE PLAN :

Week 1: Introduction to Consumer Psychology

Week 2: Overview of foundation of consumer behavior.

Week 3 : Consumer Decision Making

Week 4 : Purchase process and consumption; Consumer learning and brand loyalty

Week 5 : Low involvement decision making; Situational influences.

Week 6 : The Individual Consumer; Consumer perceptions; Consumer information processing and acquisition

Week 7 : Attitudes; Attitude reinforcement and change

Week 8 : Marketing Communications.


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HARDWARE MODELING USING VERILOG

PROF. INDRANIL SENGUPTA

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE: Computer Science and Engineering ; Electronics and Communication Engineering ; Electrical Engineering

PRE-REQUISITES : Basic concepts in digital circuit design ; Familiarity with a programming language like C or C++

INDUSTRY SUPPORT : Intel, Cadence, Mentor Graphics, Synopsys, Xilinx.

COURSE OUTLINE:

The course will introduce the participants to the Verilog hardware description language. It will help them to learn various digital circuit modeling issues using Verilog, writing test benches, and some case studies.

ABOUT INSTRUCTOR:

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 years of teaching and research experience. He has guided 22 PhD students, and has more than 200 publications to his credit in international journals and conferences. His research interests include cryptography and network security, VLSI design and testing, and mobile computing.

He is a Senior Member of IEEE. He had been the General Chairs of Asian Test Symposium (ATS-2005), International Conference on Cryptology in India (INDOCRYPT-2008), International Symposium on VLSI Design and Test (VDAT-2012), International Symposium on Electronic System Design (ISED-2012), and the upcoming Conference on reversible Computation (RC-2017). He had delivered invited and tutorial talks in several conferences in the areas of VLSI design and testing, and network security.

COURSE PLAN:

- Week 1:** Introduction to digital circuit design flow (3 hours)
- Week 2:** Verilog variables, operators and language constructs (2 hours)
- Week 3:** Modeling combinational circuits using Verilog (2 hours)
- Week 4:** Modeling sequential circuits using Verilog (3 hours)
- Week 5:** Verilog test benches and design simulation (2 hours)
- Week 6:** Behavioral versus structural design modeling (2 hours)
- Week 7:** Miscellaneous modeling issues: pipelining, memory, etc. (2 hours)
- Week 8:** Processor design using Verilog (4 hours)


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PROGRAMMING IN C++

PROF. PARTHA PRATIM DAS

Department of Computer Science and Engineering
IIT Kharagpur

TYPE OF COURSE : Rerun | Core | UG/PG**COURSE DURATION** : 8 weeks (26 Jul' 21 - 17 Sep' 21)**EXAM DATE** : 26 Sep 2021

PRE-REQUISITES : Basic Knowledge of Programming, Data Structure, C Programming Attending a course on OOP/OOAD with this course will help

INTENDED AUDIENCE : BCA, MCA, B.Tech., M.Tech.

INDUSTRIES APPLICABLE TO : Programming in C++ is so fundamental that all companies dealing with systems as well as application development (including web, IoT, embedded systems) have a need for the same. These include - Microsoft, Samsung, Xerox, Yahoo, Google, IBM, TCS, Infosys, Amazon, Flipkart, etc.

COURSE OUTLINE :

There has been a continual debate on which programming language/s to learn, to use. As the latest TIOBE Index for May 2019 indicates - Java (16%), C (14%), C++ (8%), C#(4%), and Python (8%) together control nearly half the programming community. Given this, it is still important to learn C and C++ because of the efficiency they offer. While we appreciate that Java is good for applications, for graphics; and we acknowledge that Python is appropriate for portable software, engineering problem solving, and graphics; it is worth bearing in mind that the JVM and Python interpreter are indeed written in C++, making C++ the father of all languages today.

ABOUT INSTRUCTOR :

Prof. Partha Pratim Das received his BTech, MTech and PhD degrees in 1984, 1985 and 1988 respectively from IIT Kharagpur. He served as a faculty in Department of Computer Science and Engineering, IIT Kharagpur from 1988 to 1998. In 1998, he joined Alumnus Software Ltd as a Business Development Manager. From 2001 to 2011, he worked for Interra Systems, Inc as a Senior Director and headed its Kolkata Center. In 2011, he joined back to Department of Computer Science and Engineering, IIT Kharagpur as Professor. Dr. Das has also served as a Visiting Professor with Institute of Radio Physics and Electronics, Calcutta University from 2003 to 2013.

COURSE PLAN :

Week 1: Programming in C++ is Fun : Build and execute a C program in C++, Write equivalent programs in C++

Week 2: C++ as Better C : Procedural Extensions of C

Week 3: Overview of OOP in C++ : Classes and basic Object-Oriented features (encapsulation)

Week 4: Overview of OOP in C++ : More OO features, overloading, namespace and using struct and union

Week 5: Inheritance : Generalization / Specialization of Object Modeling in C++

Week 6: Polymorphism : Static and Dynamic Binding

Week 7: Type Casting & Exceptions : C++ cast operators; C++ Exceptions & standard exception classes

Week 8: Templates & STL - Function and Class templates and using STL like containers, algorithms


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PRODUCT DESIGN AND MANUFACTURING

PROF. J. RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Innovation, better management, throughput improvements, and expansion of new technologies have led Product Design and Manufacturing as a compelling field for the students. Managing the product development process, right from idea generation to final product manufacturing has to be systematic and effective to meet the customer needs, while incorporating the time-to-market constraint as well. This course presents an overview of the product design and development process, along with the manufacturing systems aspects.

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a bachelor degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience. His research interests are Sustainable Manufacturing Processes and Systems, Simulation of Manufacturing Systems, Product Design and Manufacturing, Applied Ergonomics and Engineering Metrology. He has traveled in countries like US, Canada, and Australia to present his research in various international conferences organized by reputed bodies like CIRP and IEOM. His research is also published in various international reputed journals.

COURSE PLAN :

- Week 1:** Introduction to product design and manufacturing
- Week 2:** Product design morphology
- Week 3:** Visual Design, and Quality Function Deployment (QFD)
- Week 4:** Value Engineering
- Week 5:** Material, and Manufacturing process selection
- Week 6:** Design for Manufacturing, Assembly, and Maintenance
- Week 7:** Design for Environment, and Quality Control
- Week 8:** Patenting, and Creativity
- Week 9:** Rapid Prototyping
- Week 10:** Plant Layout Design
- Week 11:** Computer Integrated Manufacturing
- Week 12:** Reverse Engineering, and Managing Competitiveness


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INTRODUCTION TO ELECTROMAGNETIC THEORY

PROF. MANOJ HARBOLA

Department of Physics
IIT Kanpur

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 8 weeks (29 Jul'19 - 20 Sep'19)
EXAM DATE : 29 Sep 2019

INTENDED AUDIENCE : 1st & 2nd year B. Tech. in Civil, Mechanical, Aerospace and B.Sc. Students.

COURSE OUTLINE :

This course introduces students to handling electromagnetic theory using vector calculus. This enables students to handle problems that are more complicated than they are used to from their school days. Due to general nature of the mathematics they learn in this course, what they learn here will help them in their future courses like fluid dynamics that use similar mathematics.

ABOUT INSTRUCTOR :

Dr. Manoj Kumar Harbola joined the Department in 2000. He obtained his doctoral degree at the City University of New York, USA, working under the supervision of Prof. Viraht Sahni. Subsequently he carried out postdoctoral research at the University of North Carolina, Chapel Hill, USA before joining the Centre for Advanced Technology, Indore as a Scientist. He is a theoretical physicist, whose chief interest lies in Electronic Structure of Atoms, Molecules and Solids using Density Functional Methods.

COURSE PLAN :

- Week 01** : Coulomb's law Divergence of electric field Gauss' law Curl of electric field Stokes' theorem Electrostatic potential.
- Week 02** : Laplace's equation for electrostatic potential Laplace's equation in other fields Uniqueness of solution of Laplace's equation Poisson equation and uniqueness of its solution Method of images for planar surfaces Work and energy in electrostatics.
- Week 03** : Conductors and capacitors Reciprocity theorem Polarization and bound charges Linear dielectrics Electric displacement Fields in dielectrics .
- Week 04** : Magnetic field due to a magnet Magnetic field due to a steady current Divergence and curl of magnetic field Ampere's law The vector potential Magnetization and bound currents.
- Week 05** : Magnetic fields in matter Magnetic field in matter Faraday's law Induced electric field Energy in magnetic field Displacement current.
- Week 06** : Maxwell's equations Work done by electromagnetic field Poynting's theorem Momentum in electromagnetic field Angular momentum in electromagnetic field Electromagnetic waves: the wave equation.
- Week 07** : Wave equation Plane electromagnetic waves Energy carried by electromagnetic waves Pressure due to electromagnetic waves Reflection and transmission of electromagnetic waves Reflection and transmission of electromagnetic waves.
- Week 08** : Review and Problem Solving.


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002



AIRCRAFT STABILITY AND CONTROL

PROF. A.K. GHOSH

Department of Aerospace Engineering
IIT Kanpur

INTENDED AUDIENCE : Core course for UG students

INDUSTRIES APPLICABLE TO : NAL Bangalore, ARDE Pune, ADE Bangalore, ADA Bangalore

COURSE OUTLINE :

This course is designed to understand stability and control aspects of an airplane. This course will also help in creating a background to design an airplane from stability and control aspects

ABOUT INSTRUCTOR :

Prof. A.K. Ghosh is a faculty of Aerospace Engg. Department of IIT Kanpur. He is also the in-charge of the flight laboratory and unmanned aerial vehicle of IIT Kanpur. His research areas include system identification through flight tests using conventional and neural network based methods, design of aircrafts and airborne projectiles, supercavitation, unmanned aerial systems. Before joining IIT Kanpur, he worked as a scientist with Defense Research Development Organization (DRDO). He has published many peer reviewed journal papers and conference papers, guided 13 doctoral students, and 38 masters students. He is also a mentor of multiple aerospace start-up companies, and also been associated with major industry contributions of high speed low drag aircraft bomb, Pinaka Mk-I, 105mm sabot round for tracked vehicles, etc.

COURSE PLAN :

Week 1: Overview of aerodynamics and atmosphere, Wing stall and maximum lift coefficient, Wing aerodynamic center & pitching moment, Introduction to static and dynamic stability.

Week 2: Introduction to static and dynamic stability, Wing contribution, Tail contribution, Canard and fuselage contribution.

Week 3: Power plant contribution & its effect on NP, Stick fixed neutral point, Static margin, Stick fixed : maneuvering point.

Week 4: Elevator effectiveness, Elevator angle of trim, Flight measurement of X_{np} , Elevator hinge moment, Stick forces (trim tab & stick force gradient),

Week 5: Stick free neutral point, Stick free : maneuvering point, Roll stability and roll control, Yaw stability and yaw control.

Week 6: Newton's second law of rigid dynamics, Axes system and relevant transforms, Angular motion equations.

Week 7: Aerodynamic forces, Gravitational and thrust forces, Linearized equations of motion,

Week 8: Force and moment derivatives, Force and moment derivatives, Contribution of aircraft components to aerodynamic derivatives, Linear model.

Week 9: Short period approximation, Long period approximation, Pure pitching motion, Flying and handling qualities.

Week 10: Linearized lateral dynamics. Lateral motion : Linearized coupled motion, Roll approximation, Spiral approximation.

Week 11: Dutch roll approximation. Pure rolling. Pure yawing, Inertia coupling.

Week 12: Stability augmentation system: Longitudinal, Stability augmentation system: Lateral.


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MANUFACTURING OF COMPOSITES

PROF. J RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Core/Elective | UG/PG
COURSE DURATION : 8 weeks (26 Aug'19 - 18 Oct'19)
EXAM DATE : 17 Nov 2019

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE

Selecting manufacturing technique has emerged as one the paramount challenge in the field of composites. Composites are now being used in almost every field of industry, and students working in the area of the composites need to learn the basics, and progressive techniques of composites manufacturing. This course covers the important aspects of composites manufacturing: process selection guidelines, thermoset ad thermoplastic Composites manufacturing processes, process parameters and characterizations. Applications and use of each manufacturing process is focused and this is represented separately.

ABOUT INSTRUCTOR

Prof. Janakranjan .Ramkumar is currently a Professor of Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro/nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award. Over the years his contribution in teaching and research is remarkable. He has worked for BOSCH group and improved the productivity of the company. His research and teaching focus is on nano technology and inclusive design. He has several international and national patents in his credit and has published more than 100 journal papers.

COURSE PLAN

Week 1: Introduction to Composites; Introduction to Composites; Function of the Matrix and Reinforcement in Composites
Matrices: Thermosets and Thermoplastic; Fiber Reinforcement

Week 2: Properties and testing composites; Properties of Composites; Composites testing; Composites design: Laminate theory, Rule of mixtures, symmetry and balance

Week 3: Thermoset Composites manufacturing processes; Material selection process cont.; Material selection process cont. Design for manufacturing.

Week 4: Thermoset composite manufacturing processes; Thermoset Composite manufacturing:Lay-up processes,Spray up process; Thermoset Composite manufacturing:Fiber placement process; Thermoset Composite manufacturing:Resin transfer moulding

Week 5: Thermoplastic composite manufacturing processes; Thermoset Composite manufacturing:Vaccum assisted resin transfer moulding; Thermoset Composite manufacturing:Compression molding process; Thermoset composites manufacturing:Filament winding

Week 6: Thermoplastic composite manufacturing processes; Thermoplastic Composite manufacturing:Sheet moulding Thermoplastic Composite manufacturing: Injection moulding, sheet moulding, Calendaring; Thermoplastic Composite manufacturing:Extrusion, Blow molding, rotational molding, Thermoforming

Week 7: Metal and ceramic matrix composites; Metal Matrix Composites: Metal matrix and reinforcement; Manufacturing processes for Metal Matrix Composites:Dispersion hardened and particle composite; Manufacturing processes for Metal matrix composites:Layer composites and infiltration method

Week 8: Prevention of Damage, repair of Composites and selection of processes; Ceramic matrix composites: Hot isostatic processing ; Non – destructive testing of Composites; Manufacturing process selection: Cost, performance, size shape, rate of production. Steps for process selection


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INTRODUCTION TO ABRASIVE MACHINING AND FINISHING PROCESSES

PROF. MAMILLA RAVI SANKAR

Department of Mechanical Engineering
IIT Tirupati

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)

EXAM DATE : 27 Mar 2022

INTENDED AUDIENCE : BE/B.Tech, ME/ M.Tech, Ph. D (Mechanical Engineering, Production Engineering).
Faculty who teaches manufacturing.

INDUSTRIES APPLICABLE TO : Oil India Ltd., ONGC, TATA motors, ISRO, BARC, DRDL, NTPC,
CMTI, CMERI, CGCRI, Grind Master, NRL

COURSE OUTLINE :

This course will define the areas of application of traditional as well as non-traditional abrasive finishing processes in the manufacturing industry. The lectures will introduce the basic principles of material removal by use of abrasives particles and material removal mechanism of different abrasive process. The effects of various input parameters on the outputs as well as the use of cutting fluids in various finishing process will be discuss. A variety of numerical problems and MCQs, discussions will also be included.

ABOUT INSTRUCTOR :

Prof. Mamilla Ravi Sankar is currently an Assistant Professor in the Department of Mechanical Engineering, IIT Guwahati. He did his B.Tech from Sri Venkateswara University, Tirupati, and M.Tech as well as PhD from IIT Kanpur. His research group is focus on Sustainable Manufacturing, Eco-friendly Cutting fluids, Coatings, Advanced Manufacturing, Tribology and Rheology. MRS Lab also involves in development of lab scale Innovations to Commercial Manufacturing Products. He has published over 30 research articles in internationally reputed journals, 2 Patents, 2 Edited Books and 6 Book chapters. He is recipient of prestigious awards such as Institution of Engineers India (IEI) Young Engineers Award-2015 in Production Engineering, Indian Society for Advancement in Materials and Process Engineering (ISAMPE)-2011 and finalist of Indian National Academy of Engineering (INAE) Young Engineer Award-2014. Apart from academic awards, he is also received Institute Blues (Outstanding Sports Personality) of IIT Kanpur for the year 2009.

COURSE PLAN :

- Week 1:** Introduction conventional abrasive processes, Introduction to abrasive processes, Grinding Process
- Week 2:** Conventional abrasive finishing processes (CAFP): Honing & Wire Brushing, CAFP: Lapping, Buffing & Super finishing, Practical Conventional abrasive finishing processes
- Week 3:** Adv. abrasive machining processes (AAMP), AAMP
- Week 4:** Hybrid Adv. Abrasive Machining Processes, Advanced Finishing
- Week 5:** Adv. Finishing: Abrasive Flow Finishing
- Week 6:** Adv. Finishing: Magnetic Abrasive Finishing
- Week 7:** Adv. Finishing: Magnetic Rheological Finishing
- Week 8:** Hybrid abrasive finishing, Finishing of Advanced Materials

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PRINCIPLES OF CASTING TECHNOLOGY

PROF. PRADEEP KUMAR JHA

Department of Mechanical & Industrial Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG/PG

COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)

EXAM DATE : 27 Mar 2022

INTENDED AUDIENCE : Any Interested Learners

INDUSTRIES APPLICABLE TO : Casting Industries like BHEL, Tata Steel, Jindal Steel, Foundry units of medium and large sizes

COURSE OUTLINE :

The course focuses on understanding the basics of science and technology of casting processes. Metal casting industries have evolved during the past hundred years because of advancements in technologies. The properties of the cast metals significantly depends upon the type of molding, melting, solidification and post treatment practices. This needs to be understood by the young students as well as practicing shop floor engineers so that products with superior qualities can be cast. The basic purpose of this course is to provide a sound understanding of concepts and principles of casting technology so as to enable them to be conversant with advances in these methods in the long run towards increasing the productivity of casting industries.

ABOUT INSTRUCTOR :

Prof. Pradeep Kumar Jha is presently working as Associate Professor in the Department of Mechanical & Industrial Engineering at IIT Roorkee. He has been teaching the courses related to manufacturing technology and theory of production processes to undergraduate and postgraduate students for more than 12 years. He is actively involved in research work related to production processes, tundish steelmaking process, mold solidification in continuous casting etc.

COURSE PLAN :

Week 1: Introduction to Casting technology, Solidification analysis for metals and alloys

Week 2: Technology of patternmaking, study of molding sands and their testing methods

Week 3: Technology of mouldmaking and coremaking, Special sand moulding processes

Week 4: Principles of gating design for castings

Week 5: Principles of risering design for castings

Week 6: Special casting methods, Melting furnaces

Week 7: Melting and pouring practices for production of Cast Iron family, steel and non-ferrous metals and alloys

Week 8: Fettling and Heat treatment of castings, Casting defect and its diagnostic methods


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ANANTAPURAMU-515004



SURFACE ENGINEERING OF NANOMATERIALS

PROF. KAUSHIK PAL

Department of Mechanical Engineering and Industrial Engineering
IIT Roorkee

TYPE OF COURSE : Rerun | Elective | UG/PG
COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)
EXAM DATE : 27 Mar 2022

INTENDED AUDIENCE : Nano Science Nanotechnology, Chemical Engg, Chemistry, Aerospace Engg, Material Science and Mechanical Engg. etc.

INDUSTRIES APPLICABLE TO : Nanotech based industries: Nanoshel; Adnano Technologies; Mittal Enterprises; Ultrananotech; Reinste Nano Ventures; etc

COURSE OUTLINE :

Surface engineering (SE) is a sub-discipline of Materials Science and Materials Engineering which deals with the surface of a solid and its modifications. The primary goal of SE of nanomaterials is to modify the properties of surface to improve its electrical and thermal properties, and to improve the compatibility of nanomaterials with some matrix when they are used as reinforcing fillers in composites for high performance applications.

ABOUT INSTRUCTOR :

Prof. Kaushik Pal is an Associate Professor in Department of Mechanical and Industrial Engineering, IIT Roorkee since 2012. He has obtained his Ph.D Degree (2009) from IIT, Kharagpur and then joined to Gyeongsang National University, South Korea for pursuing Post-Doc research. His fields of interests are surface modification of nano-materials and use of such materials in different electronic, mechanical and bio-medical applications. Currently, he is acting as reviewer of several internationally known journals and an active member of National Academy of Sciences, American Chemical Society (ACS) and Royal Society of Chemistry (RSC). Also, he is the recipient of Brain Korea (BK-21) fellowship award and DAAD fellowship award.

COURSE PLAN :

- Week 1:** Tribology & its classification, Friction tribology, Wear & corrosion, Lubrication, Effect of tribology on surface of nanomaterials
- Week 2:** Conventional surface engineering, Types of surface modifications, Physical modifications, Chemical modifications, Application of surface engineering towards nanomaterials
- Week 3:** Deposition and surface modification methods, Physical vapor deposition, Chemical vapor deposition, Advanced surface modification practices, Advantages of deposition for surface modification
- Week 4:** Synthesis, processing and characterization of nano-structured coatings, Functional coatings, Advanced coating practices, Characterization of nano-coatings, Applications of nano-coatings
- Week 5:** Need for advanced methods of surface and coating testing, Size dependency in nanostructures of nanocoatings, Size effect in electrochemical properties of nanostructured coatings, Size effect in mechanical properties of nanostructured coatings, Size effect in physical and other properties of nanostructured coatings
- Week 6:** Thin films for surface engineering of nanomaterials, Sputtering techniques, Evaporation processes, Thin film deposition through gas phase techniques, Liquid phase techniques
- Week 7:** Microencapsulation: Processes, Microencapsulation: Kinetics of release, Plating of Nanocomposite Coatings, Advantages of microencapsulation over other conventional methods
- Week 8:** Current trends in surface modification of nanomaterials, Modified Nanomaterials: In-use for consumer products, Main problems in synthesis of modified nanomaterials


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JOINING TECHNOLOGIES FOR METALS

PROF. D. K. DWIVEDI

Department of Mechanical and Industrial Engineering
IIT Roorkee

INTENDED AUDIENCE : It is a core course for UG/PG students, practicing engineers.

COURSE OUTLINE :

It is proposed to include following joining technologies of commercial importance under different groups of processes.

- A) Fundamentals of Metal Joining Technologies: mechanisms for obtaining metallic continuity: fusion, deformation, diffusion, chemical interactions
- B) Fusion based processes: principle of fusion welding processes, oxy-fuel has welding, common arc welding processes, high energy beam welding processes, resistance welding processes, newer variants of fusion welding processes
- C) Solid-liquid joining processes: brazing and soldering, braze welding, cold metal transfer welding,
- D) Solid state joining processes: friction welding and its variants, diffusion bonding, ultrasonic welding and explosive welding and
- E) Adhesive joining: design, procedure, and applications
- F) Metallurgical Aspects of Welding: weld thermal cycle, solidification of weld metal
- G) Weldability of carbon steel, alloys steel, stainless steels; Fe-C, TTT, CCT and schaffler diagram for understanding the metallurgical transformation in weld and heat affected zone., basics of residual stresses H) Common issues related with joining technologies their causes and remedies: hardening and softening of heat affected zone, porosity, cracking,

ABOUT INSTRUCTOR :

Prof. D K Dwivedi obtained BE (mechanical engineering) , in 1993 from GEC Rewa, ME (welding engineering) Univ. of Roorkee in 1997 and PhD in Met. Engineering from MNIT, Jaipur in 2003. He has about 9 years teaching experience at NIT Hamirpur and 19 years at IIT Roorkee of subjects related with manufacturing at UG level and welding engineering related subjects at PG level. He has published more than 132 research papers in SCI/SCIE indexed journals and undertaken 24 sponsored research and 54 industrial consultancy projects. Instructor has authored five books entitled "Production and Properties of Cast Al-Si Alloys with New Age International, New Delhi (2013), Surface Engineering, Springer Nature (2018), Fundamentals of Metal Joining, Springer Nature (2021), Materials Engineering, AICTE (2022), Dissimilar metal joining, Springer Nature (2023)

COURSE PLAN :

Week 1: Fundamentals of Metal Joining Technologies

Week 2: Fusion Welding Process: Principle of fusion welding processes, oxy-fuel has welding, SMAW and GTAW

Week 3: Newer variants of GTAW processes, physics of arc welding, GMAW, SAW, LBW, ESW-EGW

Week 4: Solid-Liquid Joining Processes: brazing and soldering, braze welding, resistance welding

Week 5: Adhesive joining, weld-bonding, solid state joining fundamentals : diffusion bonding, ultrasonic welding

Week 6: Explosive welding, magnetic pulse welding, weld thermal cycle, HAZ,

Week 7: Solidification of weld, metallurgical transformation in weld and heat affected zone, residual stresses, cold cracking, solidification cracking

Week 8: Weldability of metal, metal properties and weldability, hardenability and weldability

Week 9: Weldability of precipitation hardened, work hardened , transformation hardened

Week 10: Weldability of carbon, alloy steel low carbon and mild steel

Week 11: Weldability of medium carbon, and high carbon alloy steel, heat treatable alloy alloy and Cr-Mo steel

Week 12: Weldability of pre-coated steel and stainless steel


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ANANTAPURAMU-515002



NATURAL HAZARDS

PROF. JAVED N. MALIK
Department of Civil Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | PG
COURSE DURATION : 8 weeks (24 Jan' 22 - 18 Mar' 22)
EXAM DATE : 27 Mar 2022

PRE-REQUISITES : Basic knowledge of Earth Science or Natural Disasters is recommended.

INTENDED AUDIENCE : PG students of Science and Engineering, Advance UG students too can take this course.

COURSE OUTLINE :

The course introduces students to natural disasters and their phenomenon, ground deformations, land-level changes, event recurrence intervals, associated environmental and depositional changes, sedimentation patterns, and all the related hazards. Some of the well-known natural disasters are earthquakes, landslides, floods, tsunamis, volcanic eruptions, storms, and cyclones etc. which cause different types of natural hazards in the associated environment and landscape. This course will emphasize their mechanism, origin, and impacts in the associated regions such as mainland, hilly terrain, floodplain/alluvial plain, and coastal regions etc., and also focus on the approaches for mitigating and minimizing hazards along with related hazard assessment.

ABOUT INSTRUCTOR :

Prof. Javed N. Malik finished his Ph. D in 1998 from M. S. University Baroda, Vadodara. Gujarat (Geology), did Post-Doctrate (Japan Society for Promotion of Science) from (1999-2001) Hiroshima University, JAPAN. Joined IIT Kanpur in 2001.

COURSE PLAN :

- Week 1:** Natural Hazards and Disasters ,Natural Hazards and Disasters ,Human Impact on Natural Disaster
- Week 2:** Mitigating Hazards,Plate Tectonics and related Hazards,Plate Tectonics and related Hazards
- Week 3:** Earthquakes and their causes,Earthquakes and their causes,Ground Motion and Failures
- Week 4:** Tsunami: Gaint Tsunamis,Tsunami: Gaint Tsunamis ,Tsunami: Generation and Movement
- Week 5:** Tsunami Hazard Assessment,Tsunami Hazard Assessment,Volcanic Hazard
- Week 6:** Landslide and their causes, Type of downslope movement, associated hazard,Landslide and their causes
- Week 7:** Floods and Human Interaction,Flood Frequency and Recurrence Interval,Flood Frequency and Recurrence Interval
- Week 8:** Storms: Tropical Cyclone,Storms: Tropical Cyclone,Hurricane, Tornado, Storm damage and safety,Wildfires

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PRINCIPLES OF CONSTRUCTION MANAGEMENT

PROF. SUDHIR MISHRA

Department of Civil Engineering
IIT Kanpur

INTENDED AUDIENCE : Though the course primarily targets students of civil engineering in colleges, students from other disciplines, especially mechanical and electrical engineering may find it interesting.

PRE-REQUISITES : There are no real 'pre-requisites' to this course but an exposure to construction projects would make the understanding easier.

INDUSTRIES APPLICABLE TO : It is hoped that engineers working in different contracting, consulting and other organizations related to construction projects will find the course useful, specially as a tool in induction training.

COURSE OUTLINE :

Though the course primarily targets students of civil engineering in colleges, other engineering students may also find it interesting. The course seeks to present a rounded view of the diverse issues involved in the management of construction projects, and includes aspects like construction economics, quality and safety management, and contract management, apart from time management and scheduling, estimation. It is hoped that engineers working in contracting, consulting and other organizations related to construction projects will also find the course useful.

ABOUT INSTRUCTOR :

Prof. Sudhir Misra is Professor at the Department of Civil Engineering, Indian Institute of Technology Kanpur and has a keen interest in concrete materials, construction and engineering. He has worked with consulting and construction companies also during his 35 years of professional experience, and also led the effort to initiate a graduate programme in Infrastructure Engineering and Management at IIT Kanpur. He has been a member of committees of the BIS and also worked with professional organizations in Japan and India. His research interests include durability and non-destructive testing of concrete and development and utilization of special concretes. A lecture module of Concrete Engineering and Technology by him is also available online under the NPTEL scheme of the Government of India.

COURSE PLAN :

Week 01 : General overview and project organization

Week 02 : Estimation of project cost

Week 03 : Construction Economics

Week 04 : Planning and scheduling: part-1

Week 05 : Planning and scheduling: part-2

Week 06 : Quality management

Week 07 : Safety Management

Week 08 : Legal aspects of a construction project


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INFRASTRUCTURE PLANNING AND MANAGEMENTS

PROF. ASHWIN MAHALINGAM
Department of Management Studies
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG | PG
COURSE DURATION : 12 weeks (26 Jul' 21 - 15 Oct' 21)
EXAM DATE : 24 Oct 2021

PRE-REQUISITES : NIL

INTENDED AUDIENCE : Any interested learners

INDUSTRIES APPLICABLE TO : Companies in the infrastructure space: Developers such as L&T
IDPL Consultants such as PwC, Deloitte Quasi-Government Bodies such
as TWIC, TNUIFSL etc

COURSE OUTLINE :

This course attempts to introduce students to real world risks and challenges in managing infrastructure. After a brief introduction to the infrastructure planning process as well as the state of infrastructure across sectors in India, we systematically look at various risks that plague infrastructure projects. We then look at a variety of novel solutions or fixes that can help us execute infrastructure projects better. The course is replete with real-world case studies and guest lectures to ensure that what is being discussed is practically applicable.

ABOUT INSTRUCTOR :

Following this he returned to Stanford University to pursue a PhD in the area of Infrastructure Project Management. Ashwin's research interests are in the areas of Public Private Partnerships (PPP) in Infrastructure, the management and governance of large engineering projects and the use of digital technologies in construction. Ashwin's current research focuses on institutional strengthening and post-award governance of PPP projects in India. Ashwin is also a co-founder of Okapi Advisory Services Pvt. Ltd and serves as a Director on the Board.

COURSE PLAN :

- Week 1:** Class Introduction, Introduction to Infrastructure and to the Transportation, power and telecom sectors
- Week 2:** Rural and Urban Infrastructure Sectors, Players and Phases in an Infrastructure Project
- Week 3:** Project Finance and Public Private Partnerships
- Week 4:** Construction and Economic Risks
- Week 5:** Political and Social Risks
- Week 6:** Stakeholder Management, Design Thinking and Negotiations
- Week 7:** Socio-Economic Analysis and Good Governance for Infrastructure
- Week 8:** Modeling Flexible Project Arrangements
- Week 9:** Tales from the Field: Guest Lectures from Infrastructure Practitioners
- Week 10:** Case Studies
- Week 11:** Incomplete Design and Course Wrap-up
- Week 12:** Exam

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DIGITAL LAND SURVEYING AND MAPPING (DLS&M)

**PROF. JAYANTA KUMAR
GHOSH**

Department of Civil Engineering
IIT Roorkee

TYPE OF COURSE: Rerun | Elective | UG

COURSE DURATION : 8 weeks (21 Feb' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Basics of Physics and mathematics upto 12th standard and familiarity with use of computer

INTENDED AUDIENCE : Diploma/Degree students in Civil Engineering/Geo-spatial technology;
Master/Doctoral students in Geomatics/Geospatial technology; Field surveyors;
Professional persons dealing with Land surveying.

INDUSTRIES APPLICABLE TO : <http://dir.indiamart.com/impcat/topographicsurvey-services.html>

COURSE OUTLINE :

The objective of the course is to provide basics of digital surveying and mapping of earth surface using total station, GPS and mapping software. The course starts with introduction to land surveying followed by fundamentals of total station and its working & measurements for land surveying. Then, fundamentals, working & measurements using GPS for land surveying will be discussed. Followed by mapping fundamentals, digital surveying procedure, working, data reduction etc. Finally, the course will deals with working and demonstration of a digital land surveying and mapping of an area.

This course will uncover all the major topics in pericyclic reactions and organic photochemistry. In addition to lectures there will be tutorial sessions and assignments in this course.

ABOUT INSTRUCTOR :

Prof. Jayanta Kumar Ghosh is working as Associate Professor in the Civil Engineering Department (Geomatics Engineering Group) of Indian Institute of Technology Roorkee. He is engaged in teaching, research and consultancy works in Geomatics engineering for more than 31 years. He is pioneer in introducing courses on GPS surveying in the UG & PG curriculum of Engineering education in India, since 1999. He has conducted many short term courses on Surveying for the building professionals as early as 2000. He has published TWO books on Surveying – Elementary Engineering Surveying and Introduction to GPS Surveying. He is member of different National and International technical associations.

COURSE PLAN :

Week 1: Fundamentals of Land Surveying & GPS

Week 2: Global Positioning System (GPS)

Week 3: Global Positioning System (GPS)

Week 4: TOTAL STATION(TS)

Week 5: TS & DIGITAL LAND SURVEYING (DLS)

Week 6: DLS& DIGITAL MAPPING (DM)

Week 7: DM & DIGITAL DATA MANIPULATION (DDM)

Week 8: DIGITAL LAND SURVEYING AND MAPPING (DLS&M)


REGISTRAR
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ANANTAPURAMU-515004



PLASTIC WASTE MANAGEMENT

PROF. BRAJESH KUMAR DUBEY

Department of Civil Engineering
IIT Kharagpur

PRE-REQUISITES : Basic Environmental Science, Basic Differential Equations, Basic Chemistry

INTENDED AUDIENCE : Civil and Chemical Engineering BTech programs, Environmental Engineering and Environmental Science Masters and Doctoral Programs

INDUSTRIES APPLICABLE TO : AECOM, Ramky, Environmental Resource Management (ERM), SENES/ARCADIS. Waste Management related companies, Govt. Agencies

COURSE OUTLINE :

This course will focus on: 1. Introduction of Plastic pollution as a global problem today. 2. What is Plastic Waste? The Magnitude of the problem on global scale and in Indian context. Plastic in Ocean and impact on sea life and economy. 3. What is the nature and complexity of this problem and what could be the best way to manage the plastic waste and how to mitigate the risk from plastic waste. 4. Plastic Waste Management Rules 2016, Recent Plastic Bans and the use of Extended Producer Responsibilities (EPR) concepts in managing Plastic waste in India. 5. Best Practices of Managing Plastic Waste from around the World including use of Plastic waste in road (experience from Indian context and other countries). 6. Way forward – how to manage this waste stream applying state of the art technologies

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management, Life Cycle Analysis and Environmental Risk Assessment among other courses for nearly a decade. He has taught at several universities in USA, Canada, New Zealand, China and India. He has also conducted training programs in the Integrated Waste Management areas including that for Electronics Waste. Dr. Dubey has authored/co-authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

Week 1: Plastics – What it is? Types, Uses and Global Statistics

Week 2: Plastic Waste – Sources, Production, Global and Indian Context

Week 3: Plastic Waste Management Rules 2016 (India) and Global Rules and Regulations

Week 4: Plastic Bans including China Sword Policy implication on global plastic waste management

Week 5: Impact of Plastics on Marine Life, Effect on Wildlife, Human Health and Environment

Week 6: Plastic Waste Management Practices – Use of Plastic waste in roads, issues and challenges

Week 7: Possible Alternate Materials to Plastics – Greener Alternatives

Week 8: Plastics Resource Recovery and Circular Economy.

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ANANTAPURAMU-515002



PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON

PROF. MADHAVAN MUKUND

Department of Computer Science and Engineering
Chennai Mathematical Institute

INTENDED AUDIENCE : Students in any branch of mathematics/science/engineering, 1st year

PRE-REQUISITES : School level mathematics.

INDUSTRIES APPLICABLE TO : This course should be of value to any company requiring programming skills.

COURSE OUTLINE :

This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

ABOUT INSTRUCTOR :

Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals. He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014. In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD

COURSE PLAN:**Week 1:**

Informal introduction to programming, algorithms and data structures via gcd
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 definitions: 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:

Efficient evaluation of recursive definitions: memoization
Dynamic programming: examples
Other programming languages: C and manual memory management
Other programming paradigms: functional programming



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INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

- Week 1:** Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I
- Week 2:** Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II
- Week 3:** Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II
- Week 4:** Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications
- Week 5:** Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II
- Week 6:** Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi
- Week 7:** Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT
- Week 8:** SDN for IoT (contd), Data Handling and Analytics, Cloud Computing
- Week 9:** Cloud Computing(contd), Sensor-Cloud
- Week 10:** Fog Computing, Smart Cities and Smart Homes
- Week 11:** Connected Vehicles, Smart Grid, Industrial IoT
- Week 12:** Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring


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Introduction to Modern Application Development

ABOUT THE COURSE:

IMAD, India's largest MOOC, is back and it's bigger and better than before. This course will cover the basics of the Internet, building a web application, databases, performance and security, and building a mobile application. In addition, the course will have an extensive set of Practical Tutorials which will help students get a feel for real-world development. IMAD offers opportunities for internships at Hasura for the course toppers, thus helping the best students hone their application development skills in the real world.

COURSE LAYOUT:

The course content will be covered in 8 weeks. Each week of theoretical lectures will be followed by a practical, hands-on tutorial covering the concepts discussed in the previous week. These lectures will consist of programming experiments and assignments which will help the student gain a practical understanding of the ideas discussed before. The topics covered over the 8 weeks will be -

- Introduction to the Internet
- Building a web application
- Databases
- Performance and security
- Building a mobile application

For additional information, see www.imad.tech


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PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON

PROF. MADHAVAN MUKUND

Department of Computer Science and Engineering
Chennai Mathematical Institute

INTENDED AUDIENCE : Students in any branch of mathematics/science/engineering, 1st year

PRE-REQUISITES : School level mathematics.

INDUSTRIES APPLICABLE TO : This course should be of value to any company requiring programming skills.

COURSE OUTLINE :

This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

ABOUT INSTRUCTOR :

Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals. He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014. In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD

COURSE PLAN:

Week 1:

Informal introduction to programming, algorithms and data structures via gcd
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, iter, 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:

Efficient evaluation of recursive definitions: memoization
Dynamic programming: examples
Other programming languages: C and manual memory management
Other programming paradigms: functional programming

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COMPUTER SCIENCE ENGINEERING

Computer Organization and Architecture

Type of Course	: New
Course Snapshot	: Core / UG, PG : B.E/B.Tech, M.E/M.Tech, M.S
Pre-requisites	: Basic Programming, Digital Electronics
Course Duration	: 30 hours / 12 weeks
Industry Support	: All high end and embedded processors related companies like Intel, AMD, Qualcomm, NVIDIA, IBM, Samsung, Motorola, Hewlett-Packard etc.

COURSE OUTLINE:

Computer Architecture talks about the basic digital hardware with which the processor is built and Computer Organization talks about the basic interface the digital hardware gives to the compiler and the operating systems to support the user demands. Study of Application Binary Interface is the subject matter of Computer Organization. How these functionalities are actually implemented is the subject matter of Computer Architecture. This course not only addresses the how and what but also the whys of Computer Architecture and Organization.

INSTRUCTOR:

Prof. V. Kamakoti
Department of Computer Science and Engineering,
IIT Madras



ABOUT INSTRUCTOR:

Prof. V. Kamakoti, Department of Computer Science and Engineering, IIT Madras specializes in the area of Computer Architecture and Secure Hardware Design. He is an advisor for many security critical organizations including Banking Institutions. He completed his Master of Science (By research) and PhD at the Department of Computer Science and Engineering, IIT Madras in the years 1992 and 1995 respectively. He completed his BE in Computer Science and Engineering from Sri Venkataswara College of Engineering (Affiliated to University of Madras) in the year 1989. He is a coordinator of the Information Security Education and Awareness program of the Department of Information Technology, Government of India

COURSE PLAN:

1. High-Performance Circuit Design - Fast Adder Circuits, Fast Multiplier Circuit - Floating Point - Precision and Accuracy, Addition, Subtraction and Multiplication
2. Programming using X86 Instruction Set Architecture - Orthogonal ISA, C Constructs Mapping, Addressing Modes - Atomic and Predicated Instructions - General Purpose Registers - Expanding Opcodes
3. Pipelining - Data Hazards - Instruction Scheduling: Static and Dynamic - Control Hazard, Branch Prediction
4. Segmentation - Interrupts & Process Management- Paging - Multitasking - Virtual memory - Task Switching
5. Caches - Shared Memory Architecture - Mutual Exclusion - Optimality of Parallel Algorithms - Current Trends in Computer Architecture

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CLOUD COMPUTING

PROF. SOUMYA KANTI GHOSH

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basics of Computer Architecture and Organization, Networking

INTENDED AUDIENCE : CSE, ECE, EE

INDUSTRIES APPLICABLE TO : IT industries

COURSE OUTLINE :

Cloud computing is a scalable services consumption and delivery platform that provides on-demand computing service for shared pool of resources, namely servers, storage, networking, software, database, applications etc., over the Internet. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources, which can be rapidly provisioned and released with minimal management effort. This course will introduce various aspects of cloud computing, including fundamentals, management issues, security challenges and future research trends. This will help students (both UG and PG levels) and researchers to use and explore the cloud computing platforms.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

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

Week 9: VM Resource Allocation, Management and Monitoring

Week 10: Cloud-Fog-Edge enabled Analytics

Week 11: Serverless Computing and FaaS Model

Week 12: Case Studies and Recent Advancements


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INTRODUCTION TO AIRPLANE PERFORMANCE

PROF. A.K.GHOSH

Department of Aerospace Engineering
IIT Kanpur

PROF. DEEPU PHILIP

Department of Industrial & Management Engineering
IIT Kanpur

INTENDED AUDIENCE : UG/PG of B.Tech/BE in any discipline of engineering

INDUSTRIES APPLICABLE TO : DRDO, HAL, Boeing, Airbus, Bell, McDonnell Douglas, UAV Factory, Lockheed Martin

COURSE OUTLINE :

This course is designed to provide an integrated introductory treatment of airplane performance with flavor of aircraft design and flight testing.

ABOUT INSTRUCTOR :

Prof. A.K. Ghosh is a faculty of Aerospace Engg. Department of IIT Kanpur. He is also the in-charge of the flight laboratory and unmanned aerial vehicle of IIT Kanpur. His research areas include system identification through flight tests using conventional and neural network based methods, design of aircrafts and airborne projectiles, supercavitation, unmanned aerial systems. Before joining IIT Kanpur, he worked as a scientist with Defense Research Development Organization (DRDO). He has published many peer reviewed journal papers and conference papers, guided 13 doctoral students, and 38 masters students. He is also a mentor of multiple aerospace start-up companies, and also been associated with major industry contributions of high speed low drag aircraft bomb, Pinaka Mk-I, 105mm sabot round for tracked vehicles, etc.

Prof. Deepu Philip is a faculty of Industrial & Management Engg. Department and Design Programme of IIT Kanpur. He works in the area of Production and Operations, Systems Simulation, Product Life Cycle Management, Unmanned Aerial Systems, and Systems Engineering. He holds bachelor degree in Industrial Engineering with his doctorate in Industrial & Management Engineering from MSU Bozeman. He has both academic and industrial experience with leading organizations of the world. He has experience in designing and implementing complex system of systems in different fields including defense, aviation, fertilizer, strategic chemical plants, transportation, banking, automation, health care, energy, and communication.

COURSE PLAN :

- Week 1:** General Introduction: Airplane Performance Characteristics, George Cayley: Concept of Lift and Drag, Introduction to airplane and its components, Hansa 3 Aircraft and its Primary Systems, Concept of Lift: Aerofoil, Wing, and Complete Aircraft, Drag Polar
- Week 2:** Revision, Standard Atmosphere: Description and Modelling, Measuring Instruments: Altimeter, Airspeed Indicator, Equations of Motion: Static Performance, Thrust Required, Power Required: Cruise, Excess Thrust and Power: Climb Angle and Rate of Climb
- Week 3:** Review, Thrust Required: A Closer Look, Modelling of CL: Dimensional Analysis, A Closer Look: Point Mass Model, Dimensional Analysis, Estimation of Drag Polar Through Flight Test, Estimation of Rate of Climb
- Week 4:** Revision, Range and Endurance, Range and Endurance(Continued), Gliding Flight, Accelerated Flight, V-n Diagram
- Week 5:** Revision, V stall: Cruise and Manoeuvre, Flaps: High Lift Devices to Reduce Take off / Landing Distance, Take off: Warm-up Lecture, Take off Performance, Take off Performance (Continued)


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- Week 6:** Revision, Landing Performance, Landing Performance (Continued), Challenges in Take-off and Landing: Single and Twin Engines, Introduction to Static Stability, Positioning of Centre of Pressure for Static Stability
- Week 7:** Revision, Stability and Control: Designer's Perspective, Stability and Control: Designer's Perspective (Continued), Longitudinal Control: Elevator, Stability: Wing and Tail Contribution, Stability: Wing and Tail Contribution (Continued)
- Week 8:** Control: Elevator, Control: δE Required, Control: δE Required (continued), Design Basics: Wing Loading & Thrust Loading, Design Basics: Sweep & Dihedral, Revision



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Sustainable Engineering Concepts and Life Cycle Analysis

Prof. Brajesh Kumar Dubey
Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE: Any interested learners.

PRE-REQUISITES : Environmental Sciences, Introduction to Environmental Engineering

INDUSTRIES APPLICABLE TO : list of companies/industry that will recognize/value this online course, Larsen and Turbo, Tata Group of Industries.

COURSE OUTLINE :

This course will introduce students to the fundamental concepts related to interaction of industrial and environmental/ecological systems, sustainability challenges facing the current generation, and systems-based approaches required to create sustainable solutions for society. Students will understand the concepts and the scientific method as it applies to a systems-based, trans-disciplinary approach to sustainability, and will be prepared to identify problems in sustainability and formulate appropriate solutions based on scientific research, applied science, social and economic issues. The basic concepts of life cycle assessment (LCA) will be discussed, along with life cycle inventory (LCI) and life cycle impact assessment (LCIA) including the social and economic dimensions. The application of life cycle assessment methodology using appropriate case studies will be presented.

ABOUT INSTRUCTOR :

Prof. Brajesh Kr. Dubey has his bachelors degree in Civil Engineering (Hons) from Indian Institute of Technology (IIT) Kharagpur, India and PhD in Environmental Engineering Sciences, University of Florida, Gainesville, Florida, USA. He is presently Associate Professor (Integrated Waste Management and Sustainable Engineering) in the Division of Environmental Engineering and Management at Indian Institute of Technology (IIT), Kharagpur, India. Dr. Dubey has more than 17 years of research, teaching, training and industrial outreach experience in the areas of Integrated Solid and Hazardous Waste Management, and Sustainable Engineering and Application of Life Cycle Assessment techniques. He also works in the area of Life Cycle Analysis and Sustainable Engineering. He has been teaching courses in the area of Solid Waste Management, Hazardous Waste Management, Life Cycle Analysis and Environmental Risk Assessment among other courses for nearly a decade. He has taught at several universities in USA, Canada, New Zealand, China and India. He has also conducted training programs in the Integrated Waste Management areas including that for Electronics Waste. Dr. Dubey has authored/co- authored more than 200 publications in his area of expertise and have presented at several national and international conferences. He has worked as Waste Management Expert for UN agencies and World Bank.

COURSE PLAN :

Week 1: An Introduction to Sustainability Concepts and Life Cycle Analysis (Introduction, Material flow and waste management, What it all means for an engineer? Water energy and food nexus)

Week 2: Risk and Life Cycle Framework for Sustainability (Introduction, Risk, Environmental Risk Assessment, Example Chemicals and Health Effects, Character of Environmental Problems)

Week 3: Environmental Data Collection and LCA Methodology (Environmental Data Collection Issues, Statistical Analysis of Environmental Data, Common Analytical Instruments, Overview of LCA Methodology - Goal Definition, Life Cycle Inventory, Life Cycle Impact Assessment, Life Cycle Interpretation, LCA Software tools)

Week 4: Life Cycle Assessment – Detailed Methodology and ISO Framework (Detailed Example on LCA Comparisons, LCA Benefits and Drawbacks, Historical Development and LCA Steps from ISO Framework)

Week 5: Life Cycle Inventory and Impact Assessments (Unit Processes and System Boundary Data Quality, Procedure for Life Cycle Impact Assessment, LCIA in Practice with Examples, Interpretation of LCIA

Results)

Week 6: Factors for Good LCA Study (ISO Terminologies, LCA Steps Recap, Chemical Release and Fate and Transport, and Green Sustainable Materials)

Week 7: Design for Sustainability (Environmental Design for Sustainability: Economic, Environmental Indicators, Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis)

Week 8: Case Studies (e.g., Odour Removal for Organics Treatment Plant, Comparison of Hand Drying Methods, Biofuels for Transportation, Kerosene Lamp vs. Solar Lamp, Bioplastic etc.).


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DIGITAL LAND SURVEYING AND MAPPING (DLS&M)

**PROF. JAYANTA KUMAR
GHOSH**

Department of Civil Engineering
IIT Roorkee

TYPE OF COURSE: Rerun | Elective | UG

COURSE DURATION : 8 weeks (21 Feb' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Basics of Physics and mathematics upto 12th standard and familiarity with use of computer

INTENDED AUDIENCE : Diploma/Degree students in Civil Engineering/Geo-spatial technology;
Master/Doctoral students in Geomatics/Geospatial technology; Field surveyors;
Professional persons dealing with Land surveying.

INDUSTRIES APPLICABLE TO : <http://dir.indiamart.com/impcat/topographicsurvey-services.html>

COURSE OUTLINE :

The objective of the course is to provide basics of digital surveying and mapping of earth surface using total station, GPS and mapping software. The course starts with introduction to land surveying followed by fundamentals of total station and its working & measurements for land surveying. Then, fundamentals, working & measurements using GPS for land surveying will be discussed. Followed by mapping fundamentals, digital surveying procedure, working, data reduction etc. Finally, the course will deals with working and demonstration of a digital land surveying and mapping of an area.

This course will uncover all the major topics in pericyclic reactions and organic photochemistry. In addition to lectures there will be tutorial sessions and assignments in this course.

ABOUT INSTRUCTOR :

Prof. Jayanta Kumar Ghosh is working as Associate Professor in the Civil Engineering Department (Geomatics Engineering Group) of Indian Institute of Technology Roorkee. He is engaged in teaching, research and consultancy works in Geomatics engineering for more than 31 years. He is pioneer in introducing courses on GPS surveying in the UG & PG curriculum of Engineering education in India, since 1999. He has conducted many short term courses on Surveying for the building professionals as early as 2000. He has published TWO books on Surveying – Elementary Engineering Surveying and Introduction to GPS Surveying. He is member of different National and International technical associations.

COURSE PLAN :

Week 1: Fundamentals of Land Surveying & GPS

Week 2: Global Positioning System (GPS)

Week 3: Global Positioning System (GPS)

Week 4: TOTAL STATION(TS)

Week 5: TS & DIGITAL LAND SURVEYING (DLS)

Week 6: DLS& DIGITAL MAPPING (DM)

Week 7: DM & DIGITAL DATA MANIPULATION (DDM)

Week 8: DIGITAL LAND SURVEYING AND MAPPING (DLS&M)


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Books and referer



(<https://swayam.gov.in/>)



(https://swayam.gov.in/nc_details/NPTEL)

Electric Powertrain - Energy Systems, Power electronics and drives for Hybrid, electric and fuel cell vehicles by John G. Hayes and A. Goodarzi, Wiley Publication
About Swayam (<https://swayam.gov.in/about>) | All Courses | 0

Instructor bio



Prof. Ashok Jhunjunwala, Prof. Kaushal Jha, Prof. L Kannan, Prof. Prabhjot Kaur

IIT Madras

Ashok Jhunjunwala, Institute Professor at IIT Madras, did his B.Tech degree from IIT Kanpur and MS and PhD from University of Maine, USA and was a faculty at Washington State University, USA for a year and half before joining as a faculty at IIT Madras in 1981. In 2017-18, he was on sabbatical from IITM and was Principal Advisor to Minister of Power, MNRE, and Railways, Government of India, New Delhi.

Prof. Jhunjunwala is considered a pioneer in nurturing Industry-Academia interaction in India towards Research and Development, Innovation and Product Development. He conceived and built India's first university affiliated business park (IIT Madras Research Park) to promote Industry-Academia Research and Development collaboration.

Course certificate

The course is free to enroll and learn from. But if you want a certificate, you have to register and write the proctored exam conducted by us in person at any of the designated exam centres.

The exam is optional for a fee of Rs 1000/- (Rupees one thousand only).

Date and Time of Exams: **24 October 2021** Morning session 9am to 12 noon; Afternoon Session 2pm to 5pm.

Registration url: Announcements will be made when the registration form is open for registrations.

The online registration form has to be filled and the certification exam fee needs to be paid. More details will be made available when the exam registration form is published. If there are any changes, it will be mentioned then.

Please check the form for more details on the cities where the exams will be held, the conditions you agree to when you fill the form etc.

CRITERIA TO GET A CERTIFICATE

Average assignment score = 25% of average of best 8 assignments out of the total 12 assignments given in the course.

Exam score = 75% of the proctored certification exam score out of 100

Final score = Average assignment score + Exam score

YOU WILL BE ELIGIBLE FOR A CERTIFICATE ONLY IF AVERAGE ASSIGNMENT SCORE $\geq 10/25$ AND EXAM SCORE $\geq 30/75$. If one of the 2 criteria is not met, you will not get the certificate even if the Final score $\geq 40/100$.

Certificate will have your name, photograph and the score in the final exam with the breakup. It will have the logos of NPTEL and IIT Madras. It will be verifiable at nptel.ac.in/noc (<http://nptel.ac.in/noc>).

Course Status :


[\(https://swayam.gov.in/\)](https://swayam.gov.in/)

 [\(https://swayam.gov.in/nc_details/NPTEL\)](https://swayam.gov.in/nc_details/NPTEL)

Course Type :

Duration :

About Swayam (<https://swayam.gov.in/about>) | All Courses |

0

Category :

- Electrical, Electronics and Communications Engineering

Credit Points :

3

Level :

Undergraduate/Postgraduate

Start Date :

26 Jul 2021

End Date :

15 Oct 2021

Enrollment Ends :

09 Aug 2021

Exam Date :

24 Oct 2021 IST

Note: This exam date is subjected to change based on seat availability. You can check final exam date on your hall ticket.

This is an AICTE approved FDP course

[\(/#facebook\)](#)
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[\(/#email\)](#)
[\(/#linkedin\)](#)
[\(/#whatsapp\)](#)

(https://www.addtoany.com/share?url=https%3A%2F%2Fonlinecourses.nptel.ac.in%2Fnoc21_ee112%2Fpreview&title=Electric%20Vehicles%20and%20Renewable%20Energy%20-%20Course)

Course layout

The key topics that are going to be discussed in this course are

1. Overview of Electric Vehicles in India
2. Vehicle Dynamics
3. Vehicle Subsystems: EV Power-train
- 4.a Storage for EVs
- 4.b Fundamentals of EV Battery Pack design
5. EV Motors and Controllers: Fundamentals and Design
6. Vehicle Accessories
7. Battery Charging and Swapping
8. Introduction to Energy Scenario in India
- 9.a Solar and Wind energy in India: Economics of centralized generation
- 9.b Decentralized Solar energy generation
10. Storage options for Energy



PYTHON FOR DATA SCIENCE

PROF. RAGHUNATHAN RENGASAMY

Department of Chemical Engineering
IIT Madras

PRE-REQUISITES : Knowledge of basic data science algorithms

INTENDED AUDIENCE : Final Year Undergraduates

COURSE OUTLINE :

The course aims at equipping participants to be able to use python programming for solving data science problems

ABOUT INSTRUCTOR :

Prof. Rengaswamy was a professor of Chemical Engineering before joining at IIT Madras as a professor and Co-Director of the Process Control and Optimization Consortium at Texas Tech University, Lubbock, USA. He was also a professor and associate professor at Clarkson University, USA and an assistant professor at IIT Bombay. His major research interests are in the areas of fault detection and diagnosis and development of data science algorithms for manufacturing industries.

COURSE PLAN :

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 Toyota 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
5. Functions

Week 4: CASE STUDY

Regression

1. Predicting price of pre-owned cars

Classification

1. Classifying personal income

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INTRODUCTION TO ALGORITHMS AND ANALYSIS

PROF. SOURAV MUKHOPADHYAY

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE : UG,PG, B. Tech., M. Tech., M. Sc.

INDUSTRIES APPLICABLE TO : IT Companies

COURSE OUTLINE :

This course provides an introduction to mathematical modeling of computational problems. It covers the common algorithms, algorithmic paradigms, and data structures used to solve these problems. The course emphasizes the relationship between algorithms and programming, and introduces basic performance measures and analysis techniques for these problems.

ABOUT INSTRUCTOR :

Prof. SouravMukhopadhyay is an associate professor at Indian Institute of Technology Kharagpur. He has completed his B.Sc (Honours in Mathematics) in 1997 from University of Calcutta, India. He has done M.Stat (in statistics) and M.Tech (in computer science) from Indian Statistical Institute, India, in 1999 and 2001 respectively. He worked with Cryptology Research Group at Indian Statistical Institute as a PhD student and received his Ph.D. degree in Computer Science from there in 2007. He was a Research Assistant at the Computer Science department of School of Computing, National University of Singapore (NUS). He visited InriaRocquencourt, project CODES, France and worked as a post-doctoral research fellows at the School of Computer Engineering, Nanyang Technological University (NTU), Singapore. He was a post-doctoral research fellows and a part time Lecturer with School of Electronic Engineering, Dublin City University (DCU), Ireland.

COURSE PLAN :

- Week 1:** Sorting problem, time complexity, asymptotic analysis.
- Week 2:** Solving recurrence, Divide-and-Conquer.
- Week 3:** Quicksort and Heap Sort, Decision Tree.
- Week 4:** Linear time Sorting, Order Statistics.
- Week 5:** Hash Function, Binary Search Tree (BST) Sort.
- Week 6:** Randomly build BST, Red Black Tree, Augmentation of data structure.
- Week 7:** Van Emde Boas, Amortized analysis, Computational Geometry.
- Week 8:** Dynamic Programming, Graphs, Prim's Algorithms.
- Week 9:** BFS & DFS, Shortest path problem, Dijkstra, Bellman Ford.
- Week 10:** All pairs shortest path, Floyd-Warshall, Johnson Algorithm.
- Week 11:** More amortized analysis, disjoint set data structure.
- Week 12:** Network flow, computational complexity.

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SOCIAL NETWORKS

PROF.SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

PROF.YAYATI GUPTA

Department of Computer Science and Engineering
Mahindra University, Hyderabad

INTENDED AUDIENCE : Any Interested Learners

COURSE OUTLINE :

The world has become highly interconnected and hence more complex than ever before. We are surrounded by a multitude of networks in our daily life, for example, friendship networks, online social networks, world wide web, road networks etc. All these networks are today available online in the form of graphs which hold a whole lot of hidden information. They encompass surprising secrets which have been time and again revealed with the help of tools like graph theory, sociology, game theory etc. The study of these graphs and revelation of their properties with these tools have been termed as Social Network Analysis.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

Prof. Yayati Gupta is an Assistant Professor in the Computer Science & Engineering Department at Mahindra University École Centrale School of Engineering. She is also an instructor for a couple of NPTEL/SWAYAM courses (Social Networks, Joy of Computing). She holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Ropar (November 2017). Her research primarily focuses on Social Network Analysis and Complex Networks. The major research projects include "Modeling Information Diffusion" and "Understanding Virality of Internet Memes" in online social networks.

COURSE PLAN :

- Week 1:** Introduction
- Week 2:** Handling Real-world Network Datasets
- Week 3:** Strength of Weak Ties
- Week 4:** Strong and Weak Relationships (Continued) & Homophily
- Week 5:** Homophily Continued and +Ve / -Ve Relationships
- Week 6:** Link Analysis
- Week 7:** Cascading Behaviour in Networks
- Week 8:** Link Analysis (Continued)
- Week 9:** Power Laws and Rich-Get-Richer Phenomena
- Week 10:** Power law (contd..) and Epidemics
- Week 11:** Small World Phenomenon
- Week 12:** Pseudocore (How to go viral on web)


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NATURAL LANGUAGE PROCESSING

PROF. PAWAN GOYAL

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic knowledge of probabilities for the lectures and python for programming assignment

INDUSTRIES APPLICABLE TO : Microsoft Research, Google, Adobe, Xerox, Flipkart, Amazon

COURSE OUTLINE :

This course starts with the basics of text processing including basic pre-processing, spelling correction, language modeling, Part-of-Speech tagging, Constituency and Dependency Parsing, Lexical Semantics, distributional Semantics and topic models. Finally, the course also covers some of the most interesting applications of text mining such as entity linking, relation extraction, text summarization, text classification, sentiment analysis and opinion mining.

ABOUT INSTRUCTOR :

Prof. Pawan Goyal is an Assistant Professor at the Department of Computer Science and Engineering, IIT Kharagpur. His research interests include Natural Language Processing, Text Mining, Information Retrieval and Sanskrit Computational Linguistics. He has published around 75 research papers in international conferences and journals. He has published in various top-tier conferences and journals including ACL, NAACL, EMNLP, SIGIR, KDD, CIKM, JCDL, ICWSM, CSCW, Coling, IEEE and ACM transactions. Prior to joining IIT Kharagpur, he received his B. Tech. degree in Electrical Engineering from IIT Kanpur in 2007 and his Ph.D. degree in the faculty of Computing and Engineering from University of Ulster, UK in 2011. He was then a Post Doctoral Fellow at INRIA Paris Rocquencourt.

COURSE PLAN :

Week 1: Introduction and Basic Text Processing

Week 2: Spelling Correction, Language Modeling

Week 3: Advanced smoothing for language modeling, POS tagging

Week 4: Models for Sequential tagging – MaxEnt, CRF

Week 5: Syntax – Constituency Parsing

Week 6: Dependency Parsing

Week 7: Distributional Semantics

Week 8: Lexical Semantics

Week 9: Topic Models

Week 10: Entity Linking, Information Extraction

Week 11: Text Summarization, Text Classification

Week 12: Sentiment Analysis and Opinion Mining


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PROGRAMMING, DATA STRUCTURES AND ALGORITHMS USING PYTHON

PROF. MADHAVAN MUKUND

Department of Computer Science and Engineering
Chennai Mathematical Institute

INTENDED AUDIENCE : Students in any branch of mathematics/science/engineering, 1st year

PRE-REQUISITES : School level mathematics.

INDUSTRIES APPLICABLE TO : This course should be of value to any company requiring programming skills.

COURSE OUTLINE :

This course is an introduction to programming and problem solving in Python. It does not assume any prior knowledge of programming. Using some motivating examples, the course quickly builds up basic concepts such as conditionals, loops, functions, lists, strings and tuples. It goes on to cover searching and sorting algorithms, dynamic programming and backtracking, as well as topics such as exception handling and using files. As far as data structures are concerned, the course covers Python dictionaries as well as classes and objects for defining user defined datatypes such as linked lists and binary search trees.

ABOUT INSTRUCTOR :

Prof. Madhavan Mukund studied at IIT Bombay (BTech) and Aarhus University (PhD). He has been a faculty member at Chennai Mathematical Institute since 1992, where he is presently Professor and Director. His main research area is formal verification. He has active research collaborations within and outside India and serves on international conference programme committees and editorial boards of journals.

He has served as President of both the Indian Association for Research in Computing Science (IARCS) (2011-2017) and the ACM India Council (2016-2018). He has been the National Coordinator of the Indian Computing Olympiad since 2002. He served as the Executive Director of the International Olympiad in Informatics from 2011-2014.

In addition to the NPTEL MOOC programme, he has been involved in organizing IARCS Instructional Courses for college teachers. He is a member of ACM India's Education Committee. He has contributed lectures on algorithms to the Massively Empowered Classroom (MEC) project of Microsoft Research and the QEEE programme of MHRD

COURSE PLAN:**Week 1:**

Informal introduction to programming, algorithms and data structures via gcd

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, iter, 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:

Efficient evaluation of recursive definitions: memoization

Dynamic programming: examples

Other programming languages: C and manual memory management

Other programming paradigms: functional programming

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INTRODUCTION TO MACHINE LEARNING

PROF. BALARAMAN RAVINDRAN

Department of Computer Science and Engineering
IIT Madras

PRE-REQUISITES : We will assume that the students know programming for some of the assignments. If the students have done introductory courses on probability theory and linear algebra it would be helpful. We will review some of the basic topics in the first two weeks as well.

INTENDED AUDIENCE : This is an elective course. Intended for senior UG/PG students. BE/ME/MS/PhD

INDUSTRIES APPLICABLE TO : Any company in the data analytics/data science/big data domain would value this course

COURSE OUTLINE :

With the increased availability of data from varied sources there has been increasing attention paid to the various data driven disciplines such as analytics and machine learning. In this course we intend to introduce some of the basic concepts of machine learning from a mathematically well motivated perspective. We will cover the different learning paradigms and some of the more popular algorithms and architectures used in each of these paradigms.

ABOUT INSTRUCTOR :

Prof. Balaraman Ravindran is currently an Professor in Computer Science at IIT Madras and Mindtree Faculty Fellow . He has nearly two decades of research experience in machine learning and specifically reinforcement learning. Currently his research interests are centered on learning from and through interactions and span the areas of data mining, social network analysis, and reinforcement learning.

COURSE PLAN :

- Week 0:** Probability Theory, Linear Algebra, Convex Optimization - (Recap)
- Week 1:** Introduction: Statistical Decision Theory - Regression, Classification, Bias Variance
- Week 2:** Linear Regression, Multivariate Regression, Subset Selection, Shrinkage Methods, Principal Component Regression, Partial Least squares
- Week 3:** Linear Classification, Logistic Regression, Linear Discriminant Analysis
- Week 4:** Perceptron, Support Vector Machines
- Week 5:** Neural Networks - Introduction, Early Models, Perceptron Learning, Backpropagation, Initialization, Training & Validation, Parameter Estimation - MLE, MAP, Bayesian Estimation
- Week 6:** Decision Trees, Regression Trees, Stopping Criterion & Pruning loss functions, Categorical Attributes, Multiway Splits, Missing Values, Decision Trees - Instability Evaluation Measures
- Week 7:** Bootstrapping & Cross Validation, Class Evaluation Measures, ROC curve, MDL, Ensemble Methods - Bagging, Committee Machines and Stacking, Boosting
- Week 8:** Gradient Boosting, Random Forests, Multi-class Classification, Naive Bayes, Bayesian Networks
- Week 9:** Undirected Graphical Models, HMM, Variable Elimination, Belief Propagation
- Week 10:** Partitional Clustering, Hierarchical Clustering, Birch Algorithm, CURE Algorithm, Density-based Clustering
- Week 11:** Gaussian Mixture Models, Expectation Maximization
- Week 12:** Learning Theory, Introduction to Reinforcement Learning, Optional videos (RL framework, TD learning, Solution Methods, Applications)


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FABRICATION TECHNIQUES FOR MEMS-BASED SENSORS : CLINICAL PERSPECTIVE

PROF. HARDIK JEETENDRA PANDYA

Department of Electrical, Electronics and Computer Science Engineering
IISc Bangalore

INTENDED AUDIENCE : Engineering Students, Faculty from Engineering Colleges

PRE-REQUISITES : Basic Electronics

INDUSTRIES SUPPORT : Companies working in semiconductors and integrated circuits: Intel, AMD, Samsung, Texas Instruments, Analog Devices etc.

COURSE OUTLINE :

This course is designed with an aim of educating students in the area of microtechnology and its use to fabricate sensors and systems. The students will have an exposure to sensors and its importance in the real world. The students will also be able to understand how to fabricate some of those sensors. Several examples of engineering devices used in clinical research will be also covered. Class 10000 non-conventional clean room and some equipment within it will also be shown. Below are some of the course outcomes. Ability to understand microfabrication process Understand sensors used in electronics and biomedical areas Understand Clean Room (Class 1 to Class 10000) Understand Microengineering Technology Design the process flow for fabricating microheater required in gas sensors. Design the process flow for fabricating force sensors for biomedical application. Design microheater for gas sensors as per specifications. Design force sensors as per specifications. Understand fabrication of microfluidic platforms, micro-cantilevers, flexible force sensors, inter-digitated electrodes, polymer-glass bonding etc. for clinical research

ABOUT INSTRUCTOR :

Prof. Hardik J. Pandya is an assistant professor in the Department of Electronic Systems Engineering, Division of Electrical Sciences, IISc Bangalore where he is developing Advanced Microsystems and Biomedical Devices Facility for Clinical Research and Biomedical and Electronic (10-6-10-9) Engineering Systems Laboratory to carry out cutting-edge research on novel devices to solve unmet problems in biology and medicine. He is recipient of prestigious Early Career Research Award from Science and Engineering Research Board, Government of India as well as a start-up grant of 228 Lacs from IISc. He has taught Design for Analog Circuits, Analog Integrated Circuits, VLSI technology, and Semiconductor Devices to undergraduate and graduate students from Electronic Engineering, Instrumentation Engineering, and Applied Physics. He seeks to understand and exploit novel ways of fabricating microengineering devices using glass, silicon, polymers and integrate with unusual classes of micro/nanomaterials. His research interests include integrating biology/medicine with micro- and nanotechnology to develop innovative tools to solve unmet clinical problems. His current research focuses on flexible sensors for smart catheters, microsensors, microfluidic devices, and microelectromechanical systems, all lately with an emphasis on cancer diagnosis, therapeutics, e-nose, and biomedical device technologies. Before joining IISc, he worked as a postdoctoral scientist in the Department of Mechanical Engineering, Maryland Robotics Center, University of Maryland, College Park and in the Department of Medicine, Brigham and Women's Hospital-Harvard Medical School affiliated with Harvard-MIT Health Science and Technology. His work has resulted in several patents and publications. His work has been highlighted as "Breaking Research News" by The Physicians Committee for Responsible Medicine and has been featured on IEEE Transactions on Biomedical Engineering July 2016 issue cover image as well as IEEE TBME July 2016 feature article for the website and monthly highlights. The work on portable cancer diagnosis tool was also featured on Science Translational Medicine as an Editorial Choice, Breast Cancer Diagnosis, March 2016 and has been highlighted on CapeRay blog as "Biochips and Diagnostic tools" in April 2016. His work has been published in high-quality journals including Lab on a Chip, IEEE Transactions on Biomedical Engineering, IEEE Journal of Microelectromechanical Systems, Sensors and Actuators B, Biosensors and Bioelectronics, Nanoscience and Nanotechnology Letters, Sensors and Transducers, and Journal of Micromechanics and Micromachining.

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COURSE PLAN :

- Week 01** : Introduction to microengineering devices and its applications
- Week 02** : Clean room, contaminants, wafer cleaning processes (DI water, RCA, metallic impurities, etc.).
- Week 03** : Introduction to the microheater, force sensors, microfluidic devices, its specifications, and applications.
- Week 04** : Masks: Types of masks, Types of Photoresists, Spin Coaters Lithography process: optical lithography, x-ray, and e-beam lithography, lift-off techniques, soft lithography, Use of resists (spin coating, positive and negative photoresists), photoresist pre-baking, exposure, and development.
- Week 05** : Etching: Isotropic/anisotropic, selectivity, wet and plasma assisted etching.
- Week 06** : Types of wafers and orientations. Techniques of metallization: PVD [(Sputtering – DC, RF and Magnetron), thermal evaporation, e-beam evaporation].
- Week 07** : Chemical Vapor Deposition: Dielectric films (Plasma Enhance Chemical Vapor Deposition (PECVD)), Atomic Layer Deposition
- Week 08** : Understanding and designing the process flow for fabricating microengineering devices. Process flow for microheater, force sensors, and microfluidic devices.
- Week 09** : Wafer dicing and bonding techniques. Microfluidic Chips
- Week 10** : Process Flow for Fabricating Flexible Force Sensors and Force Sensors on Silicon, Process Flow for Fabricating VOC sensors, Biochips
- Week 11** : Clinical Research: Problems and Solutions using Microengineering Device
- Week 12** : Visit to non-conventional Class 10000 Clean Room and discussing few equipment within.


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HARDWARE MODELING USING VERILOG

PROF. INDRANIL SENGUPTA

Department of Computer Science and Engineering
IIT Kharagpur

INTENDED AUDIENCE: Computer Science and Engineering ; Electronics and Communication Engineering ; Electrical Engineering

PRE-REQUISITES : Basic concepts in digital circuit design ; Familiarity with a programming language like C or C++

INDUSTRY SUPPORT : Intel, Cadence, Mentor Graphics, Synopsys, Xilinx.

COURSE OUTLINE:

The course will introduce the participants to the Verilog hardware description language. It will help them to learn various digital circuit modeling issues using Verilog, writing test benches, and some case studies.

ABOUT INSTRUCTOR:

Prof. Indranil Sengupta has obtained his B.Tech., M.Tech. and Ph.D. degrees in Computer Science and Engineering from the University of Calcutta. He joined the Indian Institute of Technology, Kharagpur, as a faculty member in 1988, in the Department of Computer Science and Engineering, where he is presently a full Professor. He had been the former Heads of the Department of Computer Science and Engineering and also the School of Information Technology of the Institute. He has over 28 years of teaching and research experience. He has guided 22 PhD students, and has more than 200 publications to his credit in international journals and conferences. His research interests include cryptography and network security, VLSI design and testing, and mobile computing.

He is a Senior Member of IEEE. He had been the General Chairs of Asian Test Symposium (ATS-2005), International Conference on Cryptology in India (INDOCRYPT-2008), International Symposium on VLSI Design and Test (VDAT-2012), International Symposium on Electronic System Design (ISED-2012), and the upcoming Conference on reversible Computation (RC-2017). He had delivered invited and tutorial talks in several conferences in the areas of VLSI design and testing, and network security.

COURSE PLAN:

- Week 1:** Introduction to digital circuit design flow (3 hours)
- Week 2:** Verilog variables, operators and language constructs (2 hours)
- Week 3:** Modeling combinational circuits using Verilog (2 hours)
- Week 4:** Modeling sequential circuits using Verilog (3 hours)
- Week 5:** Verilog test benches and design simulation (2 hours)
- Week 6:** Behavioral versus structural design modeling (2 hours)
- Week 7:** Miscellaneous modeling issues: pipelining, memory, etc. (2 hours)
- Week 8:** Processor design using Verilog (4 hours)


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COMPUTER INTEGRATED MANUFACTURING

PROF. JANAKARAJAN RAMKUMAR

Department of Mechanical Engineering
IIT Kanpur

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PROF. AMANDEEP SINGH

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : The student should have completed two semesters of UG Engineering or Science program.

INTENDED AUDIENCE : Students of all Engineering and Science disciplines.

INDUSTRIES APPLICABLE TO : HAL, NAL, SAIL, ISRO

COURSE OUTLINE :

Use of computers in manufacturing in order to design and develop the products has found unprecedented applications. Computer integrated way of manufacturing provides a myriad of benefits such as speed, flexibility, and better control. In this course, Computer Integrated Manufacturing (CIM) approaches are discussed. CAD/CAM tools and their within and between the production systems are presented along with appropriate case studies. Data storage and handling is also the need of contemporary manufacturing systems. This is also catered using software tools. The course is reinforced with the laboratory demonstrations to add a practitioners' touch. Students would develop a prowess to largely plan, design and develop a product and a production system after completing this course

ABOUT INSTRUCTOR :

Prof. Janakarajan Ramkumar is Professor of Mechanical Engineering Department, and Design Program, at Indian Institute of Technology, Kanpur. He teaches manufacturing science, micro / nano technology, new product development. He has a bachelors in Production Engineering with his doctorate in Defect quantification in drilling of composites from IIT Madras, India with a best thesis award.

Prof. Amandeep Singh is working as Research Scientist in the Mechanical Engineering Department, and Design Program, Indian Institute of Technology, Kanpur, India. He holds PhD degree from Indian Institute of Technology Kanpur, India, and a Bachelors degree in Production Engineering. Dr. Singh has ten years of industrial and academic experience.

COURSE PLAN :

Week 1: Introduction to Computer Integrated Manufacturing (CIM)

Week 2: Computer Aided Design

Week 3: Computer Aided Manufacturing

Week 4: Computer Numerical Control

Week 5: Computer Aided Process Planning (CAPP)

Week 6: CIM interfaces: CAD vs CAM

Week 7: Data and information in CIM

Week 8: Manufacturing Systems and their design

Week 9: Simulation of Manufacturing Systems

Week 10: Computer Aided Maintenance

Week 11: Computer Integrated Additive Manufacturing

Week 12: Advanced CIM techniques


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WELDING PROCESSES

PROF. MURUGAIYAN AMIRTHALINGAM

Department of Metallurgy and Material Science
IIT Madras

TYPE OF COURSE : Rerun | Elective | UG/PG

COURSE DURATION : 12 weeks (24 Jan' 22 - 15 Apr' 22)

EXAM DATE : 23 Apr 2022

PRE-REQUISITES : Graduates of Metallurgical/Mechanical/Automobile/Production Engineering

INTENDED AUDIENCE : Masters students in Metallurgical, Mechanical, Automobile and Production Engineering. Practicing welding engineers, welders, R&D personnel in academia and national laboratories, quality management personnel from welding and manufacturing industries and research scholars who are working in welding and joining.

INDUSTRIES APPLICABLE TO : Construction, Fabrication, Automobile and Power generation industries and research labs

COURSE OUTLINE :

The modern material assemblies require the combined use of alloys for a given commercial application. Welding technologies are of critical importance for the construction of virtually all components of the assemblies. This course aims to elaborate the physical principles of arc, plasma, laser, resistance spot, electron beam and solid state welding processes. This includes, physics of electric arc-plasma, engineering the arc-plasma for welding, metal transfer and mass flow in the weld pool, laser/electron beam - material interactions, pressure and force balance in keyhole mode power beam welding, fundamentals of heat generation by Joule heating and process principles and overview on types of resistance and solid state welding processes.

ABOUT INSTRUCTOR :

Prof. Murugaiyan Amirthalingam is currently working as an Assistant Professor in IIT-Madras. His research and teaching interests include welding metallurgy, welding processes development, steel product development and additive manufacturing.

COURSE PLAN :

Week 1: Introduction to the course

Week 2: Physics of welding arc – Part I

Week 3: Physics of welding arc – Part II

Week 4: Introduction to arc welding processes – Part I

Week 5: Electrical power sources for welding

Week 6: Introduction to arc welding processes – Part II

Week 7: Fundamentals of resistance welding – Part I

Week 8: Fundamentals of resistance welding – Part II

Week 9: Introduction to power beam welding processes Plasma, laser and electron beam welding processes

Week 10: Principles of power beam welding processes

Week 11: Introduction to pressure welding processes

Week 12: Principles and operational considerations of pressure welding processes

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THE JOY OF COMPUTING USING PYTHON

PROF. SUDARSHAN IYENGAR

Department of Computer Science and Engineering
IIT Ropar

INTENDED AUDIENCE : Any interested audience

PREREQUISITES : 10th standard/high school

INDUSTRY SUPPORT : Every software company is aware of the potential of a first course in computer science. Especially of a first course in computing, done right.

COURSE OUTLINE :

A fun filled whirlwind tour of 30 hrs, covering everything you need to know to fall in love with the most sought after skill of the 21st century. The course brings programming to your desk with anecdotes, analogies and illustrious examples. Turning abstractions to insights and engineering to art, the course focuses primarily to inspire the learner's mind to think logically and arrive at a solution programmatically. As part of the course, you will be learning how to practice and culture the art of programming with Python as a language. At the end of the course, we introduce some of the current advances in computing to motivate the enthusiastic learner to pursue further directions.

ABOUT INSTRUCTOR :

Prof. Sudarshan Iyengar, Associate Professor at the CSE at IIT Ropar has a Ph.D. from the Indian Institute of Science (IISc). An exemplary teacher who has delivered over 350 popular science talks to students of high school and advanced graduate programmes. Prof. Sudarshan has offered more than 100 hours of online lectures with novel teaching methodologies that have reached lakhs of Students. His research interests include Data Sciences, Social Computing, Social Networks, Collective Intelligence, Crowdsourced Technologies and Secure Computation.

COURSE PLAN :

- Motivation for Computing
- Welcome to Programming!!
- Variables and Expressions : Design your own calculator
- Loops and Conditionals : Hopscotch once again
- Lists, Tuples and Conditionals : Lets go on a trip
- Abstraction Everywhere : Apps in your phone
- Counting Candies : Crowd to the rescue
- Birthday Paradox : Find your twin
- Google Translate : Speak in any Language
- Currency Converter : Count your foreign trip expenses
- Monte Hall : 3 doors and a twist
- Sorting : Arrange the books
- Searching : Find in seconds
- Substitution Cipher : What's the secret !!
- Sentiment Analysis : Analyse your Facebook data
- 20 questions game : I can read your mind
- Permutations : Jumbled Words
- Spot the similarities : Dobble game
- Count the words : Hundreds, Thousands or Millions.
- Rock, Paper and Scissor : Cheating not allowed !!
- Lie detector : No lies, only TRUTH
- Calculation of the Area : Don't measure.
- Six degrees of separation : Meet your favourites
- Image Processing : Fun with images
- Tic tac toe : Let's play
- Snakes and Ladders : Down the memory lane.
- Recursion : Tower of Hanoi
- Page Rank : How Google Works !!


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INTRODUCTION TO INTERNET OF THINGS

PROF. SUDIP MISRA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basic programming knowledge

INTENDED AUDIENCE : CSE, IT, ECE, EE, Instrumentation Engineering, Industrial Engineering

COURSE OUTLINE :

Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in different aspects of research, implementation, and business with IoT. IoT cuts across different application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building different IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notification systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

ABOUT INSTRUCTOR :

Prof. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles. His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award). Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier). Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

COURSE PLAN :

- Week 1:** Introduction to IoT: Part I, Part II, Sensing, Actuation, Basics of Networking: Part-I
- Week 2:** Basics of Networking: Part-II, Part III, Part IV, Communication Protocols: Part I, Part II
- Week 3:** Communication Protocols: Part III, Part IV, Part V, Sensor Networks: Part I, Part II
- Week 4:** Sensor Networks: Part III, Part IV, Part V, Part VI, Machine-to-Machine Communications
- Week 5:** Interoperability in IoT, Introduction to Arduino Programming: Part I, Part II, Integration of Sensors and Actuators with Arduino: Part I, Part II
- Week 6:** Introduction to Python programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi
- Week 7:** Implementation of IoT with Raspberry Pi (contd), Introduction to SDN, SDN for IoT
- Week 8:** SDN for IoT (contd), Data Handling and Analytics, Cloud Computing
- Week 9:** Cloud Computing(contd), Sensor-Cloud
- Week 10:** Fog Computing, Smart Cities and Smart Homes
- Week 11:** Connected Vehicles, Smart Grid, Industrial IoT
- Week 12:** Industrial IoT (contd), Case Study: Agriculture, Healthcare, Activity Monitoring


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AIRCRAFT PROPULSION

PROF. VINAYAK N. KULKARNI

Department of Mechanical Engineering
IIT Guwahati

PRE-REQUISITES : Basic UG-level Fluid Mechanics and Thermodynamics

INTENDED AUDIENCE : Undergraduate students of Aerospace and Mechanical engg. (5th semester onwards) and postgraduate students specializing in the thermofluids/Fluid Mechanics/Automobiles; industry personnel associated with aerospace engineering; faculty members associated with Mechanical /Aerospace engg.

COURSE OUTLINE :

This course deals with the gas power cycles for aircraft propulsion. Therefore different types of aircraft engines, their parts and their performance parameters are discussed. Then the cycle analysis and its different attachment for improvisation are also focused. Further, different parts of aircraft engines like compressor, turbines, combustor and nozzle are discussed in detail.

ABOUT INSTRUCTOR :

Prof. Vinayak N. Kulkarni is an Associate Professor in the Department of Mechanical Engineering of Indian Institute of Technology Guwahati since January 2015. He completed his undergraduate studies in Mechanical Engineering in the Shivaji University, Maharashtra, India. His post graduation and PhD is from Aerospace Engineering Department of Indian Institute of Science Bangalore. His teaching interests are basic and applied thermodynamics, gas dynamics, aircraft propulsion and fluid mechanics. His research interests are experimental and computational compressible flows, IC engines and non-conventional energy.

COURSE PLAN :

- Week 1:** Introduction to Gas turbines and Aircraft Propulsion
- Week 2:** Aircraft propulsion
- Week 3:** Ideal and Real cycle analysis
- Week 4:** Ideal and Real cycle analysis
- Week 5:** Real cycles
- Week 6:** Real cycles
- Week 7:** Engine performance and Engine components
- Week 8:** Centrifugal Compressors
- Week 9:** Axial Compressors
- Week 10:** Axial and Radial Turbines
- Week 11:** Turbine cooling methods and Component matching
- Week 12:** Blade design and cascade theory


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INTRODUCTION TO COMPOSITES

PROF. NACHIKETA TEWARI

Department of Mechanical Engineering
IIT Kanpur

PRE-REQUISITES : Must be enrolled into a B. Tech. program or equivalent and should have completed at least second year of his 4-year program.

INTENDED AUDIENCE : UGs, PGs, professionals in industry who want to learn about basics of sound and acoustics

INDUSTRIES SUPPORT : Automotive, Composites, Aerospace, Sports, Railways, Power Generation and all industry that has to address issues related to noise.

COURSE OUTLINE :

This course is intended for all those who want to conduct experiments in area of NVH. Thus, the course is open to students of engineering and science, and also to all those who from the industry and research organizations – who are working in area of sound, NVH and acoustics. Each lecture will be followed by a quiz, which will help student the concepts better, and gain deeper insights to measurement process. The course is fairly generic so that there is no need for a particular background. Rather, what is needed is openness, and ability to learn and check out new ideas with comfort.

ABOUT INSTRUCTOR :

Prof. Nachiketa Tiwari is an Associate Professor of Mechanical Engineering at IIT Kanpur. He has a PhD in engineering mechanics from Virginia Tech. His doctoral thesis involved nonlinear analysis of composite structures through FE, analytical and experimental methods. Dr. Tiwari also has deep understanding of fundamentals of FEA as he has used several tools in industry for over a dozen years for producing world class products. His current areas of research interest are composite structures, noise, vibrations, and product design. He has established Dhvani, an Acoustics Lab at IITK, which is one of the best in the country.

COURSE PLAN :

Week 1: Intro and terminology

Week 2: Concept Review

Week 3: Fibers

Week 4: Matrix materials

Week 5: Short fiber composites

Week 6: Short fiber composites (Cont'd)

Week 7: Orthotropic lamina

Week 8: Orthotropic lamina

Week 9: Orthotropic lamina (Cont'd)

Week 10: Composite laminates

Week 11: Composite laminates

Week 12: Composite laminates (Cont'd)

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PROGRAMMING IN JAVA

PROF. DEBASIS SAMANTA

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : This course requires that the students are familiar with programming language such as C/C++ and data structures, algorithms.

INTENDED AUDIENCE : The undergraduate students from the engineering disciplines namely CSE, IT, EE, ECE, etc. might be interested for this course.

INDUSTRIES APPLICABLE TO : All IT companies.

COURSE OUTLINE :

With the growth of Information and Communication Technology, there is a need to develop large and complex software. Further, those software should be platform independent, Internet enabled, easy to modify, secure, and robust. To meet this requirement object-oriented paradigm has been developed and based on this paradigm the Java programming language emerges as the best programming environment. Now, Java programming language is being used for mobile programming, Internet programming, and many other applications compatible to distributed systems. This course aims to cover the essential topics of Java programming so that the participants can improve their skills to cope with the current demand of IT industries and solve many problems in their own field of studies.

ABOUT INSTRUCTOR :

Prof. Debasis Samanta holds a Ph.D. in Computer Science and Engineering from Indian Institute of Technology Kharagpur. His research interests and work experience spans the areas of Computational Intelligence, Data Analytics, Human Computer Interaction, Brain Computing and Biometric Systems. Prof. Samanta currently works as a faculty member at the Department of Computer Science Engineering at IIT Kharagpur.

COURSE PLAN :

Week 1: Overview of Object-Oriented Programming and Java

Week 2: Java Programming Elements

Week 3: Input-Output Handling in Java

Week 4: Encapsulation

Week 5: Inheritance

Week 6: Exception Handling

Week 7: Multithreaded Programming

Week 8: Java Applets and Servlets

Week 9: Java Swing and Abstract Windowing Toolkit (AWT)

Week 10: Networking with Java

Week 11: Java Object Database Connectivity (ODBC)

Week 12: Interface and Packages for Software Development

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GLASS IN BUILDINGS : DESIGN AND APPLICATIONS

PROF. K.N. SATYANARAYANA

Department of Civil Engineering
IITM & Glass Academy

PROF. E. RAJASEKAR

Department of Civil Engineering
IITM & Glass Academy

TYPE OF COURSE	: Rerun Elective UG	COURSE DURATION	: 12 weeks (26 Jul'21 - 15 Oct'21)
INTENDED AUDIENCE	: Any Interested Audience	EXAM DATE	: 23 Oct 2021
PRE-REQUISITES	: Elective for third Year Civil Engineering and fourth year Architecture students.		
INDUSTRIES APPLICABLE TO	: Structural Glass Industry/ Building Façade Industry		

COURSE OUTLINE :

The field of Building Envelope Design & Construction has become a specialized field with several codes emphasizing energy efficiency to buildings both on mandatory and voluntary basis. Glass is one of the energy efficient materials that lend aesthetic and functional value to a building. Glass being extensively used in buildings, whereas the fields aligning including the right selection, analysis, design including facade design and consulting is tremendously facing lack of knowledge and competent professionals across the country. This course on 'Glass in Buildings: Design and Applications' will holistically cover the critical aspects of glass facade engineering and glass architecture & design

ABOUT INSTRUCTOR :

Prof. K N Satyanarayana, Civil Engineering, IIT Tirupathi

Dr. E. Rajasekar is an assistant professor at the Department of Architecture and Planning, IIT Roorkee, India. He is an Architect with post-graduation in Building Technology and Construction Management and PhD on Thermal comfort and building performance from IIT Madras. He is a Shastri Indo - Canadian Institute Doctoral Fellow. He specializes in the field of building performance assessment focused on the thermal, acoustics and lighting parameters. He carries a rich research and industry experience in this field and has published more than 20 technical papers in peer-reviewed journals and conferences. He is a USGBC LEED accredited professional and a GRIHA certified professional.

COURSE PLAN :

- Week 01** : Introduction – Glass the Building Material
- Week 02** : Float Glass Manufacturing Process
- Week 03** : Building Envelope Design
- Week 04** : Glass Application on Facades and future of facades
- Week 05** : Architectural Glass – The Basics
- Week 06** : Fire Resistant Glazing
- Week 07** : Acoustic Glass Solutions
- Week 08** : Interior Glazing Applications
- Week 09** : Introduction to National Building Code (NBC) 2016
- Week 10** : Case Study – Design and selection of Glass and Glazing system – Safety and Structural Performance
- Week 11** : Design and selection criteria for energy performance of Glass and Glazing system
- Week 12** : Design and application of sealant


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WATER ECONOMICS AND GOVERNANCE

PROF. MANOJ KUMAR TIWARI

Department of Civil Engineering
IIT Kharagpur

INTENDED AUDIENCE : UG students of Civil Engineering / Environmental Engineering (Elective) : PG students doing specializations in Environmental Engineering / Water Engineering / Agricultural Engineering (Core/Elective)

INDUSTRIES APPLICABLE TO : Jal Boards of various cities Companies working in water management sector, such as JUSCO, CH2MHill, Veolia Water, Phonix, WABAG etc.

COURSE OUTLINE :

Freshwater is fundamental to life, livelihood, and sustainable development. The issues related to the management of freshwater, are highly sensitive due to conflicts between financial, environmental, social and political viewpoints, and often needs multi-level governance involving various stakeholders.

This course aims to discuss the integrities of economics principles and governance for sustainable water management. The course will largely cover topics including the basics concept of sustainable water uses, water rights, valuing and pricing water with various pricing models, methods of economic evaluation of water projects, water governance in India including water policies and water acts, water disputes management, and global water diplomacy. The purpose of this course is to in stillin students the comprehensive knowledge and understanding on the governance of water in India and economics involved in water management.

ABOUT INSTRUCTOR :

Prof. Manoj Kumar Tiwari [Ph.D. (IIT Kanpur)] is a civil engg. graduate with specialization in environmental engg. and holds expertise in water and wastewater treatment, water distribution systems, water pricing, and contaminant fate and transport. He is a recipient of prestigious Fulbright Fellowship. Dr. Tiwari has co- authored several papers in apex international journals, and has presented his research in various top ranked conferences across the globe. Dr. Tiwari has over 8 years of teaching experience with both UG as well as PG level course. He has designed several new courses at IIT Kharagpur for Masters programme in Water Engineering and Management. He has delivered several invited lectures at various organizations, and has also conducted short-term course under Technical Education Quality Improvement Programme (TEQIP) with participants ranging from Faculties and Ph.D. students from NITs to field professionals working in government organizations as well as private companies.

COURSE PLAN :

Week 1: Introduction: General outline; Water availability and uses: national and international scenario; Challenges in water management.

Week 2: Water Rights: Need of water rights; Water and sanitation in international law; Right to Water; Entitlements and criteria.

Week 3: Water Sustainability: Concept of sustainable water uses; The Dublin statement; Sustainable water management with economical, engineering, ecological and social viewpoints; Stakeholders' participation.

Week 4: Valuing Water: The use and non-use values of water; Valuation methods; Non-revenue waters (NRW) and unaccounted for water (UFW); Metering water uses; Water management through economic instruments.

Week 5: Water Pricing - Approach and Models: Significance of water pricing; Average and marginal cost pricing; Shortrun marginal cost pricing; Water pricing models - flat rate, uniform rate, increasing block tariff and seasonal rate models.

Week 6: Conflicts in Water Pricing: Conflicts on subsidy verses sustainability, efficiency verses fairness in supply, development decisions verses capacity restrictions; Water pricing practices in India and abroad; relevant case studies.

Week 7: Economics of Water Projects: Economics of sectoral water allocation; Capital budgeting in water projects; Costs concepts of capital budgeting; Financial evaluation of water projects.

Week 8: Economic Evaluation Methods: Methods of project evaluation; Payback Period; Discounted Payback Period; Net Present Value; Internal Rate of Return; Average Rate of Return; Benefit-Cost Ratio.

Week 9: Water Governance: Elements and dimensions of water governance; Building blocks; Effective water governance schemes; Benchmarking water governance; Indicators of good governance.

Week 10: Water Governance in India: National water policies and water acts; Water regulatory authorities; Power and roles of central and state regulatory authorities; Legal and regulatory framework for hydro projects; Institutional arrangement and administrative controls of water service; Interstate water management initiatives; Stakeholders' participation, NGOs and social movements


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Week 11: Water Disputes Management: Interstate and intrastate water disputes resolutions practices; Judiciary involvements; Tribunals for water disputes resolutions; Treaties and bilateral agreements; Environmental issues and disputes related to water resources projects; relevant case studies.

Week 12: Global Water Diplomacy: International freshwater agreements; Global water treaties and transboundary water agreements between the countries on international water resources; Multi-national water disputes and their resolution mechanisms; relevant case studies.


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CLOUD COMPUTING

PROF. SOUMYA KANTI GHOSH

Department of Computer Science and Engineering
IIT Kharagpur

PRE-REQUISITES : Basics of Computer Architecture and Organization, Networking

INTENDED AUDIENCE : CSE, ECE, EE

INDUSTRIES APPLICABLE TO : IT industries

COURSE OUTLINE :

Cloud computing is a scalable services consumption and delivery platform that provides on-demand computing service for shared pool of resources, namely servers, storage, networking, software, database, applications etc., over the Internet. It is a model for enabling ubiquitous, on-demand access to a shared pool of configurable computing resources, which can be rapidly provisioned and released with minimal management effort. This course will introduce various aspects of cloud computing, including fundamentals, management issues, security challenges and future research trends. This will help students (both UG and PG levels) and researchers to use and explore the cloud computing platforms.

ABOUT INSTRUCTOR :

Prof. Soumya K. Ghosh received the Ph.D. and M.Tech. degrees from Department of Computer Science and Engineering, Indian Institute of Technology (IIT), Kharagpur, India. Presently, he is a Professor with Department of Computer Science and Engineering, IIT Kharagpur. Before joining IIT Kharagpur, he worked for the Indian Space Research Organization in the area of satellite remote sensing and geographic information systems. He has more than 200 research papers in reputed journals and conference proceedings. His research interests include spatial data science, spatial web services and cloud computing.

COURSE PLAN :

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

Week 9: VM Resource Allocation, Management and Monitoring

Week 10: Cloud-Fog-Edge enabled Analytics

Week 11: Serverless Computing and FaaS Model

Week 12: Case Studies and Recent Advancements

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BIOLOGY FOR ENGINEERS AND OTHER NON-BIOLOGISTS**MODULE 1: Introduction**

- Origin of life and Evolution
- Evolution
- Cells
- Bio molecules-Liquids

MODULE 2: Bio molecules

- Bio molecules: carbohydrates, water
- Bio molecules: Amino Acids, Proteins
- Bio molecules: Enzymes
- Bio molecules: Nucleotides
- Bio molecules: Cell structures and function- prokaryotes
- Bio molecules: Cell structures and function- Eukaryotes

MODULE 3: Mendelian Inheritance

- Cell, Cycle
- Cell division- mitosis
- Cell division- meiosis
- Culture Growth
- Mendelian Genetics: Genetic disorders
- Mendelian Genetics: Mendelian Inheritance Principles

MODULE 4: Mendelian Genetics

- Mendelian Genetics: Pedigree Analysis
- Non-Mendelian Inheritance
- DNA Replication
- Transcription
- Translation

Books & References:

- Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)
- In addition, the participants would be directed to specific sources during the course – they will become available during the course


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STRESS MANAGEMENT

MODULE 1: Scientific Foundations of Stress

- What is stress?
- Source of stress
- Types of stress
- Personality factors and stress
- Stress and the college student

MODULE 2: Stress Psychophysiology

- Stress and nervous system
- Hypothalamic Pituitary-Adrenal(HPA) Axis
- Effect of stress on immune system
- Health Sisk Associated with Chronic Stress
- Stress and Major Psychiatric disorders

MODULE 3: Developing Resilience to Stress

- Understanding your stress level
- Role of personality pattern, Self Esteem, Locus of control
- Role of Thoughts, beliefs and Emptions – I
- Role of Thoughts, beliefs and Emptions - II
- Life situation intra personal: (Assertiveness, Time Management)

MODULE 4: Strategies For Relieving Stress

- Developing Cognitive Copping Skills
- Autogenic training, Imagery and Progressive Relaxation
- Other Relaxation Techniques
- Exercise and Health
- DIY Strategies Stress Management



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DEVELOPING SOFT SKILLS AND PERSONALITY

MODULE 1: Introduction

- A New Approach to Learning
- Planning And Goal-Setting
- Human Perceptions: Understanding People
- Types Of Soft Skills: Self-Management Skills

MODULE 2: Conflict Resolution Skills: Seeking Win-Win Solution

- Inter-Personal Conflicts: Two Examples
- Inter-Personal Conflicts: Two Solutions
- Types Of Conflicts: Becoming A Conflict Resolution Expert
- Types Of Stress: Self-Awareness About Stress

MODULE 3: Habits

- Habits: Guiding Principles
- Habits: Identifying Good and Bad Habits
- Breaking Bad Habits
- Using The Zeigarnik Effect for Productivity and Personal Growth
- Forming Habits of Success

MODULE 4: Communication

- Communication: Significance of Listening
- Communication: Active Listening
- Communication: Barriers to Active Listening
- Telephone Communication: Basic Telephone Skills

MODULE 5: Technology and Communication: Technological Personality

- Technology and Communication: Mobile Personality?
- Technology and Communication: E-Mail Principles
- Technology and Communication: How Not to Send E-Mails!
- Technology and Communication: Netiquette

MODULE 6: Effective Communication

- Communication Skills: Effective Communication
- Barriers to Communication: Arising Out of Sender/Receiver's Personality
- Barriers to Communication: Interpersonal Transactions
- Barriers to Communication: Miscommunication

MODULE 7: Nonverbal Communication

- Nonverbal Communication: Introduction and Importance
- Non-Verbal Communication: Issues and Types
- Non-Verbal Communication: Basics and Universals
- Non-Verbal Communication: Interpreting Non-Verbal Cues

MODULE 8: Presentation Skills

- Presentation Skills: Overcoming Fear
- Presentation Skills: Becoming A Professional
- Presentation Skills: The Role of Body Language
- Presentation Skills: Using Visuals
- Reading Skills: Effective Reading

Books & References:

- Petes S. J., Francis. *Soft Skills and Professional Communication*. New Delhi: Tata McGraw-Hill Education, 2011.


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Better Spoken English

MODULE 1: Why a course in Spoken English?

- Aspects of Theatre in Formal Presentation: Grooming, Body Language, Eye Contact, Voice Modulation

1. MODULE 2: Tempo of Speech

- Linguistic Aspects of Mishearing. A "Good" Tempo of Speech in English.

MODULE 3: Presentation

- Announce Topic for Presentation: Cycle II: A Civic Problem in My Place. Research and Organization of Presentation I: Sources of Information.

MODULE 4: Research and Organization

- Research and Organization of Presentation II: Tables, Charts, Graph. Making Power Point Slides and Other Presentation Aid

MODULE 5: Evaluation of Presentation

- Criteria for (Self) Evaluation of Presentation. Student Presentation: Cycle II : A Civic problem in My Place I

MODULE 6: Student Presentation

- Cycle II: A Civic problem in My Place II. Announce Topic for Cycle III: A Managerial Solution

MODULE 7: Grammar

- Grammar of Phrasal Pause in English. Rhythm in Spoken English: All I want's a room somewhere/ Far away...

MODULE 8: Phrasal

- Phrasal Pause in Spoken English. Phrasal Pause in Spoken English – II: Numbers, Units of Weight, Height...

MODULE 9: Listening

- Listening to Units of Time, Weight, Distance, Etc: Take a Break.

MODULE 10: Word Stress

- Word Stress in English: Unique Features. Stress in Simple English Words – I,II

MODULE 11: Rhythm

- Stress in Derived Words in English – I,II. Announce Topic for Cycle IV: Improving a Product/a Project

MODULE 12: Sounds

- Preparing for and Presenting a Flow Chart, Diagram, Drawing, Etc. Some "Difficult" Sounds in English – I,II


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GENDER JUSTICE AND WORKPLACE SECURITY

MODULE 1: Introduction to Gender Justice- Notion and Significance

- Introduction to Gender Justice
- International & Constitutional Perspective

MODULE 2: International and Constitutional Perspectives on Gender Equality

- International Perspective
- Constitutional Perspective
- Women at Workplace

MODULE 3: Protection of Women at Workplace

- Women at Workplace
- Gender Violence – within Beyond

MODULE 4: Gender Violence- Within and Beyond

- Gender Violence – within Beyond
- Role of different agencies

Books & References:

- Mamta Rao, Law Relating to Women and Children, Eastern Book Co, Lucknow.
- 4. K.I. Vibhute, Criminal Law, Lexis Nexis, 12th Edn.
- 5. N. Prabha Unnithan (ed.), Crime & Justice in India, Sage Pub., 2013.
- 6. Ritu Gupta, Sexual Harassment at Workplace, Lexis Nexis, 2013.


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INNOVATION, BUSINESS MODELS AND ENTREPRENEURSHIP

MODULE 1: Analyzing the Current Business Scenario

- Innovation and Creativity- An Introduction
- Innovation in Current Environment
- Types of Innovation, School of Innovation.

MODULE 2: Challenges of Innovation

- Steps of Innovation Management
- Idea Management System
- Divergent V/s Convergent Thinking

MODULE 3: Experimentation in Innovation Management

- Idea Championship
- Participation for Innovation
- Co-creation for Innovation

MODULE 4: Social Entrepreneurship

- What is a Business Model
- Who is an Entrepreneur
- Blue Ocean Strategy-I
- Blue Ocean Strategy-II

MODULE 5: Marketing of Innovation

- Technology Innovation Process
- Technological Innovation Management Planning
- Management Strategies, Technology Forecasting.

MODULE 6: Sustainability Innovation and Entrepreneurship

- Innovation Sustainable Conditions
- Innovation: Context and Pattern
- SME'S strategic involvement in sustainable development
- Exploration of business models for material efficiency services

MODULE 7: Management of Innovation

- creation of IPR
- Management of Innovation
- creation of IPR
- Patents and Copyrights

MODULE 8: Business Models and value proposition

- Business Model Failure: Reasons and Remedies
- Incubators: Business Vs Technology
- Managing Investor for Innovation
- Future markets and Innovation needs for India.

Books & References:

- Innovation and Entrepreneurship Book by Peter Drucker
- HBS series on Innovation and Entrepreneurship


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TECHNICAL ENGLISH FOR ENGINEERS

MODULE 1: Parts of speech:

- Parts of speech- Noun
- Parts of speech- Preposition and Noun Phrases
- Countable and Uncountable Nouns
- Reading and listening

MODULE 2: Subject Verb Agreement

- Articles
- Verbs
- Comparatives
- Modals and Voices

MODULE 3: Tenses

- Effective Speaking
- Formal Presentation
- Punctuations
- Reading- SQ3RW Method and note taking
- Phrasal Verbs

MODULE 4: Word Formation

- Collocation
- Understanding the Text Organization
- Writing emails

MODULE 5: Academic writing and linking words

- Paragraph writing
- Describing/Explaining Processes
- Essay Writing

MODULE 6: Essay Writing and Formal Letters

- Letter writing and usage.
- Understanding the Mechanics of Publishable Essays
- Writing Publishable Essays and Usage

MODULE 7: Everyday Usage

- Writing a statement of purpose
- CV/Resume and Cover Letters

MODULE 8: Conclusion

Books & References:

- Oxford Advanced Learners's Dictionary. 8th edition, 2013.
- Martin Hewings. Advanced Grammar in Use. Cambridge University Press, 2013.
- Michael Swan. Practical English Usage. 3rd ed. OUP, 2005.
- John Seely. The Oxford Guide to Effective Writing and Speaking. OUP, 2005.

PATENT DRAFTING FOR BEGINNERS

Module 1: Invention as a solution to an unsolved Problem

- PDB – What are Inventions?
- Field Invention, Prior Art, Patent Classification
- Technical Advance
- What are not Inventions? Why people Invent?
- How Inventions Look? Where to look for Inventions
- How to catch an Invention? Getting a working disclosure
- Searching with the disclosure, Outcome of Search
- What is patentability Search? Reasons for Ordering a Patentability Search
- Patentability Search Report, How to Pitch an invention
- How to pitch an invention, Identifying the inventive concept

Module 2: Drafting a Claim

- Problem solution Statement, Problem Solution to claim
- How to search for a Granted Patent
- Provisions relating to claim, Some exceptions to Patentability
- Structure of claims, Preamble, transition, Body
- Structural and Functional Definitions, Cooperation

Module 3: Types and Arrangement of Claims

- Types of claims, Dependent claim, Apparatus Claims, Process Claims
- Claim Drafting Best Practices, What to avoid
- How to download copy of patent specification
- Amendment to claims, Claim analysis combo pen with marker

Module 4: Structure of the Patent Specification

- Introduction to specification drafting
- Enabling disclosures, Best method, Parts of Specification
- Background & summary, Detailed Discription
- Parts of Application, Evolution of Patent Specifications

Books & References:

- Jeffrey G. Sheldon, How to Write a Patent Application, Third Edition, Practising Law Institute, 2016


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INTRODUCTION TO AIRPLANE PERFORMANCE

MODULE 1: General Introduction

- Airplane Performance Characteristics
- George Cayley: Concept of Lift and Drag
- Introduction to airplane and its components
- Hansa 3 Aircraft and its Primary Systems

MODULE 2: Revision

- Standard Atmosphere: Description and Modelling
- Measuring Instruments: Altimeter, Airspeed Indicator
- Equations of Motion: Static Performance
- Thrust Required, Power Required: Cruise

MODULE 3: Review

- Thrust Required: A Closer Look
- Modelling of CL: Dimensional Analysis
- A Closer Look: Point Mass Model, Dimensional Analysis
- Estimation of Drag Polar Through Flight Test

MODULE 4: Revision

- Range and Endurance,
- Range and Endurance, Gliding Flight
- Accelerated Flight, V-n Diagram.

MODULE 5: V stall: Cruise and Manoeuvre,

- Flaps: High Lift Devices to Reduce Take off / Landing Distance
- Take off: Warm-up Lecture
- Take off Performance.

MODULE 6: Landing Performance

- Landing Performance
- Challenges in Take-off and Landing: Single and Twin Engines
- Introduction to Static Stability
- Positioning of Centre of Pressure for Static Stability

MODULE 7: Revision, Stability and Control: Designer's Perspective

- Stability and Control: Designer's Perspective (Continued)
- Longitudinal Control: Elevator
- Stability: Wing and Tail Contribution.

MODULE 8: Control: Elevator,

- Control: delta E Required
- Control: delta E Required
- Design Basics: Sweep & Dihedral

Books & References:

- Aircraft performance and design - Anderson

CLOUD COMPUTING

MODULE 1: Introduction to Cloud Computing

MODULE 2: Cloud Computing Architecture

MODULE 3: Service Management in Cloud Computing

MODULE 4: Data Management in Cloud Computing

MODULE 5: Resource Management in Cloud

MODULE 6: Cloud Security

- Cloud Computing Security- I, II& III
- Cloud Computing: Security Issues in Collaborative SaaS Cloud
- Cloud Computing: Broker for Cloud Market place

MODULE 7: Open Source and Commercial Clouds, Cloud Simulator

- Mobile Cloud Computing- I, II
- Fog Computing- I,II
- Use case – Geo-Spatial Cloud

MODULE 8: Research trend in Cloud Computing, Fog Computing

- Introduction to DOCKER Container
- Green Cloud
- Sensor Cloud Computing
- IOT Cloud
- Course Summary and Research Areas

MODULE 9: VM Resource Allocation, Management and Monitoring

- Resource Management- I,II
- Cloud Federation

MODULE 10: Cloud-Fog-Edge enabled Analytics

- VM Migration – Basics Migration Strategies
- Containers based virtualization Kubernetes Docker container

MODULE 11: Serverless Computing and FaaS Model

- Dew Computing
- Serverless Computing – I,II
- Sustainable Cloud Computing – I,II

MODULE 12: Case Studies and Recent Advancements

Books & References:

- **Cloud Computing By Prof. Sowmya Kanti Ghosh, Dept. of, Computer Science and Engineering IIT Kharagpur.**


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INTRODUCTION TO HISTORY OF ARCHITECTURE IN INDIA

MODULE 1:

- Introduction to History of Architecture
- Indus Valley Civilisation
- Early Historic Period -Wooden and Cave Architecture

MODULE 2:

- Beginnings of the Temple
- Medieval Temples
- Islamic Architecture

MODULE 3:

- Sultanate Architecture
- Mughals and Rajputs
- Princely States

MODULE 4:

- Neo-Classical, Indo-Saracenic, Revival Gothic
- Art Deco, Modern
- International and Contemporary

Books & References:

- Introduction to history of Architecture in India By Prof. Pushkar Sohoni
Architecture And Planning IISER Pune


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DISCRETE MATHEMATICS

Module 1: Mathematical Logic

- Motivation for Counting, Factorial Example
- Counting in Computer Science, Motivation for Catalan Numbers
- Rule of Sum and Rule of product, problems, Factorial Explained
- Permutations and Combinations with Repetition- Problems
- Binominal theorem, multinomial- Problems
- Catalan Numbers and problems

Module 2: Mathematical Logic

- Introduction to Set Theory, Sets, subsets, Union & intersections of sets
- Cardinality of Union of three sets, Power set
- Connection between Binomial theorem and Power sets
- De Morgan's laws
- Set difference and Symmetric difference

Module 3: Set Theory

- Introduction to Statements, Negation.
- Primitive & compound statements, Problems Involving Operators
- Introduction to Implication, Double implication
- Tautology, acaontradiction

Module 4: Set Theory, Number Theory

- Graphical representation of a relation, various sets
- Revisiting representation of relation, Reflective relation
- Symmetric relation, transitive relation
- Anti symmetric relation
- partition

Module 5: Number Theory

- Relations Vs Functions
- Bijection, Cardiality condition in Bijection
- Inverse functions

Module 6: Algebraic Structures

- Mathematical Induction, Sum of Odd Numbers
- Inequality, Bionomial Coefficients, Consecutive intergers

Module 7: Algebraic Structure

- Cut Vertices and Cut Edges
- Phython

Module 8: Recurrences

- Dirac's theorem, ore's theoram
- Famous Non planar Graphs

- Recalling the India map coloring

Module 9: Recurrences,Combinatorics

- Binomial Expansion
- Generating Functions

Module 10: Combinatorics,Graph Theory

- Arrangements & Derrangements
- Devising a secret code
- Rook Polinomial

Module 11: Graph Theory

- Recurrent relation of Towers Hanoi
- Merge sort

Module 12: Graph Theory

- Group theory
- Lagrangee's theorem
- Partitions

Books & References:

- DISCRETE MATHEMATICS by PROF. SUDARSHAN IYENGAR Department of Computer Science and Engineering IIT Ropar PROF. ANIL SHUKLA Department of Computer Science and Engineering IIT Ropar


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INTRODUCTION TO PROBABILITY AND STATISTICS

Module 1: Different types of data, Tables, charts, histograms, frequency distributions

- Sets, Classes & collections
- Sigma-Ring, Sigma- Field, Monotone Class
- Probability Function

Module 2: Measures of association

- Conditional Probability
- Random Variables
- Moments

Module 3: Probability concepts, conditional probability, Bayes theorem

- Characteristics of distributions
- Special Discrete Distributions
- Poisson process

Module 4: Probability distributions

- random variable, expected value and variance,
- Discrete distributions – Binomial,
- Poisson Continuous distributions – Uniform, Normal

Books & References:

- Introduction to Probability and Stochastic Processes with Applications, Liliana Blanco Castaneda, Viswanathan Arunachalam, Selvamuthu Dharmaraja, Wiley, Asian Edition, Jan. 2016.
- Introduction to Statistical Methods, Design of Experiments and Statistical Quality Control, Selvamuthu Dharmaraja, Dipayan Das, Springer, 2018.
- An Introduction to Probability and Statistics, Vijay K. Rohatgi and A.K. Md. Ehsanes Saleh, John Wiley, second edition, 2001.


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SOFT SKILLS

Module 1 : Introduction to Soft Skills

- Aspects of Soft Skills
- Effective Communication Skills
- Classification of Communication,
- Personality Development

Module 02 : Positive Thinking

- Telephonic Communication Skills
- Communicating Without Words
- Paralanguage.

Module 03 : Proxemics, Haptics

- The Language of Touch
- Meta-communication
- Listening Skills
- Types of Listening.

Module 04 : Negotiation Skills

- Culture as Communication
- Organizational Communication.

Module 05 : Communication Breakdown

- Advanced Writing Skills,
- Principles of Business Writing
- Types of Business Writing.

Module 06 : Business Writing

- Business Letters, Business Letters: Format and Style
- Types of Business Letter.

Module 07 : Writing Reports

- Types of Report
- Strategies for Report Writing
- Evaluation and Organization of Data.

Module 08 : Structure of Report

- Report Style
- Group Communication Skills.

Module 09 : Leadership Skills

- Group Discussion
- Meeting Management,
- Adaptability & Work Ethics.

Module 10 : Advanced Speaking Skills

- Oral Presentation, Speeches & Debates
- Combating Nervousness
- Patterns & Methods of Presentation
- Oral Presentation: Planning & Preparation.



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Module 11 : Making Effective Presentations

- Speeches for Various Occasions, Interviews
- Planning & Preparing-Effective Resume
- Planning & Preparing Effective Resume

Module 12 : Facing Job Interviews

- Emotional Intelligence & Critical Thinking
- Applied Grammar

Books & References:

- Dorch, Patricia. *What Are Soft Skills?* New York: Execu Dress Publisher, 2013.
- Kamin, Maxine. *Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders.* Washington, DC: Pfeiffer & Company, 2013.
- Klaus, Peggy, Jane Rohman & Molly Hamaker. *The Hard Truth about Soft Skills.* London: HarperCollins E-books, 2007.
- Petes S. J., Francis. *Soft Skills and Professional Communication.* New Delhi: Tata McGraw-Hill Education, 2011.
- Stein, Steven J. & Howard E. Book. *The EQ Edge: Emotional Intelligence and Your Success.* Canada: Wiley & Sons, 2006.

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Consumer Behaviour

Module 1:

Introduction to Consumer Behaviour, The Changing Patterns of Consumer Behaviour, Dimensions of Consumerism, Use of Market Segmentation in Consumer Behaviour.

Module 2:

Theories of Motivation, Consumer Involvement, Case Study on Motivation and Involvement, Concept and Levels of Perception, Process of Perception.

Module 3:

Theories of Personality-I, Theories of Personality-II, Brand Personality & Self Concept, Theories of Learning, Attitude Formation-I.

Module 4: Attitude Formation-II, Changing Attitude, Exercise on Attitude Formation and Change.

Module 5: VALS- I Typology, VALS – TM Typology, Group Influences on Consumption.

Module 6: Role of Celebrity Endorsement, Concept of Family & Family Life Cycle, Family Buying Decisions, Diffusion of Innovations - I, Diffusion of Innovations – II.

Module 7: Influencing Factors for Adoption and Opinion Leadership, Consumer Decision making, Consumer Black Box model, Models of Consumer Behaviour – I, Models of Consumer Behaviour – II.

Module 8: Models of Consumer Behaviour – III, Models of Consumer Behaviour -IV, Organisational Buying Behaviour -I, Organisational Buying Behaviour -II, Dimensions of Consumer Research.

Books:

1. Consumer Behaviour, by Ramanuj Majumdar, PHI Learning Private Limited.


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Introduction to Smart Grid

Module 1:

Introduction to Smart Grid-I, Introduction to Smart Grid-II, Architecture of Smart Grid System, Standards for Smart Grid System, Elements and Technologies of Smart Grid System.

Module 2:

Elements and Technologies of Smart Grid System-II, Distributed Generation Resources-I, Distributed Generation Resources-II, Distributed Generation Resources-III, Distributed Generation Resources-IV.

Module 3:

Wide Area Monitoring Systems-I, Wide Area Monitoring Systems-II, Phasor Estimation-I, Phasor Estimation-II, Digital relays for Smart Grid Protection.

Module 4:

Islanding Detection Techniques-I, Islanding Detection Techniques-II, Islanding Detection Techniques-III, Islanding Detection Techniques-IV, Smart Grid Protection-I.

Module 5:

Smart Grid Protection-II, Smart Grid Protection-III, Modelling of Storage Devices, Modelling of DC Smart Grid components, Operation, and control of AC Microgrid-I.

Module 6:

Operation and control of AC Microgrid-II, Operation and control of DC Microgrid-I, Operation and control of DC Microgrid-II, Operation and control of AC-DC hybrid Microgrid-I, Operation, and control of AC-DC hybrid Microgrid-II

Module 7:

Simulation and Case study of AC Microgrid, Simulation and Case study of DC Microgrid, Simulation and Case Study of AC-DC Hybrid Microgrid, Demand side management of Smart Grid, Demand response analysis of Smart Grid.

Module 8:

Energy Management, Design of Smart grid and Practical Smart Grid case study-I, Design of Smart grid and Practical Smart Grid case study-II, System Analysis of AC/DC Smart Grid, Conclusions.

Books:

1. Smart power grids by A Keyhani, M Marwali.
2. Computer Relaying for Power Systems by Arun Phadke
3. Renewable Energy Systems by Fang Lin Luo, Hong Ye
4. Voltage-sourced converters in power systems_ modeling, control, and applications by Amirnaser Yazdani, Reza Iravani"


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Water Society and Sustainability

Module 1:

Setting the Context, Beyond Hydrology, Socio Hydrology, Political Ecology of Water, Hydrosocial.

Module 2:

Critical Physical Geography, The South Asian Context, Water Harvesting and Water Use Techniques in Ancient India 1, Water Harvesting and Water Use Techniques in Ancient India 2, Water Harvesting and Water Use Techniques in Ancient India 3.

Module 3:

Water Technology in Medieval India 1, Water Technology in Medieval India 2, Colonial Hydrology, Dams and Development in Contemporary India, The Farakka Barrage Project: Historical and Technical Details.

Module 4:

The Farakka Barrage Project: Socio-environmental Implications, Urban Waters: Historical and Political Ecological Perspectives, Transforming Trajectories of Blue Infrastructures of Kolkata, Peri-urban Water Justice in the Global South, Discussion and Conclusion.

Books:

1. Sustainable Water Management and Technologies by Daniel H. Chen.


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Advanced Aircraft Maintenance

Module 1:

Introduction, Construction

Module 2:

Performance, Lubrication system, Induction system

Module 3:

Fuel system, Ignition System, Starting System

Module 4:

Propeller, Maintenance

Module 5:

Introduction, Inlet, Compressor

Module 6:

Combustion, Turbine, Exhaust

Module 7:

Fuel system, Lubrication system, Ignition System

Module 8:

Starting, Thrust Augmentation, Material, Maintenance


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Leadership

Module 1:

Introduction to Leadership: Functions; Leadership Roles: Leaders Vs Managers: Theories

Module 2:

Leadership Styles: Effective Vs Successful Managers; Leadership Styles: Adaptation - Studies / Case: "From Sindhi to Siddhi" (Part - I), Leadership Behaviour: Emergence: Leadership and Trust; Case: "From Sindhi to Siddhi (Part-II)"/ Transformation Leadership.

Module 3:

Leadership Skills: Leadership and Management; Case: The DVC story - A First Person Account Leadership in Action - (Part - I), Competencies and Skills of Leaders: Issues in Organizational Leadership; Case: The DVC Story - A First Person Account, Leadership in Action Part – II

Module 4:

Self Regulating - The Key to Institution Building, Framework of institution Building; Case: "Rai Bahadur Mohan Singh Oberoi" (Part - I), Issues in Institution Building; Case: Rai Bahadur Mohan Singh Oberoi (Part-II)

Books and references:

1. Northouse, P. G. (2018). Leadership: Theory and practice. Sage publications.


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Python Developer

Module 1: An Introduction to the language

What is Python?, Getting started with Python, Writing, Formatting & Running Python Code, Command line basics & Python interactive shell

Module 2: Python Variables – Data Types

Variable names, Data types, String methods, None special type, Escape sequences, number methods & operations, type conversion

Module 3: Python Logic – Control Flow & Loops

Comparison Operators, Conditional Statements, Ternary Operator, Logical Operators, For Loops, Nested Loops, While Loops, Infinite Loops

Module 4: Python Functions

Function Parameters & Arguments, Function Types, Required & Optional Parameters, Non-Keyword Arguments, Scope, Debugging Code

Books:

Book by Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia, “Data Structures and Algorithms in Python”, 2013 edition



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Consumer Psychology

Module 1:

Introduction to Consumer Psychology

Module 2:

Overview of foundation of consumer behavior.

Module 3:

Consumer Decision Making

Module 4:

Purchase process and consumption; Consumer learning and brand loyalty

Module 5:

Low involvement decision making; Situational influences.

Module 6:

The Individual Consumer; Consumer perceptions; Consumer information processing and acquisition

Module 7:

Attitudes; Attitude reinforcement and change

Module 8:

Marketing Communications

Books and references:

1. Henry Assael, Consumer Behavior and Marketing Action, Cengage Learning
2. Jay Lindquist, Consumer Behavior, Cengage Learning
3. Leon Schiffman, Consumer Behavior, Pearson Press
4. Zubin Sethna, Consumer Behaviour


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Developing Soft Skills and Personality

Module 1:

Introduction: A New Approach To Learning, Planning And Goal-Setting, Human Perceptions: Understanding People, Types Of Soft Skills: Self-Management Skill, Aiming For Excellence: Developing Potential And Self-Actualisation, Need Achievement And Spiritual Intelligence

Module 2:

Conflict Resolution Skills: Seeking Win-Win Solution, Inter-Personal Conflicts: Two Examples, Inter-Personal Conflicts: Two Solutions, Types of Conflicts: Becoming A Conflict Resolution Expert, Types of Stress: Self-Awareness About Stress, Regulating Stress: Making The Best Out of Stress

Module 3:

Habits: Guiding Principles, Habits: Identifying Good And Bad Habits, Habits: Habit Cycle, Breaking Bad Habits, Using The Zeigarnik Effect For Productivity And Personal Growth, Forming Habits of Success

Module 4:

Communication: Significance of Listening, Active Listening, Barriers To Active Listening , Telephone Communication: Basic Telephone Skills, Advanced Telephone Skills, Essential Telephone Skills

Module 5:

Technology And Communication: Technological Personality, Mobile Personality, E-Mail Principles, How Not To Send E-Mails!, Netiquette, E-Mail Etiquette

Module 6:

Communication Skills: Effective Communication, Barriers To Communication: Arising Out Of Sender/Receiver's Personality, Interpersonal Transactions, Miscommunication, Pre-Thinking Assessment


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Module 7:

Non-verbal Communication: Introduction and Importance, Issues and Types, Basics and Universals, Interpreting Non-Verbal Cues, Body Language: for Interviews, For Group Discussions

Module 8:

Presentation Skills: Overcoming Fear, Becoming A Professional, The Role of Body Language, Using Visuals, Reading Skills: Effective Reading, Human Relations: Developing Trust and Integrity

Books and references:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.



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Effective Writing

Module 1:

Introduction to Effective Writing, Effective Writing as an Art, Principles of Effective Writing
Types and Stages of Effective Writing

Module 2:

Notions of Correctness and Appropriateness, Part I, Notions of Correctness and Appropriateness,
Part II, Essay Writing, Types of Essays

Module 3:

Essentials of Academic Writing, Business Writing and its Functions, Mechanics of Business
Writing, Business Letters and Memos, Format of Business Letters and Memos, Types of
Business Letter

Module 4:

Sales, Complaint and Adjustment Letters, Report Writing, Strategies and Structure of Reports
Style of Report Writing, Creative Writing

Books and references:

1. Turk, Christopher and John Kirkman. Effective Writing. London and New York: Chapman & Hall. Indian Reprint 2003
2. Pinker, Steven. The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century . Penguin Books, Reprint edition ,2015
3. Seely, John. Oxford Guide to Effective Writing and Speaking. OUP 2nd edition, 2005
4. Goins, Jeff. You Are a Writer (So Start Acting Like One). Tribe Press
5. Brohaugh, William. Write Tight: Say Exactly What You Mean with Precision and Power.
6. Janzer. Anne. The Writer's Process: Getting Your Brain in Gear. Cuesta Park Consulting, 2016
7. King, Stephen. On Writing: A Memoir of the Craft. Scribner, 2010


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Enhancing Soft Skills and Personality

Module 1:

Highlights of Developing Soft Skills and Personality, Definitions and Types of Mindset, Learning Mindsets, Secrets of Developing Growth Mindsets

Module 2:

Importance of Time and Understanding Perceptions of Time, Using Time Efficiently, Understanding Procrastination, Overcoming Procrastination, Don't Say "Yes" to Make Others Happy!

Module 3:

Types of People, How to Say "No", Controlling Anger, Gaining Power from Positive Thinking

Module 4:

What Makes Others Dislike You?, What Makes Others Like You?-1, Being Attractive

Module 5:

Common Errors

Module 6:

Humour in Communication, Humour in the Workplace, Function of Humour in the Workplace, Money and Personality, Managing Money

Module 7:

Health and Personality, Managing Health-1: Importance of Exercise, Managing Health-2: Diet and Sleep, Love and Personality, Managing Love

Module 8:

Ethics and Etiquette, Business Etiquette, Managing Mind and Memory, Improving Memory, Care for Environment, Highlights of the Course


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Books and references:

1. Dorch, Patricia. What Are Soft Skills? New York:Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers,Teams, and Leaders. Washington, DC: Pfeiffer &Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker.The Hard Truth about Soft Skills. London:HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and ProfessionalCommunication. New Delhi: Tata McGraw-HillEducation, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success.Canada: Wiley & Sons, 2006.



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Recent Advances in Transmission Insulators

Module 1:

Introduction to Transmission and Distribution Insulators, Important components of transmission system, Insulation coordination, Manufacturing process for Ceramic/Glass Insulators, Manufacturing process for Polymeric Insulators, Design Considerations of Transmission Insulators.

Module 2:

Non ceramic insulators performance-service experience, Field experience and contamination issues on transmission insulators, Pollution/contamination flashover phenomena modelling etc., Failures, importance of reliability and testing

Module 3:

High Voltage testing and techniques employed, HV testing techniques for Ceramic/Glass Insulators, Reliability, philosophy of testing, Testing of ceramic, glass, and composite insulators.

Module 4:

Surface degradation studies on composite insulators, Recent studies on composite insulators, Cleaning methods adopted for insulators, coating techniques for insulators, Introduction to Hybrid Insulators.

Books and references:

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International(P) Ltd, New Delhi, 2000.
2. E Kuffel, W S Zaengl and J Kuffel, "High Voltage Engg. Fundamentals", textbook published by Newness publishers, second edition, 2000.
3. Recent IEEE Journal / Conference and CIGRE publications. • "Outdoor Insulators", Ravi group, Edward Cherney & Jeffery Burnham Text book, 1999.
4. Insulators for High Voltage – J S T Looms, text book, Peregrines, 1988 • K Papailiou and F Schmuck, "Silicone Composite Insulators: Materials, design, Applications for Power systems, Springer Berlin Heidelberg, 2012.


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Programming, Data Structures and Algorithms using Python

Module 1:

Informal introduction to programming, algorithms and data structures via gcd, Downloading and installing Python gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Module 2:

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

Module 3:

Basic algorithmic analysis: input size, asymptotic complexity, $O()$ notation, Arrays vs lists Merge sort'n Quicksort, Stable sorting

Module 4:

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

Module 5:

Exception handling, Basic input/output, Handling files, String processing

Module 6:

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

Module 7:

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

Module 8:

Efficient evaluation of recursive definitions: memorization, Dynamic programming: examples Other programming languages: C and manual memory management, Other programming paradigms: functional programming

Books:

1. Book by Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia, "Data Structures and Algorithms in Python", 2013 edition.


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Financial Planning for Young Adults

Module 1: Setting Financial Goals and Assessing Your Situation

If Money Were No Object, Dream Big, Belize for Spring Break, What Influences Our Financial Decisions, Education, Retirement, or Fun, Where Are You Now, Turning Dreams into Goals

Module 2: Budgeting and Cash flow Management

Budgeting overview, Street Interview: How can you avoid overspending, Investment Advisor, creating a Budget, Financial Services, Alternatives to Cash, Pros and Cons of using a Credit Card.

Module 3: Saving Strategies

Do you set aside money for emergencies, Importance of saving money How to start saving money? Set a savings goal, build a savings habit, barriers to saving money, Barriers to saving, The Time value of Money.

Module 4: Borrowing and Credit

Loans and consumer Credit, Borrowing and Credit, Loan Amortization, Credit Report, Types of Credit Reports, Credit Scores, Bad and No Credit History

Financial Planning as Career:

Financial Planner duty, Middle-Age Couple meeting, Young Client meeting with financial planner, Campaign Spoke people

Books:

1. Money Skills for Teens: A Beginner's Guide to Budgeting, Saving, and Investing, by Ferne Bowe, Bemberton Limited.


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Applied Optimization for Wireless, Machine Learning, Big Data

Module 1:

Intro to properties of Vectors, Norms, Positive Semi-Definite matrices and Gaussian Random Vectors

Module 2: Gram Schmidt Orthogonalization Procedure, Null Space and Trace of Matrices, Eigenvalue Decomposition of Hermitian Matrices and Properties, Matrix Inversion Lemma (Woodbury identity), Introduction to Convex Sets and Properties, Affine Set Examples and Application

Module 3:

Beamforming in Wireless Systems, Multi-User Wireless, Cognitive Radio Systems

Module 4:

Convex Optimization problems, Linear Program, Application: Power allocation in Multi-cell cooperative OFDM

Module 5:

QCQP, SOCP Problems, Application: Channel shortening for Wireless Equalization, Robust Beamforming in Wireless Systems

Module 6:

Duality Principle and KKT Framework for Optimization, Application: Water-filling power allocation, Optimization for MIMO Systems, OFDM Systems and MIMO-OFDM systems

Module 7:

Optimization for signal estimation, LS, WLS, Regularization. Application: Wireless channel estimation, Image Reconstruction-Deblurring, Representation of Convex Optimization problem

Module 8:

Application: Convex optimization for Machine Learning, Principal Component Analysis (PCA), Support Vector Machines

Module 9:

Application: Cooperative Communication, Optimal Power Allocation for cooperative Communication, Geometric Program

Module 10:

Application: Compressive Sensing, Sparse Signal Processing, OMP (Orthogonal Matching Pursuit), LASSO (Least Absolute Shrinkage and Selection Operator) for signal estimation

Module 11:

Application: Radar for target detection, Array Processing, MUSIC, MIMO-Radar Schemes for Enhanced Target Detection

Module 12: Application: Convex optimization for Big Data Analytics, Recommender systems, User Rating Prediction and Optimization for Finance

Books:

1. Big Data Analytics for Cyber- Physical Systems, by Guido Dartmann, Houbing Song, Anke Schmeink, Joe Hayton Publisher.


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Building Arduino Robots and Devices

Module 1:

How to assemble an electrical circuit on a breadboard, Measurement of electrical properties, How to communicate the information about an assembled circuit, Development tools for the Arduino IDE, Variables, macro-definitions, and counting loops, Getting acquainted with Arduino.

Module 2:

First Sensor, How to read analog signals, Exchange of data through the serial port, Voltage divider, Reading digital signals, Program branching and Boolean expressions, The seven-segment display, Bar graph and buzzer, MicrochipsDebugging, Monitoring systems, Output shift register.

Module 3:

IR distance sensor, Arrays, Analog signal recording, Function declaration, while loop, measuring distance using ultrasound, Mapping and processing, Fighting the noise, Servo and the library, Field transistor and relay, Planning and thinkingFinite-state automaton, Power supply, Soil humidity sensor, How to receive a command from the network, water program basics, Encountering errors.

Module 4:

Starting the commutator motor, The motor control expansion board, Relay algorithm Motor driver, Analog line sensor, Regulator, SoftwareSerial, External Interrupts, Remote control and RemoteXY, Running Diagnostics, Robot car and HitchCounting the turns of the wheels, thestructure, and functions of a 3D printer Step motor, Getting the parts from models, 3D model of a part.

Books:

1. Arduino: A technical Reference by J. M. Hughes, First Edition published by O'Reilly Media.



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Innovation by Design

Module 1:

The Seven Concerns, Design Thinking & Collaboration, Challenges to Innovation Understanding Users, Arriving at Design Insights, Prototyping for User Feedback, 1st C The Cause, Crossing the First Pitfall, Trial and Error, User Feedback for Development, New users, new needs to meet, Knowing the Context.

Module 2:

2nd C The Context, The Basic Need, Ingenious Attempts, Further Insights, The Working Rig, Concepts generation, Experiencing the Product, Refinements, 3rd C - The Comprehension, Understanding Constraints, Positioning the Product, Exploring Possibilities, More Experiments, Understanding the Technology, At the 2nd Valley of Death, Finishing Touches.

Module 3:

The Check, The Cause, The Product, the Users and the Context, The Prototyping User needs, The Crucial Step Missed, 5th C The Conception, Synchronic Studies, One product, many problems, Concept Clusters, From idea to product, Prototyping Materials and Technologies, Collaborative Efforts.

Module 4:

6th C - The Crafting, The Manufacturing Challenge, The User Feedback, The Iterative Process, 7th C: The Connection, The Seed for Innovation, Pinnacle for Innovation, The Innovation Timeline, The Innovation Champions, The Innovation Domains, The Innovation Templates, The Serial Innovation.

Books:

1. Innovation by Design: How Any Organization Can Leverage, by Thomas Lockwood And Edgar Papke by Career Press.


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Introduction to battery-management systems

Module 1:

Introduction to the batteries, battery-management system, Parts of an electrochemical cell, How does an electrochemical cell store and release energy, Best materials to use in an electrochemical cell, Example electrochemical (incl. PbA and NiMH) cells.

Module 2:

Benefits of lithium-ion cells, lithium-ion cells different from electrochemical cells, Negative electrodes for lithium-ion cells, Positive electrodes for lithium-ion cells, Electrolytes and separators for lithium-ion cells, Is lithium going to run out.

Module 3:

Primary functions of a BMS, Some reasons for modular design, sense all cell voltages in a BMS, sense module temperature in a BMS, sense battery-pack current in a BMS, control contactors with a BMS, sense electrical isolation in a BMS, Control battery-pack temperature with a BMS.

Module 4:

BMS protection using and battery pack, BMS interface with other system components, BMS estimate SOC and SOH, cell SOC and battery-pack SOC, Compute cell available energy and power, Compute battery-pack available energy and power, Kinds of diagnostics must a BMS report.

Books:

1. Battery Management Systems for Large Lithium-ion Battery Packs, by Davide Andrea, Artech House.


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Patent Drafting for Beginners

Module: 1 Invention as a solution to an unsolved Problem

Background, Field of Invention, Prior Art, Patent Classification, Technical Advance, What are not inventions, Why People Invent, How Inventions Look, Where to Look for Inventions, How to Catch an Invention, Getting a working disclosure, Searching with the disclosure, Outcome of search, What is a Patentability Search, Reasons for Ordering a Patentability Search, When a Patentability Search is Not Required, How to Order a Patentability Search, Limits of Patentability Search, Patentability Search Report, How to pitch an invention, Identifying the inventive concept.

Module: 2 Drafting a Claim

Problem Solution Statement, Problem-Solution to Claim, How to Search for a Granted Patent, Provisions relating to claim, Some Exceptions to patentability Structure of Claims, Preamble, Transition, Body Form and Punctuation of Claims, Omnibus Claims, Structural and Functional Definitions, Cooperation

Module: 3 Types and Arrangement of Claims

Types of Claims, Dependent claims, Apparatus Claims, Methods or Process Claims, Claim Drafting Best Practices, Claims Drafting What to Avoid, How to Download Copy of Patent Specification, Amendment to Claims, Claim Analysis Combo Pen with Marker

Module: 4 Structure of the Patent Specification

Introduction to Specification Drafting, Enabling Disclosure, Best method Parts of the specification, Background & Summary, Detailed description, Parts of the Application, Evolution of Patent Specifications


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Recent Advances in Transmission Insulators

Module 1:

Introduction to Transmission and Distribution Insulators, Important components of transmission system, Insulation coordination, Manufacturing process for Ceramic/Glass Insulators, Manufacturing process for Polymeric Insulators, Design Considerations of Transmission Insulators.

Module 2:

Non ceramic insulators performance-service experience, Field experience and contamination issues on transmission insulators, Pollution/contamination flashover phenomena modelling etc., Failures, importance of reliability and testing

Module 3:

High Voltage testing and techniques employed, HV testing techniques for Ceramic/Glass Insulators, Reliability, philosophy of testing, Testing of ceramic, glass, and composite insulators.

Module 4:

Surface degradation studies on composite insulators, Recent studies on composite insulators, Cleaning methods adopted for insulators, coating techniques for insulators, Introduction to Hybrid Insulators.

Books and references:

1. Rakosh Das Begamudre, "Extra High Voltage AC Transmission Engineering", New Age International(P) Ltd, New Delhi, 2000.
2. E Kuffel, W S Zaengl and J Kuffel, "High Voltage Engg. Fundamentals", textbook published by Newness publishers, second edition, 2000.
3. Recent IEEE Journal / Conference and CIGRE publications. • "Outdoor Insulators", Ravi group, Edward Cherney & Jeffery Burnham Text book, 1999.
4. Insulators for High Voltage – J S T Looms, text book, Peregrines, 1988 • K Papailiou and F Schmuck, "Silicone Composite Insulators: Materials, design, Applications for Power systems, Springer Berlin Heidelberg, 2012.


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Soft Skills for Business Negotiations and Marketing Strategies

Module 1: Soft Skills and Hard Skills Week

Module 2: Non-verbal communications

Module 3: Negotiations

Module 4: Professional Negotiations

Module 5: Business Negotiation

Module 6: Product Marketing Negotiation

Module 7: Negotiation for Services

Module 8: Marketing Strategy

Module 9: Power Marketing

Module 10: Power Marketing Strategies

Module 11: Power Marketing Presentations

Module 12: Time Management in Marketing

Books:

1. Communication Skills and Soft Skills an Integrated Approach, by E. Suresh Kumar, P. Sreehari, J. Savithri, Pearson Publishers.


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Wireless Communications for Everybody

Module 1:

Introduction and History of Cellular Communication Systems: Cellular Communication, First to Second Generation (1G to 2G), Third Generation System (3G), Fourth Generation System, Future Cellular System.

Module 2:

Principles of Wireless Communication Theory: Basic principles how information can be delivered efficiently using radio, How such principles are realized in LTE systems, How people can be connected and multimedia services can be delivered in LTE systems.

Module 3:

Principles of Wireless Resource Management: Basic principles, how does the interference affect the capacity of wireless networks, why does the cellular system look like as of today, Increasing the number of cells increases the capacity, how is 5G cellular being shaped, how does the interference management increase the capacity, how does scheduling increase the average capacity.

Module 4:

Multiple Antenna technologies: basic principles of multiple antennas, array, diversity, and spatial multiplexing concepts of single-user MIMO and multi-user MIMO.

Books:

1. Wireless Communication Networks and Systems, by William Stallings, Cory Beard, Pearson Publishers.


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Node with React Full Stack Web Development

Module 1: Basics of VCS

Introduction to Full Stack Development, What and Why VCS?, Intro to Git & Git Commands using Command Line Interface, Introduction to Front End, HTML & CSS, HTML Forms & Inputs, Responsive Layouts & Mobile First Design with Flexbox

Module 2: JAVA Script Basics

Introduction to Programming in JavaScript, Variables and Data Types, Functions in JavaScript, Working with Strings & Numbers, Application Logic & Loops, Introduction to Arrays & Objects, Working with Array, Working with Objects, Variable Types & Scoping, Error Handling, Asynchronous JavaScript

Module 3: React Components and States

Introduction to Node & NPM, Create React App Boilerplate & Introduction to JSX, Organising Code & Creating a Hello World Application, React Basics: Components with States & Props, Passing Static & Dynamic Data between Components , Event Handling

Module 4: Conditional Rendering

Introduction to Conditional Rendering using React, Building the App based on Bootstrap, Content Validation using React, Introduction to Node JS & Express JS, Basic Hello World REST API in Express JS, Creating modular Routers in Express JS

Books:

1. The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer (First Edition)
2. Full Stack Web Development For Beginners: Learn Ecommerce Web Development Using HTML5, CSS3, Bootstrap, JavaScript, MySQL, and PHP


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Technologies for Clean and Renewable Energy Production

Module 1: Introduction, characterization of coal and conventional routes for energy production from coal

Coal as a source of energy, characterization of coal, conventional route for energy production from coal

Module 2: Cleaner routes for energy production from coal

Cleaner route for energy production from coal, gasification of coal, gastification of coal, direct liquefaction of coal

Module 3: Characterization of crude oil and conventional routes for crude oil utilization

Petroleum as a source of energy, characteristics of crude oil and petroleum products, refining of crude oil for liquid fuels production, conversion of intermediate products

Module 4: Cleaner routes for energy production form petroleum crude

Impurities removal from liquid fuels, residue upgradation-1, Residue upgradation-2, heavy crude oil processing

Module 5: Cleaner energy production from gaseous fuels

Properties and routes for energy production, syn gas production from natural gas, syn gas to liquid fuel production, hydrogen production from natural gas

Module 6: Solar and wind energy production

Solar Energy-1, Solar Energy-2, Wind Energy-1, Wind Energies

Module 7: Production of hydro and geothermal energy

Hydro energy-1, Hydro energy-2, Geothermal energy, Tidal energy

Module 8: Energy production from biomass and wastes and energy conservation

Energy from biomass and wastes 1 (biological route), energy from biomass and wastes 2 (chemical route), energy from biomass and wastes 3 (physical route), energy conversations

Books and references:

1. Miller Bruce G., Coal Energy Systems, Elsevier Academic Press, Paris 2005
2. Twidel, J. and Tony W., Renewable Energy Resources, Second Edition, Taylor & Francis 2006
3. Kreith F., Goswami D.Y., Energy Management and Conservation, CRC Press 2008
4. Sukhatme S., J Nayak J., Solar Energy: Principles of thermal Collection and Storage, 3 rd Ed., Tata McGraw-Hill Pulishing Company Ltd. 2008
5. Mondal P and Dalai A., Sustainable utilization of natural resources, CRC Press 2017


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Soft Skills

Module 1:

Introduction to Soft Skills, Aspects of Soft Skills, Effective Communication Skills, Classification of Communication, Personality Development

Module 2:

Positive Thinking, Telephonic Communication Skills, Communicating without Words, Paralanguage

Module 3:

Proxemics, Haptics: The Language of Touch, Meta-communication, Listening Skills, Types of Listening

Module 4:

Negotiation Skills, Culture as Communication, Organizational Communication

Module 5:

Communication Breakdown, Advanced Writing Skills, Principles of Business Writing

Module 6:

Business Letters, Business Letters: Format and Style, Types of Business Letter

Module 7:

Writing Reports, Types of Report, Strategies for Report Writing, Evaluation and Organization of Data

Module 8:

Structure of Report, Report Style, Group Communication Skills

Module 9:

Leadership Skills, Group Discussion, Meeting Management, Adaptability & Work Ethics

Module 10:

Advanced Speaking Skills, Oral Presentation, Speeches & Debates, Combating Nervousness, Patterns & Methods of Presentation, Oral Presentation: Planning & Preparation

Module 11:

Making Effective Presentations, Speeches for Various Occasions, Interviews, Planning & Preparing: Effective Résumé,

Module 12:

Facing Job Interviews, Emotional Intelligence & Critical Thinking, Applied Grammar

Books and references:

1. Butterfield, Jeff. Soft Skills for Everyone. New Delhi: Cengage Learning. 2010.
2. Chauhan, G.S. and Sangeeta Sharma. Soft Skills. New Delhi: Wiley. 2016.
3. Goleman, Daniel. Working with Emotional Intelligence. London: Banton Books. 1998.
4. Hall, Calvin S. et al. Theories of Personality. New Delhi: Wiley. rpt. 2011.
5. Holtz, Shel. Corporate Conversations. New Delhi: PHI. 2007.



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Water Society and Sustainability

Module 1:

Setting the Context, Beyond Hydrology, Socio Hydrology, Political Ecology of Water, Hydrosocial

Module 2:

Critical Physical Geography, The South Asian Context, Water Harvesting and Water Use Techniques in Ancient India 1, Water Harvesting and Water Use Techniques in Ancient India 2, Water Harvesting and Water Use Techniques in Ancient India 3

Module 3:

Water Technology in Medieval India 1, Water Technology in Medieval India 2, 'Colonial Hydrology', Dams and Development in Contemporary India, The Farakka Barrage Project: Historical and Technical Details

Module 4:

The Farakka Barrage Project: Socio-environmental Implications, Urban Waters: Historical and Political Ecological Perspectives, Transforming Trajectories of Blue Infrastructures of Kolkata, Peri-urban Water Justice in the Global South, Discussion and Conclusion

Books and references:

1. Acharya A (2015) The cultural politics of waterscapes. In: Bryant RL (ed) The International Handbook of Political Ecology. Cheltenham, UK ; Northampton, MA, USA: Edward Elgar Publishing, pp.373–386.
2. Allen A, Hofmann P, Mukherjee J and Walnycki A (2017) Water trajectories through non-networked infrastructure: insights from peri-urban Dar es Salaam, Cochabamba and Kolkata. Urban Research & Practice 10(1):22–42.
3. Bakker K (2003) Archipelagos and networks: urbanization and water privatization in the South. The Geographical Journal 169(4): 328–341.
4. Bouleau G (2014) The co-production of science and waterscapes: The case of the Seine and the Rhône Rivers, France. Geoforum 57: 248–257.
5. Budds J, Linton J and McDonnell R (2014) The hydrosocial cycle. Geoforum 57: 167–169.


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Enhancing Soft Skills and Personality

Module 1:

Highlights of Developing Soft Skills and Personality Course-1-24, Highlights of Developing Soft Skills and Personality Course-25-4, Definitions and Types of Mindset, Learning Mindsets, Secrets of Developing Growth Mindsets

Module 2:

Importance of Time and Understanding Perceptions of Time, Using Time Efficiently , Understanding Procrastination, Overcoming Procrastination, Don't Say "Yes" to Make Others Happy

Module 3:

Types of People, How to Say "No", Controlling Anger, Gaining Power from Positive Thinking-1, Gaining Power from Positive Thinking-2

Module 4:

What Makes Others Dislike You?, What Makes Others Like You?-1, What Makes Others Like You?-2, Being Attractive-1, Being Attractive-2

Module 5:

Common Errors-1, Common Errors-2, Common Errors-3, Common Errors-4, Common Errors-5

Module 6:

Humour in Communication, Humour in the Workplace, Function of Humour in the Workplace, Money and Personality, Managing Money

Module 7:

Health and Personality, Managing Health-1: Importance of Exercise, Managing Health-2: Diet and Sleep, Love and Personality, Managing Love

Module 8:

Ethics and Etiquette , Business Etiquette, Managing Mind and Memory, Improving Memory, Care for Environment, Highlights of the Course

Books and references:

1. Dorch, Patricia. What Are Soft Skills? New York:Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London:HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.


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Consumer Behavior

Module 1:

Introduction to Consumer Behaviour, The Changing Patterns of Consumer Behaviour, Use of Market, Segmentation in Consumer Behaviour, Dimensions of Consumerism, Process of Motivation

Module 2:

Theories of Motivation-1, Theories of Motivation-2, Consumer Involvement, Case study on Motivation and Involvement, Consumer perception and imagery

Module 3:

Case Study on Consumer Perception formation, Theories of Personality, Self-Concept, Learning theories, Case Study on Consumer Learning Process

Module 4:

Attitude Formation-1, Attitude Formation-2, Changing Attitude, Attitude Formation, Case Study on Consumer, Consumers' Value

Module 5:

AIO classification of Lifestyle, VALSTM Typology, Application of Lifestyle in Marketing, Culture and subculture, Group as a determinant of buyer behavior

Module 6:

Celebrities as Reference group, Concept of family and family life-cycle, Family Buying Decisions, Case Study on Family Buying Decisions, Diffusion of Innovation

Module 7:

Opinion Leadership Types of Consumer Buying Behaviour, Black-Box Model, Modelling Buyer Behaviour-1, Modelling Buyer Behaviour-2

Module 8:

Modelling Buyer Behaviour-3, Modelling Industrial buyer Behaviour-1, Modelling Industrial buyer Behaviour-2, Dimensions of Consumer Research, Course Wrap up

Books:

1. "Consumer Behaviour" by Schiffman/ Kumar.
2. "Consumer Behavior" by David Loudon and Albert Della Bitta


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Product Design and Development

Module 1:

Introduction to course, Product life-cycle, Product policy of an organization. Selection of a profitable product, Product design process, Product analysis.

Module 2:

Value engineering in product design; Advantages, Applications in product design, Problem identification and selection, Analysis of functions, Anatomy of function. Primary versus secondary versus tertiary/unnecessary functions, Functional analysis: Functional Analysis System Technique (FAST), Case studies.

Module 3:

Introduction to product design tools, QFD, Computer Aided Design, Robust design, DFX, DFM, DFA, Ergonomics in product design,.

Module 4:

DFMA guidelines, Product design for manual assembly, Design guidelines for metallic and non-metallic products to be manufactured by different processes such as casting, machining, injection molding etc., Rapid prototyping, needs, advantages, working principle of SLA, LOM and SLS

Books:

1. Inderdeep Sing, "Product Design and Development:", IIT Roorkee.


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Programming, Data Structures and Algorithms using Python

Module 1:

Informal introduction to programming, algorithms and data structures viaged, Downloading and installing Python gcd in Python: variables, operations, control flow - assignments, condition-als, loops, functions

Module 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

Module 3:

Basic algorithmic analysis: input size, asymptotic complexity, $O()$ notation, Arrays vs lists Merge sort'n Quicksort, Stable sorting

Module 4:

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

Module 5:

Exception handling, Basic input/output, Handling files, String processing

Module 6:

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

Module 7:

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

Module 8:

Efficient evaluation of recursive definitions: memorization, Dynamic programming: examples Other programming languages: C and manual memory management, Other programming paradigms: functional programming

Books:

1. Book by Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia, "Data Structures and Algorithms in Python", 2013 edition.


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Soft Skill Development

Module 1: Communication skills 1: The basics

Understanding the communicative environment-I, Understanding the communicative environment-II, What to listen for and why, When to speak and how, Starting and sustaining a conversation

Module 2: Communication skills 2: Presentation and interaction

What to present and how – I, What to present and how – II, Multimedia presentation: Understanding the basics, Communication styles, Speaking in groups

Module 3: Communication skills 3: Visual, nonverbal and aural communication

The world of visual culture, Visual perception, The aural: Its relevance and impact, The body and the way it communicates, The face, its expressions and what it says

Module 4: Interpersonal communication 1: Individuals, groups and cultures

Building Relationships, Understanding Group Dynamics- I, Understanding Group Dynamics- II, Groups, Conflicts and their Resolution, Social Network, Media and Extending Our Identities

Module 5: Interpersonal communication 2: Emotional and social skills

Module 6: Developing key traits 1: Creativity, critical thinking and problem solving

Module 7: Developing key traits 2: Motivation, persuasion, negotiation and leadership

Motivating oneself, The art of persuasion-I, The art of persuasion-II, From persuasion to negotiation, Leadership and motivating others

Module 8: Essential and vocational skills: survival strategies

Managing time, Managing stress, Resilience, Work-life balance, Applying soft-skills to workplace

Books and references:

1. Dorch, Patricia. What Are Soft Skills? New York: Execu Dress Publisher, 2013.
2. Kamin, Maxine. Soft Skills Revolution: A Guide for Connecting with Compassion for Trainers, Teams, and Leaders. Washington, DC: Pfeiffer & Company, 2013.
3. Klaus, Peggy, Jane Rohman & Molly Hamaker. The Hard Truth about Soft Skills. London: HarperCollins E-books, 2007.
4. Petes S. J., Francis. Soft Skills and Professional Communication. New Delhi: Tata McGraw-Hill Education, 2011.
5. Stein, Steven J. & Howard E. Book. The EQ Edge: Emotional Intelligence and Your Success. Canada: Wiley & Sons, 2006.


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Stress Management

Module 1: Scientific Foundations of Stress

What is stress, Sources of stress, Types of stress, Personality factors and stress, Stress and the college students

Module 2: Stress Psychophysiology

Stress and Nervous System, Hypothalamic-Pituitary-Adrenal (HPA) Axis, Effect of Stress on Immune System, Health Risk Associated with Chronic Stress, Stress and Major Psychiatric Disorders

Module 3: Developing Resilience to Stress

Understanding your stress level, Role of Personality Pattern, Self Esteem, Locus of Control, Role of Thoughts Beliefs and Emotions – I, Role of Thoughts Beliefs and Emotions – II, Life Situation Intrapersonal : (Assertiveness, Time Management)

Module 4: Strategies for Relieving Stress

Developing Cognitive Coping Skills, Autogenic Training, Imagery and Progressive Relaxation, Other Relaxation Techniques, Exercise and Health, DIY Strategies Stress Management

Books:

1. Rajlakshmi Guha, "Stress Management".


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Wildlife Conservation

Module 1: Introduction

A closer look at Biodiversity, Economics valuation of Biodiversity, Threats to Biodiversity

Module 2: Monitoring Wild Animals

Basics of Sampling, Distance sampling – I, Distance Sampling – II, Radio telemetry, Behavioral monitoring

Module 3: Monitoring and Managing Habitats

What is habitat, Habitat degradation, loss, fragmentation and displacement

Module 4: Monitoring and Wildlife Diseases

Some terminologies, Some common wildlife disease, Principles of disease management

Module 5: Capturing and restraining wild animals

Mechanical capture, Chemical capture, Capture Myopathy, Care of Immobilised animal, Legal aspects of capture and restraint

Module 6: Conservation genetics

Preliminaries and Introduction to genetics, population genetics, Chromosomal and genetic disorders, inbreeding, population viability analysis, reintroductions and outbreeding

Module 7: Ex-situ conservation

Fundamentals, Zoos and their management, Botanical gardens, Other aspect: cryopreservation, seed banks, etc.

Module 8: Management of changes

Impacts of climate change, Plastics and biodiversity, Oil spills, Crisis and learnings: The Sariska case study

Books and references:

1. Pullin, A.S., Conservation Biology. 2002: Cambridge University Press.
2. Van Dyke, F., Conservation Biology: Foundations, Concepts, Applications. 2008: Springer Netherlands.
3. Selected articles / papers as referred to in the lectures


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Entrepreneurship and IP Strategy

Module 1: Introduction to entrepreneurship and intellectual property: Definition, concepts
Introduction, What is an entrepreneurship? What do you understand by IP? Whether entrepreneurship and IP related? What is role of IP strategy in entrepreneurship? Case study I – IT industry

Module 2: Innovation and entrepreneurship

Innovation, invention and creativity, Types of innovation, Innovation, market and IP, Open innovation and IP, Case Study II – Biotechnology

Module 3: IPR: Trademark and entrepreneurship

Trademark-Definition, Trademark-Types, Trademark-Registration, Trademark infringement, Case study III - Textile industry

Module 4: IPR: Patent and entrepreneurship

Patent-introduction, Patent infringement, Patent strategies- I, Patent strategies- II, Capsule version

Module 5: IPR: Copyright and entrepreneurship

Copyright – Definition and subject matter, Copyright and related rights, Copyright registration and entrepreneurship, Copyright infringement, Case study IV – Film industry

Module 6: IPR: Industrial design and entrepreneurship

Industrial Design- Definition, concept, Industrial Designs Act - Key features, Industrial Design-Business, Industrial Design infringement, Case study V - Automobile industry

Module 7: IP strategy & entrepreneurship

IP strategy for start-up and MSME, IP transaction – introduction, IP valuation, bank loan, insurance, Success story and business model of a few start-ups, Case Study VI – Pharma industry and Agriculture

Module 8: Entrepreneurship & IP - Government initiatives

Incubators, research parks, Various Government policies, Integrative approach – Entrepreneurship & IP strategy, Capsule revision, Am I ready to venture my start up? (Course applicability)

Books and References:

Ove Granstrand, The Economic and management of Intellectual Property, (1999)

1. Narayanan, V. K., Managing technology and innovation for competitive advantage, first edition, Pearson education, New Delhi, (2006)
2. Idris, K. (2003), Intellectual property: a power tool for economic growth, second edition, WIPO publication no. 888, Switzerland
3. Bosworth D. & Webster E , The Management of Intellectual Property, Edward Elgar.
4. Berman, Ideas to Assets, Wiley publications
5. Richard Dorf & Thomas Byers, Technology ventures from idea to enterprise, 2 nd edition.

Additional Reading:

WIPO - <http://www.wipo.int/patents/en/>


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Electric Vehicles and Mobility

Module 1: Understand Mobility and its Evolutions

More on Method - Transportation Systems, Mobility and Urban Forms, Do You Know That? Urbanization of the World Population, More on Method - Socio-Technical Regimes and Technological Transition, Mobility and Ways of Life, Do You Know That? Some Highlights Regarding Mobility in the World, More on Method - Mobility Systems Observational Data, Electric Mobility: From Past to Present, Do You Know That? National Wealth and Individual Motorization, More on Method - The Four-Step Model, Electric Mobility: Actual Changes Brought on by Electric Vehicles in Terms of Mobility Systems

Module 2: Electric Mobility and Environment Impact Reduction

What are the Challenges of Climate Change?, Climate Change: Futurology of Greenhouse Gas Emissions for The 21st Century, Identifying and Reducing the Negative Impacts of Transportation, Noise, More on Method - Life-Cycle Assessment (LCA), LCA and Well-To-Wheel Analysis, Comparative LCA of Thermal and Electric Vehicles, Recycling of Electric Vehicle Batteries

Module 3: Economic Analysis

More on Method – Monetization, Total Cost of Ownership, Discount Rate, Option Value, Cost/Benefit Analysis Applied to Electric Vehicles, The Distorting Effect of Taxes, The Cost Recovery Ratio, The Issues of EVs for the Industry and Public Accounts, What is at Stake at Country Level? Effects Regarding Industrial Production, Effects Regarding Energy Supply, Oil Dependence of Transportation in The World, Fuel Poverty, Disaggregated Analysis of Household Potential EV Demand, Household Mobility Tool Ownership, Who will pick an electric vehicle?

Module 4: Electric Mobility and Infrastructures: Technical and Economic Dimensions

Issues and Present Situation of Charging Infrastructures in France, Global State of Play of Charging Infrastructures for Electric Vehicles, Charging Infrastructure Policies in Europe, Public Policies related to EV Charging Infrastructure : Global Perspective, More on method - The Technical and Economic Processes Leading to an Equilibrium Between Supply and Demand on Electric Grids Storing Electric Power, Charging Stations, EV Business Models: A Business Model Approach, EV Business Models: Value and Deployment, Batteries and Charging Infrastructures, Quickdrop, Rapid-Charges, Battery Business Model

Books:

1. Hybrid Electric Vehicle System Modeling and Control - Wei Liu, General Motors, USA, John Wiley & Sons, Inc., 2017.
2. Hybrid Electric Vehicles – Teresa Donateo, Published by ExLi4EvA, 2017.
3. Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market Gianfranco Pistoia Consultant, Rome, Italy, Elsevier Publications, 2017.
4. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, MehrdadEhsaniYiminGao Stefano Longo Kambiz M. Ebrahimi, Taylor & Francis Group, LLC, 2018.


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Leadership Emotional Intelligence

Module 1:

Concept of Emotional Intelligence, Emotion- Meaning, characteristics of emotion, components of emotion-cognitive component, physiological component, Behavioral component, Types of emotions, exposing the myths about emotion, physiological or bodily changes accompanying emotions, How emotions affect our thinking and actions?, Development of emotions and emotional maturity, Emotional Intelligence – concept, history, measurement of EI - Bar-On Emotional Quotient Inventory, emotional competency inventory, Emotional and social competency inventory, Mayer-Salovey-Caruso Emotional Intelligence Test, self-rated emotional intelligence scale.

Module 2:

Intrapersonal Awareness, Working with EI - EI can be enhanced or developed, models of EI: Ability models, Trait models, Mixed model, development of EI, Emotional Self Awareness – Introduction, Meaning and Definition, Emotional Self-awareness and Success, development of emotional self-awareness, Accurate self-assessment-meaning and definition, Introduction, accurate self-assessment and success, Self-confidence –Introduction, need and importance of self-confidence in one's life.

Module 3:

Intrapersonal Management, Emotional self-control-meaning and definition, emotional self-control and success, Developing or improving the ability of emotional self-control: stage1-identification or awareness about the parent emotional state, stage 2- determining underlying causes responsible for the present emotional state, stage3-adopting measures for getting control of the emotional state, Stress Tolerance: Stress - Meaning and definition, Factors responsible for inducing stress, Development of stress Tolerance, Assertiveness, Self-actualization and Optimism- concept, meaning and importance

Module 4:

Conflict Management and Leadership, Conflict Management- meaning, definition, concept, stages- pre-negotiation stage, negotiation stage, post negotiation stage, conflict management and success, Co-operation and collaboration- meaning, skill of co-operation and collaboration and success, development of the skill of co-operation and collaboration, Leadership- leadership – meaning and definition , leadership style and traits - task-oriented and relation oriented styles, authoritarian, democratic and laissez faire styles, Inspirational leadership., development of inspirational leadership.

Textbook:

1. Daniel Goleman (1996) Emotional Intelligence. Why it can matter more than IQ Bantam Doubleday Dell Publishing Group.
2. Daniel Goleman (2000) Working with Emotional Intelligence.
3. Bantam Doubleday Dell Publishing Group Liz Wilson, Stephen Neale & Lisa Spencer-Arnell (2012).
4. Emotional Intelligence Coaching. Kogan Page India Private Limited. Gupta S.K. (1980), Guidance and Counselling in Indian Education, New Delhi: NCERT


REGISTRAR
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Crash Course on Python

Module 1: Introduction

Introduction, What is programming?, What is automation?, Getting Computers to Work for You, What is Python?, Why is Python relevant to IT?, Other Languages, Hello, World!, Getting Information from the User, Python Can Be Your Calculator, First Steps Wrap Up, Meet Marga, the Curriculum Developer, Program Surveys, Welcome to the Course!, Uses for Automation, Study Guide: Introduction to Programming, Python Resources, A Note on Syntax and Code Blocks.

Module 2: Basic Python Syntax

Data Types, Variables, Expressions, Numbers, and Type Conversions, Defining Functions, Returning Values, The Principles of Code Reuse, Code Style, Comparing Things, Branching with if Statements, else Statements, elif Statements, Basic Syntax Wrap Up, In Marga's Words: Why I Like Python

Module 3: Loops

Introduction to Loops, What is a while loop?, More while Loop Examples, Why Initializing Variables Matters, Infinite Loops and How to Break Them, What is a for loop?, More for Loop Examples, Nested for Loops, Common Errors in for Loop, What is recursion?, Recursion in Action in the IT Context, Loops Wrap Up

Module 4: Strings, Lists and Dictionaries

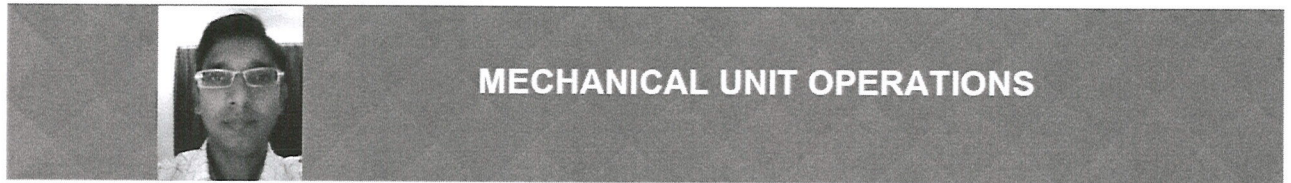
Basic Structures Introduction, What is a string?, The Parts of a String, Creating New Strings, More String Methods, Formatting Strings, What is a list?, Modifying the Contents of a List, Lists and Tuples, Iterating over Lists and Tuples, List Comprehensions, What is a dictionary?, Iterating over the Contents of a Dictionary, Dictionaries vs. Lists, Basic Structures Wrap Up

Books:

1. Book by Michael H. Goldwasser, Michael T. Goodrich, and Roberto Tamassia, "Data Structures and Algorithms in Python", 2013 edition.


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2. Mechanical Unit Operations



PROF. NANDA KISHORE

Department of Chemical Engineering
IIT Guwahati

INTENDED AUDIENCE : Chemical Engineering, Biotechnology and Food Engineering

COURSE OUTLINE :

Chemical engineering consists of several unit operations and unit processes. Before the reaction step, the raw materials should be processed through various unit operations and similarly after the reaction step as well the products are passed through various unit operations either for product separation or for purity. Thus unit operations are very essentially part of the chemical engineering; and hence, basic knowledge about the principles and equipment of solid-solid unit operations and solid-liquid unit operations is mandatory for any professional chemical engineer.

ABOUT INSTRUCTOR :

Prof. Nanda Kishore completed PhD from Indian Institute of Technology (IIT) Kanpur in 2008 and presently is a full professor in the Department of Chemical Engineering of IIT Guwahati, India. He was Brunel Research Fellow from Dec. 21, 2009 to March 31, 2011 at School of Engineering Sciences, University of Southampton, UK. He was a visiting researcher of Department of Chemical and Processing Engineering, University of Surrey, Guildford, United Kingdom from June 2016 to July 2016. He received Young Scientist Research Award in 2016 from DAE-BRNS; IET Young Engineers Award for the year 2015; Young Scientist Research Grant from Science and Engineering Research Board of Department of Science and Technology, Government of India, 2013.

COURSE PLAN :

Week 1: Introduction of Particulate Sizes and Shapes

Week 2: Screening

Week 3: Size Reduction

Week 4: Storage and Conveying of Bulk Solids

Week 5: Size Enlargement

Week 6: Flow past Bluff Bodies

Week 7: Flow Through Packed and Fluidized Beds

Week 8: Filtration

Week 9: Cross Flow Filtration and Membrane Separations

Week 10: Gravity Sedimentation

Week 11: Centrifugal Separations

Week 12: Floatation


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3. Effective Writing

Course layout

Topics :

1. Introduction to Effective Writing
2. Effective Writing as an Art
3. Principles of Effective Writing
4. Types and Stages of Effective Writing
5. Notions of Correctness and Appropriateness, Part I
6. Notions of Correctness and Appropriateness, Part II
7. Essay Writing
8. Types of Essays
9. Essentials of Academic Writing, Part I
10. Essentials of Academic Writing, Part II
11. Business Writing and its Functions
12. Mechanics of Business Writing
13. Business Letters and Memos
14. Format of Business Letters and Memos
15. Types of Business Letter
16. Sales, Complaint and Adjustment Letters
17. Report Writing
18. Strategies and Structure of Reports
19. Style of Report Writing
20. Creative Writing

Books and references

1. Turk, Christopher and John Kirkman. Effective Writing. London and New York: Chapman & Hall. Indian Reprint 2003
2. Pinker, Steven. The Sense of Style: The Thinking Person's Guide to Writing in the 21st Century . Penguin Books, Reprint edition ,2015
3. Seely, John. Oxford Guide to Effective Writing and Speaking. OUP 2nd edition, 2005
4. Goins, Jeff. You Are a Writer (So Start Acting Like One). Tribe Press
5. Brohaugh, William. Write Tight: Say Exactly What You Mean with Precision and Power.
6. Janzer. Anne. The Writer's Process: Getting Your Brain in Gear. Cuesta Park Consulting, 2016
7. King, Stephen. On Writing: A Memoir of the Craft. Scribner, 2010

Instructor bio



Prof. Binod Mishra, IIT Roorkee

Prof. Binod Mishra, presently a professor in the Department of HSS, IIT Roorkee, has been teaching English for more than two decades at various levels. He has to his credit 25 books and more than a hundred articles published in different reputed journals and books. Learners from all across the country have well received his MOOC courses on Soft Skills and Effective Writing. He has also addressed the participants in around a hundred invited talks at various conferences and symposiums. Besides being an engaging teacher and a competent researcher, Dr Mishra is also a passionate poet. Currently, he is the Vice Chairman of the Association for English Teachers of India, the largest body of English teachers. Before this, he had twice been the Editor-in-Chief of the Indian Journal of English Studies, one of the oldest English language and literature journals.


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4. Fluid Flow Operations

COURSE OUTLINE:

This course is structured as a MOOCS course for students or junior engineers studying chemical, mechanical or civil engineering. In this course, effort will be made to introduce students /engineers to fluid mechanics by making explanations easy to understand, including recent information and comparing the theories with actual phenomena. The following features will be included in the course

1. Many illustrations, photographs and items of interest will be presented for easy understanding.
2. Assignments and exercises will be given at the ends of course lecture to test understanding of the chapter topic.
3. Special emphasis will be given on real multiphase flow phenomena with specific applications

COURSE PLAN :


- Week 1 : Characteristics of a fluid
- Week 2 : Fluid statics
- Week 3 : Fundamentals of flow
- Week 4 : One-dimensional flow
- Week 5 : Flow of viscous fluid
- Week 6 : Losses in pipes
- Week 7 : Flow in a water channel
- Week 8 : Drag and lift and cavitation
- Week 9 : Dimensional analysis and law of similarity
- Week 10 : Compressible fluid flow
- Week 11 : Measurement of flow
- Week 12 : Multiphase flow phenomena and its application




Prof. Subrata K Majumder


 Professor

PhD, FCET(I), FISRD (London), FERC (USA), FIIChe, MAIChe, LMIIME, MIAE(Japan), MACBEES (Asia-Pacific)

 **Key Research Areas** : Process Intensification in Chemical Processes, Intensification in environmental process system, Micro-nano bubble science and technology and its applications, Microchannel-based and Jet driven gas-aided extraction, Mineral Beneficiation, Enhanced Oil Recovery by Micro-nanobubble, Multiphase Flow and Reactor Development

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REGISTRAR
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Mechanical Operations



MECHANICAL OPERATIONS

PROF. SHABINA KHANAM

Department of Chemical Engineering
IIT Roorkee

INTENDED AUDIENCE : Undergraduate students. However, this course will also be helpful for anyone of any professional level, preferably holding a college degree or with substantial industrial experience, working in the production, handling, processing, modification or characterization of particulate solids (powders and bulk solids).

INDUSTRY SUPPORT : Any chemical industry which deals with particulate matter.

COURSE OUTLINE :

Around 75% of chemical manufacturing processes involve small solid particles at some point. Proper design and handling of these fine particles often makes the difference between success and failure of the product. Many products such as catalysts, pigments, fertilizers, cements, ceramics and pharmaceuticals are currently manufactured in particulate forms. Mechanical Operations deal with Science and Technology of particulate matter, which is a multidisciplinary field including Materials Science, Environmental, Biomedical, Aerospace, Agricultural, Chemistry, Microbiology and Cell Science, Pharmacy and Medicine. The primary objective of this course is to

- identify the important physical mechanisms occurring in processes involving particles
- discuss unit operation and its role in Chemical industries, characteristics of particulate solids, Principles of size reduction, particle dynamics and separation of particles
- formulate and solve mathematical descriptions of such processes

ABOUT INSTRUCTOR :

Prof. Shabina Khanam is working as Associate Professor in Chemical Engineering Department of IIT Roorkee. She has completed B.Tech degree from AMU Aligarh, Aligarh in 2000 and M.Tech and Ph.D. degree from IIT Roorkee in 2002 and 2007, respectively. Her major fields of study are Process Integration, Energy Management and Modeling and Simulation. She has almost 9 years of experience in teaching and research. During this period she has supervised 1 Ph.D. and 14 M.Tech theses. At present 6 Ph.D and 3 M.Tech theses are in pipe line. She has published 29 and 24 research papers in different refereed journals and conferences, respectively. She has taught the course Mechanical Operations six times in her 9 years of teaching career.

COURSE PLAN :

Week 1

- Introduction
- Characterization of a single particle
- Characterization of collection of particles

Week 2

- Fine grain size distribution
- Effectiveness of screen
- Industrial screening equipment
- Size reduction

Week 3

- Laws of comminution
- Examples of laws of comminution
- Size reduction equipment

Week 4

- Particle dynamics
- Particle dynamics - Examples
- Classification and jigging


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5. Renewable Energy Engineering

Course layout

- Week 1:** Solar Energy: Basics and Concepts
Week 2: Non-Concentrating Solar Collectors
Week 3: Non-Concentrating Solar Collectors: Practice Problems
Week 4: Concentrating Solar Collectors
Week 5: Storage Systems
Week 6: Biomass types and characterization
Week 7: Biochemical conversion processes
Week 8: Biochemical conversion processes (Contd.)
Week 9: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass
Week 10: Bioconversion of substrates into alcohol and thermo-chemical conversion of biomass (Contd.)
Week 11: Wind Energy: Basics: Turbine terms, types and theories
Week 12: Characteristics and Power Generation from Wind Energy

1. Books and references

- (i) Sukhatme S. P., Nayak J. K., Solar Energy: Principles of thermal Collection and Storage, 3 rd Ed., Tata McGraw-Hill Education Pvt. Ltd 2008.
- (ii) Twidell, J. and Tony W., Renewable Energy Resources, 2 nd Edition, Taylor & Francis 2006.
- (iii) Khan B. H., Non-Conventional Energy Resources, 2 nd Edition, Tata McGraw-Hill Education Pvt. Ltd. 2009.
- (iv) Prabir Basu, Biomass Gasification, Pyrolysis and Torrefaction, Academic Press, Elsevier, 2013.

Instructor bio



Prof. R. Anandalakshmi, IIT Guwahati

Dr. R. Anandalakshmi is an Associate Professor in the Department of Chemical Engineering, Indian Institute of Technology, Guwahati. Her research interests are in the area of Computational Heat Transfer and Fluid Flow, Process Modeling and Simulation, Solar Thermal Energy Conversion, Energy Efficient Design of Thermal Systems, Microwave Assisted Food and Material Processing, Food Packaging and Preservation, Refrigeration and Air-conditioning Systems

Prof. Vaibhav Vasant Goud

Dr. Vaibhav V. Goud is Professor in the Department of Chemical Engineering, Indian Institute of Technology Guwahati, India since 2018. Principal research interests of Dr. Goud are in the fields of reaction engineering, renewable energy, supercritical fluids, bio lubricants. He has published more than 120 papers in international peer reviewed journals and made presentations of his research in several national/ international conferences. He has also written 14 book chapters in the area of renewable energy. He has taught energy resources as an elective course to UG, PG and Ph.D. students at IIT Guwahati for six consecutive years (2014, 2015, 2016, 2017, 2018 and 2019).



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7. Ecology and Environment

Course layout

Week 1 : Dr. B.S. Murty -Introduction (1),Sustainability Definition / Goals, Climate Change (2),Case Studies (3) (Eg: Dams, Chemicals, e-waste, IOT, Landfill siting etc)

Week 2 : Dr. Sudhir Chella Rajan-Sustainability and Economics (3),Sustainability and Ethics (3)

Week 3 : Dr. Ligy Philip-(Water Quality/ Waste Management),Water Quality and Treatment (3),Waste Management and Treatment (3)

Week 4 : Dr. B. S. Murty (Water Management/ Resources),Urban Drainage,Water Resource Management,Impact of Climate Change

Week 5 : Dr. Srinivas Jayanti (Energy)-Energy Demand / Resources (1),Pollution from Energy generation (1),Energy and Climate Change (Global Warming) (1),Energy and Sustainability (1),Long Range and Short Range Solutions (1)(Global vs. India)

Week 6 : Dr. R. Ravi Krishna-Risk Assessment Definition (1),Pollutant Pathways / Safety/ Exposure (1),Liability /Examples (1),Life Cycle Assessment (2),Environmental Management and LCA (1)

Week 7 : Dr. Sudhir Chella Rajan-Urban Planning / Sprawl (1),Challenges in Urban Planning,Transport (1),Energy (Smart Grid) (1),Waste (1),Governance (1)

Week 8 : Dr. Susy Varughese / Dr. Parag Ravindran-Ecology – definitions / Systems (1),Biodiversity (1),Examples of Historical Impact of economy on Ecology,Restoration / Ecological Engineering

Week 9 : Dr. Ligy Philip / Dr. Ravi Krishna -Solid Waste Management,Hazardous Waste Management

Books and references

1. Wrap up Emphasis on Climate Change and Adaptation

Instructor bio

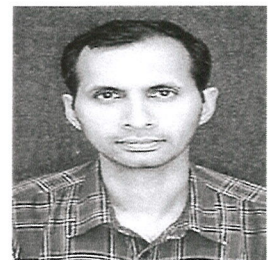
Prof. Abhijit P Deshpande, IIT Madras



Abhijit P. Deshpande is a Professor of Chemical Engineering at IIT Madras. His research focus is on polymeric systems, more specifically their aggregation and gelation behaviour. In his group, polymeric materials such as hydrogels and membranes are being investigated for applications in electrical, electromechanical and electrochemical devices. His teaching interests include specialized courses in polymers, fluid mechanics, rheology and continuum mechanics; and core chemical engineering courses such as mass transfer and thermodynamics

Prof. Ravi Krishna R, IIT Madras

Dr. R. Ravikrishna Professor(2018 Current) Indian Institute of Technology Madras Associate Professor (2013-2018) Indian Institute of Technology Madras Assistant Professor (2006-2013) Indian Institute of Technology Madras Research Associate (2000-2006) Louisiana State University, Baton Rouge, USA




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8. Visual Communication Design for Digital Media

Course layout

Week 1: Introduction to Visual Design
Introduction to Virtual Media Technology

Week 2: Applications of Visual Design in Virtual Media Paradigm
Design Thinking and Visual Cognition

Week 3: Contemporary Trends in Virtual-Media
Visual Design Methodology (continues to week 4)

Week 4: Visual Design Methodology
Case Studies of Visual Design in Virtual Media Technology

Books and references

- Krug, S. (2006) Don't Make Me Think, Rider publication.
- Lauer, D.A. and Pentak, S. (2008) Design Basics, Wadsworth Publishing.
- Lupton, E. (2004) Thinking with Type: a critical guide for designers, writers, editors and students, Princeton Architectural Press.
- Lidwell, W., Holden, K. and Butler, J. (2010) Universal Principles of Design, Rockport Publishers.
- Anshel, J. (2005) Visual Ergonomics Handbook, Taylor & Francis.

Instructor bio



Prof. Saptarshi Kolay, IIT Roorkee

Prof. Saptarshi Kolay is presently an Assistant Professor at Architecture and Planning department of Indian Institute of Technology Roorkee. After completing his under graduation in Architecture from Jadavpur University, he went on to explore User Centric design at Design Programme of Indian Institute of Technology Kanpur. Along with teaching he is pursuing his PhD from the Department of Architecture and Planning, IIT-Roorkee. He was selected in student-exchange programme for Aalto University, Finland and Escola De Arte and Desino, Spain. He has received Rafiq Azam Travel Bursary, Yuva-Ratna award and has participated in Design workshop by MIT, Media lab. His current research interest includes gerontology, way-finding design, visual communication design and contemporary art and design, etc. He has conducted one NPTEL course, titled Visual Communication Design for Digital Media.


REGISTRAR
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1. Stress Management

Instructor bio



Prof. Rajlakshmi Guha is an Assistant Professor in the Centre for Educational Technology IIT Kharagpur. She has done her PhD in Psychology. Her interest areas are Cognitive Psychology, Social Psychology and Counselling Psychology.

Course layout

Week 1 : Scientific Foundations Of Stress

Week 2 : Stress Psychophysiology

Week 3 : Developing Resilience To Stress

Week 4 : Strategies For Relieving Stress


REGISTRAR
J.N.T.U. Anantapur
ANANTAPURAMU-515002

1. Chemical Reaction Engineering – I



CHEMICAL REACTION ENGINEERING - I

PROF. BISHNUPADA MANDAL

Department of Chemical Engineering
IIT Guwahati

INTENDED AUDIENCE : B.Tech in Chemical Engineering and allied disciplines

INDUSTRY SUPPORT : Almost all chemical industries including IOCL, OIL, ONGC, etc.

COURSE OUTLINE :

This course will provide an overview of chemical kinetics and reactor design at basic to an intermediate level. This course applies the concepts of reaction rate, stoichiometry and equilibrium to the analysis of chemical and biological reacting systems such as derivation of rate expressions from reaction mechanisms and equilibrium or steady state assumptions and design of chemical and biochemical reactors via synthesis of chemical kinetics, and mass and energy balances. The goal is to provide students with the theoretical/analytical background to understand chemical kinetics and reactor design and to tackle complex problems.

ABOUT INSTRUCTOR :

Prof. Bishnupada Mandal is currently a Professor and Head in the Department of Chemical Engineering at the Indian Institute of Technology Guwahati. Dr. Mandal has over 15 years of teaching and research experience at IIT Guwahati. He was Visiting Research Professor at The Ohio State Engineering, Columbus, USA during May-July 2017. He has served as Vice Chairman as well as Chairman, IIT-JEE for IIT Guwahati Zone. He had been a recipient of the prestigious BOYSCAST fellow award of Department of Science and Technology (DST) Govt. of India. His research interest includes CO₂ capture and sequestration; wastewater treatment, etc. He has guided/ guiding 21 PhD students. He has published 2 monographs 3 book chapters, 56 research papers in reputed international journals and more than 120 papers in conference proceedings. He has over 2450 citations and h-index is 25. Dr. Mandal has served as the Editorial Board Member of Heliyon (Elsevier) and reviewer of more than 40 ACS, Elsevier and RSC journals. He is serving as the Chairman, IChE-GRC and Executive Council Member of IChE. He has served OIL, Duliajan; NTPCL, Netra; GAIL (India) Limited and BHEL, Bangalore as a consultant.

COURSE PLAN :

Week 1: Kinetics of Homogeneous Reactions

Week 2: Stoichiometry

Week 3: Interpretation of Batch Reactor Data

Week 4: Ideal Reactor Design

Week 5: Design for single reactions

Week 6: Design for parallel reactions

Week 7: Design for parallel reactions

Week 8: Temperature and Pressure Effects

Week 9: Temperature and Pressure Effects

Week 10: Residence Time Distribution

Week 11: Reactor modeling with RTD

Week 12: Reactor modeling with RTD



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