

SYLLABUS

Ph.D. COURSEWORK

CODE	Branch Specific Topics	Credit	Marks
CS-702	Advances in Computer Engineering	4	100
EE-702	Advances in Electrical Engineering	4	100
EC-702	Advances in Electronics & Tel Comm. Engineering	4	100
ME-702	Advances in Mechanical Engineering	4	100

CS-702 Advances in Computer Engineering

Credit: 4

Note: Any three units will be conducted

Unit 1: Natural Language Processing

Introduction to Natural Language Understanding, An Outline of English Syntax, Grammars and Parsing, Grammars for Natural Language, Toward Efficient Parsing, Ambiguity Resolution: Statistical Methods, Linking Syntax and Semantics, Ambiguity Resolution, Scoping and the Interpretation of Noun Phrases.

References

1. James Allen, "Natural Language Understanding", Pearson Education, 2nd Edition
2. Akshar Bharati, Vineet Chaitanya, Rajiv Sangal, "Natural Language Processing- A Paninian Perspective", PHI
3. Christopher D. Manning and Hinrich Schütze. 1999. Foundations of Statistical Natural Language Processing. MIT Press.

Unit-2: Compilers

Introduction, types of Parsers, LL (k) and LALR (k) parsers, three address codes. Introduction to code generation, simple code generation algorithm, DAGs Introduction to Code Optimization, basic blocks and flow graphs, common subexpression elimination, loop optimization, loop invariant computations, dead code elimination, code movement

Reference

1. Alfred V. Aho, Ravi Shethi, Jeffrey D Ullman, "Compilers- principle, techniques and tools", Pearson Education, 2006
2. V Raghvan, "Principles of Compiler Design", Tata McGraw Hill, 2010

Unit-3: Digital Image Processing

Digital image fundamentals: image digitization, sampling and quantization, image resolution, color perception & processing, image processing: pixel based transformation, geometric transformation, local processing restoration, binary image processing: thresholding, runlength encoding, distance transforms, medial axis transforms, morphological operations, region segmentation & representation: split & merge algorithm, region growing, image filtering histogram modification, linear and Gaussian filters, contours, digital curves, polyline splitting, Hop Along algorithm, Conic & Splines Hough transform, Fourier description, textures: statistical syntactic and model based methods, Texture image analysis, image transforms :Fourier, Hadamard, discrete cosine, wavelets and other orthogonal transforms, compression image (predictive compression methods, vector quantization, hierarchical & progressive methods, JPEG & MPEG), Motion picture analysis.

References:

1. Rafael C Gonzalez, Richard E Woods, "Digital Image Processing", Prentice Hall Publisher, 2008, 3rd Edition
2. William K Pratt, "Digital Image Processing", John Wiley (2001)
3. Millman Sonka, Vaclav Hlavac, Roger Boyle, Broos/colic, "Image Processing Analysis and Machine Vision", Thompson Learning (1999).
4. A.K. Jain, "Fundamentals of Digital Image Processing", PHI, New Delhi (1995)

Unit-4: Wireless Technology.

WSN: Design issues, System Architecture, Sensor Network OS Tiny OS, Nes C Language, Distributed data processing, Synchronization and localization, Communication and routing, Security issues, services and applications

Mobile Ad-hoc Networks: Location Management Schemes, Routing.

GSM and satellite Communication: Architecture, hand-off and power management.

Wireless Network Standards & Protocols: 802.11.X, 802.16.x, 802.15.X, Comparison 802.11a, 11b, 11g, Challenges for MAC, DCF and PCF, WEP& EAP

QoS in wireless Network: Parameters Throughput or bandwidth, Delay or latency Delay variation (delay jitter), Loss or error rate

References

1. Holger Kars, "Protocols and architectures for WSN", Wiley publication.
2. M Jochen Schiller, "Mobile communication", Pearson Publication.
3. Mathew Gast, "802.11 wireless Networks the definitive guide", O'Reilly.

Unit-5: Network Security

Network threats and attacks, Security Services, Number Theory Concepts, Cryptographic algorithms, Network Security Protocols, System Security, Security research in wired, wireless and ubiquitous networks, Security Standards and RFCs

References

1. William Stallings, "Cryptography and Network Security", Fourth Edition, Pearson Education 2007.
2. Behrouz A. Forouzan, "Cryptography & Network Security", TMH 2007.
3. Robert Bragg, Mark Rhodes, "Network Security: The complete reference", TMH

Unit-6: Artificial Intelligence

AI problems, AI intelligent agents: Agents and Environments, the concept of rationality, the nature of environments, structure of agents, problem solving agents, problem formulation. Searching: Searching for solutions, uniformed search strategies, Heuristic functions. Constraint satisfaction problems: Game Playing Alpha-Beta pruning, Evaluation functions, cutting of search, Knowledge Representation & Reasoning logical Agents, logic, propositional logic, Resolution patterns in propositional logic, Resolution, Forward & Backward Chaining, Planning - Classical planning problem, Language of planning problems, Expressiveness and extension, planning with state.

References

1. Stuart Russel, Peter Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, PHI/Pearson Education.
2. Patrick Henry Winston, "Artificial Intelligence", 3rd Edition, Pearson Education.

Unit-7: Language Translation

Language Processing: applications and key issues; lexicon and morphology; Phrase structure grammars and English syntax; Part of speech tagging; Syntactic parsing, top-down and bottom-up parsing strategies; Semantics, Word Sense Disambiguation, Semantic

parsing; Information retrieval and Question answering; knowledge representation and reasoning, local discourse context and reference

References

1. Christopher D. Manning and Hinrich Schütze, "Foundations of Statistical Natural Language Processing", MIT Press, 1999.
2. James Allen, "Natural Language Understanding", Pearson Education, 2nd Edition

Unit-8: Machine Learning

Designing a Learning system, Learning Process, Learning methods, Forms of learning, Induction learning, Learning with complex data, learning with Hidden variables, Parametric-Nonparametric methods, Multivariate methods, Feature extraction, clustering, Decision tree, Artificial Neural networks, Self Organization Map, Regression, Radial Basis Function networks, Function Approximation, Hopfield models Evaluating Hypotheses, Computational Learning theory, Instance based learning, rule based learning, Analytical Learning, Reinforcement learning, Hidden Markov Models, Probability, classification, Linear Discrimination.

References

1. Simon Haykin, "Neural networks - A comprehensive foundation", Pearson Education 2nd Edition 2004.
2. Ethem Alpaydin, "Introduction to Machine Learning", PHI
3. Tom Mitchell, "Machine Learning", MGH

Unit-9: Graphics & Visualization

Picture analysis, Modeling: 2D, 3D Geometric modeling and transformations, projections, Clipping, curves and fractals. Illumination models and Rendering: Light, Ambient Light, Diffuse reflection, Specular reflection, Shading algorithms, Color models, Ray tracing, Texture mapping. Scientific Visualization: Methods of Scientific Exploration, Data Aspects and Transformations, Time-Tested Principles for Good Visual Plots, Tone Mapping, Matters of Perception, Visualizing Multidimensional Data, Scalar Data Visualization, Vector Data Visualization. Graphics User Interfaces, image manipulation and storage, advanced modeling techniques.

References

1. Peter Shirley, Ashikhmin Gleicher et. al., "Fundamentals of Computer Graphics", A. K. Peters Ltd., 2005
2. Hearn and Baker, "Computer Graphics", PHI
3. Van Dam Feiner, Hughes, Foley, "Computer Graphics: Principles and Practice", PHI

Unit-10: Advanced Algorithms and Applications

Problem solving, Probabilistic analysis and randomized algorithms, Perfect Hashing, The Floyd-Warshall algorithm, Johnson's algorithm for sparse graphs, NP-hard problems, Approximation algorithms, Online algorithms and competitive analysis. Linear-Programming Algorithms: Structure of Optima, Interior Point. Computational geometry: convex hull. Random Walks and Markov chains

References

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms," Third Edition PHI 2010.

Unit-11: Data warehousing and Mining

Data Mining Tasks, Data Warehouse (Multidimensional Data Model, Data Warehouse Architecture, Implementation), Data Warehousing to Data Mining, Data Preprocessing: Why Preprocessing, Cleaning, Integration, Transformation, Reduction, Discretization, Concept Hierarchy Generation, Descriptive Statistical Measures, Classification: Decision Trees, Model Over fitting, Bayesian Classification, Rule-based classification, Nearest Neighbor Classifier, Classification by Back-propagation, Support vector machines, Association Rule Based, Other Classification Methods, Prediction, Classifier Accuracy, Cluster Analysis: K-means, Agglomerative Hierarchical Clustering, DBSCAN, Association Rules: Apriori algorithm, FP-growth algorithm, Advanced techniques, Data Mining software and applications: Text mining (extracting attributes/keywords, structural approaches - parsing, soft parsing, Bayesian approach to classifying text), Web mining (classifying web pages, extracting knowledge from the web), Data Mining software and applications

Reference

1. J. Han and M. Kamber, "Data Mining- Concepts and Techniques," 2nd Edition, Morgan Kaufmann, 2006.
2. Margaret H. Dunham, "Data Mining Introductory and Advanced Topics," Prentice Hall
3. P. Tan, M. Steinbach and V. Kumar, "Introduction to Data Mining," Addison Wesley, 2006.

Unit-12: Parallel and Distributed Systems

Terminology of Parallel and Distributed Computing, Parallel and Distributed Architectures, Parallel Performance, Shared Memory and Threads, Parallel Algorithms, Message Passing, Distributed Systems, Distributed Coordination, Distributed File Systems, Distributed Shared Memory, Cloud Computing, Computational Grids and Applications

References

1. G Coulouris, J Dollimore and T Kindberg, "Distributed Systems Concepts and Design," Third Edition, Pearson Education.
2. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing," McGraw Hill

Note: Any three units will be conducted

Unit 1: Intelligent Control

Neural network architecture for modeling and Control, System identification and control, Fuzzy, Neuro-fuzzy, Typical applications of ANN , Classification, Clustering, Pattern Recognition, Different architectures of neural network, Learning algorithms, Knowledge based systems, Genetic algorithms.

Reference Books:

1. Simon Haykin, -Neural Networks: A Comprehensive Foundation, Second Edition, Person Education.
2. Zimmermann, H.J, -Fuzzy Set Theory and its Applications, Second Edition, Kluwer Academic Publishers.
3. M. Ganesh, -Introduction to fuzzy sets and fuzzy Logic, Prentice Hall India.
4. Mohamed H. Hassoun, -Fundamentals of Artificial Neural Network, Prentice Hall India.
5. Jacek Zurada, -Introduction to Artificial Neural Network, Jaico Publishing House India.

Unit 2: Multivariable and Optimal Control Systems

Introduction, general structure Examples, state space and transfer matrix forms; Controllability and observability, state Estimation, decoupling , model matching control, classical control extended to multivariable control system. Pontryagin's minimum principle and its application to optimal control. Continuous and discrete time systems , linear regulator problem, minimum time optimal control , bang bang control.

Reference Books:

1. -Linear Multivariable Control Systems, Y. S. Apte, New Age International Publications.
2. -Multivariable Control System, W.M. Wonham.
3. -Optimal Control: An Introduction, O Kirk, Prentice Hall.
4. -Multivariable Feedback Control, S. Skogestad, I.P. Postlethwaite,
5. John Wiley and Sons, 2005

Unit 3: Control System Design

Design of linear and non-linear systems, continuous and discrete time, SISO and MIMO systems by state variable techniques. Advanced PID design techniques, Application of softwares, Simulink and CAD for control system design.

Reference Books:

1. -Control System Design, G.C. Godwin, S.F. Graebe, M. E. Salgado, Prentice Hall of India .
2. -Control System Design Guide: A practical Guide, George Eills, Academic Press (3rd Edition).
3. -Control System Principles and Design, M. Gopal.
4. -Control System Engineering, Norman S. Nise, Wiley (Third Edition)

Unit 4: Modeling of Dynamic Systems

Modeling and simulation techniques applied to dynamic systems covering physical systems such as electrical, mechanical, thermal, chemical, biomedical and biological.

Reference Books:

1. -System modeling and response: Theoretical and Experimental Approaches, Ernst O.Dobling, John Wiley and Sons , 1980.
2. -Modeling and Identification of Control Systems, M. Gopal
3. -Modeling and Simulation of Dynamic Systems, Robert Woods, Kent L. Lawrence, Prentice Hall.

Unit 5: Renewable Energy Sources

Solar Photovoltaic, new organic photovoltaic materials and devices, Modeling and characterization of PV cells and modules, Grid integration of PV systems. Wind Energy systems, wind turbine Electrical generators and converters, Wind turbine system reliability, Wind resources and its characterization, grid integration of wind turbines and wind farms., Power quality and reliability issues related with wind farm interfaced to weak grid.fuel cells systems. Hybrid systems, standalone hybrid systems, other sustainable Energy sources such as biomass, tidal, wave, geothermal, small and micro hydel systems.

Reference Books:

1. Renewable Energy technologies: R.Ramesh, Narosa Publications .
2. Energy Technology: S.Rao, Parulkar.
3. Non-Conventional Energy Systems: Mittal , Wheeler Publication
4. Wind and solar Systems by Mukund Patel , CRC press.
5. Solar Photovoltaic for terrestrials, Tapan Bhattacharya.
6. Wind Energy Technology: Njenkins, John Wiley Sons.
7. Grid integration of wind Energy conversion Systems: Siegfried, Wiley Publications , John Wiley and Sons.

Unit 6: Power Electronics and Drives

Modern power switching devices, Voltage source converter topologies, Multi pulse converters, Inverter, Multilevel Inverters and Chopper, Current source converters, Harmonics elimination schemes.

Variable speed drives for various industrial applications, advanced control techniques. (16 Hours)

Reference Books :

1. Power Electronics : M.H.Rashid (Prentice Hall India Pvt.Ltd.)
2. Power Electronics Handbook : M.H.Rashid, Academic Press Series in Engineering.
3. First Course in Power Electronics : Ned Mohan, MNPHERE publications.
4. Electric Drives: Ion Boldea, Sayd Nasar ,CRC Press, Boca Raton London New York Washington, D.C.
5. Practical Variable Speed Drives and Power Electronics : Malcolm Barnes, ELSEVIER Newnes Publications, Linacre House, Jordan Hill, Oxford OX2 8DP, 200 Wheeler Road, Burlington, MA 01803

Unit 7: Power system restructuring

Power tariff , pricing issues , market reforms and models , policies, methods of comparing investment options , Electricity market pricing and non pricing issues, spot pricing , reactive power pricing .(10 Hours)

Reference Books:

1. Sally Hunt, -Making competition work in Electricity, 2002 John Wiley Inc.

2. -Regulation in infrastructure services: Progress and the way Forwardø TERI .
3. -Market operations in electric power systems forecasting , Scheduling and Risk Managementø Mohammad Shaedepur , Hatim, Zuri Li.

Unit 8: Numerical protection

Numerical protection, Numerical protection of transmission line, synchronous generator, power transformer, relay co-ordination.(10 Hours)

Reference Books:

1. -Digital protectionø, L.P. Singh , New Age International (P) ltd. Publishers, New Delhi. ,
2. -Transmission network protectionø Paithankar , Marcel and Dekker , New York
3. -Fundamental of power system protectionø Paithankar and Bhide , Prentice hall of India Pvt.Ltd. New Delhi.
4. -Protective relaying for power system IIø , Stanley Horowitz , IEEE press , New York.

Unit 9 : Power System Analysis

Synchronous machine modeling, excitation system, modeling, transmission line modeling, analysis of single machine and multi machine, power system stabilizers, voltage stability, islanding (10 Hours)

Reference Books:

1. Power system dynamics :K.R.Padiyar , B.S.Publications.
2. Power system Control and Stability :Vol.I, Anderson & Foud , IEEE Press New York.
3. Power system Dynamics and Control :Kundur , IEEE Press New York.
4. 4 .Power System operation and control :P.S.R Murthy
5. Power System stability : E.W.Kimbark, IEEE Press , N.Y.Vol.3
6. Power system control and stability , Vol.1 , Anderson and Foud , IEEE Press New York.
7. Power System Voltage Stability :C.W.Taylor, McGraw Hill International student Edition .

Unit 10 : Computer Applications in power system

Optimization techniques, classical techniques, single variable and multivariable optimization, Newton Raphsonø method, Descent method, non linear programming, load flow under linear as well as non linear load connected to power system, motor starting analysis, symmetrical and un-symmetrical power system fault analysis, decoupled load flow, methods of optimal power flow (10 Hours)

Reference Books:

1. Computer Aided Applications in power system operation and Analysis: R.N.Dhar, Tata Mc-Graw Hills , New Delhi.
2. 2.Computer techniques in power system Analysis: M.A.Pai, Tata Mc Graw Hills , New Delhi.
3. Optimization Techniques: S.S Rao , Wiely Eastern Ltd., New Delhi .
4. Electrical Energy System Theory: An Introduction , Olle Elgred, TMH Publishing Company , New Delhi.

Unit 11: Power Quality

Power quality definitions as per IEEE Std. 1159, RMS Voltage variations , such as voltage sag, swell, under and over voltage , Flicker , its sources, effects on equipments and solutions , IEEE Std 1346 . Waveform distortion , various factors governing waveform distortion , Harmonic sources , its effect on equipment , harmonic mitigation techniques K

Rated transformer , series and parallel resonance , IEEE Std 519-1992. Power quality monitoring as per IEEE Std. 1159. Transients , impulsive and oscillatory transients , capacitor switching transient , Methods to control transient , TVSS.(10 Hours)

Reference Books:

1. IEEE std. 1159, IEEE Press,USA.
2. IEEE Std, 1346 , IEEE Press, USA.
3. IEEE Std 519, IEEE Press , USA.
4. Understanding power quality Problems , Voltage Sag and interruptions :M.H.Bollen ,IEEE Press , 2000 , Series on Power Engineering.

Unit 12 : Grounding

Objectives of grounding , Factor affecting soil resistivity , single layer and multilayer homogeneous and heterogeneous soil modeling , Sub station grounding Design as per IEEE standard 80 , Grounding of sensitive Electronic equipments as Per IEEE std. 1100 .EMI and Electrostatic shielding .(10 Hours)

Reference Books:

1. Power System Analysis , B.R.Gupta
2. IEEE Std. 80 , IEEE Press , USA
3. IEEE Std, 1100 , IEEE Press, USA.

Unit 13: Energy Management

Energy management and audit, Energy and mass balance , Energy modeling , Energy conservation opportunities in Thermal , HVAC, Electrical , compressed air , Centrifugal pumps , Blowers . Waste heat recovery, CHP , Energy Efficient technologies ,Energy conservation Building Codes.(10 Hours)

Reference Books:

1. IEEE recommended Practice for Energy Management in Industrial and commercial facilities , IEEE Std 739 -1995
2. Energy Efficiency in Electrical utilities , Guide Book for National Examination for Energy Managers and Energy Auditors , BEE, New Delhi.
3. Energy Efficiency in Thermal utilities , Guide Book for National Examination for Energy Managers and Energy Auditors , BEE, New Delhi.

Unit 14: Condition Monitoring

Condition monitoring of transformer, solid , liquid and gaseous phase monitoring , SFRA techniques , On line off site condition monitoring of transformer , residual life assessment of transformer , Noninvasive testing on transformer for condition assessment, Condition monitoring of OLTC . Condition monitoring of induction motor by MCSA , rotor and bearing fault analysis of induction motor , condition monitoring of cables and switch gears.

Unit 15: Smart Grid

1. Formation of microgrids and interconnections to established grid.
2. Integration of wind, solar and other renewable generation into the present distribution.
3. Dispersed generation including captive power co-generation and mini-hydel.
4. Disaster and emergency management in case of disturbance in distribution.
5. Communication requirement protocols and standards.
6. Development of microgrid management software
7. Present status of microgrids in the world power system (10 Hours)

EC-702 Advances in Electronics and Tele Communication/ Electronics Engineering

Credit: 4

Note: Any *three* units will be conducted

Unit 1: Microelectronics and VLSI

Microelectronic devices, characteristics, mathematical modeling, performance parameters, design aspects, parasitics, integration issues, layout rules, optimization techniques.

Unit 2: RFIC Design

RF Amplifiers, characteristics, mathematical models, power relations, stability considerations, stability circles, unconditional stability, stabilization methods, designs, circles, circles.

Unit 3: Mixed Signal Analysis

Signal integrity, techniques, equivalent models, characteristics, limitations, mixed signal processing, simulation, physical parameters.

Unit 4: RF Systems

The techniques of RF amplifier, mixer and local oscillator designs, Advanced YIG and narrow band filters, amplifiers, Transmission line design, Design challenges in satellite frequency bands.

Unit 5: Microwave and Antennae

Microwave sources, Passive devices, MMIC, MMIC fabrication techniques, Thick and Thin film technologies and materials, Microstrips, Microwave antennae.

Unit 6: Coding and Modulation Techniques in Communication

Digital communication system architectures, Source coding, Channel coding, Performance measures of communication systems, PLD based system implementations and related issues.

Unit 7: Communication Network

Various IEEE standards, Performance issues, Trade-offs, Network architectures, Security algorithms with their performance measures.

Unit 8: Wireless & Broadband Communication

IEEE/ITU/ ETSI communication standards and specifications, various trade-offs in functionality, implementation, Transmitter/Receiver architectures and related issues, Wireless embedded approach, Antennae and front end design issues.

Unit 9: Advanced Topics in Signal Processing

Modeling different Signals and systems, various transforms, System design and Implementation issues, DSP architectures and related issues, Evaluation parameters for the various applications.

Unit 10: Image Processing & Pattern Recognition

Image representation formats, noise, processing techniques, Performance measures, various algorithms, Pattern classifications and recognition techniques, Biometrics.

Unit 11:Speech Processing

Speech recognition and synthesis techniques, modeling the speech signal, various algorithms, trade-offs and implementation issues.

Unit 12:Processor Architectures

Design philosophy of RISC, CISC, Multi-core, Various processor architectures, Design of microcontroller CPU.

Unit 13: Programmable Architectures and Memories

HDL programming, PLDs, floating point arithmetic, multipliers, modeling a sequential machine, Barrel shifter, HDL models for memories and buses.

Unit 14: System on Chip and MEMs

Chip architecture, Clock & power related issues, SRC, DRC, I/O architectures, Wire parasitic, Design validation, MEMs.

Unit 15:Modern Control Theory

Control mechanisms and their modeling, Implementation aspects and related trade-offs, various applications, Selection criteria of control systems for various applications, Performance evaluation techniques.

Unit 16: Human Machine Interface

Different techniques used for HMI, Algorithms, Related issues and constraints, Performance issues, Applications.

Unit 17:Machine Vision

Human vision, Expert systems, Algorithms, Implementation issues and trade offs, Performance measures and analysis.

Unit 18:Biomedical Engineering

Biomedical Signals, Biomedical Systems, Analysis, Implementation issues, Performance measures.

Unit 19:Nano Technology

Present devices and materials, Advance materials such as Carbon nano tubes etc., advance devices, constraints, applications, Tradeoffs.

Reference Books:

1. M.J. Roberts, Signals and Systems, Tata McGraw Hi ll Publications, 2003.

2. M. Burns, "Introduction to Mixed Signal IC Test and Measurement", Oxford University Press Publications, New York.
3. Xilinx, "The Programmable Logic Data Book", Xilinx, California.
4. Hu, Yu Hen, "Handbook of Neural Network Signal Processing", CRC Press Publications.
5. Yacoub M.D., "Wireless Technology", CRC Press Publications.
6. Gold B., "Speech and Audio Signal Processing", John Wiley Publications.
7. Kuo B.C., "Digital Control System", Sounders College Publications, New York.
8. Comer "Digital Logic and State Machine Design", Sounders College Publications, New York.
9. Prokis J.G., "Digital Signal Processing", PHI Publications.
10. Alley, Charles L., "Micro Electronics", McGraw Hill Publications.
11. Ha, Tri T., "Digital Satellite Communication", McGraw Hill Publications.
12. Peebles, "Probability and Random Signals", McGraw Hill Publications.
13. Balanis, "Antenna Theory analysis and Design", John Wiley Publications.
14. Gray R.P., "Analysis and Design of Analog ICs", John Wiley Publications.
15. Tompkins J.W., "Biomedical Digital Signal Processor", PHI Publications.
16. Collin E.R., "Foundations for Microwave Engineering", McGraw Hill Publications.
17. Freeman R.L., "Radio System Design for Telecommunication", John Wiley Publications.
18. Kronsjo L., "Advances in Parallel Algorithms", Blackwell Scientific Publication, London.
19. Xavier, Eugene S.P., "Statistical Theory of Communication", New Age International Publication.
20. Baker R.J., "CMOS: Circuit Design, Layout and Simulation", IEEE Press Publication.
21. McGillen C.D., "Continuous and Discrete Signal and System Analysis", Oxford University Press.
22. Russ J.C., "The Image Processing Handbook", CRC Press Publications.
23. Franssila S., "Introduction to Micro fabrication", John Wiley Publications.
24. Park J., "Practical Embedded Controllers", Elsevier Publications, Amsterdam.
25. Kabatiansky G., "Error Correcting Coding and Security for Data Network", John Wiley Publications.
26. Lee K., "Semiconductor Device Modeling For VLSI", PHI Publications.
27. Maxfield C.M., "The Design Warriors Guide to FPGA", Elsevier Publications, Amsterdam.
28. **Carsten Steger, Markus Ulrich, Christian Wiedemann, "Machine Vision Algorithms and Applications"**, Wiley-VCH, Weinheim Publications.
29. Pires, J. Norberto, "Human Machine Interface for Industrial Robotic Cells", Springer Publications.

ME-702 Advances in Mechanical Engineering

Credit: 4

Note: Any three units will be conducted

Unit 1: Vibrations

Multi-degree freedom systems, Approximate and numerical methods, Continuous systems, Nonlinear systems

Reference Books

1. Balakumar Balachandran and Edward Magrab, *Vibrations*, Thomson Brooks/Cole, 2004.
2. Kelly S.G., *Mechanical vibrations*, McGraw-Hill, 2007

Unit 2: Acoustics

Wave propagation, generation/transmission of sound, noise control

Reference Books

1. Kinsler, Frey and Coppens, *Fundamentals of Acoustics*, John Wiley & Sons
2. Allan D Pierce, *Acoustics: An Introduction to its Physical Principles and Applications*, Acoustical Society of Amer, 1989.

Unit 3: Fracture Mechanics

Linear Elastic Fracture Mechanics, Elastic Plastic Fracture Mechanics, Fracture Mechanisms in Metals

Reference Books

1. T L Anderson, *Fracture Mechanics- Fundamentals and Applications*, CRC Publishers, 2nd edition, 1995
2. Ashok Saxena, *Nonlinear Fracture Mechanics for Engineers*, CRC Publications
3. Hertzberg R.W., *Deformation and Fracture Mechanics of Engineering Materials*, Wiley, 4th edition, 1996.

Unit 4: Convective Heat Transfer:

Fully developed flows, exact and similarity solutions, boiling and condensation, special topics

Reference Books:

1. W.M Kays and M.E. Crawford, *Convective Heat and Mass Transfer*, McGraw Hill Intl.
2. T Cebeci, *Convective Heat Transfer*, Springer

Unit 5: Mass Transfer:

Mass transfer - 1, Droplet vaporization -1, Mass transfer-2, Droplet vaporization ó 2, Mass transfer- 3 (Any two)

Reference Books:

1. W.M Kays and M.E. Crawford, *Convective Heat and Mass Transfer*, McGraw Hill Intl.
2. D. Brian Spalding, *Combustion and mass Transfer* 1st edition, Pergamon Press, 1979

Unit 6: Computational Fluid Dynamics – I (CFD – I)

Finite volume algorithm, up-winding, Solution of pressure field on Cartesian meshes

Unit 7: Computational Fluid Dynamics – II (CFD-II)

Mesh generation techniques, Solution on Non-Cartesian meshes.

Reference Books (Common for both unit 4 and 5)

1. Wesseling P, *Principles of Computational fluid dynamics*, Springer

2. Ferziger J.H., *Computational methods for fluid dynamics*, Springer
3. Anderson, J.D. *Computational Fluid Dynamics: The Basics with Applications*, McGraw Hill, 1995

Unit 8: Turbulence

Governing equations, Free shear flows, Near wall behaviour, Energy spectrum, Turbulence models

Reference Books:

1. Stephen B. Pope, *Turbulent flows*, Cambridge Univ. Press
2. Hinze J.O., *Turbulence*, McGraw Hill

Unit 9: Advanced Topics in Refrigeration and Cryogenics

Refrigeration applications in preservation of Food, transport by trucks and containers; Railway cars; Marine Refrigeration; Fans and Blowers, Sound Control. Construction of psychrometric charts, enthalpy deviation curves (Any two)

Reference Books

1. ASHRAE HANDBOOKS (i) Fundamentals (ii) Refrigeration
2. Dossat R.J., *Principles of Refrigeration*, Pearson Education Asia
3. *Handbook of air-conditioning system design*, Carrier Incorporation, McGraw Hill Book Co., U.S.A.
4. Hainer R.W. *Control Systems for Heating, Ventilation and Air Conditioning*, Van Nostrand Reinhold Co., New York, 1984.

Unit 10: Advanced Theory of Elasticity (3-dimensional problems):

Theories of Stress and strain, Transformation of stress and strain, Linear stress-strain & temperature relations, Applications of energy methods, Torsion, Bending, Plates

Reference Books

1. Richard Budynas, *Advanced strength of applied stress analysis*, McGraw Hill
2. Cook R.D., Young W.C., *Advanced Mechanics of Materials*, Prentice Hall
3. Timoshenko and Goodier, *Theory of Elasticity*, Mc-Graw-Hill Publications
4. Ugural and Fenster, *Advanced Strength and Applied Elasticity*, 4th Ed., Prentice Hall, PTR, 2003.
5. Srinath L.S, *Advanced Mechanics of Solids*, Tata Mc-Graw Hill, New Delhi, 2003.

Unit 11: Advanced Gas dynamics:

Linearized flow, Method of characteristics, Shock boundary layer interaction, Numerical methods

Reference Books

1. Anderson J.A., *Compressible Flow*, McGraw Hill.
2. Shapiro A.H., *Dynamics and Thermodynamics of Compressible Fluid Flow*, MIT Press
3. Zucker R. D. and Biblarz Oscar, *Introduction to Gas Dynamics*, John Wiley and Sons. Inc., Second Edition, 2002

Unit 13: Advanced Topics in I C Engines:

Engine Emissions & Control, Engine Electronics, Modelling Real Engine Flow and Combustion Process, Fuel/Air Mixture Requirements (Any two)

Reference Books

1. Charles Fayette Taylor, *The Internal Combustion Engine in Theory and Practice*, Vol. I & II, The MIT Press.
2. John B Heywood, *Internal Combustion Engine Fundamentals*, McGraw Hill International Edition, 1998
3. SAE publications

Unit 14: Combustion:

Premixed and Diffusion flames

Reference Books

1. Kenneth K.Kuo, "Principles of Combustion", John Wiley and sons. Inc, 2005
2. Irvin Glassman, "Combustion", Academic Press, 1987
3. Turns, S.R., "An Introduction to Combustion, Concepts and Applications", McGraw Hill, 2000

Unit 15: Finite Element Methods

Thermal analysis (temperature effects), 2D, 3D elements, Contact analysis, Non-linear static analysis

Reference Books:

1. Bathe K J "Finite Element Procedures", Cambridge, M A 2007
2. Sequerlind L J, "Finite Element Analysis", Wiley, 2nd edition, 1984
3. Reddy J.N., "An Introduction to Finite Element Method", McGraw Hill

Unit 16: Micro Electro Mechanical Systems (MEMS)

From Microphysics to Macrophysics, Thermodynamics of Microstructures, Reliability of MEMS

Reference Books

1. Balian Roger, "From Microphysics to Macrophysics", 1st edition, Springer, 2006.
2. Thermodynamics of Microstructures, ASM International, 2008
3. Younes Shabany, "Heat transfer Thermal Management of electronics", CRC Press.
4. Electronics cooling magazine issues from 1997 -2010

Unit 17: Reliability Engineering:

Reliability evaluation of complex systems, Safeties and certifications, Terro technological Aspects

Reference Books

1. M/c standard 8005
2. Kapur K.C., and Lamberson L.R., "Reliability in Engineering Design", Wiley India Pvt. Ltd., 2009.

Unit 18: Turbo Machinery:

Analysis of flow, Design aspects, Cooling of turbo-machines, Special topics (Thermal and Hydro turbo machines)

Reference Books

1. Lakshminarayana B., "Fluid Dynamics and Heat Transfer of Turbo Machinery", Wiley ó Interscience, 1995.
2. Rangwala A.S., "Turbo-Machinery Dynamics", McGraw Hill,
3. Earl Logan, Jr, Ramendra Roy, "Handbook of Turbo Machinery", 2nd Edition (Mechanical Engineering, No. 158)
4. Rama S.R. Gorla, "Turbo Machinery: Design and Theory", Marcell Dekker

Unit 19: Metal Forming:

Yield criteria, Slip line field theory, Temperature Field in Material.- Plastic and Viscoplastic behaviour of material, Surfaces of Discontinuity, Numerical Models of Plasticity.

Reference Books

1. Sluzalec and Andrzej, "Theory of Metal Forming Plasticity - Classical and Advanced Topics", Springer Publications

2. Avitzur B., *öMetal Forming - Process and analysisö* Tata Mc-Graw Hill
3. Mielnik E.M., *öMetal working science and Engineerin gö*, Mc-Graw Hill. Inc

Unit 20:

Metal Machining - Modelling and control of Chip Formation, Machining of hard materials and metal matrix reinforced composites, Characterization and surface integrity in hard machining, Modern concepts of machining

Reference Books

1. Milton C Shaw, *öMetal Cutting Principlesö* 2nd Edition, Oxford series in Advanced Manufacturing.
2. Paulo Davim (Ed.), *öMachining ó Fundamentals and Advancesö* Springer-Verlag, London, 2008.
3. Childs Thomas, Maekawa K., Obikawa T., and Yamane Y., *öMetal machining ó Theory and Applicationsö* John Wiley & Sons, New York, 2000

Unit 21: Modelling of Manufacturing Systems

Markov chains ó Continuous and Discrete, Petrinets ó Timed and Stochastic

Reference Books

1. Viswanadham, N and Narahari, Y. *öPerformance Modelling of Automated Manufacturing Systemsö*, Prentice Hall of India, New Delhi, 2000
2. Hruz B. and Zhou M.C., *öModelling and Control of Discrete Event Dynamic Systemsö*, Springer, London, 2007.
3. Curry G., Feldman R.M., *öManufacturing Systems Modelling and Analysisö*, Springer-Verlag, Heidelberg, 2009.

Unit 22: Reverse Engineering :

Reverse engineering ó Methodologies and Techniques, Hardware and software, Rapid prototyping ó Relationship with reverse engineering

Reference Books

1. Vinesh Raja and Kiran J Fernandes, *öReverse Engineering ó An Industrial perspectiveö*, Springer, London, 2008
2. Pham D and Dimov S, *öRapid manufacturing - The technologies and applications of rapid prototyping and rapid tooling*. Springer-Verlag, London, 2001.

Unit 23: Manufacturing Systems:

Machine tool design, control, automation and analysis, Computerized process planning

Reference Books

1. George Chryssolouris, *öManufacturing Systems: Theory and Practiceö*, 2nd Edition, Springer, New York, 2006.
3. Chang T.C., *öExpert Process Planning for Manufacturingö*, Addison ó Wesley, MA, 1990
4. Slocum A.H., *öPrecision Machine Designö*, SME, Prentice-Hall Inc, 1992.

Unit 24: High Integrity Die Casting

Vacuum die casting, Squeeze casting, Semi solid metal working, Design considerations for high integrity die Castings

Reference Books

1. Edward J Vinarcik, *öHigh Integrity Die Casting Processesö*, John Wiley & Sons Inc., New York
2. Campbell John, *öcastingö*, Butterworth ó Heinemann, 2000.

Unit 25: Computational Welding Mechanics:

Models for welding heat sources, Thermal analysis of welds, Fracture Mechanics of welded structures, Friction Stir welding

Reference Books

1. Goldak J.A., and Akhlaghi M., *Computational Welding Mechanics*, Springer, New York, 2005.
2. Radaj D., *Heat Effects on Welding: Temperature field. Residual stress and Distortion*, Springer, 1992.
3. Mishra. R.S and Mahoney. M.W, *Friction Stir Welding and Processing*, ASM,2007

Unit 26: Composite Materials:

Elastic behavior of unidirectional and multi directional composites, Laminated composite beams and plates (Any one)

Reference Books

1. Isaac and Daniel M., *Engineering Mechanics of Composite Materials*, Oxford University Press, 1994.
2. Jones R.M., *Mechanics of Composite Materials*, McGraw Hill, New York, 1975
3. Calcote L.R., *Analysis of Laminated Composite Structures*, Van Nostrand Reinhold, New York, 1969