

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech(ME)– III-II Sem

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(19A03603a) INTRODUCTION TO TURBO MACHINERY
PROFESSIONAL ELECTIVE - II

UNIT 1

Introduction and Classification: Axial flow, radial flow and mixed flow machines, the equations of motion in rotating frame of reference, effects of Coriolis and Centrifugal forces, momentum and energy equation, Euler work and illustrative examples.

UNIT 2

Gas Turbine Cycle: Brayton Cycle, regenerative cycle, reheat, inter-cooling, turboprop, turbojet and turbofan engine, thrust augmentation and illustrative examples.

UNIT 3

Similarity Analysis: Similarity rules, specific speed, Cordier diagram and illustrative examples. Cascade Analysis: Two-dimensional cascade theory, lift and drag, blade efficiency, estimation of loss, compressor and turbine cascade, blade geometry and illustrative examples.

UNIT 4

Axial Flow Compressor: Two-dimensional pitch line design and analysis, h-s diagram, degree of reaction, the effect of Mach number, performance and efficiency, three-dimensional flow, tip clearance, losses, compressor performance and illustrative examples.

Centrifugal Pump and Compressor: Theoretical analysis and design, the effect of circulation and Coriolis forces, reversal eddies, slip factor, head and efficiency, diffuser, introduction to the combustion system and illustrative examples.

UNIT 5

Axial Flow Turbine: Two-dimensional pitch line design, stage loading capacity, degree of reaction, stage efficiency, turbine performance, blade cooling, and illustrative examples.. CFD Applied to Turbomachinery Flows: Governing equations, numerical methods, and test cases illustrating flow and heat transfer related to turbo machines.

Books and references:

- (1). Fluid Mechanics and Thermodynamics of Turbomachinery, S. L. Dixon and C. A. Hall, Butterworth-Heinemann, Seventh Edition, 2014.
- (2). Gas Turbine Theory, H. Cohen, GFC Rogers and HHH Saravanamuttoo, Addison Wesley Longman Limited, 4th Edition, 1996.

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**(19A03603b) FUNDAMENTALS OF ADDITIVE MANUFACTURING
PROFESSIONAL ELECTIVE - II**

UNIT 1

Introduction to Additive Manufacturing , Additive manufacturing processes, Extrusion, Beam deposition, sheet lamination, photo polymerization, sintering, powder bed fusion

UNIT 2:

Computer Aided Process Planning for Additive Manufacturing, Liquid Additive Manufacturing

UNIT 3:

Sheet Additive Manufacturing, process and material selection, applications

UNIT 4:

Wire Additive Manufacturing, process and material selection, applications

UNIT 5

Powder Additive Manufacturing, process and material selection, applications, trends and future directions

Books and references

- 1.Venuvinod, Patri K., and Weiyin Ma. Rapid prototyping: laser-based and other technologies. Springer Science & Business Media, 2013.
2. Ian Gibson, David Rosen, and Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, New York, NY, 2015.
3. Kumar, L. Jyothish, Pulak M. Pandey, and David Ian Wimpenny, eds. 3D printing and additive manufacturing technologies. Singapore: Springer, 2019.
4. Jacobs, Paul F. "Fundamentals of stereolithography." In 1992 International Solid Freeform Fabrication Symposium. 1992.

(19A03603c) INTRODUCTION TO COMPOSITES
PROFESSIONAL ELECTIVE - II

UNIT 1

Introduction and terminology, Concept Review, Fibres : Glass Fibres, Graphite Fibres, Aramid Fibres, Metallic Fibres and others

UNIT 2

Matrix materials and Polymers, Metals and Fillers, Manufacture of Thermoset composites, other composite fabrication methods

UNIT 3

Behaviour of Uni directional composites, Short fiber composites,

UNIT 4

Behaviour of Orthotropic laminates, laminated composites,

UNIT 5

Failure of composites, Hygro thermal effects, Residual thermal stresses

Books and references

- Analysis & Performance of Fiber Composites: Bhagwan D. Agarwal & Lawrence J. Broutman

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(19A03603d) COMPUTATIONAL FLUID DYNAMICS

UNIT 1

Introduction to Computational Fluid Dynamics, classification of partial differential equations their physical behaviour, Fundamentals of discretization

UNIT 2

Finite Volume approach and discretization of unsteady-state problems, Important consequences of discretization of time-dependent diffusion type problems

UNIT 3

Discretization of time-dependent diffusion type problems (contd.); finite volume discretization of 2-D unsteady state diffusion type problems

UNIT 4

Solution of systems of linear algebraic equations

UNIT 5

A finite volume discretization of convection-diffusion equations
Discretization of Navier-Stokes equations

Books and references

1. S. V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill.
2. John D. Anderson Jr, Computational Fluid Dynamics, McGraw Hill Book Company
3. John C. Tannehill, Dale A. Anderson and Richard H. Pletcher, Computational Fluid Mechanics and Heat Transfer, Taylor & Francis.
4. T. J. Chung, Computational Fluid Dynamics, Cambridge University Press.

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**(19A03603e) ENGINEERING FRACTURE MECHANICS
PROFESSIONAL ELECTIVE - II**

UNIT 1

EFM Course outline and Spectacular Failures, Introduction to LEFM and EPFM, Fatigue Crack Growth Model

UNIT 2

Crack Growth and Fracture Mechanisms, Griffith TMs Theory of Fracture, Energy Release Rate

UNIT 3

Review of Theory of Elasticity , Westergaard Solution for Stress and Displacements for Mode I, Relationship between K and G

UNIT 4

Introduction to multi parameter stress field for Mode I, Mode II and Mixed Modes, SIF for Various Geometries, Modeling Plastic Deformation, Irwin TMs model, Dugdale Model

UNIT 5

Fracture Toughness Testing, Paris Law and Sigmoidal curve, Crack Closure, Crack Growth Models, J-Integral, Failure Assessment Diagram, Mixed Mode Fracture, Crack Arrest and Repair Methodologies

Books and references

- 1.K. Ramesh, e-Book on Engineering Fracture Mechanics, IIT Madras, 2007. Visit Page
2. Prashant Kumar, Elements of Fracture Mechanics, Tata McGraw Hill, New Delhi, India, 2009.
3. K. R.Y. Simha, Fracture Mechanics for Modern Engineering Design, Universities Press (India) Limited,2001
4. D. Broek, Elementary Engineering Fracture Mechanics, Kluwer Academic Publishers, Dordrecht, 1986.
5. T.L. Anderson, Fracture Mechanics "Fundamentals and Applications, 3rd Edition, Taylor and Francis Group, 2005.