Biju Patnaik University of Technology, Odisha B.E./B.Tech MECH Sem 6 syllabus

Artificial Intelligence and Machine Learning

Artificial Intelligence and Machine Learning

Module-I: INTRODUCTION –The Foundations of Artificial Intelligence; - INTELLIGENT AGENTS – Agents and Environments, Good Behaviour: The Concept of Rationality, the Nature of Environments, the Structure of Agents, SOLVING PROBLEMS BY SEARCH – Problem-Solving Agents, Formulating problems, Searching for Solutions, Uninformed Search Strategies, Breadth-first search, Depth-first search, Searching with Partial Information, Informed (Heuristic) Search Strategies, Greedy best-first search, A* Search, CSP, Means-End-Analysis.

Module-II: ADVERSARIAL SEARCH – Games, The Mini-Max algorithm, optimal decisions in multiplayer games, Alpha- Beta Pruning, Evaluation functions, Cutting off search, LOGICAL AGENTS – Knowledge-Based agents, Logic, Propositional Logic, Reasoning Patterns in Propositional Logic, Resolution, Forward and Backward chaining - FIRST ORDER LOGIC – Syntax and Semantics of First-Order Logic, Using First-Order Logic , Knowledge Engineering in First-Order Logic - INFERENCE IN FIRST ORDER LOGIC – Propositional vs. First-Order Inference, Unification and Lifting, Forward Chaining, Backward Chaining, Resolution

Module-III: UNCERTAINTY – Acting under Uncertainty, Basic Probability Notation, The Axioms of Probability, Inference Using Full Joint Distributions, Independence, Bayes' Rule and its Use, PROBABILISTIC REASONING – Representing Knowledge in an Uncertain Domain, The Semantics of Bayesian Networks, Efficient Representation
of Conditional Distribution, Exact Inference in Bayesian Networks, Approximate Inference in Bayesian Networks

Module-IV: LEARNING METHODS – Statistical Learning, Learning with Complete Data, Learning with Hidden Variables, Rote Learning, Learning by Taking Advice, Learning in Problem-solving, learningfrom Examples: Induction, Explanation-based Learning, Discovery, Analogy, FormalLearning Theory, Neural Net Learning and Genetic Learning. Expert Systems: Representingand Using Domain Knowledge, Expert System Shells, Explanation, Knowledge Acquisition.

Books:

[1] Elaine Rich, Kevin Knight, & Shivashankar B Nair, Artificial Intelligence, McGraw Hill,3rd ed.,2009
[2] Stuart Russell, Peter Norvig, Artificial Intelligence -A Modern Approach, 2/e, Pearson, 2003.
[3] Nils J Nilsson, Artificial Intelligence: A New Synthesis, Morgan Kaufmann Publications,2000
[4] Introduction to Artificial Intelligence & Expert Systems, Dan W Patterson, PHI.,2010
[5] S Kaushik, Artificial Intelligence, Cengage Learning, 1st ed.2011

Machining Science and Technology

RME6C002 Machining Science and Technology

MODULE – I

Geometry of cutting tools in ASA and ORS, Effect of Geometrical parameters on cutting force and surface finish, Mechanics of chip formation, Merchant’s theory, Force relationship and velocity relationship, Cutting tool materials. Types of Tool Wear: Flank wear, Crater wear, Wear measurement, Cutting fluid and its effect; Machinability Criteria, Tool life and Taylor's equation, Effect of variables on tool life and surface finish, Measurement of cutting force, Lathe tool dynamometer, Drill tool dynamometer. Economics of machining.

MODULE II

Conventional machining process and machine tools – Turning, Drilling, Shaping, Planning, Milling, Grinding. Machine tools used for these processes, their specifications and various techniques used. Principles of machine tools : Kinematics of machine tools, speed transmission from motor to spindle, speed reversal mechanism, mechanism for feed motion, Tool holding and job holding methods indifferent Machine tools, Types of surface generated, Indexing

mechanism and thread cutting mechanism, Quick return mechanism Production Machine tools – Capstan and turret lathes, single spindle and multi spindlesemiautomatics, Gear shaper and Gear hobbing machines, Copying lathe and transfer machine

MODULE III
Non-traditional Machining processes : Ultrasonic Machining, Laser Beam Machining, Plasma Arc Machining, Electro Chemical Machining, Electro Discharge Machining, Wire EDM , Abrasive Jet Machining

Books :
3. Fundamentals of Machining and Machine Tools, G.Boothroyd and W.A.Knight, CRC Press
2. Metal Cutting Principles, M.C.Shaw, Oxford University Press
1. Metal Cutting Theory and Practice, A.Bhattacharya, Central Book Publishers
4. Manufacturing Technology – by P.N.Rao, Tata McGraw Hill publication.
5. Modern Manufacturing Processes, P.C.Pandey, H.S.Shan, Tata McGraw Hill
6. Manufacturing Science, Ghosh and Mallik, East West Press.
7. Metal Cutting Theory and Practice, D.A.Stephenson and J.S.Agapiou, CRC Press
8. Machining Technology; Machine Tools and Operation, H.A.Youssef and H. El-Hofy, CRC Press
9. Machine Tools and Manufacturing Technology, Krar, Rapisarda and Check, Cengage Learning
10. Technology of Machine Tools, Krar, Gill and Smidt, Tata McGraw Hill
11. Principles of Metal Cutting, G.Kuppuswamy, Universities Press
12. Metal Cutting and Machne Tools, G.T.Reddy, Scitech
13. Fundamentals of tool Engineering Design, S.K.Basu, S.K.Mukherjee, R. Mishra , Oxford & IBH Pub Co.
14. Machine Tools, R.N.Datta, New Central Book Agency

Smart and Composite Materials

RME6D001 Smart and Composite Materials

MODULE I
Introduction: definitions and classifications; natural composites; role of matrix and reinforcement; factors which determine properties;

the benefits of composites. Reinforcements and the reinforcement matrix interface: natural fibers; synthetic organic fibers – aramid, polyethylene; and synthetic inorganic fibers – glass, alumina, boron, carbon, silicon based fibers; particulate and whisker reinforcements, reinforcement-matrix interface – wettability, interfacial bonding, methods for measuring bond strength.

MODULE II

Metal matrix composites: Introduction, important metallic matrices; metal matrix composite processing: solid state processing – diffusion bonding, powder metallurgy; liquid state processing – melt stirring, compocasting (rheocasting), squeeze casting, liquid infiltration under gas pressure; deposition – spray co-deposition and other deposition techniques like CVD and PVD; in situ processes. Interface reactions. Properties of MMCs – physical properties; mechanical properties like elastic properties, room temperature strength and ductility, properties at elevated temperatures, fatigue resistance. Processing, structure of multifilamentary superconductors, properties of aluminium reinforced with silicon carbide particles

MODULE III

Ceramic matrix composites: Introduction; processing and structure of monolithic materials – technical ceramics, glass-ceramics. Processing of ceramics: conventional mixing and pressing – cold pressing and sintering, hot pressing, reaction bonding processes, techniques involving slurries, liquid state processing – matrix transfer moulding, liquid infiltration, sol-gel processing, vapour deposition techniques like CVD, CVI, liquid phase sintering, lanxide process and in situ processes. Processing, properties and applications of alumina matrix composites - SiC whisker reinforced, zirconia toughened alumina; Glass-ceramic matrix composites; Carbon-carbon composites - porous carbon-carbon composites, dense carbon-carbon composites.

MODULE IV

Polymer matrix composites: Introduction; polymer matrices – thermosetting, thermoplastic, rubbers. Processing of PMCs: Hand methods – hand lay-up, spray-up methods; Moulding methods – matched die moulding, bag moulding processes (autoclave moulding), resin transfer moulding, pultrusion; Filament winding; Injection moulding. Processing, properties and applications of fibre-reinforced epoxies, PEEK matrix composites, rubber matrix composites. Damping characteristics. Environmental effects in polymer matrix

composites. Recycling of PMCs.

MODULE V

Sandwich structures, foam core type arrangements; Honey comb structures. Micromechanics of unidirectional composites: micromechanics models for stiffness – longitudinal stiffness, transverse stiffness, shear modulus, poisson's ratio. Micromechanics models for strength – longitudinal tensile strength, longitudinal compressive strength, transverse tensile strength, transverse compressive strength, inplane shear failure, thermal and moisture effects. Short fibre composites: reasons for using short fibre composites, fibre length, fibre orientation, stress and strain distribution at fibres, critical fibre length and average fibre stress, stiffness and
strength: stiffness of aligned systems, non-aligned systems and variable fibre orientation, strength of aligned systems, 2-D composites, variable fibre orientation.

Books:

[1] Composite Materials: Engineering and Science, by Matthews and Rawlings, CRC Press.
[2] An Introduction to composite material, by D.Hull and T.W. Clyne, Cambridge University press.
[3] Metal Matrix Composites, Thermomechanical Behaviour by M.Taya, and R.J.Arsenault, Pergamon Press, Oxford.
[4] Fundamentals of Metal Matrix Composites by S.Suresh, A.Martensen, and A.Needleman, Butterworth, Heinemann
[5] Mechanics of composite materials, R. M. Jones, Mc Graw Hill Book Co.

[6] Mechanics of composite materials and structures, M Mukhopadhay, Universities Press.
[7] Fiber-Reinforced composite materials, Manufacturing & Design, P. K. Mallick, Marcel Dekken, Inc. New York & Basel.
[8] F.L. Matthews and R.D. Rawlings, Composite Materials: Engineering and Science, Chapman Hall, London, 1994.
[9] Weinheim, Structure and Properties of Composites, Materials ScienceTechnology, Vol. 13, VCH, Germany, 1993.