

SYLLABUS FOR INTERDISCIPLINARY RESEARCH

MODULE 1 COMPUTER INTEGRATED MANUFACTURING: Smart manufacturing, Industry 4.0, Additive manufacturing, types and classification, Digital twins.

MODULE 2 ARTIFICIAL INTELLIGENCE IN MANUFACTURING: Artificial Neural Networks, Fuzzy Logic and Genetic Algorithms, Predictive Maintenance, Machine Learning Techniques, Supervised, unsupervised, and reinforcement learning, Common algorithms: Regression, Classification, Clustering, Deep Learning and Neural Networks, ANN, CNN, NLP.

MODULE 3 MECHATRONICS AND AUTOMATION: Introduction to Automation of different manufacturing processes. types of automation system, Microprocessor based controllers and its application, Programmable Logic Circuit. Types of sensor and transducer. Hydraulics & Pneumatic Systems Electro Pneumatic & Electrohydraulic Systems design, Feedback control systems, PID Controller.

MODULE 4 CAD/CAM: Fundamentals of Computer Graphics- Product cycle, sequential and concurrent engineering, Computer Aided Design, CAD system architecture, computer graphics, Geometric Modelling- straight line, representation of curves, Hermite curves, Bezier curves, B-spline curves, rational curve

MODULE 5 ROBOT DRIVES AND CONTROL: Controlling the Robot motion –Design of drive systems – Hydraulic and Pneumatic drives, electric. Robotic Sensor, Transducers and Sensors, Robotic vision, Pattern recognition.

MODULE 6 CONTROL SYSTEMS: Mathematical modelling and representation of systems, Feedback principle, transfer function, Block diagrams and Signal flow graphs, Transient and Steady-state analysis of linear time invariant systems, Stability analysis using Routh-Hurwitz and Nyquist criteria, Bode plots, Root loci, Lag, Lead and Lead-Lag compensators; P, PI and PID controllers; State space model, Solution of state equations of LTI systems.

MODULE 7 ELECTRICAL AND ELECTRONIC MEASUREMENTS Bridges and Potentiometers, Measurement of voltage, current, power, energy and power factor; Instrument transformers, Digital voltmeters and multi-meters, Phase, Time and Frequency measurement; Oscilloscopes, Error analysis.

MODULE 8 ANALOG AND DIGITAL ELECTRONICS: Simple diode circuits: clipping, clamping, rectifiers; Amplifiers: biasing, equivalent circuit and frequency response; oscillators and feedback amplifiers; operational amplifiers: characteristics and applications; single stage active filters, Active Filters: Sallen Key, Butterworth, VCOs and timers, combinatorial and sequential logic circuits, multiplexers, demultiplexers, Schmitt triggers, sample and hold circuits, A/D and D/A converters.