

ANNA UNIVERSITY, CHENNAI
NON- AUTONOMOUS COLLEGES AFFILIATED TO ANNA UNIVERSITY
M.E. MECHATRONICS
REGULATIONS – 2021
CHOICE BASED CREDIT SYSTEM
I TO IV SEMESTERS CURRICULA AND I SEMESTER SYLLABI
SEMESTER I

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	MA4104	Applied Mathematics for Mechatronics	FC	3	1	0	4	4
2	MR4101	Concepts in Electronics Engineering	FC	2	0	2	4	3
	MR4102	Concepts of Machines and Mechanisms			0	2		
3	MR4103	Sensors and Actuators	PCC	3	0	0	3	3
4	MR4104	Control System Design	PCC	3	0	2	5	4
5	MR4105	Industrial Automation	PCC	3	0	0	3	3
6	RM4151	Research Methodology and IPR	RMC	2	0	0	2	2
7		Professional Elective – I	PEC	3	0	0	3	3
8		Audit Course -I	AC	2	0	0	2	0
PRACTICAL								
9	MR4111	Sensors and Actuators Laboratory	PCC	0	0	4	4	2
10	MR4112	Industrial Automation Laboratory	PCC	0	0	2	2	1
TOTAL				21	1	10	32	25

* Audit Course is optional

SEMESTER II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.	MR4201	Mechatronics System Design	PCC	3	0	2	5	4
2.	MR4202	Industrial Robotics and Control	PCC	3	0	0	3	3
3.	MR4203	Machine Vision Systems	PCC	3	0	0	3	3
4.	MR4204	Intelligence in Systems	PCC	3	0	0	3	3
5.	MR4205	Smart Embedded Systems	PCC	3	0	0	3	3
6.		Professional Elective – II	PEC	3	0	0	3	3
7.		Audit Course II*	AC	2	0	0	2	0
PRACTICAL								
8.	MR4211	Industrial Robotics and Embedded Systems Laboratory	PCC	0	0	4	4	2
9.	MR4212	Machine Vision and Intelligence Laboratory	PCC	0	0	4	4	2
			TOTAL	20	0	10	30	23

* Audit Course is optional

SEMESTER III

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1.		Professional Elective - III	PEC	3	0	0	3	3
2.		Professional Elective - IV	PEC	3	0	0	3	3
3.		Open Elective	OEC	3	0	0	3	3
PRACTICAL								
4.	MR4311	Project Work - I	EEC	0	0	12	12	6
TOTAL				9	0	12	21	15

SEMESTER IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			CONTACT PERIODS	CREDITS
				L	T	P		
PRACTICAL								
1	MR4411	Project Work-II	EEC	0	0	24	24	12
TOTAL				0	0	24	24	12

TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE = 75

PROFESSIONAL ELECTIVES**SEMESTER I, ELECTIVE - I**

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MR4001	Computer Aided Inspection	PEC	3	3	0	0	3
2.	MR4002	Digital Manufacturing	PEC	3	3	0	0	3
3.	MR4003	Computer Aided Production and Automation of Plants	PEC	3	3	0	0	3
4.	MR4004	Design of Machine Elements and Product Development	PEC	3	3	0	0	3
5.	MR4005	Multi-Body Dynamics	PEC	3	3	0	0	3
6.	MR4006	Onboard Computers and Python Programming	PEC	3	3	0	0	3

SEMESTER II, ELECTIVE - II

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MR4007	Micro and Nano Systems	PEC	3	3	0	0	3
2.	MR4008	Advanced Control Systems	PEC	3	3	0	0	3
3.	MR4009	Biomechatronics	PEC	3	3	0	0	3
4.	MR4010	Solid State Drives	PEC	3	3	0	0	3
5.	MR4011	Automotive Electronics	PEC	3	3	0	0	3
6.	MR4012	UAV	PEC	3	3	0	0	3

SEMESTER III, ELECTIVE - III & IV

SL. NO.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	MR4013	Intelligent Product Design	PEC	3	3	0	0	3
2.	MF4072	Industrial Safety	PEC	3	3	0	0	3
3.	MR4071	Internet of Things	PEC	3	3	0	0	3
4.	MR4014	Communication Protocols	PEC	3	3	0	0	3
5.	MR4015	Advanced Computer Vision	PEC	3	3	0	0	3
6.	MR4016	Mechatronics in Aero Systems	PEC	3	3	0	0	3
7.	MR4017	Medical Mechatronics	PEC	3	3	0	0	3
8.	MR4018	Mobile Robotics	PEC	3	3	0	0	3
9.	CM4071	Green Manufacturing	PEC	3	3	0	0	3
10.	MR4019	Haptics and Augmented Reality	PEC	3	3	0	0	3
11.	MR4020	Industrial Instrumentation and Control	PEC	3	3	0	0	3
12.	MR4021	Modeling and Analysis of Electromechanical Systems	PEC	3	3	0	0	3

AUDIT COURSES (AC)

Registration for any of these courses is optional to students

SL. NO.	COURSE CODE	COURSE TITLE	PERIODS PER WEEK			CREDITS
			L	T	P	
1.	AX4091	English for Research Paper Writing	2	0	0	0
2.	AX4092	Disaster Management	2	0	0	0
3.	AX4093	Constitution of India	2	0	0	0
4.	AX4094	நற்றமிழ் இலக்கியம்	2	0	0	0



COURSE OBJECTIVES:

1. Mathematical foundations of numerical techniques for solving linear systems, eigenvalue problems and generalized inverse.
2. To expose the students to variational formulation and numerical integration techniques and demonstrate solution methodology for the variational problems.
3. To understand the basics of random variables with emphasis on the standard discrete and continuous distributions.
4. To make the students appreciate the purpose of using Laplace transforms to solve the partial differential equation.
5. To introduce the Fourier transforms and its properties.

UNIT – I MATRIX THEORY**12**

Matrix representation of Linear Transformation – Eigen values – Generalized Eigenvectors – Rank of Matrix – The Cholesky decomposition – Canonical basis – QR factorization – Least squares method – Singular value decomposition.

UNIT – II CALCULUS OF VARIATIONS**12**

Concept of variation and its properties – Euler's equations – Functional dependent on first and higher order derivatives – Functional dependent on functions of several independent variables – Variational problems with moving boundaries – Isoperimetric problems – Direct methods: Ritz and Kantorovich methods – Taylor polynomials and Taylor series.

UNIT – III PROBABILITY AND RANDOM VARIABLES**12**

Probability – Axioms of probability – Conditional probability – Bayes' theorem – Random variables – Probability function – Moments – Moment generating functions and their properties – Binomial, Poisson, Geometric, Uniform, Exponential, Gamma and Normal distributions – Function of a random variable.

UNIT – IV LAPLACE TRANSFORM TECHNIQUES FOR PDE**12**

Laplace transform – Definitions – Properties – Transform error function – Bessel's functions – Dirac delta function – Unit step functions – Convolution theorem – Inverse Laplace transform: Complex inversion formula – Solutions to Partial Differential Equations (PDE): Heat equations – Wave equation.

UNIT – V FOURIER TRANSFORM TECHNIQUES FOR PDE**12**

Fourier transform: Definitions, properties – Transform of elementary functions - Dirac Delta function – Convolution theorem - Parseval's identity – Solutions to partial differential equations: Heat equation - Wave equation - Laplace and Poisson's equations.

TOTAL: 60 PERIODS**COURSE OUTCOMES:**

At the end of the course, students will be able to

1. apply various methods in matrix theory to solve system of linear equations.
2. maximizing and minimizing the functional that occur in various branches of Engineering disciplines.
3. computation of probability and moments, standard distributions of discrete and continuous random variables and functions of a random variable.
4. application of Laplace transforms to initial value, initial- boundary value and boundary value problems in Partial Differential Equations.
5. obtain Fourier transforms for the functions which are needed for solving application problems.

REFERENCES:

1. Andrews, L. C. and Shivamoggi, B., "Integral Transforms for Engineers", Prentice Hall of India, New Delhi, 2003.
2. Bronson, R., "Matrix Operations", Schaum's outline series, 2nd Edition, McGraw Hill, 2011.
3. James, G., "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2004.
4. Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
5. O'Neil P.V., "Advanced Engineering Mathematics", Thomson Asia Pvt. Ltd., Singapore, 2003.
6. Sankara Rao,K., "Introduction to Partial Differential Equations", Prentice Hall of India Pvt. Ltd., New Delhi, 1997.

MR4101

CONCEPTS IN ELECTRONICS ENGINEERING

L T P C
2 0 2 3

UNIT I ELECTRONIC COMPONENTS AND DEVICES

6

Resistors, capacitors, inductors, transformers – types and properties - junction diodes, Zener diodes, transistors and thyristors - types-operating mechanism-characteristics and applications. LED – characteristics and applications

UNIT II OPERATIONAL AMPLIFIERS AND APPLICATIONS

6

Operational amplifiers – principles, specifications, characteristics and applications- arithmetic operations, integrator, differentiator, comparator, Schmitt trigger, instrumentation amplifiers, active filters, linear rectifiers, waveform generators, A/D converters, feedback and power amplifiers, sine wave oscillators

UNIT III DIGITAL ELECTRONICS

6

Number systems – Logic gates – Boolean algebra – Simplification of Boolean functions– Study of Combinational Logic Circuits-Full Adder, Code Converters, Multiplexers, Encoder and Decoders, Study of Sequential Logic Circuits-Flip-flops, Counters, Shift registers – D/A Converters.

UNIT IV SIGNAL PROCESSING AND MEASURING DEVICES

6

Rectifiers and Filters - Regulated Power Supply – Switching Power Supplies, Thermal Considerations. Measurement of voltage, current, frequency and power using Multi meters, oscilloscopes, recorders, data loggers, signal sources, counters, analyzers and printers.

UNIT V POWER MANAGEMENT

6

Pulse width modulation and pulse position modulation – batteries–SMPS - sensors, actuators and controllers' energy consumption -power optimization of integrated system.

TOTAL: 30 PERIODS

REFERENCES

1. Helfrick A.D and Cooper .W. D. "Modern Electronic Instrumentation and Measurements Techniques", Prentice Hall, 2008.
2. Jacob Mill Man, Microelectronics Digital and Analog Circuits & Systems – McGraw-Hill, 2004.
3. Malvino & Leach, Digital Principles & Application, TMH, 2015.
4. Mill Man and Halkias, "Electron Devices and Circuits", McGraw-Hill 2010.
5. Ray & Chaudary, Linear Integrated Circuits, New Age, 2006.

LABORATORY

LIST OF EXPERIMENTS

1. Study of digital storage oscilloscope.
2. Experimentation with CRO.
3. Design of DC power supplies
4. Design of inverting amplifier and non-inverting amplifiers
5. Design of Instrumentation amplifier.
6. Design of analog filters.
7. Design of combinational circuits and sequential circuits.
8. Design of A/D converters and D/A converters.
9. RC Servo motor driver circuit.
10. Design of stepper motor driver circuit.

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

1. CRO-1
2. DSO-1
3. DC Power supply
5V – 5 No's
12V, 10A - 1 No
24V, 10A or higher - 1 No
4. Function generator-1
5. OP-Amp trainer kit (inverting and non-inverting amplifier module)
6. Analog filters trainer kit
7. Sequential circuit trainer kit
8. Combination circuit trainer kit
9. A/D Converter trainer kit -1 No
10. D/A Converter Trainer kit-1 No
11. Driver Circuit Module for servomotor-1 No
12. Driver Circuit module for stepper motor-1 No
13. Multi-Meter, bread board, and solder machine.
14. Electronic components for power supply (transformer, regulator, diode, capacitors) -5 No's.

MR4102

CONCEPTS OF MACHINES AND MECHANISMS

L	T	P	C
2	0	2	3

UNIT I MECHANISMS

6

Definition – Machine and Structure – Kinematic link, pair and chain – classification of Kinematic pairs – Constraint & motion - Degrees of freedom – Slider crank – Single and double – Crank rocker mechanisms – Inversions – applications. Kinematic analysis and synthesis of simple mechanisms – Determination of velocity and acceleration of simple mechanisms.

UNIT II FRICTION

6

Types of friction – friction in screw and nuts – pivot and collar – thrust bearings – collar bearing – plate and disc clutches – belt (flat & vee) and rope drives – creep in belts – Jockey pulley – open and crossed belt drives – Ratio of tensions – Effect of centrifugal and initial tension – condition for maximum power transmission.

UNIT III GEARING AND CAMS**6**

Gear profile and geometry-nomenclature of spur and helical gears – law of gearing – interference requirement of minimum number of teeth in gears-gear trains-simple and compound gear trains determination of speed and torque in epicyclic gear trains-Cam profile-different types of followers.

UNIT IV VIBRATION**6**

Free, forced and damped vibrations of single degree of freedom systems – force transmitted to supports – vibration Isolation – vibration absorption – torsional vibration of shafts – single and multirotor systems – geared shafts – critical speed of shafts.

UNIT V MACHINE TOOLS**6**

Machine tool construction-features – operations of lathe, milling machine, drilling machine – Drive system for machine tools – mechanical, hydraulic and electric stepped and variable speeds – spindle speeds and feed drives-linear and reciprocation motion generation.

TOTAL : 30 PERIODS**REFERENCES**

1. Bansal R.K, "Theory of Machines", Laxmi Publications (P) Ltd., New Delhi. 2016.
2. G.C.Sen and A. Bhattacharya, "Principles of Machine Tools", New Central book Agency, 2009.
3. Joseph Edward Shigley, Charles R.Mischke, "Mechanical Engineering Design", Mcgraw Hill International Edition, 2008.
4. Malhotra .D.R. and Gupta .H.C. "The Theory of Machines" SatyaPrakasam, Tech. India Publications, 1989.
5. R.S.Khurmi and Gupta, "Theory of Machines" Eurasia Publishing House Pvt Ltd. 2020.

LABORATORY**LIST OF EXPERIMENTS**

1. 2D modeling and 3D modeling of Bearing, and Couplings.
2. 2D modeling and 3D modeling of Gears and Ball screw.
3. 2D modeling and 3D modeling of Sheet metal components
4. 2D modeling and 3D modeling of Jigs, fixtures and Die.
5. 2D modeling and 3D modeling of Structures and frames
6. Modeling and simulation of mechanism of 4 Bar chain
7. Modeling and simulation of mechanism of Slider crank,
8. Modeling and simulation of mechanism of Ball and screw and Rack and pinion.
9. Modeling and simulation of mechanism of Belt and chain drives.
10. Modeling and simulation of mechanism of Quick return and elliptical trammel.

TOTAL: 30 PERIODS**LIST OF SOFTWARES**

Solid Works/ OpenCAD /CREO /CATIA/ NX CAD/MSC-Adams – 15 No's

UNIT I INTRODUCTION TO SENSORS 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types. Temperature – IC, Thermistor, RTD, Thermocouple.

UNIT II MOTION, OPTICAL AND RANGING SENSORS 9

Motion Sensors – Brush Encoders, Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer.,– GPS, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR). Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors.

UNIT III FORCE, MAGNETIC, AND HEADING SENSORS 9

Strain Gage, Load Cell Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV FLUID POWER ACTUATORS 9

Hydraulic and Pneumatic System– ISO Symbols for their Elements - Hydraulic Pumps and Motor - Linear Actuators and Types - Control and Regulating Elements — Direction, Flow and Pressure Control Valves - Methods of Actuation, Types, Sizing of Ports - Spool Valves - Electro Hydraulic Servo Valves - Types - Sequencing Circuits Design - Combinational Logic Circuit Design – Interfacing to PLC.

UNIT V ELECTRICAL DRIVES AND ACTUATORS 9

DC Motors and Types – Single Phase and Three Phase AC Motors – Servomotors - Stepper Motors - BLDC Motor and its Operating Modes - Piezo Electric Actuators – Linear Electrical Actuators - Switching Devices - Relay, BJT, MOSFET, IGBT, SCR - H-Bridge DC Drives under PWM Mode. VFD Drives – AC Servo Drives – Stepper Motor Drives - Drives for BLDC Motor - Selection of Drives – Protection and Switchgears.

TOTAL : 45 PERIODS

REFERENCES

1. Bolton W., "Mechatronics", Pearson; 5th edition, 2015
2. Bradley D.A., and Dawson, Burd and Loader, "Mechatronics", Thomson Press India Ltd., 2004
3. Ernest O. Doebelin, "Measurement system, Application and Design", Tata McGraw Hill Publishing Company Ltd., Fiftieth Edition, 2004
4. Patranabis D., "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2005.
5. Renganathan S., "Transducer Engineering", Allied Publishers (P) Ltd., 2003
6. Antony Esposito, "Fluid Power Systems and Control", Prentice-Hall, 2006.
7. Austin Hughes, "Electric Motors and Drives Fundamentals, Types and Applications", Fourth Edition, Elsevier, 2013

UNIT I **SYSTEM REPRESENTATION AND MODELLING** **9**

Introduction and need for Control Systems with examples – Feedback systems – Block Diagram – Definition of Process variable, Set-point, Manipulated variable and Final control element with examples -Open loop and Closed loop systems – Transfer Function Model – State Space Model – Mathematical Modelling of Mechanical, Electrical, Pneumatic and Hydraulic systems – Block Diagram reduction – Signal flow graph.

UNIT II **DESIGN OF FEEDBACK CONTROL SYSTEM** **9**

Feedback systems – Block Diagram – Definition of process variable, set –point, manipulated variable and final control element with examples – characteristics of on –off, P, PI, PD and PID controllers – Implementation issues of PID controller – Modified PID controller – Tuning of controller.

UNIT III **TIME AND FREQUENCY DOMAIN ANALYSIS** **9**

Time response of First & Second order systems – Time domain specifications - steady state errors and error constants – Routh Hurwitz criterion – Root locus – Bode Plot – Polar Plot – Nyquist stability criterion – Stability analysis – Experimental determination of Transfer Functions

UNIT IV **CONTROL SYSTEM DESIGN** **9**

Root locus approach to control system design – lead, lag, lag-lead compensation using time domain analysis. Control system design using frequency domain analysis – lead, lag, lag-lead compensation using frequency domain analysis– P, PI, and PID controllers – tuning methods and rule.

UNIT V **CONTROL AND ANALYSIS OF SERVO MOTOR** **9**

Servo motor – Mathematical Modelling of Servo Motor – Analysis of Servo motor system using Routh Hurwitz criterion, Root locus, Bode Plot, Polar Plot and stability analysis – Implementation of P, PI, PD and PID controllers for servo motor and analysis - bumpless control transfer between manual and PID Control- anti-windup control using PID Controller.

TOTAL : 45 PERIODS

PROGRESS THROUGH KNOWLEDGE

REFERENCES

1. A. NagoorKani, "Control Systems", RBA Publications (P) Ltd., 2020.
2. B.C. Kuo, "Automatic Control Systems", Prentice Hall of India Pvt. Ltd., New Delhi, 2018.
3. I.J.Nagrath and Gopal, "Control System Engineering", New Age international (P) Ltd., 2006.
4. K.Ogata, "Modern Controls Engineering", Prentice Hall of India Pvt. Ltd., New Delhi, 2005.
5. M. Nakamura .S.Gata&N.Kyura, Mechatronic Servo System Control, Springer.

LABORATORY

LIST OF EXPERIMENTS

1. Mathematical Modelling and Simulation of a Physical Systems.
2. Simulation and Reduction of Cascade and Parallel, and Closed Loop Sub-System.
3. Plot the pole-zero configuration in s-plane for the given Transfer Function.
4. Simulation and Analysis of First and Second Order System Equations in Time and frequency Domain
5. Simulation and Analysis of Root-Locus and Bode Plot.
6. Simulation and Implementation of PID Controller Combinations for First and Second Order Systems.
7. Simulation of Motor velocity, position and torque control.

TOTAL: 30 PERIODS

LIST OF SOFTWARE FOR A BATCH OF 30 STUDENTS:

1. MATLAB/ SCILAB – Control System Tool Box - 15 No's

MR4105

INDUSTRIAL AUTOMATION

L T P C

3 0 0 3

UNIT I INDUSTRIAL INSTRUMENTATION AND CONTROL

9

Introduction and need for automation-Instrumentation system for measurement of process parameters – overview on flow, level, pressure, temperature, speed, current and voltage measurements – proximity and vision-based inspection systems – process control systems – continuous and batch process – feedback control system overview.

UNIT II PROGRAMMABLE LOGIC CONTROLLER

9

Fundamentals of programmable logic controller - functions of PLCs - features of PLC - selection of PLC - architecture – Basics of PLC programming - logic ladder diagrams – communication in PLCs – Programming Timers and counters – Data Handling - PLC modules - Advanced PLCs.

UNIT III DATA COMMUNICATION AND SUPERVISORY CONTROL SYSTEMS

9

Industrial data communications - fiber optics – Modbus – HART – Device Net – Profibus – Fieldbus – Introduction to supervisory control systems – SCADA - Distributed control system (DCS) – Safety systems – man-machine interfaces.

UNIT IV FACTORY AUTOMATION

9

Factory layout - Tools and software based factory modeling -case study on automated manufacturing units, assembly unit, inspection systems and PLC based automated systems- Introduction to factory automation monitoring software

UNIT V BUILDING AUTOMATION

9

Building layout and its 3D model-Power Distribution System in Buildings- HVAC systems- Systems Design & Operation- PLC in Building Services- Building Automation Systems – control panel- Introduction to building automation software

TOTAL : 45 PERIODS

REFERENCES

1. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems", Newnes, 1st Edition, 2004.
2. D.Patranabis, "Principles of Industrial Instrumentation", Tata McGraw-Hill Publishing Ltd., New Delhi, 2010.
3. Frank D. Petruzella, "Programmable Logic Controller" McGraw – Hill Publications, 2016.
4. Frank Lamb, "Hands on Industrial Automation", McGraw-Hill Profession, 2013.
5. Hughes, T., "Programmable Logic Controllers", ISA Press, 2000.
6. Lucas, M.P., "Distributed Control System", Van Nostrand Reinhold Company, New York, 1986.
7. Shengwei Wang, "Intelligent Buildings and Building Automation", Routledge Publishers, 2009.

RM4151

RESEARCH METHODOLOGY AND IPR

L T P C

2 0 0 2

UNIT I RESEARCH DESIGN

6

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES

6

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING

6

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS

6

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS

6

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filing, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL :30 PERIODS

REFERENCES

1. Cooper Donald R, Schindler Pamela S and Sharma JK, "Business Research Methods", Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, "Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets", Entrepreneur Press, 2007.
3. David Hunt, Long Nguyen, Matthew Rodgers, "Patent searching: tools & techniques", Wiley, 2007.
4. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, "Professional Programme Intellectual Property Rights, Law and practice", September 2013.

MR4111

SENSORS AND ACTUATORS LABORATORY

L	T	P	C
0	0	4	2

LIST OF EXPERIMENTS

SENSORS AND TRANSDUCERS

- 1 Experiments Using Strain Gauge Sensor: Load, Torque and Force Measurement.
- 2 Determine the characteristics of Pressure Sensor and Piezoelectric Force Sensor
- 3 Displacement Measurement using LVDT.
- 4 Determine the Characteristics of Various Temperature Sensors.
- 5 Determine the Characteristics of Various Light Detectors (Optical Sensors).
- 6 Distance Measurement using Ultrasonic and Laser Sensor.
- 7 Determine angular velocity using gyroscope, Vibration measurement using Accelerometer and Direction measurement using Magnetometer.
- 8 Speed and Position Measurement Using Encoders.

ACTUATORS

- 1 Experiments on control of Speed and Direction Control of DC Motor
- 2 Experiments on control of Position, Speed and Direction Control of Stepper Motor.
- 3 Experiments on control of Position, Speed and Direction Control of AC Servo Motors.
- 4 Experiment on control of Position, Speed and Direction Control of DC Servo Motors.

TOTAL: 60 PERIODS

MR4112

INDUSTRIAL AUTOMATION LABORATORY

L	T	P	C
0	0	2	1

LIST OF EXPERIMENTS

1. Experiments on Ladder Logic Program for Various Logic Gates AND, OR, NOT, NOR, NAND, EX-OR and EX-NOR.
2. Implement Various Mathematical Functions in PLC Using Ladder Diagram Programming Language.
3. Develop Ladder Diagram Programming to set Timer and Counter in PLC.
4. Experiments on Sensor and Actuator Interfacing and PLC to PLC Communication.
5. Experimental Verification of Speed Control Circuits in Pneumatic and Hydraulic Trainer.
6. Experimental Verification of Single and Double Acting Cylinder Circuits Using Different Directional Control Values.
7. Experimental Verification of Pneumatic Sequencing Circuits.
8. Experiments on Control of PLC Based Electro Pneumatic Sequencing Circuits.
9. Experiments on Control of PLC Based Electro Hydraulic Sequencing Circuits.
10. Develop PLC Program to Maintain the Pressure and Level in a Bottle Filling System.
11. Develop Ladder Diagram Program in PLC For Material Filling and Object Shorting.
12. Develop the Ladder Diagram Program in PLC for Material Handling, Delaying Conveyor, Pick and Place Operation.

Note : Any of the 10 experiments to be conducted

TOTAL: 30 PERIODS

LIST OF EQUIPMENT FOR A BATCH OF 30 STUDENTS:

- PLC Software -2 Users
- PLC Station with Communication Protocol, Sensors and Actuators – 2 No's
- Electro Pneumatic Sequencing -1 Unit
- Electro Hydraulic Sequencing Circuits – 1 Unit
- PLC station with Pressure and Level in a Bottle Filling System – 1 Unit
- PLC station with Material Handling, Delaying Conveyor, Pick and Place Operation – 1 Unit.

MR4001**COMPUTER AIDED INSPECTION**

L	T	P	C
3	0	0	3

UNIT I FUNDAMENTALS AND CONCEPTS IN METROLOGY 9

Standards of measurement – Analog and digital measuring instruments-comparators – Limits, Fits and Tolerances – Gauge design – Angular measurements – Surface Roughness – Form errors and measurements.

UNIT II INSPECTION AND GENERAL MEASUREMENTS 9

Inspection of gears and threads – Tool makers' microscope – Universal measuring machine – use of Laser interferometer in machine tool Inspection – use of laser in on-line Inspection – Laser micrometer – Laser Alignment telescope.

UNIT III OPTO ELECTRONICS IN ENGINEERING INSPECTION 9

Use of opto electronics in Tool wear measurement – Micro hole measurement and surface Roughness – Applications in In-Process measurement and on line Inspection.

UNIT IV MACHINE VISION 9

Fundamentals of Image Processing – Steps involved in Image Processing – Machine Vision applications in manufacturing and metrology.

UNIT V COORDINATE METROLOGY AND QUALITY CONTROL 9

Co-ordinate measuring machines – Applications and case-studies of CMM in Inspection – Use of Computers in quality control – Control charts – Reliability.

TOTAL : 45 PERIODS**REFERENCES**

1. Anil.K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India Pvt. Ltd., 2015.
2. Dale.H. Besterfield, "Total Quality Management", Pearson Education Asia, 2018.
3. Jain R.K., "Engineering Metrology", Khanna Publishers, 2018.
4. Manuals of C.M.M. and Systems.
5. Robert G. Seippel, "Opto Electronics for technology and engineering", Prentice Hall, New Jersey, 1989.

UNIT I INTRODUCTION OF NC, CNC, DNC AND ADAPTIVE CONTROL 9

Classification of machine tools – types, functions and processes - fundamentals of NC and CNC technologies Adaptive control - types, application and benefits - general configuration of adaptive control and function – reasons for process change - practical problems with adaptive control - example for feedback and adaptive control.

UNIT II MECHATRONIC ELEMENTS IN CNC MACHINE TOOLS 9

CNC systems - configuration of the CNC system – interfacing – monitoring – diagnostics - machine data - compensations for machine accuracies - PLC in CNC – PLC programming for CNC, steps in programming and case studies - machine structure -types of loads on CNC machine - guide ways and types - mechanical transmission elements - elements for rotary motion to linear motion - ball screw and types - roller screw and types - rack and pinion - various torque transmission elements - requirements of feed drives and spindle drive.

UNIT III MECHATRONICS ELEMENT IN CNC MEASURING SYSTEM AND TOOLING 9

Measuring systems - feedback devices - velocity feedback - analog and digital - position feedback - rotary and linear. Tooling - requirement and planning - preset, qualified and semi qualified tools. Fixtures – requirement - unified and modular fixtures - tool identification - touch trigger probe- tool coding - EEPROM tools. 19 Tool condition monitoring - various indirect and direct methods. Identification and gauging of work piece. Tool locking system - ball lock mechanism and contact pressure monitoring. Automatic tool changing system - types and benefits - tool magazine – sensors in CNC.

UNIT IV CNC PROGRAMMING 9

Machine axes identification - primary, secondary and tertiary - manual CNC programming - Milling programming fundamentals - compensation and offset in milling -fixed cycles in milling - repetitive programming - loops, sub programs and macros. Turning programming fundamentals - compensation and offset in turning - fixed cycles in turning. Computer assisted programming in APT - basic geometry definition - cutter motion definition - postprocessor statements - generation and execution of APT programs.

UNIT V TESTING AND MAINTENANCE OF CNC MACHINES 9

Verification of technical specification and functional aspects, Verification during idle running & machine tool and the work piece accuracy - Installation of CNC machines - Maintenance of CNC machines - machine elements – hydraulic elements - electrical and electronic elements – maintenance schedules.

TOTAL : 45 PERIODS

REFERENCES

1. HMT Limited, "Mechatronics", Tata Mcgraw-Hill Publishing Co Ltd, 2017.
2. Groover, M.P., "Automation, Production System and CIM", Prentice Hall of India Pvt. Ltd, 2016.
3. Stenerson and Curran, "Computer Numerical Control-Operation and Programming", PHI Learning Pvt. Ltd., 2008.
4. Jayakumar, V., and Mahendran, B., "Computer Aided Manufacturing", Lakshmi Publications, 2005.
5. Jonathan Lin, S.C., "Computer Numerical Control (From Programming to Networking)", Delmar Publishers Inc., 2000.
6. Radhakrishnan, P., "CNC Machine", New Central Book Agency, 2000.
7. Sehrawatt, M.S., and Narang, J.S., "CNC Machine", Dhanpat Rai And Co, 2002.
8. Grahamt.Smith, "Advanced Machining: The Handbook of Cutting Technology", IFS Publications Ltd., 1989.

MR4003	COMPUTER AIDED PRODUCTION AND AUTOMATION OF PLANTS	L	T	P	C
		3	0	0	3

UNIT I COMPUTER AIDED PRODUCTION PLANNING 9

Application – Process, Demand, Volume, Quality, Manufacturing Task. Automated Factory- Requirements- Factory Planning - Layout- Macro, Micro, and Submicro Layouts - Work Cell Design - Manufacturing Task - Equipment, Tools and Resources Identification – Levels of Automation- Device, Machine, Cell, Plant, Enterprises - Computer Aided Process Planning (CAPP) - MRP – Capacity Planning- Shop Floor Planning – Inventory Control. Tools for Digital Factory Modeling

UNIT II AUTOMATED MATERIAL TRANSFER AND STORAGE SYSTEM 9

Automated Production Line – System Configurations, Work Part Transfer Mechanisms – Fundamentals of Automated Assembly System – System Configuration, Part Delivery at Workstations – Design For Automated Assembly – Overview of Material Handling Equipment's – Consideration In Material Handling System Design – Conveyor Systems – Types of Conveyors – Operations and Features. Automated Guided Vehicle System – Types of Vehicles And AGVs Applications - Automated Transport System- Cranes - Hoist - Conventional Storage Methods and Equipments – Automated Storage/Retrieval System and Carousel Storage System Deadlocks in Automated Manufacturing Systems – Petrinet Models – Applications in Dead Lock Avoidance.

UNIT III GROUP TECHNOLOGY AND FLEXIBLE MANUFACTURING SYSTEMS 9

FMS - Overview – Levels- Manufacturing Module -Assembly Cell -Manufacturing Group - Production Systems-Manufacturing Line - Part Families – Visual – Parts Classification and Coding – Production Flow Analysis – Grouping of Parts And Machines by Rank Order Clustering Method – Benefits of GT – Case Studies. FMS – Components – Workstations – FMS Layout Configurations – Computer Control Systems – FMS Planning and Implementation Issues – Architecture of FMS – Flow Chart Showing Various Operations in FMS

UNIT IV AUTOMATION SYSTEMS AND ADVANCED MANUFACTURING TECHNIQUES 9

Intelligent Manufacturing – Virtual Manufacturing- Internet Controlled Manufacturing- Intelligent Agents – Advanced Manufacturing Systems - Robots Role in Various Levels of manufacturing- Sensors in Manufacturing Process-Automated Measurement and Inspections- Vision based inspection Manufacturing Process - Network and Computer Interface - Industrial Networks for Production Line Control

UNIT V CASE STUDIES 9

Case studies of Automated Factory – Manufacturing Task - Car Manufacturing & Assembly – Electronics Manufacturing – Food Processing – Textile Processing

TOTAL : 45 PERIODS

REFERENCES

1. Alavudeen and Venkateshwaran, — Computer Integrated Manufacturing II, PHI Learning Pvt. Ltd., New Delhi, 2008.
2. Marion I. Tobler-Rohr, Handbook of Sustainable Textile Production, Woodhead Publishing Limited, 2011
3. Mikell P.Groover, —Automation, Production system and Computer integrated Manufacturing II, Prentice Hall of India Pvt. Ltd., 2008. 3. Kant Vajpayee, S., —Computer Integrated Manufacturing II, Prentice Hall of India, New Delhi, 2007.
4. Mohammed A. Omar, The automotive body manufacturing systems and Process, John Willey and Sons, First edition, 2011.

5. P. Fellows, Food Processing Technology: Principles and Practice Second Edition, CRC Press, 2000.
6. Phillip R. Edwards, Manufacturing Technology in the Electronics Industry: An introduction, Springer - Science+Business Media, B.V, First Edition, 1991.
7. SabrieSoloman, Sensors and control systems in Manufacturing, Second Edition, McGrew Hill Publications, 2010.
8. Viswanathan, N., and Narahari, Y., —Performance Modeling and Automated Manufacturing Systems II, Prentice Hall of India Pvt. Ltd., 2000.

MR4004	DESIGN OF MACHINE ELEMENTS AND PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

UNIT I INTRODUCTION 9

Introduction to national and international symbols- Engineering materials and their physical properties and applied to design- Selection of materials- selection for new design and material considerations-Factors of safety in design- Dimensioning and detailing- Fitness and tolerance- Surface finish and machining symbols –Product development- Elementary concept of functional, aesthetic and form design- Principles of design optimization- Future trends- CAD.

UNIT II STATIC AND VARIABLE STRESSES 9

Static and variable loading in machine elements- Stress concentration- Goodman and Soderberg method of design- Design of power transmission shafts- Subjected to torsion, bending and axial loads- Design of close coiled helical spring -Design of couplings- Muff, Flange, Bushed and pin types.

UNIT III DESIGN OF TRANSMISSION ELEMENTS 9

Design of gears - Selection and specification- Principle of hydrodynamic lubrication – Design of journal bearings – Selection and specification of anti-friction bearings – Life rating of roller bearings.

UNIT IV PRODUCT DESIGN AND DEVELOPMENT 9

Quality function development (QFD) - product design and specification, design for manufacturability (DFM), design for assembly and disassembly, human factors in design ergonomics, creativity in design, TRIZ- axiomatic design.

UNIT V FINITE ELEMENT ANALYSIS 9

Basic Concept of FEA - finite element analysis of one dimensional and two dimensional problems-variational formulation of B.V.P. – Ritz Method-Examples related to one-dimensional and two-dimensional problems.

TOTAL : 45 PERIODS

REFERENCES

1. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 6th Edition, 2021, ISBN 978-007-127189-9.
2. Jain R.K., "Machine design", Khanna Publishers, Delhi, 2006.
3. Khurmi R.S and Gupta J.K, "A Text Book of Machine Design", Eurasia Publishing House (P) Ltd, New Delhi, 2006.
4. PSG Design data Handbook, Kalaikhathir Publications, CBE 2002.
5. Ramamurthi, V., "Finite Element Method in Machine Design", Narosa Publishing House, January 2009, ISBN: 978-81-7319-965-3
6. Shigley J.E. "Mechanical Engineering Design", McGraw-Hill Book Co., Delhi, 2004.
7. Spotts N.F. "Design of Machine Elements", Prentice-Hall of India, 2004.

COURSE OBJECTIVES

1. To understand the important concepts of multi-body dynamics.
2. To familiar the various computational methods multi-body dynamics.
3. To characterize the nonlinear concepts of multi-body dynamics.
4. To recognize the need of control in nonlinear dynamics multi body interactions.
5. To interpret the nonlinear dynamics of multi body systems and its realization of control.

UNIT I INTRODUCTION TO DYNAMICS**9**

Importance of Multibody Dynamics - Particle Mechanics - Rigid Body Mechanics - Deformable Bodies - Constrained Motion- -Kinematics - Rotation - Translation - Velocity- Acceleration Equations – Mechanics of Deformable Bodies - Floating Frame Reference Formulation – Inertia - Generalized Forces - Equation of Motions - Multi Body Systems - Sub Systems - Friction and Spring Nonlinear Model - Nonlinear Dynamic Equations Formulation

UNIT II COMPUTATIONAL METHODS FOR DYNAMIC ANALYSIS**9**

Jacobian Matrix - Newton-Raphson Method - Nonlinear Kinematic Constrain Equation – System Mass Matrix - External and Elastic Forces - Acceleration Vector – Lagrangean Multiplier - Lagrange's Equation – Kinetic Energy – Hamilton Equation - Hamilton vector Field- Euler - Lagrange Equation- Generalized Reaction Forces – State Vector and Equation Formulation.

UNIT III NONLINEAR SYSTEMS AND CONCEPTS**9**

Linear Time Varying and Linearization – Input and Output Stability - Lyapunov Stability Analysis – Asymptotic Stability - Popov's and Circle Criterion - Perturbed System – Chaos – Periodic Orbits- Index theory and Limit Cycle – Centre Manifold Theory- Normal Forms- Nonlinear analysis- Poincare Maps - Bifurcations – Maps - Vector Fields - Methods – Control System Design using Lyapunov's Direct Method.

UNIT IV SYSTEM CHARACTERIZATION**9**

Stability, Controllability, Observability - Phase Plane Analysis - Phase Portrait - Limit Cycle - Describing Function - Assumption – Limit Cycles.

UNIT V CONTROL OF NONLINEAR MECHANICAL SYSTEMS**9**

Double Inverted Pendulum – Nonlinear Machineries – Robots - Suspension System - Aircraft.

TOTAL: 45 PERIODS**REFERENCES**

1. Ahmed A. Shabana, "Dynamics of Multibody Systems", Cambridge University Press, 2013.
2. Brian L. Stevens, Frank L. Lewis, "Aircraft Control and Simulation", Wiley India Pvt Ltd, 2010.
3. Hasan Khalil, "Nonlinear Systems and Control", Prentice Hall, 2002.
4. Mahmut Reyhanoglu, "Dynamics and Control of a Class of Under Actuated Mechanical Systems", IEEE Transactions on Automatic Control, 44(9), 1999.
5. Stephen Wiggins, "Introduction to Applied Nonlinear Dynamics System and Chaos", Springer-Verlag, 2000.
6. Wei Zhong and Helmut Rock, "Energy and Passivity Based Control of the Double Inverted Pendulum on a Cart", IEEE, 2001.

UNIT I INTRODUCTION TO SINGLE BOARD COMPUTERS 9

On-Board System Architecture- Processor- Architecture – Features - SPI-I2C- UART- USB - Ethernet- CAN Protocol - Wi-Fi – Bluetooth- HDMI- GPIO- Memory- Input Devices – Camera Interfacing.

UNIT II REAL TIME OPERATING SYSTEM 9

Operating System Architecture – File Systems- Resource Management – Process Scheduling – Applications.

UNIT III PYTHON PROGRAMMING 9

Python Language – Using The Interpreter – Python Data types And Functions – Working With Data – List, Dictionary and Set – Processing Primitives – List Comprehensions – File Handling – Object Model Including Variables, Reference Counting, Copying, and Type Checking – Error Handling Iterative Statement- Conditional Statement –Operators – Arrays Libraries- Library - GUI Development.

UNIT IV EMBEDDED PYTHON PROGRAMMING 9

GPIO Programming – Numerical Library- Communication Library- Image Processing – Machine Learning.

UNIT V APPLICATIONS 9

Case Studies in Automotive- Robotics - IOT- Factory Automation - Home Automation.

TOTAL: 45 PERIODS**REFERENCES**

1. Gabriele Manduchi and Ivan Cibrario Bertolotti, Real-Time Embedded Systems: Open-Source Operating Systems, CRC Press, 2012.
2. Guttag, John. Introduction to Computation and Programming Using Python. MIT Press, 2013.
3. Mark Lutz, "Learning Python, Powerful OOPs, O'reilly, 2011
4. NInad Sathaye, Learning python application development, Packt publishing, 2016
5. Sai Yamanoor, Srihari Yamanoor, Raspberry Pi Mechatronics Projects Packt publishing, 2016.
6. Warren Gay, Mastering the Raspberry Pi, Apress, 1st ed. edition, 2014

PROGRESS THROUGH KNOWLEDGE

AUDIT COURSES

AX4091

ENGLISH FOR RESEARCH PAPER WRITING

L T P C
2 0 0 0

COURSE OBJECTIVES

- Teach how to improve writing skills and level of readability
- Tell about what to write in each section
- Summarize the skills needed when writing a Title
- Infer the skills needed when writing the Conclusion
- Ensure the quality of paper at very first-time submission

UNIT I INTRODUCTION TO RESEARCH PAPER WRITING 6

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

UNIT II PRESENTATION SKILLS 6

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction

UNIT III TITLE WRITING SKILLS 6

Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check

UNIT IV RESULT WRITING SKILLS 6

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions

UNIT V VERIFICATION SKILLS 6

Useful phrases, checking Plagiarism, how to ensure paper is as good as it could possibly be the first- time submission

TOTAL: 30 PERIODS

COURSE OUTCOMES

- CO1 –Understand that how to improve your writing skills and level of readability
CO2 – Learn about what to write in each section
CO3 – Understand the skills needed when writing a Title
CO4 – Understand the skills needed when writing the Conclusion
CO5 – Ensure the good quality of paper at very first-time submission

REFERENCES

1. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011
2. Day R How to Write and Publish a Scientific Paper, Cambridge University Press 2006
3. Goldbort R Writing for Science, Yale University Press (available on Google Books) 2006
4. Highman N, Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book 1998.

COURSE OBJECTIVES

- Summarize basics of disaster
- Explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Develop the strengths and weaknesses of disaster management approaches

UNIT I INTRODUCTION**6**

Disaster: Definition, Factors and Significance; Difference between Hazard And Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

UNIT II REPERCUSSIONS OF DISASTERS AND HAZARDS**6**

Economic Damage, Loss of Human and Animal Life, Destruction Of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT III DISASTER PRONE AREAS IN INDIA**6**

Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides And Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference To Tsunami; Post-Disaster Diseases and Epidemics

UNIT IV DISASTER PREPAREDNESS AND MANAGEMENT**6**

Preparedness: Monitoring Of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological And Other Agencies, Media Reports: Governmental and Community Preparedness.

UNIT V RISK ASSESSMENT**6**

Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival

TOTAL : 30 PERIODS**COURSE OUTCOMES**

CO1: Ability to summarize basics of disaster

CO2: Ability to explain a critical understanding of key concepts in disaster risk reduction and humanitarian response.

CO3: Ability to illustrate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

CO4: Ability to describe an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

CO5: Ability to develop the strengths and weaknesses of disaster management approaches

REFERENCES

1. Goel S. L., Disaster Administration And Management Text And Case Studies”, Deep & Deep Publication Pvt. Ltd., New Delhi,2009.
2. Nishitha Rai, Singh AK, “Disaster Management in India: Perspectives, issues and strategies “NewRoyal book Company,2007.
3. Sahni, Pardeep Et.Al. ,” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi,2001.

AX4093

CONSTITUTION OF INDIA

L T P C
2 0 0 0

OBJECTIVES

Students will be able to:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional Role and entitlement to civil and economic rights as well as the emergence nation hood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

UNIT I HISTORY OF MAKING OF THE INDIAN CONSTITUTION

History, Drafting Committee, (Composition & Working)

UNIT II PHILOSOPHY OF THE INDIAN CONSTITUTION

Preamble, Salient Features

UNIT III CONTOURS OF CONSTITUTIONAL RIGHTS AND DUTIES

Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

UNIT IV ORGANS OF GOVERNANCE

Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

UNIT V LOCAL ADMINISTRATION

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO, Municipal Corporation. Panchayati raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy(Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

UNIT VI ELECTION COMMISSION

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners - Institute and Bodies for the welfare of SC/ST/OBC and women.

TOTAL: 30 PERIODS

OUTCOMES

Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party[CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.

SUGGESTED READING

1. The Constitution of India,1950(Bare Act),Government Publication.
2. Dr.S.N.Busi, Dr.B. R.Ambedkar framing of Indian Constitution,1st Edition, 2015.
3. M.P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis,2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

AX4094

www.binils.com

நற்றமிழ் இலக்கியம்

L T P C
2 0 0 0

UNIT I

சங்க இலக்கியம்

6

1. தமிழின் துவக்க நூல் தொல்காப்பியம்
– எழுத்து, சொல், பொருள்
2. அகநானூறு (82)
- இயற்கை இன்னிசை அரங்கம்
3. குறிஞ்சிப் பாட்டின் மலர்க்காட்சி
4. புறநானூறு (95,195)
- போரை நிறுத்திய ஒளவையார்

UNIT II

அறநெறித் தமிழ்

6

1. அறநெறி வகுத்த திருவள்ளுவர்
- அறம் வலியுறுத்தல், அன்புடைமை, ஒப்புறவு அறிதல், ஈகை, புகழ்
2. பிற அறநூல்கள் - இலக்கிய மருந்து
– ஏலாதி, சிறுபஞ்சமூலம், திரிகடுகம், ஆசாரக்கோவை (தூய்மையை வலியுறுத்தும் நூல்)

UNIT III**இரட்டைக் காப்பியங்கள்****6**

1. கண்ணகியின் புரட்சி
- சிலப்பதிகார வழக்குரை காதை
2. சமூகசேவை இலக்கியம் மணிமேகலை
- சிறைக்கோட்டம் அறக்கோட்டமாகிய காதை

UNIT IV**அருள்நெறித் தமிழ்****6**

1. சிறுபாணாற்றுப்படை
- பாரி முல்லைக்குத் தேர் கொடுத்தது, பேகன் மயிலுக்குப் போர்வை கொடுத்தது, அதியமான் ஓளவைக்கு நெல்லிக்கனி கொடுத்தது, அரசர் பண்புகள்
2. நற்றிணை
- அன்னைக்குரிய புன்னை சிறப்பு
3. திருமந்திரம் (617, 618)
- இயமம் நியமம் விதிகள்
4. தர்மச்சாலையை நிறுவிய வள்ளலார்
5. புறநானூறு
- சிறுவனே வள்ளலானான்
6. அகநானூறு (4) - வண்டு
நற்றிணை (11) - நண்டு
கலித்தொகை (11) - யானை, புறா
ஐந்திணை 50 (27) - மான்
ஆகியவை பற்றிய செய்திகள்

UNIT V**நவீன தமிழ் இலக்கியம்****6**

1. உரைநடைத் தமிழ்,
- தமிழின் முதல் புதினம்,
- தமிழின் முதல் சிறுகதை,
- கட்டுரை இலக்கியம்,
- பயண இலக்கியம்,
- நாடகம்,
2. நாட்டு விடுதலை போராட்டமும் தமிழ் இலக்கியமும்,
3. சமுதாய விடுதலையும் தமிழ் இலக்கியமும்,
4. பெண் விடுதலையும் விளிம்பு நிலையினரின் மேம்பாட்டில் தமிழ் இலக்கியமும்,
5. அறிவியல் தமிழ்,
6. இணையத்தில் தமிழ்,
7. சுற்றுச்சூழல் மேம்பாட்டில் தமிழ் இலக்கியம்.

TOTAL: 30 PERIODS

தமிழ் இலக்கிய வெளியீடுகள் / புத்தகங்கள்

1. தமிழ் இணைய கல்விக்கழகம் (Tamil Virtual University)
- www.tamilvu.org
2. தமிழ் விக்கிப்பீடியா (Tamil Wikipedia)
- <https://ta.wikipedia.org>
3. தர்மபுர ஆதின வெளியீடு
4. வாழ்வியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்
5. தமிழ்கலைக் களஞ்சியம்
- தமிழ் வளர்ச்சித் துறை (thamilvalarchithurai.com)
6. அறிவியல் களஞ்சியம்
- தமிழ்ப் பல்கலைக்கழகம், தஞ்சாவூர்

