Syllabus of Courses offered to B.Tech. (Mechatronics) III year

UTTARAKHAND TECHNICAL UNIVERSITY

Program: B. Tech- MECHATRONICS

Scheme and Evaluation Pattern Year: 3, Semester: V

S.No	Course No.	Subject	Periods			Evaluation				Total Marks
			L	T	P	Sessional			External Exam	
						CT	TA	Total		
Semester:5th										
Theory										
1.	TEC-502	Digital Signal Processing	3	1	0	30	20	50	100	150
2.	TMTE-501	Fluid Mechanics & Hydraulic Machines	3	1	0	30	20	50	100	150
3.	TMTE-502	Power Electronics and Drives	3	1	0	30	20	50	100	150
4.	TEC-504	Advanced Microprocessor	3	1	0	30	20	50	100	150
5.	TMTE-503	Robotics & Vision System	2	1	0	15	10	25	50	75
6.	TMTE-504	Sensors and Actuators	2	1	0	15	10	25	50	75
Practical/Design										
1.	PMTE-552	Power Electronics and Drives Lab	0	0	2	0	0	25	25	50
2.	PMTE-553	Sensors & Actuators Lab	0	0	2	0	0	25	25	50
3.	PEC-551	Advanced Microprocessor Lab	0	0	2	0	0	25	25	50
4.		Discipline	0	0	0	0	0	50	0	50
5.		General Proficiency	0	0	0	0	0	50	0	50
Total										**1000**
Semester: VI										
Theory										
S.No	**Course No.**	**Subject**	**Periods**			**Evaluation**				**Total Marks**
			L	**T**	**P**	**Sessional**			**External Exam**	
						CT	**TA**	**Total**		
1.	TMTE-601	Design of Machine Elements	3	1	0	30	20	50	100	150
2.	TMTE-602	Digital System Design Using VHDL	3	1	0	30	20	50	100	150
3.	THU-608	Principles of Management	2	1	0	15	10	25	50	75
4.	TCS-603	Artificial Intelligence	3	1	0	30	20	50	100	150
5.	TMTE-603	Programmable Logic Controllers	2	1	0	15	10	25	50	75
6.	TMTE-604	Hydraulics & Pneumatics Systems	3	1	0	30	20	50	100	150
Practical/Design										
1.	PMTE-651	VHDL Lab/FPGA kit	0	0	2	0	0	25	25	50
2	PMTE-652	PLC Lab	0	0	2	0	0	25	25	50
3.	PMTE-653	Hydraulics & Pneumatics Lab	0	0	2	0	0	25	25	50
4.		Discipline	0	0	0	0	0	50	0	50
5.		General Proficiency	0	0	0	0	0	50	0	50
Total										**1000**

Uttrakhand Technical University

Subject Code: TEC-502 **Course Title:** Digital Signal Processing
Contact Hours: L: 3 T:1 P: 0 **Examination Duration:** 3 Hours

Course Contents:

UNIT I

Discrete Fourier Transform: Frequency Domain Sampling: The Discrete Fourier Transform Frequency Domain Sampling and Reconstruction of Discrete-Time Signals. The Discrete Fourier Transform (DFT). The DFT as a linear Transformation. Relationship of the DFT to Other Transforms. Properties of the DFT: Periodicity, Linearity, and Symmetry Properties. Multiplication of two DFTs and Circular Convolution. Additional DFT Properties. Frequency analysis of signals using the DFT. Introduction to MATLAB. (Coding of Implementation of LTI using DFT)

UNIT II

Efficient Computation of DFT: Efficient Computation of the DFT: FFT Algorithms, Direct Computation of the DFT. Radix-2 FFT algorithms. Efficient computation of the DFT of two real sequences, computations, efficient computation of the DFT of 2N-Point real sequences. (Coding of FFT algorithms)

UNIT III

Filter Structures: Direct form (I & II), LATTICE for FIR & IIR Filters.

UNIT IV

Design of Digital IIR Filters: Impulse invariant and bilinear transformation techniques for Butterworth and chebyshev filters; cascade and parallel. (Coding of Butterworth and chebyshev filters)

Design of Fir Filters:- windowing, optimum approximation of FIR filters, multistage approach to sampling rate concession. Design of Hilbert transforms. (Coding of windowing for
FIR Filters)

UNIT V

Adaptive Wiener Filter and LMS Algorithm: Application of adaptive filtering to echo cancellation and equalization.

Application of DSP and Coding: Audio and Video coding, MPEG coding standardization, DCT, Walsh and Hardmard Coding.

Recommended Books:

1. Proakis, J.G. & Manolakis, D.G., “Digital Signal Processing: Principles Algorithms and Applications”, Prentice Hall (India).
2. Apte, “ Digital Signal Processing”, 2nd Edition, John Wiley (India),2009.
3. Rabiner, L.R. and Gold B., “Theory and applications of DSP”, PHI.
4. Thomas J, Cavichhhi, “Digital Signal Processing”, John Wiley & Sons
5. Roman KUC, Digital Signal Processing, BSP Hyderabad

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Uttrakhand Technical University

Subject Code: TMTE-501 **Course Title:** Fluid Mechanics and Hydraulic Machines
Contact Hours: L: 3 T:1 P: 0 **Examination Duration:** 3 Hours

Unit I

Introduction: Dimensions and units, physical properties of fluids- specific gravity, viscosity, surface tension, vapor pressure and their influence on fluid motion, atmospheric gauge and vacuum pressure, measurement of pressure- Piezometer, Utube and differential manometers.

Fluid statics: Pressure-density-height relationship, pressure on plane and curved surfaces, centre of pressure, buoyancy, stability of immersed and floating bodies, fluid masses subjected to linear acceleration and uniform rotation about an axis.

Unit II

Fluid kinematics: stream line, path line and streak lines and stream tube, classification of flows-steady & unsteady, uniform, non-uniform, laminar, turbulent, rotational, and irrotational flows, equation of continuity for one dimensional and 3D dimensional flow, circulation, stream function and velocity potential, source, sink and doublet.

Fluid dynamics: surface and body forces – Euler's and Bernoulli's equations for flow along a stream line, measurement of flow – pitot tube, venture meter, orifice meter, momentum equation and its application on force on pipe bend.

Unit III

Internal and External Flows: Flow through tubes and plates -Shear stress and velocity distributions, Navier-stokes equations of fluid motion (Explanation only), Reynolds transport theorem, Reynolds experiment - Darcy-Weisbach equation, Minor losses in pipes - pipes in series and pipes in parallel, total energy line, hydraulic gradient line.

Unit IV

Basics of turbo machinery: hydrodynamic force of jets on stationary and moving flat, inclined, and curved vanes, jet striking centrally and at tip, velocity diagrams, work done and efficiency, flow over radial vanes.

Hydraulic Turbines: classification of turbines, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine - working proportions, work done, efficiencies, hydraulic design, draft tube – theory, functions and efficiency.

Unit V

Centrifugal pumps: classification, working, work done, manomertic head, losses and efficiencies, specific speed, pumps in series and parallel-performance characteristic curves, NPSH.

Reciprocating pumps: Components & Principles, Classification, discharge, work done, power requirement.

Recommended Books:

1. Modi P.N. and Seth S.M.: Hydraulics and Fluid Mechanics, Standard Book House
2. R K Bansal: Fluid Mechanics and Hydraulic Machines, Laxmi publications.
3. Pillai N.N. & Ramakrishnan C.R.: Principles of Fluid Mechanics and Fluid Machines, University Press, 2nd edition.
4. Som, S.K. & Biswas G.: Introduction of Fluid Mechanics & Fluid Machines, TMH, 2000, 2nd edition.
5. Ojha C.S.P., Berndtsson R. & Chandramouli P.N.: Fluid Mechanics and Machinery, Oxford University Press.

Uttrakhand Technical University

Subject Code: TMTE-502 **Course Title:** Power Electronics & Drives
Contact Hours: L: 3 T:1 P:0 **Examination Duration:** 3 Hours
Course contents:

Unit I

Power Semiconductor devices: Power semiconductor devices, their symbols and static characteristics, characteristics and specifications of switches, types of power electronic circuits, thyristor operation, V-I characteristics, two transistor model, method of turn on operation of GTO, MCT and TRIAC.

DC-DC Converter: Principle of step down chopper, step down chopper with R-L load, principle of step up chopper and operation with R-L load, classification of choppers.

Unit II

Phase controlled converters: Single phase half wave controlled rectifier with resistive and inductive loads, effect of freewheeling diode, single phase fully controlled and half controlled bridge converters.

Unit III

Fundamentals of Electric Drives: Electric drives and its parts, advantage of electric drives, classification of electric drives, speed-torque conventions and multi-quadrant operations, constant torque and constant power operation, types of load, load torque: components, nature and classification.

Unit IV

Dynamics of motor load combination, steady state stability of electric drive, transient stability of electric drive,

Selection of motor power rating: thermal model of motor for heating and cooling, classes of motor duty, determination of motor power rating for continuous duty, short time duty and intermittent duty, load equalization.

Unit V

Power Electronic Control of DC & AC Drives: Rectifier control of dc series motor, chopper control of separately excited dc motor and dc series motor, special drives switched reluctance motor, brushless dc motor, servo control.

Recommended Books:

1. P.S.Bhimbhra, “Power Electronics”, Khanna Publication
2. Aggarwal. J.P., “Power Electronics”, Pearson Education
3. M.S. Jamil Asghar, “Power Electronics”, Prentice Hall of India Ltd., 2004
4. V. Subrahmanyam, “Electric Drives: concept and applications”, Tata McGraw Hill
5. Gopal k. Dubey, ‘Fundamentals of Electric Drives’, Narosa Publishers, New Delhi

Uttrakhand Technical University

Subject Code: TEC-504 **Course Title:** Advance Microprocessor
Contact Hours: L: 3 T:1 P:0 **Examination Duration:** 3 Hours
Course contents:

UNIT I

8–Bit Microprocessor (8085*): Architecture, addressing modes, Assembly Language Programming.

*** Programming should be covered in Labs**

16-bit Microprocessors (8086*): Architecture, Physical address, segmentation, memory, difference between 8085 & 8086, Assembler Directives.

*** Programming should be covered in Labs**

UNIT II

Data Transfer Schemes: Introduction, Types of transmission, 8257 (DMA), 8255 (PPI), Serial Data transfer (USART) 8251), Keyboard-Display controller (8279), Programmable Priority
Controller (8259), 8253 Timer.

UNIT III

Advance Microprocessors: Introduction to 80186, 80286, 80486, Pentium Microprocessors, Introduction to Dual core, core to Duo.

UNIT IV

8051 Micro Controller- Architecture; I/O ports; memory organization in 8051; timer, serial comm.-Addressing mode; Instruction sets; Assembly Language programming.

UNIT V

Interfacing of 8051 and its Applications: LEDs:, push buttons, latch connection, keyboards, 7-segment display, LCD interfacing. Different waves generation.

Recommended Books:

1. R.S Gaonkar: Microprocessor Architecture, Programming and Applications with 8085/8080, Penram Publication
2. Y.C. Liu and G.A. Gibson: Microcomputer Systems: The 8086/8088 Family Architecture Programming and Design, PHI 2nd Edition

Uttrakhand Technical University

Subject Code: TMTE-503 **Course Title:** Robotics And Vision System
Contact Hours: L: 2 T:1 P: 0 **Examination Duration:** 2 Hours
Course contents:

UNIT I
Basics of Robotics
Introduction- Basic components of robot-Laws of robotics- classification of robot-work spaceaccuracy- resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives

UNIT II
Robot End Effectors
Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper
mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III
Robot Mechanics
Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT IV
Machine Vision Fundamentals
Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

UNIT V
Robot Programming: Robot Languages
Classification of robot language-Computer control and robot software - Val system and Languages- application of robots.

Recommended Books:

1. Sathya Ranjan Deb, robotics Technology & flexible Automation Sixth edition, Tata Mcgraw-Hill Publication, 2003.
2. Gorden M.Dair, Industrial Robotics, PHI 1988.
3. K.S.Fu, R.C.Gonzalez, C.S.G.Lee, Robotics: Sensing, Vision& Intelligence, Tata Mcgraw-Hill Publication, 1987.
4. John.J.Craig, Introduction to Robotics: Mechanics & control, Second edition-2002.
5. M.P.Groover, Industrial robotics- Technology, programming and Applications, McGraw-Hill, 1986

Uttarakhand Technical University

Subject Code: TMTE-504 **Course Title: Sensors and Actuators**

Contact Hours: L: 2 T: 1 P: 0 **Examination Duration: 2 Hours**

Course Contents:

Unit I

Introduction: Basic of electrical/mechanical instruments (push buttons, relays, MCBs, MCCBs, Contactors), basic of transducers/sensors and actuators, Active and Passive transducers, analog/digital output of sensor, static characteristics of transducers and transducers system.

Unit II

Electrical Sensors: Charge, Current, Potential, Electric Field (amplitude, phase), conductivity and permittivity.

Thermal Sensors: Temperature (RTD, thermocouples), Flux, Specific heat, thermal conductivity.

Unit III

Mechanical Sensors: Position (Linear- LVDT, Angular- Encoders), Acceleration, Force, Stress, Pressure, Flow, Strain, Mass, Torque, Analog Instruments (Voltmeters, AC/DC current probes, Wattmeter, Energy meter).

Unit IV

Analog to digital converters (ADC), Digital to analog converters (DAC), Digital Displays, digital counter/timer and frequency meter, digital voltmeter and millimeter, accuracy and resolution consideration, smart sensors.

Unit V

Actuators: Mechanical, Electrical, Pneumatic/Hydraulic, Electromechanical

Recommended Books:

1. Johnson C. D., " Process Control Instrumentation Technology", 8th Edition, Prentice Hall of India Private Limited
2. Cooper W. D. and Helfrick A. D., "Modern Electronic Instrumentation and Measurement Techniques:, Pearson Education.
3. R. K. Jain, 'Mechanical & Industrial Measurement', Khanna Publishers
4. S. S. Kumar, 'Mechanical Measurement & Control', Metropolitan Book Co.
5. Anand Kumar, 'Fundamentals Digital Circuits', PHI

Uttrakhand Technical University

Subject Code: PMTE-552 **Course Title:** Power Electronics & Drives Lab
Contact Hours: L: 0 T: 0 P: 2

List of Experiments:

1. To study V-I characteristics of SCR and measure latching and holding currents.
2. To study UJT trigger circuit for half wave and full wave control.
3. To study single phase half wave controlled rectified with (i) resistive load (ii) inductive load with and without freewheeling diode.
4. To study single phase (i) fully controlled (ii) half controlled bridge rectifiers with resistive and inductive loads.
5. To study single phase ac voltage regulator with resistive and inductive loads.
6. To study speed control of separately excited dc motor by varying armature voltage using single phase fully controlled bridge converter.
7. To study speed control of separately excited dc motor by varying armature voltage using single phase half controlled bridge converter.
8. To study speed control of separately excited dc motor using MOSFET/IGBT chopper.
9. To study closed loop control of separately excited dc motor.
10. To study speed control of single phase induction motor using single phase ac voltage controller.
11. To study speed control of three phase induction motor using three phase ac voltage controller.
12. To study speed control of three phase slip ring induction motor using static rotor resistance control using rectifier and chopper.

Uttarakhand Technical University

Subject Code: PMTE-553 **Course Title: Sensors and Actuators Lab**
Contact Hours: L: 0 T: 0 P: 2
Course Contents:

List of experiments:

1. Measurement of displacement using LVDT.
2. Measurement of displacement using strain gauge based displacement transducer.
3. Measurement of displacement using magnetic pickup.
4. Measurement of load using strain gauge based load cell.
5. Measurement of water level using strain gauge based water level transducer.
6. Measurement of flow rate by anemometer.
7. Measurement of temperature by RTD.
8. Measurement of temperature by thermocouple.
9. Study of P, PI, PID controller.
10. Study of storage oscilloscope and determination of transient response of RLC circuit.

Uttrakhand Technical University

Subject Code: PEC-551 **Course Title:** Advanced Microprocessor Lab
Contact Hours: L: 0 T:0 P:2

List of Experiments:

1. To perform Addition/ Multiplication of two 8 bit numbers
2. To Find the maximum value in an array
3. To perform BCD to Hex conversion & Hex to BCD conversion
4. To Design Counter using timer
5. Programming with 8086 –16-bit, 32 bit multiplication/division
6. Interfacing with 8085/8086/8051 – 8255, 8253
7. Interfacing with 8085/8086/8051 – 8279,8251
8. Stepper motor interfacing, Seven Segment display interfacing using 8051

NOTE: The institution may add 2 more practical in above prescribed list.

Uttrakhand Technical University

Subject Code: TMTE-601 **Course Title:** Design of Machine Elements

Contact Hours: L: 3 T: 1 P:0 **Examination Duration:** 3 Hours

UNIT-I

Introduction, Definition, Methods, standards in design & selection of preferred size;

Selection of materials for static & fatigue loads; Materials for components subjected to creep; BIS system of designation of steels, steels, plastics & rubbers. AISI (American Iron & Steel Institution); ASTM rubber testing methods.

UNIT-II

Design against static load: Modes of failure, Factor of safety, stress-strain relationship, principal stresses, theories of failure. **Design against fluctuating load** stress concentration, stress concentration factors; fluctuating/alternating stresses, fatigue failure, endurance limit, design for finite & infinite life, Soderberg & Goodman criteria.

UNIT-III

Design of Joints: Welded joint, screwed joints, ecentric loading of above joints, Joint design for fatigue loading. **Shaft, keys & coupling**: Design against static and fatigue loads, strength & rigidity design, Selection of square & flat keys & splines; rigid & flexible couplings. **Spur Gears:** Tooth forms, System of gear teeth, contact ratio, Standard proportions of gear systems, Interference in involute gears, Backlash, Selection of gear materials, Gear manufacturing methods, Design considerations, Beam strength of gear tooth, Dynamic tooth load, Wear strength of gear tooth, Failure of gear tooth, Design of spur gears

UNIT-IV

Mechanical springs: Design of Helical and leaf springs, against static & fatigue loading. **Design analysis of Power Screws:** Form of threads, square threads, trapezoidal threads, stresses in screw, design of screw jack.

UNIT-V

Sliding Contact Bearing Types, Selection of bearing, Plain journal bearing, Hydrodynamic journal bearing, Design of journal bearing, Thrust bearing-pivot and collar bearing, Hydrodynamic thrust bearing**.**

Rolling Contact Bearing: Advantages and disadvantages, Types of ball bearing, Thrust ball bearing, Types of roller bearing, Selection of radial ball bearing, Bearing life, Selection of roller bearings, Dynamic equivalent load for roller contact bearing under constant and variable loading,

Recommended Books

1. Mechanical Design Theory and methodology by Waldron, Springer India
2. Machine Design by Juvinall, Wiley India , New Delhi
3. Shigleys Mechanical Engineering Design ,TMH
4. Design of Machine Elements : Bhandari, TMH
5. Machine design : Sharma & Aggarwal, Katsons publications

Uttrakhand Technical University

Subject Code: TMTE-602 **Course Title:** Digital System Design Using VHDL
Contact Hours: L: 3 T: 1 P:0 **Examination Duration:** 3 Hours
Course contents:

UNIT I
Introduction to VHDL: VHDL description, combinational networks, modeling flip-flop using VHDL, VHDL model for multiplexer, compliance and simulation of VHDL, codes, modeling a sequential machine, variables, signals and constants, arrays VHDL operators, VHDL functions, VHDL procedures, packages and libraries, VHDL model for a counter. Attributes, transport and inertial delays, operator over loading, multi valued logic and signal resolution, IEEE-1164, standard logic, generic, generates statements, synthesis of VHDL codes.

UNIT II
Design of Networks for Arithmatic Operations: Design of serial adder with accumulator, state graph for control networks design of binary multiplier, multiplication of signed binary numbers, design of binary divider.
Digital Design With SM Chart: state machine charts, derivation of SM charts, realization of SM charts, implementation of dice game, alternative realization of SM charts using microprogramming.

UNIT III
Floating Point Arithmetic: Representation of floating point numbers, floating point multiplication, and other floating point operations.
Designing with Programmable Gate Arrays and Complex Programmable Logic Devices: Xilinx 3000 series FPGAs, Xilinx 4000 series FPGAs, using one hot state assignment.
UNIT IV
Memory Models for Memories and Buses: Static RAM, a simplified 486 bus model, interfacing memory to microprocessor bus

UNIT V
Design Examples: UART design, description of MC68HC05 microcontroller, design of microcontroller CPU, and complete microcontroller design.

Recommended Books:
1. Charles H Roth Jr, “Digital System Design using VHDL”, Thomson
Learning, 02.
2. Stephen Brown & Zvonko Vranesic, “Fundamentals of digital logic design with VHDL”,
TMH, 2nd Ed., 2007.
3. Jhon F Wakerly, “Digital design”, PHI, 4th Ed.

Uttrakhand Technical University

Subject Code: TMTE-604 **Course Title:** Hydraulics and Pneumatics Systems
Contact Hours: L: 3 T: 1 P:0 **Examination Duration:** 3 Hours

UNIT I

Fluid Power Systems and Fundamentals: Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids, General types of fluids, Fluid power symbols. Basics of Hydraulics, Applications of Pascals Law, Laminar and Turbulent flow, Reynold's number, Darcy's equation, Losses in pipe, valves and fittings.

UNIT II

Hydraulic System & Components: Sources of Hydraulic Power: Pumping theory, Pump classification, Gear pump, Vane Pump, piston pump, construction and working of pumps, pump performance, Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators, Types of hydraulic cylinders, Single acting, Double acting special cylinders like tandem, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators, Fluid motors,
Gear, Vane and Piston motors.

UNIT III

Design of Hydraulic Circuits: Construction of Control Components: Directional control valve, 3/2 way valve, 4/2 way valve, Shuttle valve, check valve, pressure control valve, pressure reducing valve, sequence valve, Flow control valve, Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators, Accumulators circuits, sizing of accumulators, intensifier, Applications of Intensifier, Intensifier circuit.

UNIT IV

Pneumatic Systems and Components: Pneumatic Components, Properties of air, Compressor Filter, Regulator, Lubricator Unit, Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Penumo hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V

Design of Pneumatic Circuits: Servo systems, Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control; fluid power circuits; failure and trouble shooting.

Recommended Books:

1. Esposito A., "Fluid Power with Applications", Pearson Education 2005.
2. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
3. Shanmugasundaram K, "Hydraulic and Pneumatic controls", Chand & Co, 2006.
4. Majumdar S.R., "Pneumatic systems – Principles and maintenance", Tata McGraw Hill, 1995
5. Michael J, Prinches and Ashby J. G, "Power Hydraulics", Prentice Hall, 1989.

Uttrakhand Technical University

Subject Code: TCS-603 **Course Title:** Artificial Intelligence
Contact Hours: L: 3 T: 1 P:0 **Examination Duration:** 3 Hours

UNIT I

Introduction: History of AI, Intelligent agents – Structure of agents and its functions, Problem spaces and search - Heuristic Search techniques – Best-first search, Problem reduction - Constraint satisfaction - Means Ends Analysis.

UNIT II

Knowledge Representation: Approaches and issues in knowledge representation, Knowledge Based Agent, Propositional Logic, Predicate logic – Unification – Resolution, Weak slot – filler structure, Strong slot - filler structure.

UNIT III

Reasoning under uncertainty: Logics of non-monotonic reasoning, Implementation, Basic probability notation, Bayes rule, Certainty factors and rule based systems, Bayesian networks, Dempster - Shafer Theory, Fuzzy Logic.

UNIT IV

Planning and Learning: Planning with state space search, conditional planning, continuous planning, Multi-Agent planning. Forms of learning - inductive learning – Reinforcement Learning - learning decision trees - Neural Net learning and Genetic learning

UNIT V

Advanced Topics: Game Playing: Minimax search procedure - Adding alpha-beta cutoffs. **Expert System:** Representation - Expert System shells - Knowledge Acquisition. **Swarm Intelligent Systems** – Ant Colony System, Development, Application and Working of Ant Colony System.

Recommended Books:

1. Elaine Rich, Kevin Knight and Shivashankar B.Nair, “Artificial Intelligence”, Tata McGraw-Hill, Third edition, 2009. (UNITs I, II, III & V)
2. Stuart J. Russell and Peter Norvig, "Artificial Intelligence: A Modern Approach", Pearson Education Asia, Second edition, 2003. (UNIT IV)
3. N. P. Padhy, “Artificial Intelligence and Intelligent System”, Oxford University Press, Second edition, 2005. (UNIT V)
4. Rajendra Akerkar, “Introduction to Artificial Intelligence”, Prentice-Hall of India, 2005.
5. Patrick Henry Winston, “Artificial Intelligence”, Pearson Education Inc., Third edition, 2001.
6. Eugene Charniak and Drew Mc Dermott, “Introduction to Artificial Intelligence", Addison-Wesley, ISE Reprint, 1998.
7. Nils J.Nilsson, “Artificial Intelligence - A New Synthesis", Harcourt Asia Pvt. Ltd., Morgan Kaufmann, 1988.

Uttrakhand Technical University

Subject Code: TMTE-603 **Course Title:** Programmable Logic Controllers
Contact Hours: L: 2 T: 1 P:0 **Examination Duration:** 2 Hours

Unit I

Introduction to Programmable logic controllers: Logic Controllers, Hardware of PLC, Internal architecture, PLC systems

Input/output Processing: Input/output units , Signal conditioning, Remote connections, Networks, Processing inputs, I/O addresses

Unit II

Ladder & Functional Block Programming and Internal Relays: Ladder diagrams, Logic functions, Latching, Multiple outputs, Entering programs, Function blocks, Program examples **IL, SFC and ST programming methods:** Instruction lists, Sequential function charts, Structured text, Program examples

Unit III

Jump and call , Timers and Counters: Jump Instructions, Subroutines, Types of timers, Programming timers, On-delay timers, Off-delay timers, Pulse timers, Retentive on delay times, Forms of counter, Programming Up and down counting, Timers with counters, Sequencer, Programming examples

Shift registers and Data handling: Shift registers, Ladder programs, Registers and bits, Data handling, Arithmetic functions, Closed loop control, Programming examples

Unit IV

Designing systems: Program development, Safe systems, commissioning, Fault finding, System documentation

Industrial Programs: Temperature control, Valve sequencing, Conveyor belt control, Control of a process

Recommended Books:

1. W. Bolton , “Programmable Logic Controllers”, 4th Edition by, Newnes/ ELSEVIER Publication.
2. Jhon W Webb, Ronald A Reis, “Programmable Logic Controllers, Principles and Applicaiotns” Prentice Hall of India Pvt. Ltd.
3. John R. Hackworth, Frederick D., Hackworth Jr., “Programmable Logic Controllers Programming Methods and Applications”
4. LOGO Manual and S7-300 Manual of Siemens for Instructions
5. Bob Fendler, Carey W. Ripple, Anthony F. Lexa, ‘Programmable Logic Controllers’, Schoolcraft Publishing 1992.

Uttrakhand Technical University

Subject Code: THU-608 **Course Title:** Principles of Management
Contact Hours: L: 2 T: 1 P:0 **Examination Duration:** 2 Hours

UNIT I

Introduction To Management: Theories of management: Traditional behavioral, contingency and systems approach. Organization as a system.

UNIT II

Management Information: Interaction with external environment. Managerial decision making and MIS.

UNIT III

Planning Approach To Organizational Analysis: design of organization structure; job design and enrichment; job evaluation and merit rating.

UNIT IV

Motivation And Productivity: Theories of motivation, leadership styles and managerial grid. Co-ordination, monitoring and control in organizations. Techniques of control. Japanese management techniques.
Minor Project: submission of 15 pages of Case studies on above.

Recommended Books:

1. Peter Drucker, Harper and Row: The Practice of Management.
2. Schemerhorn" introduction to Management" 10th edition, John Wiley (India).
3. Staner: Management, PHI Learning
4. Daft: Principles of Management, Cengage Learning

Uttrakhand Technical University

Subject Code: PMTE-651 **Course Title:** VHDL Lab/FPGA kit
Contact Hours: L: 0 T: 0 P: 2

List of Experiments:

1. Design of following ckt using appropriate software like VHDL/ FPGA and OFC kits.
2. 3-input NAND gate.
3. Half adder, Full Adder
4. D-Latch, T Flip Flop
5. Serial in-serial out shift register, Bidirectional shift Register
6. 3 Bit synchronous counter
7. To set up Fiber Optic Analog link.
8. To set up fiber Optic Digital link.
9. Measurement of Propagation loss and numerical aperture.

Uttrakhand Technical University

Subject Code: PMTE-652 **Course Title:** PLC Lab
Contact Hours: L: 0 T: 0 P:2

List of Experiments:

1. Tank level control by using PLC.
2. To control Conveyor belt operation using PLC.
3. Traffic light control using PLC.
4. DOL starter & star delta starter operation by using PLC.
5. Lift Control simulation using PLC.
6. Process control in paint industry using PLC.
7. To control the operation of drill machine using PLC.
8. Alarm annunciation using PLC.
9. To control the operation two conveyor belt using PLC.
10. Analog input/output simulation using PLC.

Uttrakhand Technical University

Subject Code: PMTE-653 **Course Title:** Hydraulics and Pneumatics Lab
Contact Hours: L: 0 T:0 P:2

List of Experiments:

1. Graphical Symbol as per DIN-ISO: 1219
2. To understand working and construction of hydraulic components and basic circuits with using of Basic Hydraulic Software by Bosch web trainer.
3. To understand working and construction of pneumatic components and basic circuits with using of Basic Pneumatic Software by Bosch web trainer.
4. To control Double acting pneumatic cylinder through 5/2 D.C. Valve
5. To control Double acting pneumatic cylinder by 3/2 push button valves and Shuttle valve
6. To understand use of Logic element 'OR' gate and 'AND' gate
7. To understand use of Quick Exhaust & Flow control valve.
8. To illustrate the use of Time Delay valve with 'OR' gate and 'AND' gate
9. To illustrate pneumatic circuit involving two cylinders.
10. Speed control of Hydraulic cylinder through Throttle valve.
11. Speed control of Hydraulic cylinder through The Flow control valve in Bypass.
12. Flow control valve in Meter-in & Meter-out circuits.
13. Electro Hydraulic circuit –Speed and Pressure control of double acting cylinder
14. Electro Hydraulic circuit—Sequential operation of double acting cylinder through Limit switches.
15. To control double acting cylinder through 5/2 solenoid operated D.C. valve and PLC controller.
16. To control double acting cylinder through 5/2 solenoid operated D.C. valve and PLC controller

Out of the above list, the institute may decide any ten experiments.