Bachelor of Technology [Mechanical & Mechatronics Engineering (Additive Manufacturing)]
KUK Credit-Based (2025-26 Onwards)
SCHEME OF STUDIES/EXAMINATIONS (Semester-IV)

S. No	Course No./Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B24-ESC-202	Mechatronics	3:0:0	3	3	70	30	--	100	3
2	B24-MMAC-202	Fluid Mechanics and Machines	4:1:0	5	5	70	30	--	100	3
3	B24-MMAC-204	Pneumatic and Hydraulic Systems	3:0:0	3	3	70	30	--	100	3
4	B24-MMAC-206	Programmable Logic Controller	3:0:0	3	3	70	30	--	100	3
5	B24-MMAC-208	Manufacturing Technology	3:0:0	3	3	70	30	--	100	3
6	B24-HSM-202	Innovation, Start-up and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
7	B24-ESC-204	Mechatronics Lab	0:0:2	2	1	--	40	60	100	3
8	B24-MMAC-210	Fluid Mechanics and Machines Lab	0:0:2	2	1	--	40	60	100	3
9	B24-MMAC-212	Pneumatic and Hydraulic Systems Lab	0:0:2	2	1	--	40	60	100	3
10	B24-MMAC-214	Programmable Logic Controller Lab	0:0:2	2	1	--	40	60	100	3
11	B24-MAC-202	Essence of Indian Traditional Knowledge	3:0:0	3	1	--	100	--	100	3
Total				**31**	**25**	**420**	**440**	**240**	**1100**	

Note:

- **All students have to undertake the industrial training for 4 to 6weeks after 4th semester which will be evaluated in 5thsemester.**

B24-ESC-202	Mechatronics						
L	**T**	**P**	**Credit**	**EndSemester Exam**	**Internal Assessment**	**Total**	**ExamTime**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

CourseOutcomes	
CO 1	Students will be able to understand Mechatronics systems and their applications. The students will be able to understand different sensors.
CO 2	Students will be able to understand various types of actuator.
CO 3	Students will be able to understandtransducers, and digital principles of number system, gates and Booleanalgebra
CO 4	Students will be able to understand the architecture of microprocessor and microcontroller

Unit-I

Introduction: Definition of mechatronics, Evolution of mechatronics, scope of mechatronics, components of a mechatronic system, mechatronics design approach, Examples of mechatronic systems, Advantages and disadvantages of mechatronics engineering ,Role of various disciplines in mechatronics, Applications of mechatronics.

Sensors: Introduction, Proximity sensors: eddy current proximity sensors, capacitive proximity sensor, inductive proximity switch, pneumatic sensors, light sensors: photodiodes, phototransistors, photoresistor, Digital Optical Encoders, selection of sensors.

Unit-II

Actuators: Introduction, Electrical actuators: DC Motors- PMDC motor, Stepper Motor, AC Motors: Single phase induction motor: Construction & working, application & disadvantages Three Phase Induction Motor: Construction & operation. Hydraulic Actuators: General aspects, Hydraulic power supply, linear actuators: cylinder types, single and double acting, telescoping cylinders, rotary actuators: hydraulic motors, gear motor, vane motor, piston motor. Pneumatic actuators: components of pneumatic system, Linear actuators: pneumatic cylinders, Rotary actuators: air motors.

Unit-III

Transduces: Classification of transducers, Resistance transducers: linear and angular potentiometers, Variable inductance transducers: self-generating type, passive type (LVDT), capacitive transducers: capacitive tachometer, piezoelectric transducer: Piezoelectric accelerometer. Photoelectric transducers: photo emissive cell, photovoltaic cell, photoconductive cell, photoelectric tachometer.

Unit-IV

Microprocessors: Introduction, Microprocessor based digital control, Microprocessor architecture, Terminology, Instruction types, Addressing modes, Intel's8085A microprocessor.

Microcontrollers: Introduction, Difference between microprocessor and microcontroller, General requirements for control and their implementation in microcontrollers, Classifications, Introduction of Intel 8051 microcontroller.

Text books:

1. A Textbook of Mechatronics- R. K Rajput, S. Chand & Company, 4th Edition 2016
2. Mechatronics, W. Bolton – Pearson Education Asia – 6th Reprint Edition, 2015.

Reference books:

1. Mechatronics Principles, Concepts and Application-Nitaigour and Premchand, Mahilik – Tata McGraw Hill – 2003
2. MECHATRONICS A Foundation Course- Clarence W. de Silva-CRC Press, Taylor & Francis Group-2010.
3. Mechatronic Systems Fundamentals-Rolf Isermann, Springer-2005.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MMAC-202	Fluid Mechanicsand Machines						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**ExamTime**
4	**1**	**0**	**5**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	By the end of this course,students will understand the fundamental concepts of fluid properties.
CO 2	To grasp the fundamental concepts of fluid kinematics and dynamics.
CO 3	Students will be capable of estimating major and minor losses in pipes.
CO 4	Students will be able to explore dimensional analysis methods and performance evaluation of pumps and turbines.

UNIT-I

Fluid Properties: Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, weight density, specific volume, specific gravity, viscosity, compressibility, surface tension and capillarity.

Fluid Kinematics and Fluid Dynamics: Types of fluid flows, stream, streak and path lines; flow rate and continuity equation, Euler's equation, Navier-Stokes equation, Bernoulli's equation and its practical applications (venturimeter, orificemeter and pitot tube),Problems.

UNIT-II

Viscous and Turbulent Flow: Flow of viscous fluid through circular conduits, methods of determination of coefficient of viscosity (capillary tube method, falling sphere resistance method and orifice type viscometer),Darcy Weisbach equation, friction factor, minor energy losses in pipes, flow through series and parallel connection of pipes, branched pipes, Problems.

Dimensional Analysis: Dimensional homogeneity, methods of dimensional analysis, type of forces acting in moving fluid, dimensionless numbers and its applications, Problems.

UNIT-III

Hydraulic Pumps: Centrifugal pumps, working principle, main parts of a centrifugal pump, workdone by the centrifugal pump on water, heads and efficiencies of a centrifugal pump, minimum speed for starting a centrifugal pump, priming, cavitation in pumps, Reciprocating pumps, working principle, main parts of a reciprocating pump, discharge, workdone and power required to drive a single and double acting pump, slip of reciprocating pump, Problems.

UNIT-IV

Hydraulic Turbines: Introduction, heads and efficiencies, Classification of hydraulic turbines, velocity triangles and workdone for Pelton wheel, Francis turbine and Kaplan turbines, draft tube and types, Specific speed, unit quantities, performance curves for turbines, governing of turbines. Problems.

Text Books:

1. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
2. Fluid Mechanics – Frank M. White, McGraw Hill.
3. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons.
4. Fluid Mechanics and Hydraulic Machines – R.K. Bansal, Laxmi Publications (P) Ltd.
5. Fluid Mechanics – Streeter V L and Wylie E B, McGraw Hill.
6. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.

Reference Books:

1. Mechanics of Fluids – I H Shames, McGraw Hill.
2. Fluid Mechanics: Fundamentals and Applications - YunusCengel and John Cimbala, McGraw Hill.
3. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MMAC-204	Pneumatic and Hydraulic Systems						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Exam Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	Students will develop the knowledge of hydraulic systems & components.
CO 2	Students will develop the knowledge of the pneumatic system and its components.
CO 3	Students will develop the knowledge of hydraulic and pneumatic circuits.
CO 4	Students will develop the knowledge of failure troubleshooting and maintenance of hydraulic & pneumatic systems.

UNIT-I

Hydraulic Systems and its Components : Introduction, Principal, Pascal's Law, Pressure Drop, Viscosity, Pumps: Pumping Theory, Pump Classification, Hydrodynamic pumps, Hydrostatic pumps, Gear Pump, Vane Pump, Piston Pumps, Actuators: Cylinders, types of cylinders, Motors

Direction control valve (DCV): Poppet valve, spool valve, sliding spool valve, check valve & its types, two-way valves, four-way valves, Pilot operated DCV, Flow control valves, flow control methods: Meter-in, Meter-out, Bleed-off, Accumulator, pressure switches, pressure gauges, flow meter, manifolds, pressure intensifier, Hydraulic symbols.

UNIT-II

Pneumatic Systems and its Components: Introduction, Boyle's Law, Pneumatic symbols, Components: Air preparation, compressor, Reservoir/air receiver, Inlet filters, Inter coolers, After coolers, safety relief valve, Pressure switches, Air dryers, Air distribution, Sizing pipe system, flow resistances, pipe material, piping layout, types of layout: Dead end, Loop, Decentralized; service unit, air filters, standard filters, coalescing filters, vapor absorbing filters, air regulator, air lubricator (FRL), actuator and output devices, single and double acting cylinders, cylinders with end position cushioning, tandem double acting cylinder, double rod cylinder, multi-position cylinder, motors, Direction control valves: poppet valves, slides valves, 2/2-way, 3/2-way valves, check valves, air consumption.

UNIT-III

Hydraulic Circuits & Pneumatic Circuits: Hydraulic Circuits: Single acting cylinder circuit, double acting cylinder circuit, pump unloading circuit, regenerative circuit, Accumulator circuit

Pneumatic circuits: Control of single acting cylinder, manual controlled double acting cylinder, air pilot control of double acting actuator, two step speed control of a cylinder, Two handed safety circuit.

UNIT-IV

Maintenance, failure & troubleshooting in fluid power system: Introduction, Troubleshooting-oil hydraulics, troubleshooting-pneumatics, maintenance of pneumatic system and hydraulic system: maintenance schedule, operation task, periodic maintenance, annual maintenance, Trouble, possible causes and remedies of hydraulic system: Hydraulic motor, hydraulic cylinder, accumulator. Trouble, possible causes and remedies of pneumatic system: Compressor, FRL unit, Regulator, lubricator, Installation of pneumatic system: FRL units, pneumatic cylinder, compressor, piping.

Suggested Books:

1. Hydraulic & Pneumatic Controls, K ShanmugaSundaram, S Chand, 2012.
2. Introduction to Hydraulics and Pneumatics, S Ilango, V. Soundarajan, PHI 2013.
3. Pneumatic & Hydraulic, Andrew Parr PHI, 1999.

Reference Books:

1. Industrial Hydraulics, McGraw, John Pippenger, Tyler Hicks, Hill International Edition, 1980.
2. Esposito A., "Fluid Power with Applications", Pearson Education 2005.
3. Michael J, Principles and Ashby J.G, "Power Hydraulics", Prentice Hall, 1989.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MMAC-206	Programmable Logic Controller						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Exam Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	Students will have the knowledge of PLC, its elements, types and operations.
CO 2	Students will have the knowledge of input output devices and their applications.
CO 3	Students will develop the ability to develop logic gate circuits using Boolean algebra.
CO 4	Students will develop the ability to develop the ladder diagram program.

UNIT-I

Introduction: Introduction to PLCS, History of PLC, Elements (components) of a PLC, Advantages and disadvantages of PLC, Programming languages for PLC, Rules for ladder diagram, Functions of PLC, PLC types, PLCS normal operation, Definitions of commonly used terms for PLC, Comparison between computer and PLC, Characteristic of PLC, Comparison between PICO, NANO, MICRO and MINI PLC, Comparison between small, medium and large PLC, Role of PLC in automation, types of PLC system.

UNIT-II

Input-Output Devices: Input devices, Mechanical switches, Proximity switches, Photoelectric sensors and switches, Encoders, Temperature sensors, Position/displacement sensors, Strain gauges, Pressure sensors, Liquid level detector, Fluid flow measurement, Smart sensors. Output devices: Relay, Directional control valves, Motors, Stepper motors, Examples of applications: conveyor belt, lift, robot control system, Liquid level monitoring.

UNIT-III

Number Systems & Fundamentals of Logic: Decimal System, Binary System, Negative Numbers, Octal System, Hexadecimal System, Binary Coded Decimal (BCD) System, Binary concept, AND, OR, NOT, Exclusive-OR (XOR)functions, Boolean algebra, Developing logic gate circuits from Boolean expressions, Producing the Boolean equation for a given logic gate circuit.

UNIT-IV

Ladder Diagram Programming: Introduction, Ladder logic programming, Rung in a ladder logic program,Program execution sequence in ladder logic,Rungcondition,Role of instructions in ladder diagram programming,Ladder diagram programs,Ladder diagram programs based on basic instructions, Ladder diagram program for realizing various Boolean functions (NOT, AND, OR, NOR, NAND, EX-OR).

Text Books:

1. Programmable Logic Controller and Microcontrollers,UmeshRathore, VedPrakashVerma, S K Kataria and Sons.

2. Programmable Logic Controller, Vijay R. Jadhav, Khanna Publisher

Reference Books:

1. Programmable Logic Controllers, W. Bolton, Newnes (an imprint of Butterworth-Heinemann Ltd); 6th edition, 2015
2. Programmable Logic Controllers, Frank D. Petruzella, 5th Edition, McGraw Hill Publication.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-MMAC-208	Manufacturing Technology						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Exam Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	Develop the knowledge of the concept of plant layout, casting and moulding processes.
CO 2	Develop the knowledge of metal forming and plastic processes.
CO 3	Develop the knowledge of different welding processes.
CO 4	Develop the knowledge of various machining processes.

UNIT-I

Plant Layout & manufacturing concept: Factors in plant layout, Principles and Objectives of plant layout, Types of plant layout, Comparison of different layouts, Manufacturing-Product Design and Concurrent Engineering-Sustainable Manufacturing.

Casting Processes: Metal casting–Patterns, Pattern material, Types of pattern, Pattern allowances, colour coding for patterns, Moulding, Mould materials, Moulding sand constituents, Types of mould, Moulding methods, Core types, Core making, Core chaplets, Melting equipment, Casting processes classification, permanent mould and die casting, Centrifugal casting, Investment casting, Continuous casting, Defects in castings.

UNIT-II

Metal forming processes: Hot working, Hot working processes, Hot rolling, Hot forging, Hot spinning, Hot extrusion, Hot drawing, Cold working, Cold working processes, Cold rolling, Cold forging, Cold spinning, Cold extrusion, Cold bending, Cold drawing.

Plastic Processing: Compression molding-Transfer molding-Injection molding, Blow molding–Extrusion-Thermoforming.

UNIT-III

Welding Processes: Welding classification, Oxy acetylene gas welding, Air acetylene gas welding, Electric Arc Welding principle, Polarity, Carbon arc welding, Flux shielded metal arc welding, TIG, MIG, Resistance welding principle, Spot and Seam welding, Friction welding, Explosion welding, Ultrasonic welding, Thermit welding, Laser Beam and Electron beam welding, Welding defects.

UNIT-IV

Machining Processes: Cutting tools, Cutting forces, Mechanism of chip formation, Lathe, Types of lathe, Principal parts of lathe, Lathe operations, Drilling, Types of drilling, Parts of drilling machine, Drilling operations, Shaper, Parts of shaper, Classification, Crank and slotted quick return mechanism principal, Planer and its types, Parts of planer Slotter, parts of slotter, Types of slotter, Milling, Principal parts of milling machine, Up and Down milling, Milling operations, Grinding, Types of grinding machine, Grinding wheel, Wheel shapes, Wheel truing.

Text Books:

1. Comprehensive Workshop Technology (Manufacturing Processes), S. K. Garg, Laxmi Publications (P) Ltd.
2. Manufacturing Technology (Volume 2) Foundry, ForgingandWelding,P.N.Rao,4th Edition, Tata McGraw Hill Education, New Delhi.
3. A Textbook of Manufacturing Technology: Manufacturing Processes, R. K Rajput, Laxmi Publications (P) Ltd.
4. Manufacturing Engineering and Technology, SeropeKalpakjian; Steven R. Schmid, 6th Edition, Publisher: Prentice Hall.

Reference Books:

1. Manufacturing Processes, H. N. Gupta, New Age Publishers, 2012.
2. Fundamentals of Modern Manufacturing Materials, Processes and Systems, Mikell P. Groover, Wiley India, 2012.

Note: The paper setter will set the paper as per the question paper templates provided.

B24-HSM-202	Innovation, Start-up and Entrepreneurship						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Exam Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	Student will be able to understand and explain the concepts of Entrepreneurship
CO 2	Students will be able to understand the role of and importance of innovation in entrepreneurship and startups.
CO 3	Student will be able to understanding concept of start-ups, market analysis and creating the business models.
CO 4	Student will be able to understand the significance of Intellectual Property rights, Fundraising Strategies and risk analysis

Unit -I

Concepts of Entrepreneurship: Scope of Entrepreneurship, Definitions of Entrepreneurship and Entrepreneur, Characteristics of an Entrepreneur, Entrepreneurial Development models and Theories, Entrepreneurs Vs Managers Classification of Entrepreneurs; Major types of Entrepreneurship – Techno Entrepreneurship, Women Entrepreneurship, Social Entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Rural Entrepreneurship, Family Business etc.; Problems for Small Scale Enterprises and Industrial Sickness; Entrepreneurial Trait Tests; Entrepreneurial Environment – Political, Legal, Technological, Natural, Economic, Socio – Cultural etc. ; Motivation; Business Opportunity Identification.

Unit -II

Innovation: Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation, Issues and Challenges in Commercialization of Technology Innovations.

Unit -III

Startups: Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit -IV

Fundraising, Investment and Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowd funding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work.

Books Recommended:

1. Design the Future: Simplifying Design Thinking to Help You, Shrutin N Shetty, Notion Press, 2018
2. Entrepreneurship Development Small Business Enterprises, Poornima M Charantimath, Pearson, 2013.
3. Entrepreneurship, Roy Rajiv, Oxford University Press, 2011.
4. Innovation and Entrepreneurship, Peter F Drucker, Harper Business, 2006.
5. Dynamics of Entrepreneurship Development – Vasant Desai.
6. Entrepreneurship Development and small business management – Poornima M. Charantimath
7. Dynamics of Entrepreneurship Development – Vasant Desai.
8. Innovation and Entrepreneurship – Peter F. Drucker
9. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016.
10. Vijay Sathe, Corporate Entrepreneurship, Cambridge, 2009
11. Alexander Osterwalder and Yves Pigneur, Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, John Wiley & Sons, Jul2010.
12. Peter Thiel and Blake Masters, Zero to One: Notes on Startups, or How to Build the Future, Virgin Books, 2015.
13. Alejandro Cremades, The Art of Startup Fundraising: Pitching Investors, Negotiating the Deal, and Everything Else Entrepreneurs Need to Know" by, John Wiley & Sons, Inc., Hoboken, New Jersey, 2016.
14. Christensen, Clayton M. The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail. Boston, MA: Harvard Business School Press, 1997.
15. Brad Feld and Jason Mendelson, Venture Deals: Be Smarter Than Your Lawyer and Venture
16. Capitalist, Wiley; 4th edition, 1 October 2019.

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B24-ESC-204	Mechatronics Lab						
L	**T**	**P**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Exam Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**

Course Outcomes	
CO1	Students will get familiar with components of Mechatronics systems.
CO2	Students will develop the ability to perform operations on Pneumatic and Hydraulic training kit.
CO3	Students will be able to perform operations using 8085 microprocessor.
CO4	Students will be able to perform operations using 8051 microcontroller.

LIST OF EXPERIMENTS

1. To study and demonstration of Mechatronics system components
2. To perform an experiment on a hydraulic trainer kit.
3. To perform an experiment on a pneumatic trainer kit.
4. To study various types of sensors and transducers.
5. Study and Demonstration of Actuators.
6. To understand working principle of LVDT.
7. Measurement temperature of the temperature transducer (RTD) and verify the performance with output voltage.
8. To perform the 8-bit addition and subtraction using 8085 Microprocessor.
9. To perform 1's and 2's complement of 8 bit number using 8085 Microprocessor.
10. To control a traffic light system using 8051 Microcontroller.
11. Stepper motor interface with 8051– Microcontroller.

Note: At least 9 experiments to be performed during the semester.

B24-MMAC-210	Fluid Mechanics and Machines Lab						
L	**T**	**P**	**Credit**	**Internal Assessment**	**Practical**	**Total**	**ExamTime**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**

CourseOutcomes	
CO1	Handle and operate equipment and instrumentation for fluid flow.
CO2	Collect and analyze data by applying fluid mechanics principles and experimental techniques.
CO3	Calculate the discharge coefficient for different flow measurement devices and hydraulic turbine performance evaluation.
CO4	Compute flow characteristics, including Reynolds number and friction factor, from laboratory measurements and hydraulic pumps and hydraulic ram.

LIST OF EXPERIMENTS

1. To verify the Bernoulli's Theorem experimentally.
2. To calculate flow of fluid using orifice meter. Find out coefficient of discharge for the given orifice meter.
3. To determine the coefficient of discharge of Notch (V or Rectangular type).
4. To determine the coefficient of discharge of Venturimeter.
5. To find critical Reynolds number for a pipe flow.
6. To determine the friction factor for the pipes.
7. Determination of the performance characteristics of Pelton Wheel.
8. Determination of the performance characteristics of a Francis Turbine.
9. Determination of the performance characteristics of a Kaplan turbine.
10. Determination of the performance characteristics of a Centrifugal Pump.
11. Determination of the performance characteristics of a Reciprocating Pump.
12. Determination of the performance characteristics of a Gear Pump.
13. Determination of the performance characteristics of a Hydraulic Ram.

Note: At least 9 experiments to be performed during the semester.

B24-MMAC-212	Pneumatic and Hydraulic Systems Lab						
L	**T**	**P**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**ExamTime**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**

Course Outcomes	
CO1	Student will become familiar with symbolic representation of hydraulic and pneumatics.
CO2	Student will understand the working of hydraulic and pneumatic circuits
CO3	Student will develop the ability to perform control operations on hydraulic system.
CO4	Student will develop the ability to perform control operations on pneumatic system.

LIST OF EXPERIMENTS

1. Study of graphical symbol for hydraulic and pneumatic.
2. To understand working and construction of hydraulic components and basic circuits.
3. To understand working and construction of pneumatic components and basic circuits.
4. To study Different types of actuators in Hydraulic and Pneumatics.
5. Control of Single Acting Cylinder on hydraulic trainer kit.
6. Control of double acting cylinder on hydraulic trainer kit.
7. Control of Single Acting Cylinder on pneumatic trainer kit.
8. Control of double acting cylinder on pneumatic trainer kit.
9. To study of speed control circuit on hydraulic trainer
10. Study of synchronizing circuit on hydraulic trainer
11. To study single acting and double acting pneumatic cylinder uses D.C. Valve.
12. To study pressure sequence valve and time delay valve in pneumatic circuit.

Note: At least 9 experiments to be performed during the semester.

B24-MMAC-214	Programmable Logic Controller Lab						
L	**T**	**P**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Exam Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hrs.**
Course Outcomes							
CO1	Student will become familiar with PLC interface modules.						
CO2	Ability to understand logic gate functions and mathematical operations in PLC.						
CO3	Ability to develop control operations using PLC.						
CO4	Ability to implement ladder diagrams for process control.						

LIST OF EXPERIMENTS

1. Study of PLC field device interface modules.
2. Programming Logic Gates Function in PLC
3. Implementing mathematical operations in PLC
4. PLC Exercises:- 1. Traffic Light Control and Filling/Draining Control Operation
5. PLC Exercise: 1. Reversal of DC Motor Direction 2. ON/OFF Controller for Thermal Process.
6. To design a Water Level Controller using PLC.
7. Automatic bottle filling machine using PLC.
8. Identify Different types of LADDER LOGIC.
9. Develop ladder programming for a given statement - To on the bulb1 after 5sec of switch1 on. Turn the bulb2 on after the 5 sec of bulb1 on and test.
10. Develop ladder programming for a given statement -To on the bulb after 5sec of switch off. Turn the bulb2 off after the 5 sec of bulb1 on and test.
11. Develop ladder programming for a given statement - To on or off the motor via one switch and test.
12. Design a ladder to operate bottler filling plan and test.

Note: At least 9 experiments to be performed during the semester.

B24-MAC-202	Essence of Indian Traditional Knowledge						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**ExamTime**
3	**0**	**0**	**1**	**---**	**100**	**100**	**3 Hrs.**

Course Outcomes	
CO 1	The students will be able to grasp, relate, and explain Indian traditional knowledge from a modern scientific perspective.
CO 2	The students will develop the understanding to holistic health through the Indian Knowledge System.
CO 3	The students will learn to manage thoughts and emotions, fostering positivity, self-regulation, and control
CO 4	The students will attain consciousness through the Indian Knowledge System.

UNIT-I

Introduction to Indian Traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, Indigenous Knowledge and its characteristics, Traditional Knowledge vis-à-vis Indigenous Knowledge, Traditional Knowledge vis-a-vis Western Knowledge.Philosophical systems, Basics of Rajyoga and Karamyoga, Benefits of Raj yoga and Karamyoga.

UNIT-II

Holistic Health using Indian Knowledge System: Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras.Physical, Mental, Emotional and Spiritual health using traditional knowledge.

UNIT-III

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem.Managing thoughts and Emotions with the help of Rajyoga.Achieving Powers for Self Mastery.

UNIT-IV

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well being.

Suggested Books:

1. Mahadevan, M., Bhat, V.R. &Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning
2. Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.

3. Cornelissen, R.M., Misra G. &Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.
4. Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation. Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.
5. PrakartikSwasthyaShastra, Publisher Natural Lifestyle

Note: The paper setter will set the paper as per the question paper templates provided.