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**Question Paper Code: U5103**

M.E. DEGREE EXAMINATION, DEC 2025

Professional Elective

CAD/CAM

21PCD503 – DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS

(Regulations 2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART - A (5 x 20 = 100 Marks)

1. (a) Select a suitable hydraulic pump for an industrial milling machine requiring 150 bar operating pressure and 30 L/min flow. Specify the pump type, displacement, materials, and justify your selection based on the machine's duty cycle. CO4-App (20)

Or

- (b) Apply the understanding of actuator properties (stiffness, hysteresis, leakage, and pressure variation) to choose a suitable actuator for an industrial automation application and explain your choice. CO4-App (20)

2. (a) Analyse the functional differences and performance implications of direct-acting vs. pilot-operated relief valves in high-pressure industrial hydraulic systems. Include the impact on dynamic response, stability, and energy efficiency. CO6-Ana (20)

Or

- (b) Modern hydraulic systems increasingly use microprocessor-based control methods. Analyse how control system classification (continuous, discrete, feedback, adaptive) influences the performance, robustness, and fault tolerance of such systems in industrial automation. CO6-Ana (20)

3. (a) Design a hydraulic reciprocating circuit for an industrial forging application. Explain component selection, valve arrangement, cylinder control strategy, and how smooth forward return motion is achieved under varying load conditions. CO5-App (20)

Or

- (b) Develop a complete hydraulic circuit for a hydraulic milling machine incorporating feed control, table movement, and automatic reversal. Apply design principles to select pumps, valves, actuators, and safety components suitable for precision machining applications. CO5-App (20)
4. (a) Apply the functions of pneumatic control elements directional valves, pressure sensors, and flow regulators to explain how they influence the speed, accuracy, and safe operation of a pneumatic cylinder. Give suitable examples. CO5-App (20)
- Or
- (b) Apply the cascade, mapping, and step-counter methods to design multi-step pneumatic sequences. Explain how each method works and show where it can be used in industry. CO5-App (20)
5. (a) Design a ladder diagram to control a pneumatic cylinder using a timer for delayed retraction. Explain how relays, timer contacts, and solenoid valves work together to achieve the required sequence. CO5-App (20)
- Or
- (b) Design a low-cost pneumatic automation system for packing small items. Explain the required cylinders, sensors, valves, and how a simple PLC or microcontroller can control the sequence. CO5-App (20)