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Question Paper Code : 12342

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2026.

Fourth Semester

Mechanical Engineering

ME3492 — HYDRAULICS AND PNEUMATICS

(Common to: Mechanical Engineering (Sandwich)/Mechanical Engineering
(Specialised in Automobile)/Mechanical Engineering (Specialised in Smart
Manufacturing)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

(Use of Standard Design Data Book is Permitted)

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. In a hydraulic jack, a 300 N force is applied to a 10 cm² small piston, which is connected to a 50 cm² larger piston. Find the output force on the larger piston.
2. List any two industrial applications where pneumatic drives are used.
3. Why do we need cushioning in a hydraulic cylinder?
4. Sketch the ANSI symbols of (a) variable displacement bidirectional motor
(b) sequence valve.
5. Why are air-over oil circuits preferred for feed drives?
6. State any four advantages of hydrostatic transmission over other forms of power transmission.
7. With an example, state the significance of an up-down counter.
8. What is fluidics? Give any one advantage of fluidic devices.
9. 'Installation of hydraulic machines shall be done only by the experts' – why?
10. Why is integration of pneumatic systems and IoT essential in today's industrial world?

PART B — (5 × 13 = 65 marks)

11. (a) What is the purpose of hydraulic oil? Explain any six desirable properties of hydraulic oil.

Or

- (b) With a neat sketch, illustrate the construction and working of a vane pump.

12. (a) (i) Illustrate the construction and working of a 3/2 valve. (7)
(ii) Brief on the working of a simple pressure relief valve. (6)

Or

- (b) (i) Illustrate the construction and working of an external gear motor. (7)
(ii) Brief on any two types of filters used in a hydraulic system. (6)

13. (a) (i) Illustrate the construction and working of a pump intensifier. (7)
(ii) Describe a deceleration circuit with an industrial example. (6)

Or

- (b) (i) Illustrate the construction and working of an unloading valve. (7)
(ii) A mass of 2500 kg is to be accelerated horizontally upto a velocity of 1 m/s from rest over a distance of 50 mm. The coefficient of friction between the load and guide is 0.12. Calculate the bore of the cylinder required to accelerate this load if the maximum allowable pressure at the full bore end is 120 bar (take seal friction to be equivalent to a pressure drop of 5 bar). Assume that the back pressure at the annulus end of the cylinder is zero. (6)

14. (a) Illustrate the construction and working of regulator and lubricator in a pneumatic FRL unit.

Or

- (b) (i) Illustrate a 'start selection module' with options for auto-start and manual-start. (7)
(ii) Illustrate the construction and working of a quick exhaust valve. (6)

15. (a) Why is maintenance of hydraulic systems important? Explain any six guidelines for proper upkeep of a hydraulic system.

Or

- (b) Design a hydraulic circuit for a surface grinding machine and explain the components involved in the design.

PART C — (1 × 15 = 15 marks)

16. (a) An industry is interested in developing a hydraulic drilling machine to drill steel plates. Since, the cycle time of the process has to be minimum, faster approach and retraction strokes are essential. A powerpack with a single pump system is already available with the industry and hence the same is proposed to be used.
- (i) Illustrate how a regenerative circuit can satisfy the above objectives. (8)
 - (ii) Justify that the extension velocity is faster than the conventional hydraulic circuit and derive the ratio of extension and retraction velocities. (7)

Or

- (b) The function of a punching press is as follows:

The workpiece is placed in the fixture manually by a operator. Once a 'START' button is pressed, the workpiece is clamped by extension of clamping cylinder 'A'. Then, cylinder 'B' slowly performs the punching operation. After the punching process is over, unclamping is done automatically and the operator removes the punched workpiece manually. Design a pneumatic circuit for the above application using Cascade method. Both A and B are double acting cylinders.

