ADDITIONAL CONTROLLER OF EXAMINATIONS
AU
CHENNAI
600 025

Roll No. | | | | | | | | |

B.E / B.Tech ( Full Time) DEGREE END SEMESTER EXAMINATIONS, APR / MAY 2024

MECHANICAL ENGINEERING

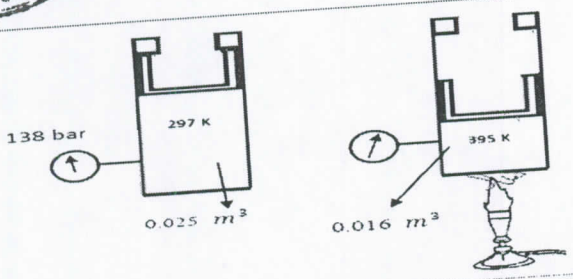
Fourth semester

ME 5451 HYDRAULICS & PNEUMATICS
(Regulation 2019)

Time : 3 Hours  Answer ALL Questions  Max. Marks 100

PART-A (10 x 2 = 20 Marks)

| Q.No. | QUESTIONS | CO | BL | PO | PI |
|---|---|---|---|---|---|
| | UNIT- 1 | | | | |
| 1. | If a hydraulic pump discharges 30 L · min−1 of fluid to a system with an operation pressure of 10 MPa, what is the hydraulic power the pump is delivering? | 1 | L2 | 1 | 1.4.1 |
| 2. | Why positive displacement pumps is suitable for hydraulic applicatications? | 1 | L2 | 1 | 2.1.2 |
| | UNIT- 2 | | | | |
| 3. | Draw the symbols of the following<br>i).pilot operated check valve ii). 4/3 pilot operated spring centered DCV<br>iii). Pressure reducing valve iv). Pressure compensated flow control valve... | 2 | L2 | 3 | 3.2.1 |
| 4. | Why cushioning is used in cylinders and list its types? | 2 | L2 | 2 | 2.1.2 |
| | UNIT- 3 | | | | |
| 5. | List the purpose of each of the following circuits:<br>Unloading., Sequencing., Regenerative and Synchronous... | 3 | L2 | 2 | 2.1.2 |
| 6 | What is fail safe circuit? | 3 | L3 | 3 | 3.2.1 |
| | UNIT- 4 | | | | |
| 7 | Gas in a 0.025 $m^3$ cylinder at 138 bar is reduced in volume to 0.016 $m^3$. While heated from 297 K to 395 K. what is the final gauge pressure in the cylinder? | 4 | L4 | 3 | 3.2.1 |

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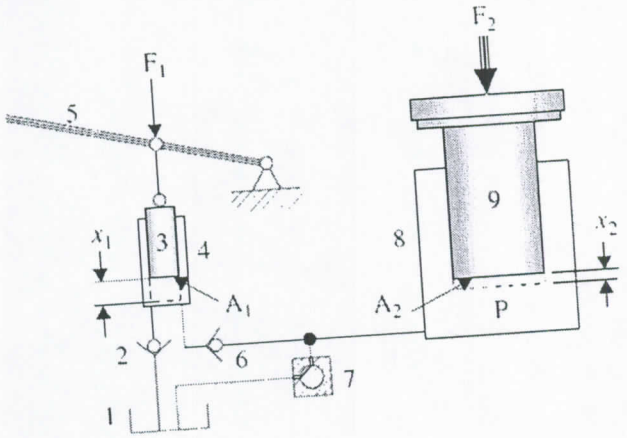
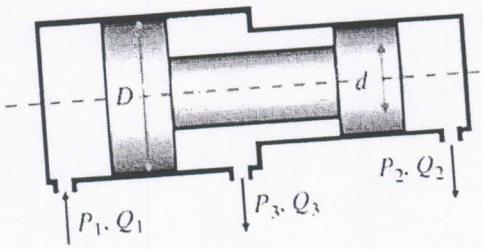
| 8 | Draw a travel step diagram for the sequence in Q.No 16? | 4 | L3 | 3 | 3.2.1 |
| | **UNIT- 5** | | | | |
| 9 | When a hydraulic filter is used, it can reliably remove at least 99 out of 100 6 µm or larger particles. What is the absolute filter ratings, and nominal rating of the filter? | 5 | L2 | 3 | 3.2.1 |
| 10 | Define Low cost automation/. | 5 | L2 | 2 | 2.1.2 |

Part – B (5 x 13 = 65 Marks)

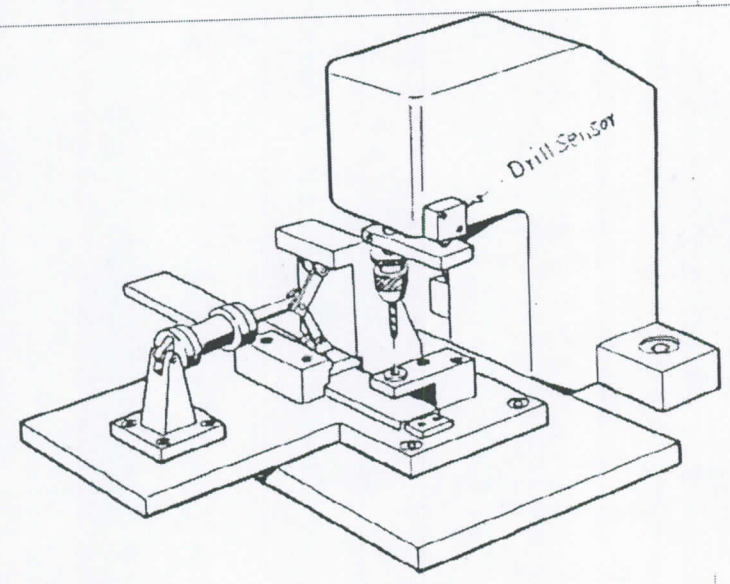
| Q.No. | | QUESTIONS | Marks | CO | BL | PO | PI |
|---|---|---|---|---|---|---|---|
| | | **UNIT- 3** | | | | | |
| 11 | a) | i) List and explain any five properties of hydraulic fluids | 5 | 1 | L2 | 2 | 2.3.2 |
| | | ii) The hydraulic jack depicted in Figure below, if the small piston area $A_1$ is 5 $cm^2$ the large piston area $A_2$ is 100 $cm^2$,and the load applied on the large piston is 50 kN, calculate (x) the fluid pressure p in the device; (y) the force $F_1$ required to apply on the small piston; and (z) how many 10 cm strokes of the small piston are needed to lift the large piston for 1 cm (assuming all the energy losses are negligible). | 8 | 1 | L3 | 3 | 3.2.1 |




(OR)

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | b) i | With neat sketches explain the construction principle, operation of an inline axial piston pump. Derive an expression for its output. | 8 | 1 | L3 | 3 | 3.2.2 |
| | ii | The full displacement of a variable displacement axial piston pump is 1.6 L, achieved at a 22° swash plate angle. If this pump discharges a 212 L/min flow when operating at 600 rpm with the swash plate set at 6°, what is the displacement of the pump at the condition, and what is the volumetric efficiency under the condition? | 5 | 1 | L1 | 1 | 1.4.1 |
| | | **UNIT- 2** | | | | | |
| 12 | a) i) | Classify linear actuators and with a neat sketch explain the construction and working of telescopic cylinder. | 7 | 2 | L1 | 2 | 2.2.2 |
| | ii) | An application requires driving a maximum torque load of 500 N · m when rotating at 3000 rpm. Assume the maximum allowable system pressure of 20 MPa and a return line pressure of 0.7 MPa. If the volumetric and overall efficiencies are 93 and 82%, respectively, Determine the size the motor and the required supplying flow rate. | 6 | 2 | L4 | 3 | 3.1.5 |
| | | **(OR)** | | | | | |
| | b) i. | Explain with a neat sketch the principle, construction and working of a balanced piston relief valve. | 8 | 2 | L4 | 3 | 3.1.5 |
| | ii. | As depicted in below, the diameters of the larger and smaller pistons in a pressure intensifier are 120 mm and 90 mm, respectively. When a 25 L · min−1 flow of 20 MPa is supplied to the larger piston chamber, what are the rate and pressure of the output flow from the smaller piston chamber   | 5 | 2 | L3 | 3 | 3.1.5 |
| 13 | A i) | A double acting cylinder is hooked in a regenerative circuit. The relief valve setting is 105 bar. The piston area is 130 $cm^2$ and the rod area is 65 $cm^2$. If the pump flow is 0.0016 $m^3$ /s,find the load carrying capacity during the forward and return stroke. | 7 | 3 | L6 | 3 | 3.1.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | ii) | Draw and explain over load protection circuit. | 6 | | | | |
| | | (OR) | | | | | |
| 13 | b i) | With a neat circuit explain the working of Hi-Lo circuit. | 7 | 3 | L2 | 1 | 1.4.1 |
| | ii | A double acting cylinder has to be automated to reciprocate continuously with the help of two pressure control valves. Draw and explain the circuit. | 6 | 3 | L2 | 1 | 1.4.1 |
| 14 | a i | Explain the various stages of conditioning the compressed air. | 6 | 4 | L2 | 1 | 1.4.1 |
| | ii | The Clamping of workpiece must be possible slowly by manual control from two positions.<br>Unclamping must be carried out quickly and initiated by a further manual push button<br>Clamping must be possible only when the work pieces has been inserted which is being sensed by a sensor<br>Unclamping must not be possible during the drilling operation. Draw a pneumatic circuit | 7 | 4 | L6 | 3 | 3.1.5 |



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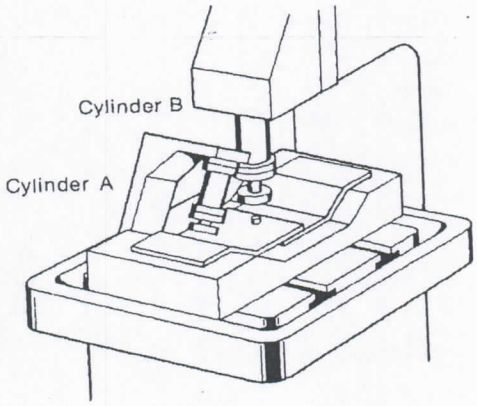
| | | (OR) | | | | | |
| | b i | Explain the working of any two dryers unit with a neat sketch.. | 6 | 4 | L3 | 1 | 1.4.1 |
| | ii | A pneumatic cylinder has a bore of 200 mm and a piston rod diameter of 140 mm. For an extend speed of 5m/min. Calculate<br>a) The supply flow rate<br>b) The flow rate from the annulus side on extend<br>c) The retract speed using Quick Exhaust valve<br>d) The flow rate from the full bore end on retract | 7 | 4 | L4 | 3. | 3.1.5 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 15 | a i | Draw and explain the hydraulic circuit used in surface grinding machine | 6 | 5 | L2 | 1 | 1.4.1 |
| | ii | . Sheet metal components are to be riveted using two Pneumatic Cylinders. A Clamping cylinder (A) first advance and clamps the sheet metal parts.<br>• While the parts are clamped a second cylinder (B) advance and performs riveting operation<br>• The riveting cylinder retracts and finally clamping cylinder retracts **.Draw an electro pneumatic circuit**<br>  <br> | 7 | | L4 | 3 | 3.1.5 |
| | | (OR) | | | | | |
| | b | Write short notes on any two of the following:<br>(i) Metering circuits<br>(ii) Accumulator<br>(iii) Trouble shooting of DCV. | 2X6.5 =13 | 5 | L2 | 2 | (2284.46) |

Part – C (1 x 15 = 15 Marks)

| Q.No. | QUESTIONS | CO | BL | PO | PI |
|---|---|---|---|---|---|
| | UNIT- 4 | | | | |
| 16. | Square shaped work has to be drilled using a drilling machine which is pneumatically operated. Work pieces are fed from a gravity magazine to a drilling machine. These work pieces are pushed and clamped by means of clamping cylinder 1.0 (A). hole is drilled by the drilling cylinder 2.0 (B). and work piece is ejected by ejecting cylinder 3.0 (C). The displacement step diagram is shown in Figure below. The sequence of operation has to be carried out either for one cycle or for continuous cycle with start and stop controls. Develop a pneumatic circuit using cascade method to implement the given control task To improve the efficiency of the circuit ,the circuit has to added with the following fringe conditions (10)<br>(i).The sequence of operations as to be carried out either for one cycle or for continuous cycles with 'start' and 'stop' controls. (2)<br>(ii).On Emergency, press of a control valve all the cylinder has to retract to its initial position. (3) | 4 | L6 | 3 | 3.1.6 |