

Name:

Enrolment No:



**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**  
**End Semester Examination, April/May 2018**

**Course: Robotics Based Industrial Automation**  
**Program: M.tech A&RE**  
**Time: 03 hrs.**

**Semester: II**

**Max. Marks: 100**

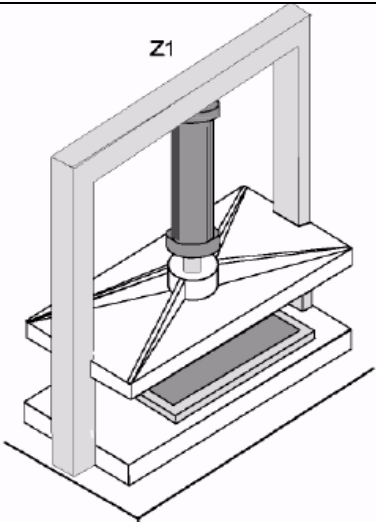
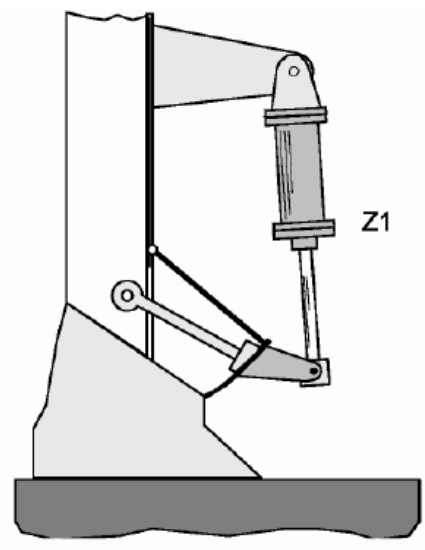
**Instructions: Section A carries 20 marks and all questions are compulsory**  
**Section B carries 40 marks and answer any four questions.**  
**Section C carries 40 marks and all questions are compulsory.**

**SECTION A**

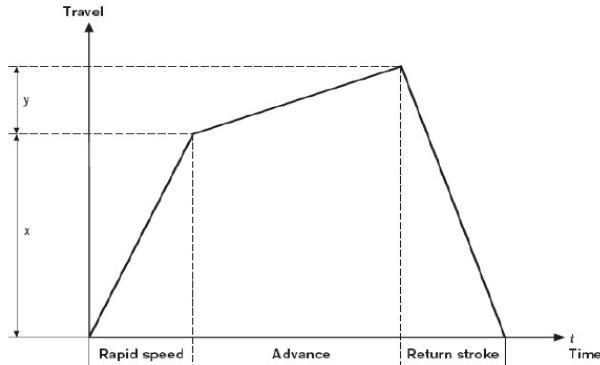
S. No.		Marks	CO
Q 1	Explain the concept of automation pyramid with a neat sketch	5	CO1
Q2	Describe the working of bag type accumulator with a neat sketch.	5	CO3
Q3	Explain a three safety circuit(dominant off) with a suitable pneumatic and electrical diagram	5	CO4
Q4	Explain the application of Pascal's law in pressure and force multiplication with relevant mathematical equations.	5	CO2

**SECTION B**

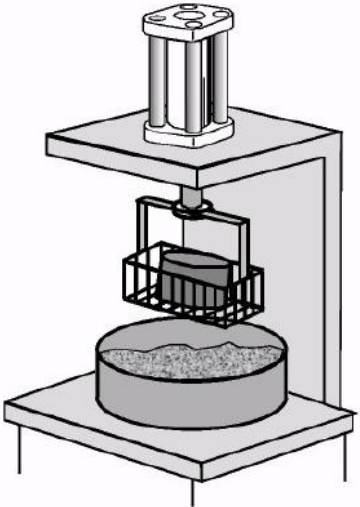
Q5	There are certain safety requirements applied to protect the workers operating presses and punching machines. To trigger dangerous movements, the operating personnel are forced to actuate 2 hand lever switches simultaneously with both hands. These hand lever switches must be actuated within a period of 0.5 seconds and remain actuated so that the drive (cylinder) of a plate press can press two plates together. If one of the two hand lever switches is released, the cylinder retracts again immediately as quickly as possible. If the hand lever switches are not actuated within 0.5 seconds then the procedure cannot be triggered. If only one hand lever switch is actuated, or one of them is mechanically blocked, or a contact has a short circuit, both signals must be enabled again. Only when this has taken place can a new release take place by actuating both signals in a time span of 0.5 seconds. Use 5X2 electrically controlled spring return DCV	10	CO5
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<p>Q6</p>	<p>The piston rod of a double-acting cylinder, which is mounted with the piston rod facing downwards, opens a flap shutter for loose material when a push button is pressed. After opening it to a full extent, the cylinder automatically shuts the flap shutter again. The initial setting of the cylinder rod is ‘extended’. The extension speed should be infinitely adjustable. An electrically controlled 5/2 directional control valve with spring return is used as an actuator. Proximity sensors (B1,B2) are available for use. Develop pneumatic circuit and electrical diagram to realize the same</p> 	<p>10</p>	<p>CO4</p>
<p>Q7</p>	<p>A production line, work piece are to be lifted from conveyor belt and put down on the pallet. The lifting movement is to be performed using a hydraulic cylinder. To achieve shorter cycle times, fast motion sequences are required. Due to changing work piece weights,(that can be identified with a proximity switch B1) the residual stroke is to be performed independently of loads at strongly reduced velocity. The return stroke is to</p>	<p>10</p>	<p>CO3</p>

be performed as fast as possible. Travel/time diagram is shown in below figure. Design hydraulic system and relay logic circuit for the above objective.



**Q8** In a dip varnishing apparatus, cylinder lowers a basket with a work piece into an immersion bath. The basket with the work piece remains in the immersion bath for 5 seconds and is then automatically raised. The time span that the work piece is in the immersion bath can be set between 0.5 and 15 seconds. Changing the speed of the piston rod must have no effect on the set dipping time. The extension speed can be infinitely adjusted. An electrically controlled 5/2 directional control impulse valve (bitable) is used as an actuator. Design a pneumatic circuit and electrical circuit diagram to realise the same. Proximity switches are available for use.



**10 CO4**

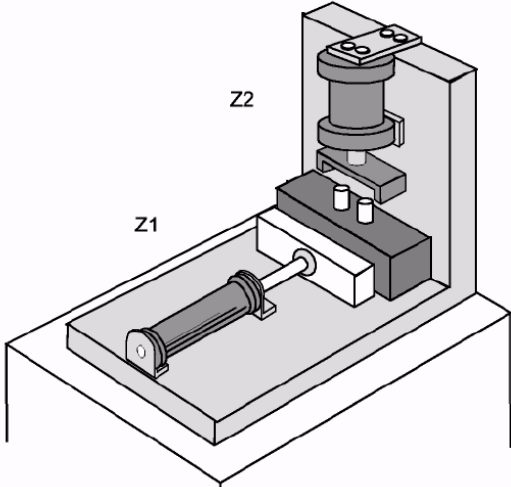
**Q.9.A** With a neat sketch discuss the construction and applications of rodless cylinder.

**4 CO4**

**Q.9.B** What is pumping theory? With a neat sketch disuss the construction and working of Gear pumps

**6 CO3**

**SECTION-C**

<p>Q.10.A</p>	<p>To realise a Pressing-in device two bolts are pressed in by a cylinder in a pressing-in device. The bolts are put in by hand. The procedure is fully automated: after actuating the start button S0, cylinder 1 clamps the workpiece and cylinder 2 presses the bolts in. For safety reasons the clamping cylinder must clamp the workpiece until the cylinder that does the pressing-in returns to its back end position. Electrically controlled impulse are used as actuators. The sensors are electric cylinder switches (magnetic field sensors). The extension speed of both cylinders should be infinitely adjustable</p> <div style="text-align: center;">  </div>	<p><b>16</b></p>	<p><b>CO5</b></p>
<p>Q.10.B</p>	<p>With relevant timing diagrams and applications explain the concept of ON timer and OFF timer circuits used in industrial automation.</p>	<p><b>4</b></p>	<p><b>CO3</b></p>
<p>Q.11</p>	<p>Design a garage door control using pneumatic circuit, controlled through relay logic. The behavior of the garage door controller is as follows:</p> <ol style="list-style-type: none"> <li>a) There are three push buttons (OPEN, CLOSE and STOP) place inside garage and outside the garage.</li> <li>b) When either of the buttons is pressed, the door will either open or close and stop accordingly.</li> <li>c) Proximity sensors are placed to stop the door when it has reach its end position (i.e., either close or open)</li> <li>d) An infrared beam monitors for any motion while the door is closing, if interrupted the door will stop at the location and wait for the user input.</li> <li>e) When the door is open a Light in the garage turns “ON” and while the gate is closed the light goes “OFF” after 2 minutes once the door is closed.</li> </ol>	<p><b>20</b></p>	<p><b>CO5</b></p>

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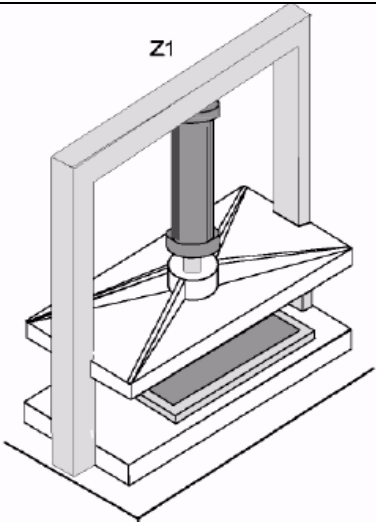
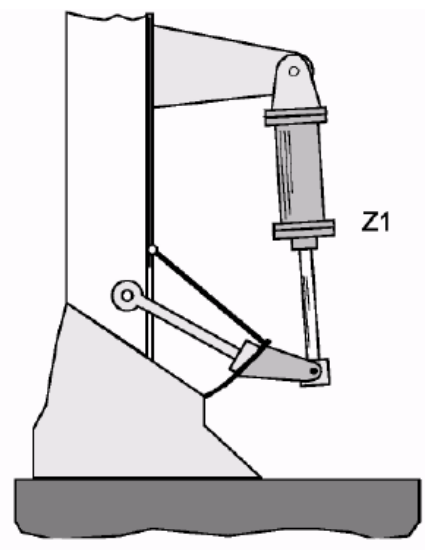
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**SECTION A**

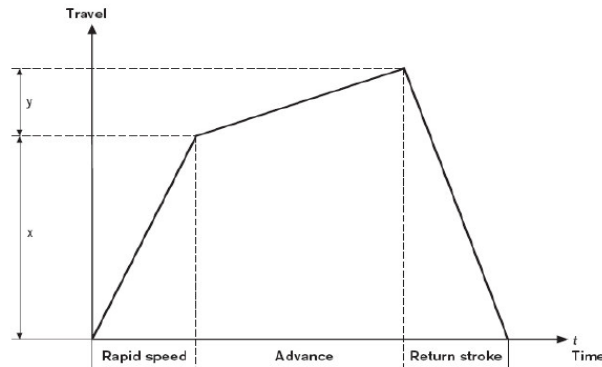
S. No.		Marks	CO
Q 1	Explain the concept of low cost automation with a suitable example	5	CO1
Q2	Describe the working of pressure relief valve with a neat sketch.	5	CO3
Q3	Explain a three safety circuit(dominant off) with a suitable pneumatic and electrical diagram	5	CO4
Q4	Explain the application of Pascal's law in pressure and force multiplication with relevant mathematical equations.	5	CO2

**SECTION B**

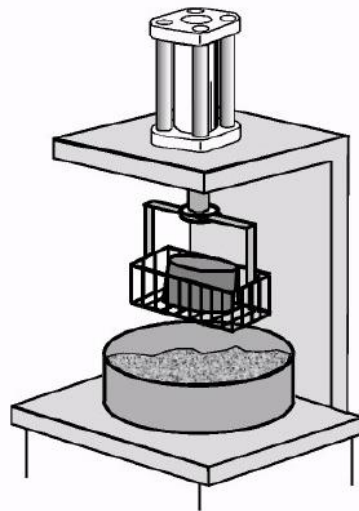
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<p>Q6</p>	<p>The piston rod of a double-acting cylinder, which is mounted with the piston rod facing downwards, opens a flap shutter for loose material when a push button is pressed. After opening it to a full extent, the cylinder automatically shuts the flap shutter again. The initial setting of the cylinder rod is ‘extended’. The extension speed should be infinitely adjustable. An electrically controlled 5/2 directional control valve with spring return is used as an actuator. Proximity sensors (B1,B2) are available for use. Develop pneumatic circuit and electrical diagram to realize the same</p> 	<p>10</p>	<p>CO4</p>
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10

CO4

Q.9.A With a neat sketch discuss the construction and applications of telescoping rod cylinder

4

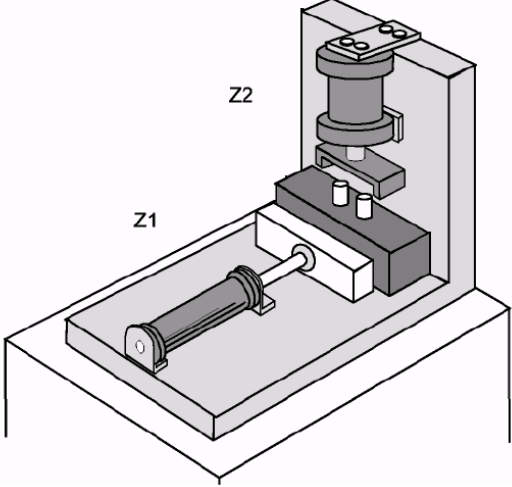
CO4

Q.9.B What is pumping theory? With a neat sketch disuss the construction and working of Vane pumps

6

CO3

**SECTION-C**

<p>Q.10.A</p>	<p>To realise a “pressing-in device” two bolts are pressed in by a cylinder in a pressing-in device. The bolts are put in by hand. The procedure is fully automated: after actuating the start button S0, cylinder 1 clamps the workpiece and cylinder 2 presses the bolts in. For safety reasons the clamping cylinder must clamp the workpiece until the cylinder that does the pressing-in returns to its back end position. Electrically controlled impulse are used as actuators. The sensors are electric cylinder switches (magnetic field sensors). The extension speed of both cylinders should be infinitely adjustable</p> 	<p>16</p>	<p>CO5</p>
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