

# SPPU In-Sem Offline Examination-April 2022

Class: S.E. Branch: Robotics and Automation Semester: I

Subject : Design of Machine Elements (Code: 211510)

Maximum Marks: 30

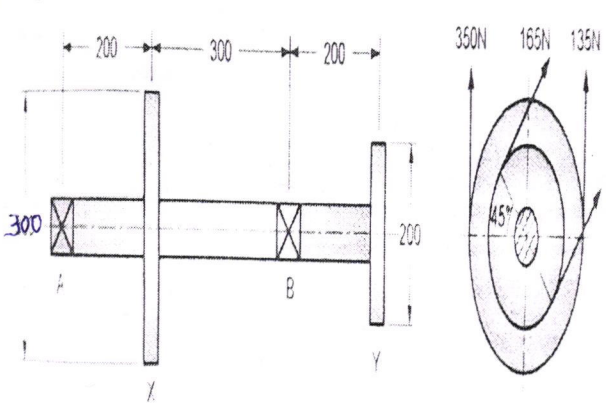
Duration: 60 Minutes

Date : 07/04/2022

Special Instructions: 1) Answer Q.1 or Q.2, Q.3 or Q.4

2) Draw neat and labelled diagram whenever necessary

3) Assume suitable data if required

Q. No.	Question / Description	Marks	CO	BL	PI
1	Design a cotter joint to transmit a load of 100 kN in tension or compression. Assume the following stresses for socket, spigot, and cotter: Allowable tensile stress= $90 \text{ N/mm}^2$ Allowable crushing stress= $170 \text{ N/mm}^2$ Allowable shear stress= $60 \text{ N/mm}^2$	15	1	3	1.4.1
2	Give the application of knuckle joint, and design a knuckle joint subjected to an axial load of 25 kN. It is made of plain carbon steel with yield strength in tension $760 \text{ N/mm}^2$ . Design the joint with factor of safety 5. Assume compressive strength of material to be 20 % more than the tensile strength. Allowable shear stress is 0.577 of the tensile strength of the material.	15	1	3	1.4.1
3	a) What is meant by shaft? Give its types, application, material used for the shaft and properties of shaft material	5	2	2	3.1.1
	b) A steel shaft made of 40C8 is used to drive a machine. The pulleys X, Y and bearings A, B are located as shown in figure 1 (all dimensions are in mm). If yield strength of shaft material is $330 \text{ N/mm}^2$ and ultimate tensile strength is $600 \text{ N/mm}^2$ , determine the diameter of the shaft using A.S.M.E. code. The shock and fatigue factors are $K_b=1.5$ and $K_t=1.2$ . If rectangular key is made of the same material design the key.	10	2	3	1.4.1
 <p>The diagram shows a horizontal shaft supported by two bearings, A and B. Pulley X is mounted on the left end of the shaft, and pulley Y is mounted on the right end. The distance between the centers of pulleys X and Y is 1000 mm. The distance from the center of pulley X to the center of bearing A is 200 mm. The distance between the centers of bearings A and B is 300 mm. The distance from the center of bearing B to the center of pulley Y is 200 mm. The shaft has a diameter of 300 mm. A force of 350 N is applied to pulley X at a 45-degree angle to the horizontal. A force of 165 N is applied to pulley Y at a 45-degree angle to the horizontal. A force of 135 N is applied to pulley Y at a 45-degree angle to the horizontal.</p>					
4	a) Explain the design of shaft by maximum principal stress theory	5	2	2	3.1.1

b) A pulley weighing 1.2 kN and 500 mm diameter is driven by horizontal belt drive. The power is transmitted through a solid circular shaft to a pinion keyed to the shaft which in turn meshes with a gear. The belt tension and the compression of gear reactions on the pinion are shown in figure 2 (all dimensions are in mm). Design the shaft and square key using the suitable values of stresses for commercial shafting. Assume shaft and key are made of the same material. The shock and fatigue factors are  $K_b=2$  and  $K_t=1.5$

10

2

3

1.4.1

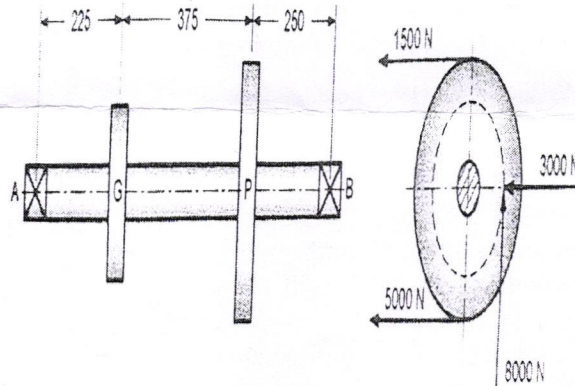
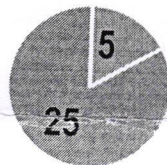


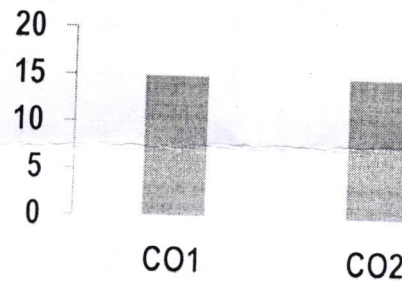
Figure 2

### Bloom's Level wise Marks Distribution



■ Level 2 ■ Level 3

### Course Outcome Wise Marks Distribution



BL – Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)



**SPPU In-Sem Offline Examination-April 2022**

Class: SE      Branch: Robotics and Automation      Semester: I

Subject: Metrology and Quality Assurance (Code: 211511) Pattern: 2019

Maximum Marks: 30

Duration: 60 Minutes

Date: 08/04/2022

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**Special Instructions :** (i) Attempt Q.1 or Q.2, Q.3 or Q.4, Q.5 or Q.6, Q.7 or Q.8, Q.9 or Q.10.  
(ii) Neat diagrams must be drawn wherever necessary.  
(iii) Figures to the right indicate full marks.  
(iv) Assume suitable data, if necessary.  
(v) Use of electronic pocket calculator and logarithmic tables is allowed

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Q. No.	Question / Description	Marks	CO	BL	PI
1	What is Metrology? Describe the specific needs of metrology	5	1	2	1.3.1
	<b>OR</b>				
2	Draw sketches of Meter and Yard. What do you mean by Airy points?	5	1	2	1.3.1
3	Explain with neat sketch difference between Precision and Accuracy	5	1	2	1.3.1
	<b>OR</b>				
4	Show schematically difference between Hole Basis and Shaft Basis system	5	1	2	2
5	Which instruments are used for angle measurement? Draw sketches showing the uses of sine bar and sine centre.	5	1	2	1.3.1
	<b>OR</b>				
6	Explain with neat sketch Construction of Sigma Comparator.	5	1	2	1.3.1
7	Show schematically difference between Allocation of gauge tolerance and wear allowance for plug and ring limit gauges	7	2	3	1.3.1
	<b>OR</b>				
8	State Taylor's principle of gauge design. List out types of limit gauges used in industry.	7	2	3	1.3.1
9	Design limit gauges for checking 75H <sub>8</sub> . Given (i) diameter 75 lies in 50-80. (ii) IT8 = 25i.	8	2	4	1.4.1
	<b>OR</b>				
10	Design limit gauges for checking 95 h <sub>9</sub> shaft. Given (i) diameter 95 lies in 80-100. (ii) IT9 = 40i.	8	2	4	1.4.1

**SPPU In-Sem Offline Examination-April 2022**

Class: SE

Branch: Robotics and Automation

Semester: II

Subject: Control System Engineering (Code:211509 )

Maximum Marks: 30

Duration: 60 Minutes

Date: 5/4/2022

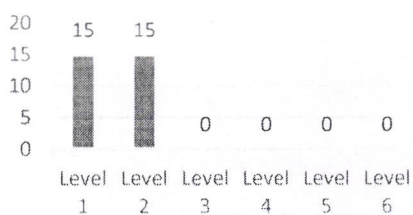
Special Instructions:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Use of Calculator is allowed.*
- 3) *Assume Suitable data if necessary*

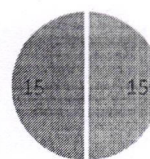
Q. No.	Question / Description	Marks	CO	BL	PI
1.	(a) The impulse response of the system in time domain is : $Y(t) = -t.e^{-t} + 2.e^{-t}$ when $t > 0$ . What will be the transfer function of the system?	8	1	2	
	<b>OR</b>				
	(a) What is closed loop control system? Explain with neat sketch its components. Also state any two application of closed loop control system.				
	(b) What are advantages and disadvantages and applications of open loop control system?	7	1	2	
	<b>OR</b>				
	(b) Derive an expression for transfer function of a hydraulic system to maintain the desired liquid level in the tank by controlling the flow rate in tank for changing outflow rate.				
2.	Obtain the controller output of a Proportional controller for a process having transfer function $\frac{3}{s+5}$ for step response of 6. Feedback transfer function is the gain of 0.2 and proportional gain $K=5$ .	10	2	3	
	Explain why Integral (I) and Derivative (D) type controllers cannot be used alone?	5	2	2	
	<b>OR</b>				
	(a) For a spring mass damper system, mass = 2 Kg, damping coefficient = 12 Ns/m, Spring stiffness =	8	2	3	

	15 N/m. If proportional gain ( $K_p$ ) = 200, derivative gain ( $K_d$ ) = 10 and force of 2 KN is applied, derive an expression of transfer functions for PD controller.				
	(b) Explain with neat sketch following terms related transient response of a control system : (1) % Overshoot (2) Settling time (3) Rise time (4) Steady state error	7	2	3	

Course Outcomewise Marks Distribution



Blooms Levelwise Marks Distribution



BL – Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)



### SPPU In-Sem Offline Examination-April 2022

Class: SE

Branch: Robotics and Automation

Semester: II

Subject: Computer Graphics for Robotics

(Code:211512)

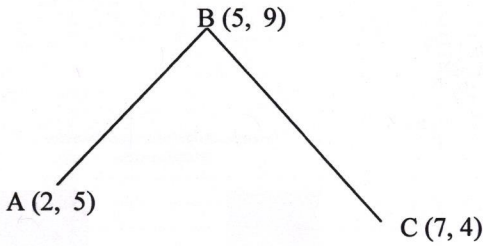
Maximum Marks: 30

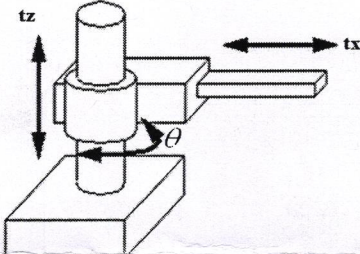
Duration: 60 Minutes

Date: 9/4/2022

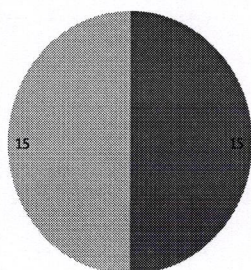
Special Instructions:

- 1) *Neat diagrams must be drawn wherever necessary.*
- 2) *Use of Calculator is allowed.*
- 3) *Assume Suitable data if necessary*

Q. No.	Question / Description	Marks	CO	BL	PI
1.	(a) Determine mathematically area of a triangular plate having co-ordinates of vertices as A (20, 10, 12), B (15, 21, 30) and C (10, 30, 40).	8	1	2	2.1.3
	<b>OR</b>				
	(a) Determine mathematically the angle formed by two intersecting lines AB and CD as shown in Fig. below.	7	1	2	1.1.1, 2.1.3
					
	(b) A plane is determined by a normal vector $i-j+k$ and point (2, 3, -1) find the distance from point (5, 2, 7) to the plane.				
2	<b>OR</b>	7	2	3	1.4.1
	(b) Write short notes on: (1) Role of computer graphics in robotics (2) Parametric circle generation				
	(a) Reflect a triangle A (2, 1), B (4, 2), C (3, 5) about line represented by an equation $y = 2x + 3$				

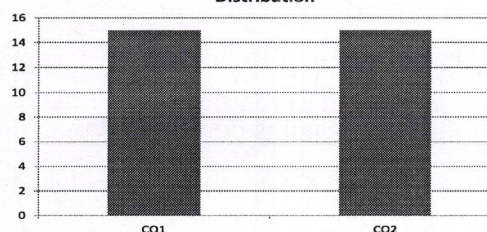
	<p>(b) For a cylindrical robot shown in Fig. 1, following transformations are applied:</p> <ul style="list-style-type: none"> <li>• Swing (<math>\theta</math>) = <math>30^\circ</math></li> <li>• Stroke (<math>t_z</math>) = 2 Units</li> <li>• Reach (<math>t_x</math>) = 1.5 Units.</li> </ul> <p>If the end effector is originally at (5, 0, 3), determine its transformed position.</p>  <p>Fig. 1</p>	8	2	3	2.1.3
	<b>OR</b>				
	<p>(b) Obtain the 3D transformation matrix for forward kinematic analysis of a spherical robot.</p>				

Blooms Texonomy wise Marks Distribution



■ Level 1  
■ Level 2  
■ Level 3

Course Outcomewise Marks Distribution



BL – Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 – Applying, 4 – Analysing, 5 – Evaluating, 6 - Creating)



**SPPU In-Sem Offline Examination- April 2022**

**Class: SE**

**Branch: Robotics and Automation**

**Semester: IV**

**Subject: Industrial Engineering and Management (Code: 211508 )**

**Maximum Marks: 30**

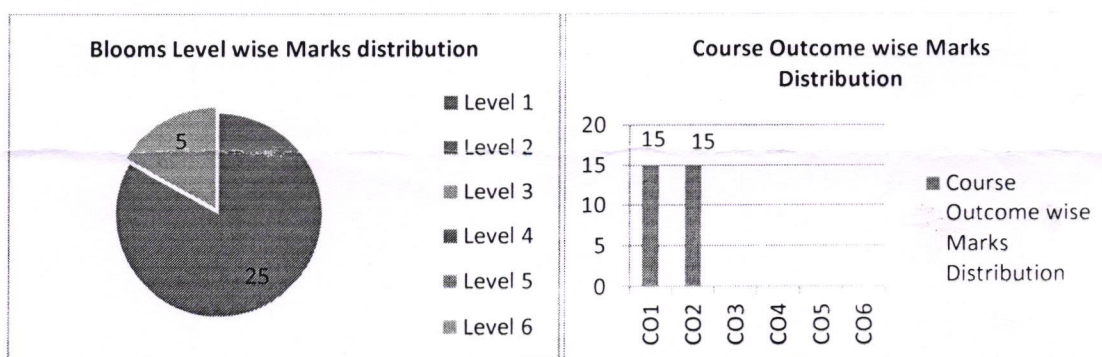
**Duration : 60 Minutes**

**Date:4/4/2022**

**Special Instructions to the candidates:**

- 1) Answer Q.1 or Q.2 and Q.3 or Q.4,
- 2) Neat diagrams must be drawn wherever necessary.
- 3) Assume Suitable data if necessary

Q. No.	Question / Description	Marks	CO	BL	PI
Q.1.(a)	Describe various functions of Management	5	1	2	7.4.1
Q.1.(b)	Describe F. W. Taylor's scientific management approach	5	1	2	6.4.1
Q.1.(c)	Describe line organization with suitable example. State merits and demerits.	5	1	3	6.3.1
<b>OR</b>					
Q.2. (a)	Describe Henry Fayol's fourteen principles of management	10	1	2	6.4.1
Q.2. (b)	Describe & Compare sole proprietorship and partnership firm. State the advantages and disadvantages also.	5	1	2	9.5.1
Q.3.(a)	Describe Douglas McGregor Theory X and Theory Y of motivation	5	2	2	6.3.1
Q.3.(b)	Describe Democratic Leadership. State Merits and demerits of Democratic Leadership	5	2	2	9.5.1
Q.3.(c)	Describe Five stage model of group development	5	2	2	9.5.1
<b>OR</b>					
Q.4.(a)	Describe Vroom's expectancy theory of motivation	5	2	2	6.3.1
Q.4.(b)	Describe Autocratic Leadership style. State Merits and demerits of Autocratic Leadership	5	2	2	9.5.1
Q.4.(c)	Describe managerial grid model of Leadership	5	2	2	9.5.1



BL - Bloom's (Revised) Taxonomy Levels (1- Remembering, 2- Understanding, 3 - Applying, 4 - Analysing, 5 - Evaluating, 6 - Creating), PO - Program Outcomes; PI Code - Performance Indicator Code