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PRODUCTION AND INDUSTRIAL ENGINEERING

Objective Practice Sets

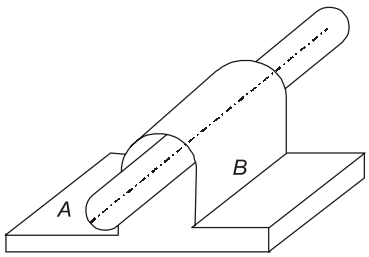
General Engineering : Volume IV

Theory of Machines

MADE EASY Publications

Theory of Machines

Q.1 A round bar *A* passes through the cylindrical hole in *B* as shown in the given figure. Which one of the following statements is correct in this regard?



(a) The two links shown form a kinematic pair
(b) The pair is completely constrained
(c) The pair has incomplete constraint
(d) The pair is successfully constrained

Q.2 Which of the following statements regarding laws governing the friction between dry surface are correct?

1. The friction force is dependent on the velocity of sliding.
2. The friction force is directly proportional to the normal force.
3. The friction force is dependent on the materials of the contact surfaces.
4. The Friction force is independent of the area of contact surfaces.

(a) 2, 3 and 4 (b) 1 and 3
(c) 2 and 4 (d) 1, 2,3 and 4

Q.3 Match **List-I** with **List-II** and select the correct answer using the codes given below the lists:

List-I

A. Quadric cycle chain
B. Single slider crank chain
C. Double slider crank chain
D. Crossed slider crank chain

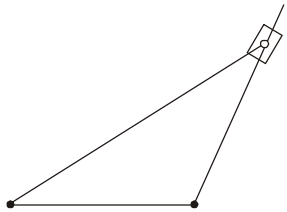
List-II

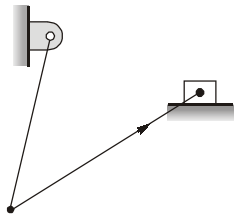
1. Rapson's slide
2. Oscillating cylinder engine mechanism
3. Ackermann steering mechanism
4. Oldham coupling

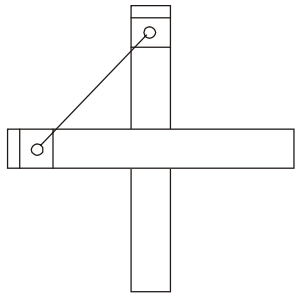
Codes:

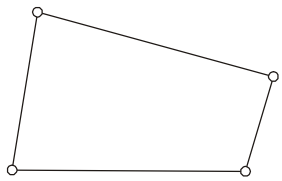
	A	B	C	D
(a)	1	2	4	3
(b)	4	3	1	2
(c)	3	2	4	1
(d)	3	4	2	1

Q.4 Which of the following are examples of a kinematic chain?

1. 

2. 

3. 

4. 

Select the correct answer using the codes given below :

Answers Theory of Machines

1. (c)	2. (a)	3. (c)	4. (d)	5. (c)	6. (d)	7. (a)	8. (a)
9. (b)	10. (c)	11. (c)	12. (a)	13. (d)	14. (b)	15. (c)	16. (a)
17. (a)	18. (c)	19. (a)	20. (c)	21. (d)	22. (c)	23. (c)	24. (b)
25. (d)	26. (c)	27. (d)	28. (a)	29. (c)	30. (b)	31. (c)	32. (c)
33. (c)	34. (b)	35. (b)	36. (a)	37. (b)	38. (c)	39. (a)	40. (b)
41. (b)	42. (b)	43. (c)	44. (b)	45. (b)	46. (b)	47. (a)	48. (d)
49. (d)	50. (c)	51. (c)	52. (a)	53. (a)	54. (a)	55. (d)	56. (b)
57. (c)	58. (b)	59. (b)	60. (c)	61. (b)	62. (b)	63. (c)	64. (c)
65. (d)	66. (a)	67. (c)	68. (c)	69. (c)	70. (b)	71. (c)	72. (a)
73. (c)	74. (d)	75. (a)	76. (d)	77. (b)	78. (d)	79. (c)	80. (d)
81. (c)	82. (c)	83. (c)	84. (b)	85. (a)	86. (b)	87. (a)	88. (d)
89. (a)	90. (a)	91. (c)	92. (c)	93. (b)	94. (b)	95. (c)	96. (d)
97. (a)	98. (c)	99. (c)	100. (a)	101. (a)	102. (c)	103. (a)	104. (d)
105. (c)	106. (b)	107. (c)	108. (a)	109. (a)	110. (b)	111. (a)	112. (a)
113. (31.26)	114. (104.719)	115. (a)	116. (c)	117. (34.92)	118. (d)	119. (b)	120. (c)
121. (d)	122. (b)	123. (824.7)					

Explanations Theory of Machines

1. (c)

A round bar in a cylindrical hole can revolve as well as reciprocate. Therefore, the pair is incompletely constrained i.e. relative motion is possible in more than one direction.

A rectangular bar in a rectangular hole can only reciprocate. Therefore, the pair is completely constrained i.e. relative motion is possible in only one direction.

Foot step bearing in a shaft is an example of successfully constrained motion. i.e. the motion is made constrained with some external forces.

2. (a)

Laws of friction:

The force of solid friction

1. is directly proportional to normal force between the two surfaces.
2. opposes the motion between the surfaces.
3. depends upon the material of the two surfaces.
4. is independent of the area of contact.
5. is independent of the velocity of sliding.

The last of these laws (i.e. point 5) is not true in the strict sense as it has been found that the friction force decreases slightly with the increase in velocity.

Only option (2), (3) and (4) is correct.

3. (c)

4-Bar Mechanism:

(1) Quadric cycle chain → Ackermann steering
(2) Single slider crank chain → oscillating cylinder engine mechanism
(3) Double slider crank chain → Oldham coupling
(4) Crossed slider crank chain → Rapson's slide

4. (d)

For kinematic chain

$3l = 2p - 4$

where, l = no. of link

p = no. of pair

Here, number of pair, $p = 4$

Number of link, $l = 4$

5. (c)

Oldham's coupling → Double slider crank chain

Whitworth quick return motion → Single slider crank chain

Scotch yoke → Double slider crank chain

6. (d)

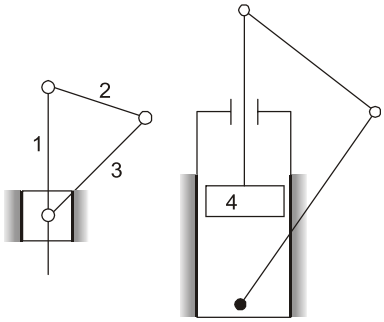
If $l = (2p - 4)$ → Complete constraint

$l > (2p - 4)$ → Rigid frame

$l < (2p - 4)$ → Incomplete constraints

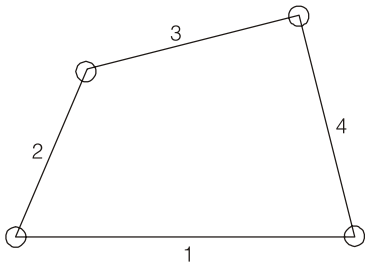
7. (a)

If is the fourth inversion of slider crank chain when slider is fixed.



8. (a)

Here all turning pair



9. (b)

(1) Compound train → transmission of motion around bends and corners.

(2) Quick return mechanism → Coriolis force.

(3) Exact straight line motion → Hart mechanism.

(4) Approximate straight line motion → watt mechanism.

10. (c)

Kinematic inversion	Application
1. Frame is fixed	Compressor
2. Crank is fixed	Whitworth quick return mechanism
3. Connecting rod is fixed	Oscillating cylinder engine
4. Slider is fixed	Hand pump

11. (c)

A round bar in a cylindrical hole can revolve as well as reciprocate. Therefore, the pair is incompletely constrained i.e. relative motion is possible in more than one direction.

A rectangular bar in a rectangular hole can only reciprocate. Therefore, the pair is completely constrained i.e. relative motion is possible in only one direction.

Foot step bearing in a shaft is an example of successfully constrained motion. i.e. the motion is mode constrained with some external forces.

12. (a)

Cam and follower → pressure angle

Screw pair → single degree of freedom

4-bar mechanism → Grashoff's linkage

Degree of freedom → Grubler's rule of planar mechanism

13. (d)

(1) Sliding pair → piston and cylinder

(2) Revolute pair → Crank shaft in a journal bearing in an engine

(3) Rolling pair → A road roller rolling over the ground

(4) Spherical pair → Ball and socket joint

14. (b)

(1) Hart mechanism → exact straight line motion

(2) Pantograph → copying mechanism

(3) Whitworth mechanism → quick return mechanism

(4) Scotch yoke → Simple harmonic motion.