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SEAT No. :

P3869

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[4960] - 1068

M.E. (Mechanical) (Design Engineering)

ANALYSIS AND SYNTHESIS OF MECHANISM

(2013 Pattern) (Semester - II)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answer any five questions.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of Calculator is allowed.***
5) ***Assume Suitable data if necessary.***

Q1) a) Derive 'Kutzbach Equation' and discuss on how this equation can be extended to obtain equation for number of pairs having 1-Degree of freedom in terms of total number of links. **[5]**

b) Discuss the importance of the following terms with reference to 4-bar mechanism **[5]**

i) Transmission angle

ii) Mechanical advantage

iii) Toggle position

Q2) a) State and discuss steps in using 'Principle of Superposition' for making complete dynamic force analysis of a planar motion mechanism. **[5]**

b) Explain the steps in the dynamic force analysis for simple mechanism in brief. Discuss method of dynamic analysis for elastic mechanisms.**[5]**

Q3) a) Discuss the terms fixed centrode, moving centrode and Ball's point.**[5]**

b) State Bobillier theorem. Explain Bobillier Construction for locating the inflection circle. **[5]**

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Q4) a) Which trial method is used for spacing of precision positions? Using this method, find the spacing for six precision points, if the function varies from 0 to 10. **[5]**

b) Discuss 3-position graphical synthesis of 4-bar mechanism for body guidance with suitable example. **[5]**

Q5) a) What are the branch and order defects? Discuss with suitable examples. **[5]**

b) Discuss the procedure to synthesize 4-bar linkage for given angular velocity & acceleration using Freudenstein's equation. **[5]**

Q6) Using complex number notations, derive the link lengths a_1, a_2, a_3 & a_4 for a 4-bar mechanism in terms of angular velocity & angular acceleration. Using this method, determine the link lengths of a 4-bar linkage that will in one of its position satisfy the following specifications of angular velocity & angular acceleration. Length of input link is to be unity. Draw the mechanism & comment on the resulting mechanism. (Use Complex number method.) **[10]**

Links	Angular velocity	Angular acceleration
Input link	$\omega_1 = -10.00$ rad/sec	$\alpha_1 = 0$ rad/sec^2
Coupler	$\omega_2 = 5$ rad/sec	$\alpha_2 = 0$ rad/sec^2
Output link	$\omega_3 = 0$ rad/sec	($\alpha_3 = 86.6$ rad/sec^2

Q7) a) Define a 'Spatial Mechanism'? Discuss important parameters used in the analysis of spatial mechanisms. **[5]**

b) Name any two spatial mechanisms and elaborate the steps involved in matrix method of analysis of these mechanisms. **[5]**