Tick 31/12/2013

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

End sem Kt-examination May- June 2013

Total Marks: 100 Duration: 4 Hours

CLASS: M.E.(Mech) M/c Design, Sem: I SUBJECT: **Stress Analysis**

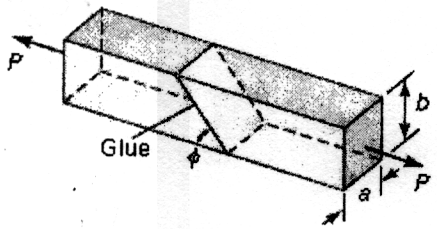
- Attempt any **Five** questions out of **seven** questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.
- Answer to all sub questions should be grouped together.

MASTER

Q. no.1 a) Determine the stress invariants, deviatoric stress tensor, and normal and shearing stresses on a plane with direction cosines (1/ 3, 1/ 2, 1/ 6) , also determine principal stresses and their dcs, for a state of a stress as- **(20)**

$$\begin{matrix} 10 & 1 & -8 \\ 1 & -6 & 6 \\ -8 & 6 & 20 \end{matrix} \text{ MPa}$$

Q. no. 2 a) Two prismatic bars of 45 mm X 80 mm cross section are glued as shown in fig. The allowable normal and shearing stresses for the glued joint are 750 and 550 kPa respectively. Assuming that the strength of the joint controls the design, what is the largest axial load P that may be applied? $\Phi = 35^0$ **(06)**



b) Explain stress analysis using Mohr's circle method in 2-D. **(04)**

c) For a given strain at a point determine stress matrix **(06)**

$$\begin{matrix} 0.001 & 0 & -0.002 \\ 0 & -0.003 & 0.0003 \\ -0.002 & 0.003 & 0 \end{matrix}$$

Take $E = 205*10^6$ kPa. $G = 79*10^6$ kPa

d) Explain the plane stress and plane strain condition with suitable example. **(04)**

Q.no.3 a) The state of a strain at a point on a steel plate is given by $e_x = 510\mu$, $e_y = 120\mu$, $\gamma_{xy} = 260\mu$. Determine, using Mohr's circle of strain i) the state of a strain associated with x', y' which makes an angle of 25^0 with the axes x,y; ii) the principal strains and the directions of the principal axes; iii) the maximum shear strains and associated normal strains. **(10)**

b) Write the compatibility equations in terms of stresses in y-z plane assuming a plane stress condition. **(05)**

c) State and explain orthogonality and normality condition for dc's. **(05)**

Page a

M.E(M) with role Design Sem I Strain Analysis

3/6/13

Q.no.4 a) Determine whether the following stress field are possible within elastic structural member in equilibrium. The c's are constant, and it is assumed that the body forces are negligible. Derive the equation of equilibrium in 3D. *(10)*

(a) $\begin{bmatrix} c_1x + c_2y & c_5x - c_1y \\ c_5x - c_1y & c_3x + c_4 \end{bmatrix}$, (b) $\begin{bmatrix} -\frac{3}{2}x^2y^2 & xy^3 \\ xy^3 & -\frac{1}{4}y^4 \end{bmatrix}$

b) Derive the bi-harmonic equation for Airy's stress function, also determine the stress distribution in cantilever beam of rectangular cross section loaded by a concentrated force at its free end. (use Airy's SF). **(10)**

Q.no.5 a) Describe experimental setup of Photoelasticity and explain its working in brief, mention the formula to give the difference between principal stresses. **(10)**

b) What is first theorem of Castigliano?. Derive its expression. **(10)**

Q.no.6 a) Derive general equations for determining the displacements due to thermal stresses **(10)**

b) Determine the expression for shear stress in case of equilateral triangle cross section subjected to torque T. **(10)**

Q.no.7 a) Write short note on strain rosettes. **(07)**

b) List different types of strain gauges. Classify them. **(05)**

c) Write short note on computational methods for stress analysis **(08)**

1 cycle

Bhartiya Vidya Bhavan's

Sardar Patel College of Engineering

(An Autonomous Institution Affiliated to University of Mumbai)

M.E (Mech) with Mc Design -I Sem I

First Half 2013

Class/ Sem: **M.E. (Machine Design) / I** Subject: **Tribology**

Duration: 4Hrs. Total Marks: 100

Note: Attempt any five question out of seven questions.

Answers to all sub questions should be grouped together.

Figures to the right indicate full marks.

MASTER

1. Answer any four of the following: **20**
   a) Compare hydrostatically lubricated bearings with hydro dynamically lubricated bearings.
   b) Write note on solid lubricants.
   c) Significance of elastohydrodynamic lubrication.
   d) Explain Stick slip phenomenon.
   e) Define viscosity and its units in different systems. Also obtain equations to convert value of viscosity from one system to another.

2. a) Explain the use of various dimensionless parameters in the design of hydro-dynamically lubricated journal bearings. **06**

   b) Design a self contained hydrodynamic full journal bearing for a reciprocating pump main shaft to support a radial load of 6 kN at 1400RPM. Analyse various parameters such as oil temperature, viscosity, flow rate, frictional power loss, coefficient of friction, maximum pressure, and minimum film thickness. **14**

3. a) Select a suitable type and size of a rolling contact bearing subjected to following loading cycles:

Sr. No.	Radial Load(kN)	Axial Load(kN)	Speed (RPM)	Time (sec)	Load type
1	4	1.5	500	2	Uniform
2	2	1.2	450	3	Moderate Shock
3	2	1	400	4	Mild Shock

The operating temperature is 150^0C, probability of survival 92%, and expected life 15,000Hrs. **14**

   b) Derive the fundamental equation for viscous flow through rectangular slot. **06**

4. a) A hydrostatic thrust bearing 500mm diameter and a central recess of 300mm diameter is designed for supply pressure of 1.5MPa with a uniform clearance of 0.12mm for a shaft speed of 1000RPM. The lubricant viscosity, specific gravity and specific heat are 30cP, 0.8 and $1.75 kJ/kg^0C$ respectively. Calculate its load

Page(1)

Tribology M.E(M) with ME Design sem I 7/6/17

capacity, flow requirement in lit/min, pumping power loss, total power loss & temperature rise. 10

b) Define wear and state different types of wear. Describe adhesive wear and its estimation. 10

5. a) A single row deep groove ball bearing No. 6002 is subjected to an axial trust of 1000N and a radial load of 2200N. Find the expected life that 50% of the bearings will complete under this condition. 10

b) State the types of failures in sliding contact bearing. 06

c) State any two advantages & limitations each of deep groove ball bearing. 04

6. a) Describe Kingsbury's electrical analogy method for measurement of pressures developed in hydro-dynamically lubricated bearing. 08

b) Write note on dynamic load carrying capacity of a bearing and equivalent bearing load. 07

c) Where do you use self aligning ball bearing & spherical roller bearings. 05

7. Write notes on any four: 20

a) Stribeck curve.

b) Classification of lubricants.

c) Laws of friction.

d) Pressure distribution in elastohydrodynamic lubrication.

e) Hydrostatic lift.

Page 2

May 4/6/13

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

M.E(M) with m/c Design Sem I

Kt exam-june-2013

Total Marks: 100 Duration: 4 Hours

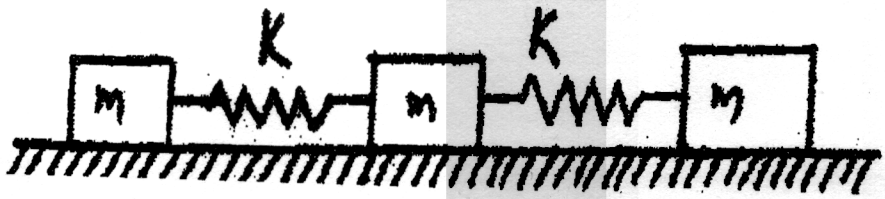
CLASS: **M.E.(Mech)M/c Dsg**, Sem: **I SUB**: **Machine Dynamics and advanced Vibrations**

- Attempt any **Five** questions out of the seven questions.
- Figures to the right indicate full marks.
- Make any suitable assumption if needed with proper reasoning.

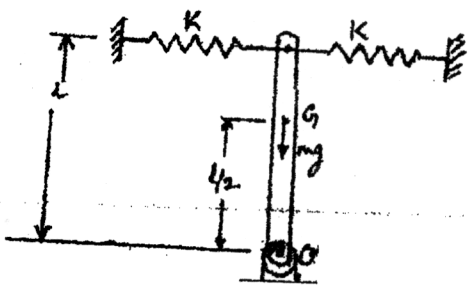
MASTER

1. a .What is inertia tensor? Find the inertia tensor for a solid cube of mass M and side' a' rotating about a corner — 15+5
   b. What is the principle axis of a body
2. **a.** What is influence coefficient? — 5x4
   b. Define logarithmic decrement.
   c. What are undamped vibrations?
   d. Define magnification factor. How is magnification factor related to frequency ratio. What will be the applied force and natural frequency of the system if the magnification factor is less than unity?

3 Explain Holzer's method — 20
Use Holzer's method to determine the natural frequencies of the spring mass



4 Determine the natural frequencies and mode shapes of the system shown using matrix method. — 20



Page 1

Bharatiya Vidya Bhavan's

SARDAR PATEL COLLEGE OF ENGINEERING

(An Autonomous Institution Affiliated to University of Mumbai)

5	a.	Explain Rayleigh Ritz method of finding natural frequency.	8+12
	b.	How does a vibration isolator function. Derive for a single degree of freedom system?	
6	a.	What is Chasles' theorem.?	5+15
	b.	Derive the time derivatives of a point fixed on rigid body moving on rigid body for different reference frames	
7	a.	Show the various terms in the forced equation of motion of a viscously damped system in a vector diagram	8+6+6
	b.	Will the force transmitted to the base decrease with the addition of damping. Explain	
	c.	Why is viscous damping used in most cases rather than other types of damping?	