M.Tech (Machine Design) sem I - Tribology.

Lib 07-01-16 Re-Exam

Bhartiya Vidya Bhavan's

Sardar Patel College of Engineering

(An Autonomous Institution affiliated to University of Mumbai)

Repeat Exam. **07.01.2016 First Half 2015-16**

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

Duration: **4 Hrs.** Total Marks: **100**

Master file.

N.B.: 1. Answer any **five** questions.
2. Use of **PSG Design Data Book** and **Certified Charts** is permitted.
3. Assume suitable data, if necessary, giving reasons.
4. Draw neat sketches to illustrate your answers.
5. Figures to the right indicate full marks.

1. (a)Derive Petroff's equation and explain its significance. **06**
   (b)Design a hydrodynamically lubricated journal bearing to support a radial load of 20kN for turbine shaft operating at 400 rpm. Select a suitable lubricating oil, show thermal balance and analyse the operating parameters such as oil temperature, viscosity, flow rate, minimum film hickness, coefficient of friction, friction power loss, maximum pressure, etc. **14**

2. (a)Explain briefly the procedure of selecting a suitable rolling contact bearing for different given applications. Discuss important factors. **06**
   (b) Select suitable size of deep groove ball bearing subjected to the following load cycle which is repeated. **14**

Sr. No.	Radial Load (kN)	Axial Load (kN)	Speed (rpm)	Percent Time	Load Type
1	3.0	1.6	200	35	Uniform
2	4.0	2.1	260	45	with mild shock
3	2.5	1.0	340	20	with moderate

   The expected life is 10000 hrs, a probability of survival of 92 percent and operating at 110° C temperature.

3. (a)Describe the constructional features and operating principles of fixed and tilting pad hydrodynamically lubricated thrust bearings. Compare fixed and tilting pad bearings. **06**
   (b)Design a hydrodynamic rectangular plane-slider bearing, length in direction of motion B, 0.8 times the length in direction perpendicular to motion L, slider velocity u = 1 m/s, load W=20 kN, lubricating oil used SAE 30 at 65°C. Assume maximum load condition for which, $C_P = 0.16024$, $C_F = 0.753191$, $C_f = 4.7000$, and $C_C = 0.5779$. **14**
   Find the inclination of the surfaces, coefficient of friction, power loss, heat generated, oil flow rate, oil temperature rise, location of centre of pressure etc. Use minimum film thickness 40 microns.

4. (a)Define wear and explain briefly different types of wear. Describe in detail abrasive wear, factors affecting it and its estimation. **10**
   (b)Describe briefly the requirements and properties of lubricants, the additives used and their role in enhancing the properties and utility of lubricants. **10**

M.Tech. (Machine Design) Sem I -
Tribology - Dt. 07/01/16.

5. (a) Explain various types of compensators and their use in hydrostatic bearings. What is oil-lift? **06**
   (b) Design a circular pad hydrostatically lubricated thrust bearing to support a load of 20 kN for a shaft operating at 300 rpm. The bearing is fed from a manifold pressure of 40 bar through an orifice compensator, the film thickness is 40 micron, oil SAE 20 at 53° C. Assume recess to pad radii ratio for minimum pump power and compensator to bearing resistance ratio for maximum bearing stiffness condition. Calculate oil flow rate, pump power, friction power, bearing stiffness, oil temperature rise, orifice size, etc. **14**

6. (a) Describe theory of elastohydrodynamic lubrication, along with pressure distribution. **06**
   (b) Discuss various theories of friction. **06**
   (c) Two smooth circular discs, each 200 mm in diameter, are separated by film of SAE 40 oil At 25° C. Find the time required for the oil film to change its thickness from 40 micron to 6 micron, if the load applied is 500 N. Derive the equations used, if any. **08**

7. (a) A 600 mm square pad with four 200mm square recesses placed at 60 mm from the edges, supports load of 600 kN. Calculate the recess pressures at lift-off and during sliding, flow rate for, a film thickness of 0.1 mm of SAE 30 oil at 45° C. Calculate also the resistance to slider motion at a velocity of 0.4 mm/s, coefficient of friction, pump power, oil temperature rise etc. If a capillary compensator is used in each recess circuit with a pressure drop equal to that for the bearing and a single pump, revise the calculations. **12**
   (b) Describe Kingsbury's electrical analogy method for measurement of pressures developed in hydrodynamically lubricated journal bearing. Draw neat sketches . **08**

Lib — Re-Exam
05-01-16

M.Tech. (Mech) Sem I.
Machine Dynamics & Advanced Vibration.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

Re-Examination
January 2016

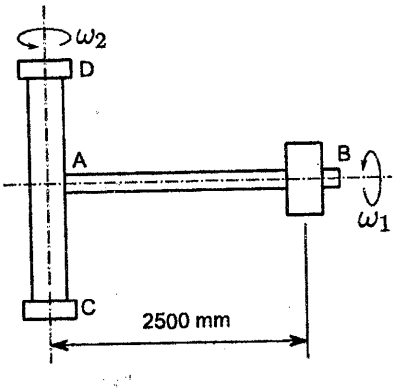
Max. Marks: **100** Duration: **4 Hour**
Class: **M.Tech.** Semester: **I** Program: **M.Tech. in Machine Design**
Name of the Course: **Machine Dynamics and Advanced Vibration** Course Code: **MTMD102**

Instructions:
1. Question No 1 is **compulsory**. Attempt any four questions out of remaining six.
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary

Master file.

Q1 a) State Chasles' theorem for describing the general motion of a rigid body. **(3)**
b) Write short note on Euler's equations of motion. **(3)**
c) A vehicle is vibrating badly while moving on a uniformly bumpy road. Will a change in speed improve the condition? Explain briefly. **(2)**
d) Explain the stiffness and flexibility influence coefficient methods employed in analysis of vibration problems. **(3)**
e) Explain single and double plane balancing in brief. **(3)**
f) How do you recognize a nonlinear vibration problem? What are the various sources of nonlinearity in a vibration problem? Provide suitable examples. **(3)**
g) Give two examples of mechanical vibration exciters. Support your answer with neat sketches. **(3)**

Q2 a) A thin disk weighing 5 kg rotates on rod AB at speed of $\omega_1 = 50$ rad/s in clockwise direction looking from B to A. The radius of disk is 125 mm and the disk is located 2500 mm from centreline of shaft CD, to which rod AB is fixed. Shaft CD rotates at $\omega_2 = 25$ rad/s in counter clockwise direction looking from D to C. Find bending moment on rod AB at the location of disk. **(8)**



b) An engine weighing 2800 N is supported on pedestal mount. It has been observed that the engine induces vibration into the surrounding area through its pedestal mount at an operating speed of 5500 rpm. Determine parameters of vibration absorber that will reduce the vibration when mounted on pedestal. The magnitude of exciting force is 280 N and amplitude of auxiliary mass is to be limited to 3 mm. **(5)**

(1)

M.Tech. (Mech) Sem I - Dt - 05/01/16.
Machine Dynamics & Advanced Vibrations.

c) Explain signature analysis in the context of experimental study of vibrations. (3)

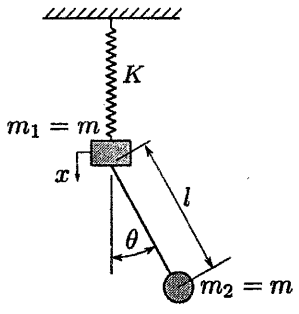
d) A vibration pickup has a natural frequency of 6 Hz and a damping ratio of ζ = 0.5. Find the lowest frequency that can be measured with 2 percent error. (4)

Q3 a) Prove that mass moment of inertia of a rigid body about axis '*kk*' having direction cosines *(l, m, n)* with respect to coordinate system *xyz* is given by (5)

$$I_{kk} = l^2 I_{xx} + m^2 I_{yy} + n^2 I_{zz} - 2lmI_{xy} - 2lnI_{xz} - 2mnI_{yz}$$

where I_{ij} are mass inertia terms in *xyz* coordinate system.

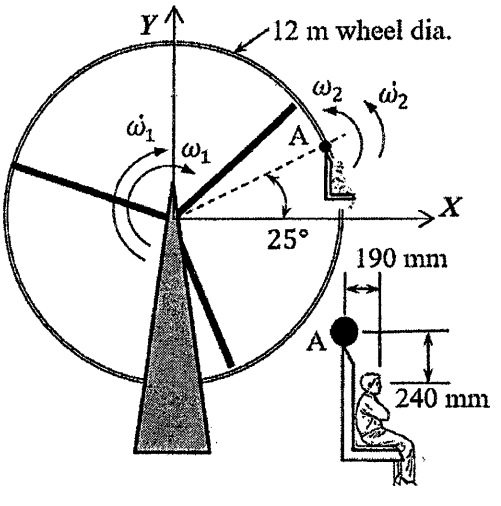
b) Develop the equation of motion for the system shown by using Lagrange's equation with x and θ as generalised coordinates. (7)



c) Write a short note on method to find response of a single degree of freedom system subjected to general periodic forcing conditions. (4)

d) What us meant by static and dynamic coupling? How can you eliminate the coupling of equations of motion? (4)

Q4 a) A Ferris wheel, at the instant shown, has an angular speed $\omega_1 = 0.25$ rad/sec and a rate of change of angular speed $\dot{\omega}_1 = 0.02$ rad/sec^2 relative to the ground. At this instant a chair shown in the diagram has an angular speed $\omega_2 = 0.45$ rad/sec and a rate of change of angular speed $\dot{\omega}_2 = 0.03$ rad/sec^2 both relative to the Ferris wheel. The figure shows details of the passenger's position at this instant. Note that the hinge of the seat is at A. How many g's of acceleration is the passenger's head subjected to? (12)



b) What is the principle of operation of vibration isolator? Explain briefly with appropriate equation and sketch. (4)

c) An accelerometer has an undamped natural frequency of 100 Hz and damping constant of 22 N-s/m. It is used to measure vibrations of a machine operating at a speed of 1800 rpm. If the actual and recorded accelerations are 8 and 7.9 m/s^2, find the mass and the spring constant of the accelerometer. (4)

Q5 a) Explain meaning of a singular or equilibrium point of a non-linear vibration system. Give the classification of equilibrium points with their representation on phase plane diagram. Describe in short the concept of limit cycles with a sketch. (7)

(2)

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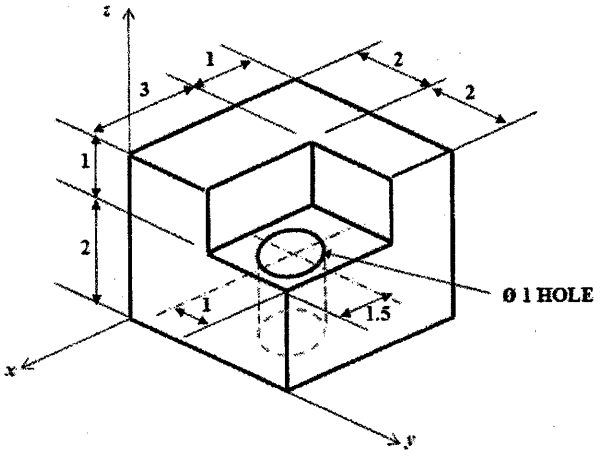
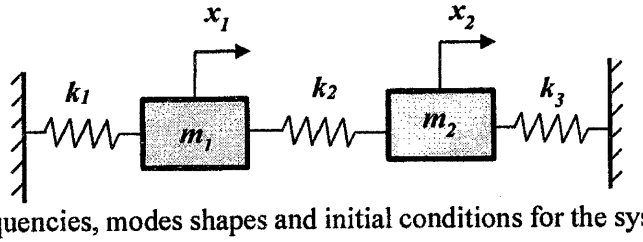
Machine Dynamics & Advanced Vibration

b) Find I_{yy} for the body about origin of axes x, y, z shown in the figure. All dimensions are in meters. Take unit density for the body. **(4)**



c) Find free vibration response of spring-mass system shown below using modal analysis. Consider $m_1 = 2$, $m_2 = 3$, $k_1 = 10$, $k_2 = 20$, $k_3 = 30$. **(9)**



Natural frequencies, modes shapes and initial conditions for the system are as given below.

$$\omega_1 = 2.7615, \quad \{X^{(1)}\} = \begin{Bmatrix} 1 \\ 0.7374 \end{Bmatrix} X_1^{(1)}$$

$$\omega_2 = 4.9032, \quad \{X^{(2)}\} = \begin{Bmatrix} 1 \\ -0.904 \end{Bmatrix} X_1^{(2)}$$

$$\{x(0)\} = \begin{Bmatrix} 1 \\ 0 \end{Bmatrix}; \ \{\dot{x}(0)\} = \begin{Bmatrix} 0 \\ 0 \end{Bmatrix}$$

Q6 a) Explain using suitable example, Holzer's method for obtaining natural frequency and mode shapes of a vibration system. **(5)**

b) Derive the governing partial differential equation of motion for free vibration of a stretched cable or string. Highlight the assumptions made. **(9)**

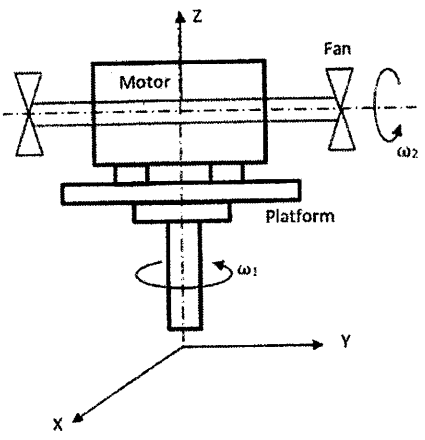
c) A rotor with an unbalance during a balancing test indicates an amplitude of 10 μm and a phase angle of 32° anticlockwise from phase mark. After a trial weight of magnitude 3 gm is added at an angular position 45° clockwise from the phase mark, the amplitude and the phase angle become 5 μm and 110° anticlockwise, respectively. Find the magnitude and angular position of the balancing weight required. **(6)**

Q7 a) Illustrate with suitable example, t he procedure for obtaining solution to the equation of motion of a non-linear vibration system using graphical method. Explain meaning of following terms used in the method: (i) phase plane, (ii) trajectory and (iii) isocline. Explain how you can obtain time solution from phase plane trajectories. **(8)**

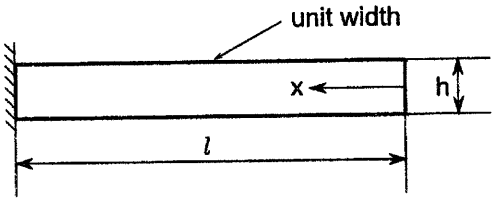
(3)

M-Tech. (Mech) Sem I & DT - 05/01/16.
Machine Dynamics & Advanced Vibration.

b) An electric motor is mounted on a rotating platform having an angular velocity $\omega_1 = 3$ rad/s. The motor drives two fans at the rate of $\omega_2 = 1200$ rpm relative to the platform. The fan plus armature of motor have total mass of 12 kg and a radius of gyration along axis of 100 mm. About Z-axis the radius of gyration is 100 mm. What is the torque coming onto bearings of the motor as a result of motion? **(5)**



c) Find fundamental frequency of transverse vibration of a cantilever beam shown in the figure using Rayleigh's method. Use deflection shape, $w(x) = (1 - x/l)^2$ **(7)**



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Lib – Re-Exam
04-01-16

F.Y.M.Tech.(Mech-m/c design) sem I.
Stress Analysis.

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar, Andheri (West), Mumbai 400 058

(A Government Aided Autonomous Institute)

Re-exam-END SEMESTER- JAN-2016

Course: MTMD101 – STRESS ANALYSIS

Duration: 4 hours Marks: 100

Class/Branch: First year M.Tech. (Mechanical-m/c design) Semester: I

Note:

- **Question No 1 is compulsory**
- **Attempt any four questions out of remaining six.**
- Assume suitable data if required and state it clearly.
- Figures to right indicate full marks.
- Answers to all sub-questions should be grouped together. Master file.

Q1. **a)** Derive the equation of stress equilibrium in 3-D. **20**

b) State the advantages of Experimental Stress Analysis. List the different techniques of ESA.

c) Write step by step graphical construction for determination of normal and shearing stress.

d) Define composites. Name any four fields of applications where composites are widely used. Classify FRP composites.

Q2 **a)** Derive the tranformation equations for stresses at a point (i.e. from XYZ coordinates to X'Y'Z'), for six stress components. **20**

Q3 **a)** State of a stress at a point is given by, $\sigma_x = 20$, $\sigma_y = 40$, $\sigma_z = -20$, $\tau_{xy} = -40$, $\tau_{xz} = -60$, $\tau_{zy} = 20$; in MPa units. Determine i)principal stresses and their directions. ii)max shearing stress, iii)octahedral stresses, iv)stress deviator. **10**

b) For the given stresses in Q.3a. find the strain component at this point. Take $G = 80 \times 10^6$ kPa, $\nu = 0.3$. **06**

c) State and explain Airy's stress function. **04**

(1)

F.Y.M.Tech. (Mech. m/c design) sem I.
Stress Analysis - Dt. 04/01/16.

Q4	a)	Name the different theorems used for analysis of stress. Explain Maxwell-betti-Reyleigh reciprocal theorem.	12
	b)	Write the expression for elastic energy due to: axial force, shear force,bending moment,torque.	8
Q5	a)	Classify the strain gauges; what are the characteristics of ideal SG? What is gauge factor?	10
	b)	What are the types of strain gauge Rosettes? Explain rectangular type SGR	10
Q6	a)	What is transverse isotropic composites? Obtain stress strain relation and compliance coefficients b_{ij} in terms of E,ν and G.	10
	b)	Draw the neat sketch of experimental set-up and discuss photo-elastic method of stress analysis.	10
Q7	a)	Derive the Bi-harmonic equation in Polar Coordinates.	10
	b)	Proove that for rotating disc- $\sigma_r = -\left(\frac{3+\nu}{8}\right)\rho\omega^2 r^2 + \frac{C_1}{2} + \frac{C_2}{r^2}$ $\sigma_\theta = -\left(\frac{1+3\nu}{8}\right)\rho\omega^2 r^2 + \frac{C_1}{2} - \frac{C_2}{r^2}$	10

(2)

Library
21/11/15

M.Tech. Machine Design - Sem I.
Machine Dynamics & Advanced Vibrations.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Examination Master File.
November 2015

Max. Marks: **100** Duration: **4 Hour**
Class: **M.Tech.** Semester: **I** Program: **M.Tech. in Machine Design**
Name of the Course: **Machine Dynamics and Advanced Vibration** Course Code: **MTMD102**

Instructions:

1. Question No 1 is **compulsory**. Attempt any four questions out of remaining six.
2. Answers to all sub questions should be grouped together.
3. Figures to the right indicate full marks.
4. Assume suitable data if necessary

Q1 a) What is Ellipsoid of Inertia? Explain briefly and discuss physical interpretation of its shape. **(3)**

b) A cylindrical object is having rotational speed of $\vec{\omega} = 3\vec{i} + 4\vec{j} + 5\vec{k}$ rad/s. It is subjected to external torque of $\vec{T} = 50\vec{k}$ Nm. Calculate the angular acceleration components of object at this instant. The object has mass of 100 kg and radii of gyration are $k_x = k_y = 1$ m and $k_z = 0.5$ m. **(3)**

c) Describe the meaning of coordinate coupling with an example of two-DOF system. Define the principal coordinates of system. **(3)**

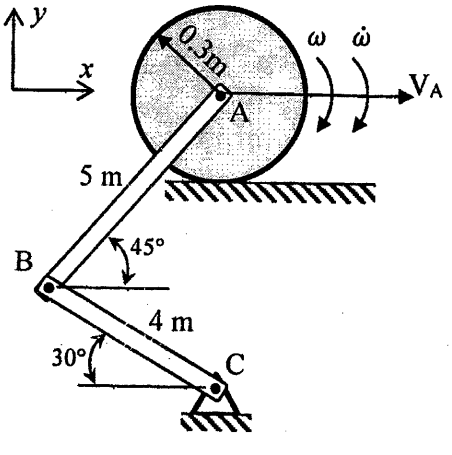
d) Derive the expression for computing natural frequency using Dunkerley's method. **(3)**

e) Write short note on Tuned Vibration Absorber. State its characteristics. **(3)**

f) What is a Limit cycle in the context of non-linear vibration? Briefly describe. **(3)**

g) Sketch a electrodynamic shaker and label its important parts. **(2)**

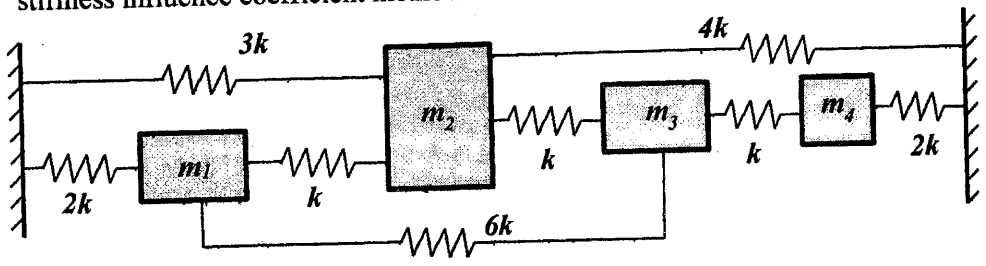
Q2 a) A cylinder rolls without slipping. It has angular velocity $\omega = 0.5$ rad/s and angular acceleration $\dot{\omega} = 0.02$ rad/s^2. Calculate the angular velocity of member AB.
Propose method to obtain the angular acceleration of member AB (do not perform numerical calculations for angular acceleration). **(12)**



(1)

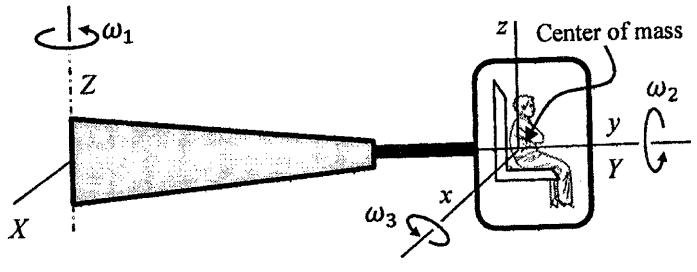
M.Tech. Machine Design - Sem I Dt. 21/11/15
Machine Dynamics & Advanced Vibrations

b) Derive the stiffness matrix of the spring-mass system shown in the figure using stiffness influence coefficient method. **(5)**



c) Differentiate between a vibration isolator and a vibration absorber. **(3)**

Q3 a) A person is seating in a centrifuge which allows rotation of seating chamber about axes x, y, Z. If $\omega_1 = 1$ rad/s, $\omega_2 = 2$ rad/s and $\omega_3 = 3$ rad/s, what torque must the seat develop about the center of mass of the person as a result of this motion? The person weighs 700 N and has following radii of gyration while seating in the seat: $k_x = 600$ mm, $k_y = 500$ mm, $k_z = 150$ mm. **(8)**

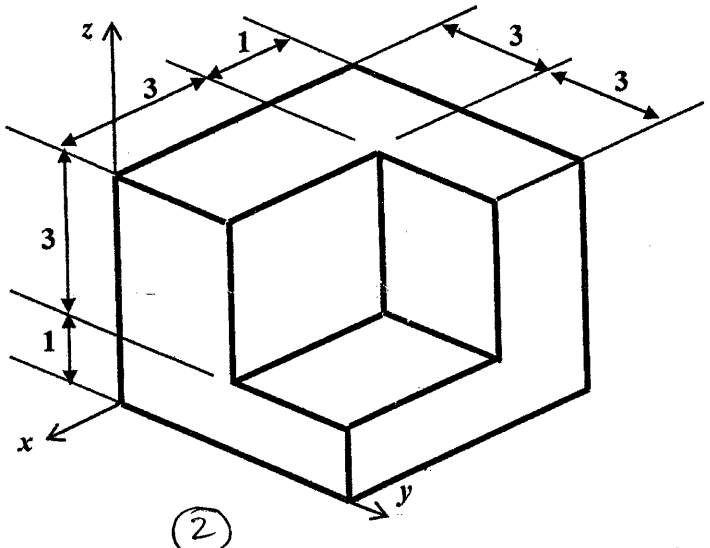


b) A vibrometer is to be used to measure vibration of the foundation of an internal combustion engine over speed range of 500 to 1000 rpm. The vibration is composed of two harmonics, the first one caused by the primary inertia forces and the second one by the secondary inertia forces in the engine. Prescribe t he maximum natural frequency of the vibrometer in order to have an amplitude distortion less than 2 percent. **(4)**

c) Briefly describe two types of frequency measuring mechanical instruments. **(4)**

d) Explain signature analysis in the context of experimental study of vibrations. **(4)**

Q4 a) Find I_{xx} and I_{xy} for the body about origin of axes x, y, z shown below. All dimensions are in meters. Take unit density for the body. **(4)**

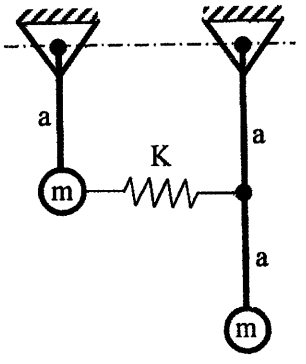


(2)

M.Tech. Machine Design - Sem I Dt. 21/11/15

Machine Dynamics & Advanced Vibrations.

b) Use Lagrange's equations to formulate the differential equations governing the motion of pendulum-spring system shown in the figure. Assume rods are rigid and mass of rod is neglected. **(8)**

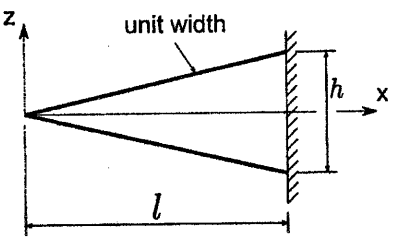


c) Describe the method of "Modal Analysis" used to obtain solution for free vibration of a multi-degree of freedom system. **(4)**

d) Explain how Fourier series expansion can be used to obtain response of a single degree of freedom vibration system under general periodic forcing function **(4)**

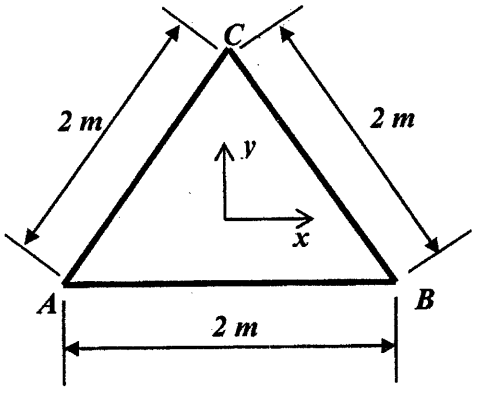
Q5 a) Illustrate two degree of freedom system with any four examples taken from real life. Support your answer with neat sketches. **(4)**

b) Find fundamental frequency of transverse vibration of non-uniform cantilever beam shown below using Rayleigh's method. Use deflection shape $w(x) = \left(1 - \frac{x}{l}\right)^2$. Explain the Rayleigh-Ritz method used to compute natural frequency. Compare the Rayleigh-Ritz method against Rayleigh method. **(10)**



c) An unbalanced flywheel shows an amplitude of 8 μm and a phase angle of 22° clockwise from the phase mark. When a trial weight of magnitude 4 gm is added at an angular position 30° counter clockwise from the phase mark, the amplitude and the phase angle become 10 μm and 60° counter clockwise, respectively. Find the magnitude and angular position of the balancing weight required. **(6)**

Q6 a) A triangular plate is moving along horizontal surface. The components of velocity of three corners are $V_{Ax} = -3$ m/s, $V_{By} = +2$ m/s and $V_{cy} = -1$ m/s. What is the angular speed of plate? **(4)**



b) A 150 kg sewing machine operates at 1200 rpm and has a rotating imbalance of 0.45 kg-m. Calculate the maximum stiffness of an isolator with damping ratio of 0.08 such that the force transmitted to the machine's foundation is less than 2000N. **(8)**

(3)

M.Tech. Machine Design - Sem I Dt. 21/11/15

Machine Dynamics & Advanced Vibrations.

c) What is a singular or equilibrium point of a non-linear vibration system? With derivation of necessary equations explain the classification of equilibrium points. Draw neat sketches to illustrate nature of the equilibrium points. **(8)**

Q7 a) The angular momentum of a body about point A is $\overrightarrow{H_A} = I_{xx}\omega_x\vec{i} + I_{yy}\omega_y\vec{j} + I_{zz}\omega_z\vec{k}$ when the coordinate axes x,y,z are aligned with axes of principal M.I. of body. Formulate Euler's equations of motion using the expression for $\overrightarrow{H_A}$. **(5)**

b) Formulate governing partial differential equation of motion for free vibration of a stretched cable or string. Highlight the assumptions made. **(7)**

c) Explain the procedure for obtaining solution to the equation of motion of a non-linear vibration system using graphical method. Explain meaning of following terms used in the method: (i) phase plane, (ii) trajectory and (iii) isocline. Describe the procedure employed to obtain time solution from phase plane trajectories. **(8)**

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24/11/2015

M Tech. Mech. Sem I
Reliability Engg. & Design of Experiments.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam

November 2015

Max. Marks:100 **Duration: 4hrs**

Class: MTech Mechanical **Semester: I** **Program: MTech Mechanical**

Name of the Course: Reliability Engg. And Design of Experiments **Course Code : MTMD103**

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary
5. Use of Standard Tables permitted

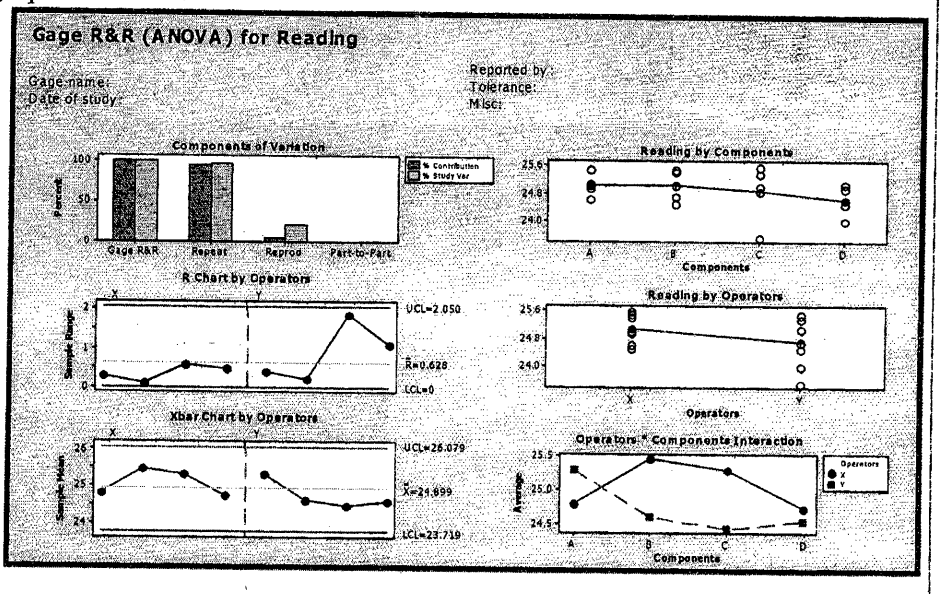
Master file.

<table>
<tr><th>Question No</th><th></th><th>Maximum Marks</th></tr>
<tr><td>Q1</td><td>Write the short notes on the followings
A. Definition of Reliability
B. Guage R and R
C. Design of orthogonal array
D. Bath tub curve</td><td>20</td></tr>
<tr><td>Q2A</td><td>Weight of 10 products are given in the table. Can we declare the variance of distribution of all wts. of all products from which the sample of 10 products was drawn is equal to 20 kgs? Test this at 5% and 1 % level of significance
<table>
<tr><td>Sr no</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td></tr>
<tr><td>wts</td><td>38</td><td>40</td><td>45</td><td>53</td><td>47</td><td>43</td><td>55</td><td>48</td><td>52</td><td>49</td></tr>
</table></td><td>10</td></tr>
<tr><td>Q2B</td><td>Find an equation of line. Refer the Following table.
<table>
<tr><td>X</td><td>1</td><td>3</td><td>4</td><td>6</td><td>8</td><td>9</td><td>11</td><td>14</td></tr>
<tr><td>Y</td><td>1</td><td>2</td><td>4</td><td>4</td><td>5</td><td>7</td><td>8</td><td>9</td></tr>
</table></td><td>10</td></tr>
</table>

01

M.Tech. Mech. Sem I. Dt. 24/11/15

Reliability Engg. & Design of Experimental.

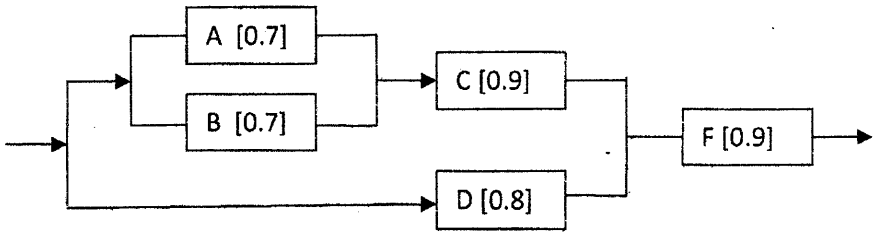
Q3A	Minitab output is given below for MSA. Comment on the following graphs in detail. 	10
Q3B	For an emergency operation theatre in a hospital, the power is obtained from the main city supply through a transformer connected in series. To ensure an uninterrupted supply, an auxiliary generator is also used with a suitable switch over. The probability of failure of the city supply is 0.01 and the transformer reliability is 0.996. The auxiliary power generator has a reliability factor of 0.99. Draw the block diagram for the system. Construct the fault tree, calculate the reliability of the system.	10
Q4A	Prepare a Design FMEA for launching a New Solar Water Heater.	10
Q4B	Test results conducted under severe adverse conditions on 1000 safety valves are given in table. Compute the Failure density and hazard rate when time interval is four hours instead of one hour.	10

Time interval	Number of failures
0	0
0-4	267
4-8	59
8-12	36
12-16	24
16-20	23
20-24	11

Q5A	Explain the following points with respect to Chi Square test. A. Purpose of using Chi Sq Tests B. Chi Sq. Distribution C. Chi Sq.Table D. Observed frequencies and Estimated frequencies E. Types of application of Chi Sq Test	10
Q5B	Explain the following terms with suitable examples. A. Bias B. Linearity C. Scatter Digram and its significance D. Karl pearson coefficient of corelation and its significance E. Types of DOE and applications	10

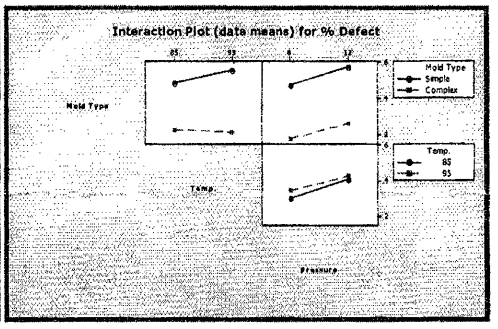
M.Tech. Mech. Sem I. Dt. 24/11/15

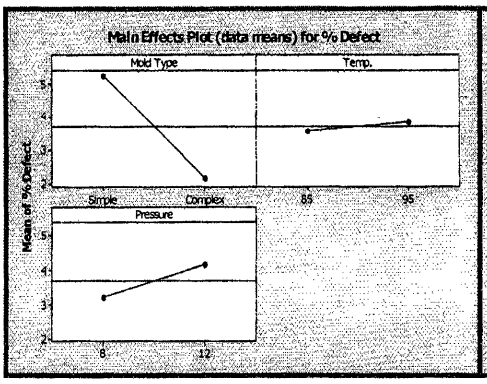
Reliability engg & Design of Experiments.

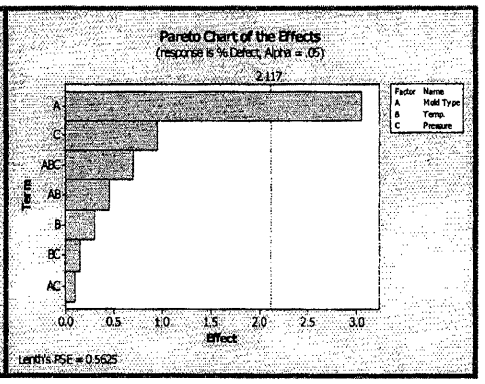
Q6A	Five elements [A,B,C,D, and F] of a system are connected as shown in figure, which also shows reliability of each element. Calculate the system reliability. 	10
Q6B	We want to test on the basis of sample size 35 determinations and at 0.05 level of significance whether the thermal conductivity of a certain kind of cement plate is 0.34 units, as has been claimed. The mean of sample is 0.343. From the information gathered in similar studies , we can expect that the variability of such determinations is given by $\sigma = 0.01$.	10
Q7	Comment on the following graphs for the design of experiments. Prepare the Prediction model based on the minitab results. Explain the terms lurking variable, degree of freedom, type I and Type II error	20

Estimated Coefficients for % Defect using data in uncoded units

Term	Coeff.
Constant	-8.12500
Mold Type	-28.7250
Temp.	0.105000
Pressure	0.912500
Mold Type*Temp.	0.305000
Mold Type*Pressure	3.12500
Temp.*Pressure	-0.00750000
Mold Type*Temp.*Pressure	-0.0350000







3

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Best of Luck !!!

M.E. (Machine Design) I
Tribology

Lib
26-11-15

Bhartiya Vidya Bhavan's

Sardar Patel College of Engineering

(An Autonomous Institution affiliated to University of Mumbai)

End Sem. Exam. **26.11.2015 First Half f2015-16**
Class/Sem.: **M.E. (Machine Design)/I** Subject: **Tribology**
Duration: **4 Hrs.** Total Marks: **100**

N.B.: 1. Answer any **five** questions.
2. Use of PSG Design Data Book is permitted.
3. Assume suitable data, if necessary, giving reasons.
4. Draw neat sketches to illustrate your answers.
5. Figures to the right indicate full marks.

Master file.

1. (a) Explain principles of operation, construction and control of hydrostatic thrust bearing and various factors affecting the design. **06**

(b) Design a circular pad hydrostatically lubricated thrust bearing to support a load of 60 kN for shaft operating at 240 rpm. The bearing is fed from a manifold pressure of 40 bar through a capillary restrictor, the film thickness is 0.05 mm, oil SAE 30 at 45° C, density 0.86 gm/cc, specific heat 1.76 kJ/kg °C. Assume recess to pad radii ratio of 0.5 and restrictor to bearing resistance ratio for maximum bearing stiffness condition. Calculate bearing inlet pressure, oil flow rate, pump power, friction power, bearing stiffness, oil temperature rise and capillary dimensions etc. **14**

2. (a) State advantages, disadvantages of rolling contact bearing over sliding contact bearing. **06**

(b) Select the suitable size and type of rolling contact bearing subjected to the following load cycle which is repeated. **14**

Sr. No.	Radial load (kN)	Axial load (kN)	Speed (rpm)	Type of load	Time(sec)
1	3	1.4	300	Steady	3
2	4	1.6	400	Moderate shock	2
3	2.4	2.0	200	Mild shock	5

The expected life is 8000 hrs., a probability of survival of 92% and an operating temperature of 120° C.

3. (a) Describe the constructional features and operating principles of fixed and tilting pad hydrodynamically lubricated thrust bearings. Compare fixed and tilting pad bearings. **06**

(b) Design a hydrodynamically lubricated thrust bearing for vertical turbine shaft to support a thrust 400 kN, when operating at 240 rpm. Use minimum oil film thickness of 0.06 mm, lubricating oil SAE 30 at 65°C. Assume maximum load condition for which, **14**

$C_P = 0.16024$, $C_F = 0.753191$, $C_f = 4.7000$, and $C_C = 0.5779$.

Find the inclination of the surfaces, coefficient of friction, power loss, heat generated, oil flow rate, oil temperature rise, etc.

4. (a) Define wear and explain briefly different types of wear. Describe in detail adhesive wear and its estimation. **10**

(b) Describe theory of elastohydrodynamic lubrication and its importance. Discuss the oil film shape and pressure distribution with neat sketches. **10**

M.E. (Machine Design)/I.
Tribology. Dt. 26/11/15

5. (a) State most general form of 3-dimensional Reynold's equation and explain significance of each term of the equation and applications. **06**

(b) Design a hydrodynamically lubricated journal bearing to support a radial load of 16 kN for a turbine shaft operating at 600 rpm. Select a suitable lubricating oil, show heat balance and analyse the operating parameters such as oil temperature, viscosity, flow rate, minimum film thickness, coefficient of friction, friction power loss, maximum pressure, etc. **14**

6. (a) A rectangular pad 300mm x 200mm with four rectangular recesses each 100mm x 60mm located symmetrically at 25 mm from the respective edges, supports a thrust load of 120 kN. Calculate the recess pressures at lift-off and during sliding, flow rate for oil SAE 30 at 45°C and film thickness of 0.06 mm. Calculate also the resistance to slider motion at a velocity of 0.5mm/s, coefficient of friction, pump power, oil temperature rise etc. If a capillary restrictor is used in each recess circuit with a pressure drop equal to that for the bearing and a single pump, revise the calculations. **12**

(b) A boat is moved at 25 km/hr by a 125 rpm speed propeller, powered from 250 kW engine with propeller efficiency of 80 percent. The thrust bearing on propeller shaft 120mm diameter, consists of several flat faced collars on the shaft, bearing against stationary rings in a housing, with net-bearing surfaces140 mm inside, 220 mm outside diameter and equal sharing of thrust. Use pv= 0.35 MPa.m/sec, taking velocity v at mean diameter, calculate the thrust and number of collars. Also calculate the power loss in bearing friction and wear on pads in 1000 hours. Assume wear coefficient $K=20\times10^{-6}$, hardness H=800 MPa and coefficient of friction f=0.10. **08**

7. Write notes on any four of the following: **20**
   (a) Theories of friction
   (b) Stick-slip phenomenon.
   (c) Solid lubricants.
   (d) Friction materials for brakes and clutches and their properties.
   (e) Preloading of rolling contact bearings.

M.Tech. (M/C design) Sem I.
CAD.

Gibray
28/11/2015

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

End Semester Exam
November 2015

Max. Marks:100
Class: M.tech M/C design
Name of the Course: CAD

Semester: I

Duration: 4hrs
Program: Mtech. M/C Design
Course Code : MTMD111

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Master file.

Q.1 (a) Develop a C++ program to carry out following transformations on a 2D object like line. Insert necessary comments wherever necessary. **[20]**

1) Shear 2) Rotation 3) Reflection 4) Translation

Q.2 (a) Construct a B-Spline curve of order 4 and with 4 polygon vertices A (1,1), B(2,3), C(4,3) and D(6,2) **[12]**

(b) Using Bresenham's Circle Algorithm produce sequence of atleast five points along the circumference of the circle with radius = 20 and centered at (50,50). Write all the iterations required. **[05]**

(c) Write a note on significance of Object Oriented database in Mech. Engg. **[03]**

Q.3 (a) Use the Cohen Sutherland Algorithm to clip two lines P1 (40,15) P2 (75,45) and P3(70,20) P4 (100,10) against a window A(50,10) B(80,10) C(80,40) D(50,40). **[06]**

(b) Explain Painters Algorithm along with neat sketches **[08]**

(c) Consider a line from (5,5) to (13,9). Use the Bresenhams Algorithm to rasterize the Line **[06]**

M.Tech. (M/C design) Sem I
CAD. Dt. 28/11/15

Q.4 (a) What do you understand by the terms "Window" & "Viewport". Derive the mapping for any given point (Xw Yw) from the window onto the viewport. **[10]**

(b) Triangle PQR has vertices as P (2, 4), Q (4, 6), and R (2, 6). It is desired to reflect through an arbitrary line L whose equation is Y=0.5x+2. Calculate the new vertices of triangle. **[06]**

(c) Explain the concept of Knowledge Based Engineering **[04]**

Q.5 (a) A triangle is defined by three vertices A (0,2,1) B (2,3,0) C (1, 2, 1). Find the final Coordinates after it is rotated by 45 degree around a line joining the points (2,2,2) and (1,1,1) **[10]**

(b) Explain Feature recognition along with neat sketches **[07]**

(c) Write a note on Jupiter technology **[03]**

Q.6 (a) Explain Reverse Engineering & its data capture techniques with neat sketches **[10]**

(b) Explain the complete concept of Design for Assembly **[10]**

Q.7 Write Short notes on (Any Three) **[20]**

- Virtual Manufacturing
- Graphics Standards
- Artificial Intelligence in Design
- Design of Gears using Object Oriented Programming.
- Structured Query Language (SQL)
- Geometric Modeling

Re.Exam Lib
08-01-16

M.Tech.(M/C design) sem I.
CAD.

Bharatiya Vidya Bhavan's

Sardar Patel College of Engineering

(A Government Aided Autonomous Institute)
Munshi Nagar, Andheri (West), Mumbai – 400058.

January 2016

Max. Marks:100 | Re-exam | Duration: 4hrs
Class: M.tech M/C design | Semester: I | Program: Mtech. M/C Design
Name of the Course: CAD | Course Code : MTMD111

Master file.

Instructions:

1. Question No 1 is compulsory.
2. Attempt any four questions out of remaining six.
3. Draw neat diagrams
4. Assume suitable data if necessary

Q.1 (a) Explain the properties of Bezier & B-Spline curve with neat sketches? **(12)**

(b) Write a C++ program for Bresenham's Line Algorithm? Insert comments wherever necessary **(08)**

Q.2 (a) Write a note on Structured Query Language? **(05)**

(b) Explain the concept of Design for Assembly in detail **(10)**

(c) Explain Cohen Sutherland Algorithm **(05)**

Q.3 Write Short notes on (Any Three) **(20)**

a) Window & Viewport Transformation
b) Design of Gears using Object Oriented Programming
c) Painters Algorithm
d) CSG - B-Rep & CAD system Architecture
e) Graphics Standards
f) Concurrent Engineering

Q.4 (a) Explain different Geometric modeling techniques with neat sketches **(10)**

(b) Explain the concept of Feature Recognition in detail **(10)**

M.Tech. (CM/C design) Sem I.
CAD. Dt. 08/01/16.

Q.5 (a) Explain Gouraud Shading Algorithm with figures **(05)**

(b) Explain the concept of Knowledge Based Engineering in detail **(10)**

(c) Write a note on virtual reality **(05)**

Q.6 (a) Find a transformation of triangle A (1,0) , B (0,1) C (1,1) by **(08)**

I. Rotating 45 degree about origin and then translating one unit in x & y direction
II. Translating one unit in x & y direction & then rotating 45 degree about origin

(b) Obtain transformation matrix for rotation about the line joining the points (0,0,0) and (1,1,1) with the angle of rotation 45 degree in counter clockwise sense **(06)**

(c) Explain the concept of Object oriented database **(06)**

Q.7 (a) How Reverse Engg. can be utilized by Indian Automotive/Auto component Industries for product development? Explain different data capture techniques used for the same. **(12)**

(b) Write a C++ program for Bresenham's circle algorithm **(08)**

Library
19/11/2015

F.E. M.Tech. Mech-Sem I
M/c Design.

BHARATIYA VIDYA BHAVAN'S

SARDAR PATEL COLLEGE OF ENGINEERING

Munshi Nagar, Andheri (West), Mumbai 400 058

(A Government Aided Autonomous Institute)

END SEMESTER NOV-2015

Course: MTMD101 – STRESS ANALYSIS

Duration: 4 hours Marks: 100

Class/Branch: First year M.Tech. (Mechanical-m/c design) Semester: I

Note:

- **Question No 1 is compulsory**
- **Attempt any four questions out of remaining six.**
- Assume suitable data if required and state it clearly.
- Figures to right indicate full marks.
- Answers to all sub-questions should be grouped together.

Master file.

Q1. **a)** Discuss Engesser's theorem. **20**

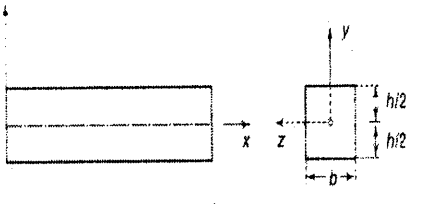
b) State the advantages of Experimental Stress Analysis. List the different techniques of ESA.

c) Write step by step graphical construction for determination of normal and shearing stress.

d) Define composites. Name any four fields of applications where composites are widely used. Classify FRP composites.

Q2 **a)** Derive the equation of stress equilibrium in 3-D. **06**

b) Determine σ_{xy} and σ_y; for the rectangular beam as shown in fig. Assume $\sigma_z = \sigma_{xz} = \sigma_{zy} = 0$. Boundary conditions are $\sigma_{xy} = \sigma_y = 0$ at the y=-h/2, $\sigma_{xy} = 0$ at y=h/2. (Take $\sigma_x = 12My/bh^3$). **10**



c) 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. **04**

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

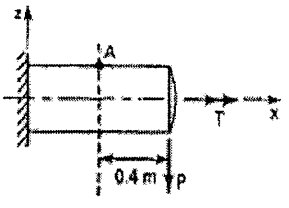
(1)

F.E. M.Tech. Mech. Sem I.
M/c Design Dt. 19/11/15

Q3 **a)** State of a stress at a point is given by, $\sigma_x = -5c$, $\sigma_y = \sigma_z = c$, $\tau_{xy} = c$, $\tau_{xz} = \tau_{zy} = 0$; where c=1000 kPa. Determine i)principal stresses and their directions. ii)max shearing stress, iii)octahedral stresses, iv)stress deviator. **10**

b) State of a stress at a point is given by, $\sigma_x = 100$ MPa, $\sigma_y = -20$ MPa, $\sigma_z = -40$MPa, $\tau_{xy} = \tau_{xz} = \tau_{zy} = 0$. Determine i) Principal shear strain ii) octahedral shear strain. Take E= 200 GPa. ν=0.25. **06**

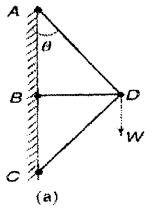
c) A thin walled cylinder pressure vessel of 240mm diameter and 5mm wall thickness is rigidly attached to a wall, forming a cantilever (as shown in fig.). Calculate the maximum shearing stresses and associated normal stresses at point 'A'. Given, int. pressure p= 1.1MPa, P=10kN, T= 5kN.m. **04**



Q4 **a)** Explain the Castigliano's first theorem. What is fictitious load method? How it is different from Castigliano's first theorem? **08**

b) Explain the theorem of virtual work. **4**

c) Three elastic members AD,BD and CD are connected by smooth pins as shown in figure. All the menbers have same cross-sectional area and are of the same material.BD is 150mm long and members AD and CD are each 300mm long. Calculate the deflection of D under load W. **8**

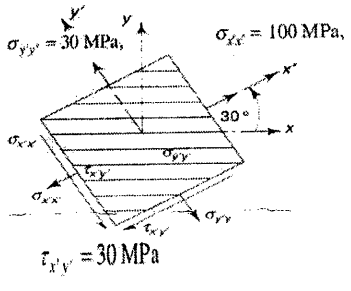


Q5 **a)** Classify the strain gauges; what are the characteristics of ideal SG? What is gauge factor? **10**

b) Draw the neat sketch of experimental set-up and discuss photo-elastic method of stress analysis. **10**

Q6 **a)** What is transverse isotropic composites? Obtain stress strain relation and compliance coefficients b_{ij} in terms of E,ν and G. **10**

b) At a point in the laminate the stresses given are as shown in figure.Determine the Principal stresses and principal strains and their orientation in the plane of laminate. Given: E_{xx}= 100GPa; E_{yy}= 10 GPa; ~~G_{xy}=5 GPa, ν_{yx}~~ = 0.25. **10**



Q7 **a)** Derive the Bi-harmonic equation in Polar Coordinates. **10**

b) Proove that for rotating disc- **10**

$$\sigma_r = -\left(\frac{3+\nu}{8}\right)\rho\omega^2 r^2 + \frac{C_1}{2} + \frac{C_2}{r^2}$$

$$\sigma_\theta = -\left(\frac{1+3\nu}{8}\right)\rho\omega^2 r^2 + \frac{C_1}{2} - \frac{C_2}{r^2}$$

(2)