Ganpat University

M. Tech. (CAD/CAM) Sem. I Mechanical Engineering

CBCS (New) Regular Examination Nov/Dec. 2015

(3ME114) Advanced Machine Design and Dynamics

Duration: 3 hours | Marks: 60

Instructions:

1. All questions are compulsory.
2. Assume suitable data if necessary.
3. Right figure indicate full marks.
4. Only scientific calculator is allowed.

SECTION - I

Q.1 Attempt the followings.

(a) Enlist the types of wear and explain adhesive wear in detail. Enlist the laws of adhesive wear. Also write the applications in which adhesive wear play major role. [4]

(b) A single row deep groove ball bearing operates for extra light load having the 15 mm diameter. The bearing subjected to an axial thrust of 1000 N and radial load of 2200 N. Find the expected life that 50% of the bearings will complete under this condition. [6]

OR

Q.1 Attempt the followings.

(a) Explain the objectives of lubrication. Explain different types of lubrication in detail. [4]

(b) The following data is given for a hydrostatic thrust bearing: [6]
Thrust load = 400 KN, shaft speed = 700 rpm, shaft diameter = 480 mm, recess diameter = 240 mm, oil film thickness = 0.15 mm, viscosity of lubricant = 160 SUS, specific heat of lubricant = 1.76 KJ/kg °C, and specific gravity of lubricant = 0.86, calculate: (i) supply pressure, (ii) flow required in lit/min, (iii) frictional power loss, (iv) pumping power loss, and (v) temperature rise.
Assume that the total power loss in the bearing is converted into frictional heat.

Q.2 Attempt the followings.

(a) Explain critically damped system using non-dimensional displacement-time plot and derive the equation for displacement of critically damped system. [4]

(b) A machine having a mass of 800 kg rests on four springs each having a stiffness of 4000 KN/m. The machine runes at 2500 rpm. The damping factor of the dashpot is 0.25. Under thses operating conditions, the machine is found to deflect by 0.08 mm. Determine: (i) magnification factor and (ii) force transmitted through each mounting. [6]

OR

Q.2 Attempt the followings.

(a) Explain the frequency response curves of magnification factor versus frequency ratio for different values of damping factor using neat sketch. Enlist the characteristics of magnification factor from the frequency response curves. [4]

(b) Find the frequency of the oscillation of the roller if it rolls without slipping for the system as shown in **Fig. (A)**, m = 6 kg, k = 9810 N/m. [6]

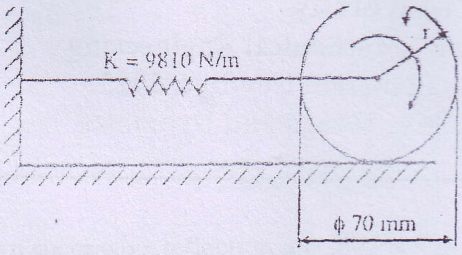

Fig. (A)

Q.3 Attempt the followings.

(a) Explain design of spindle for rigidity with neat sketch in detail. [3]

(b) Define wear. Explain factors which are affecting on wear behavior with neat sketch. [3]

(c) Explain Beats phenomenon with neat sketch. [4]

SECTION – II

Q.4 Attempt the followings.

(a) Explain various factors for correcting endurance limit. [3]

(b) A rectangular plate with a central hole is subjected to a completely reversed axial load of 20 KN as shown in **Fig. (B)**. The notch sensitivity can be assumed as 0.8. Determine the plate thickness for infinite life, if the factor of safety is 2. Assume the ultimate tensile strength as 500 MPa. The surface factor is 0.8, size factor is 0.85 and the calculations are expected at 90% respectively for which the reliability factor is 0.897. The theoretical stress concentration factor at hole can be taken as 2.5. [7]

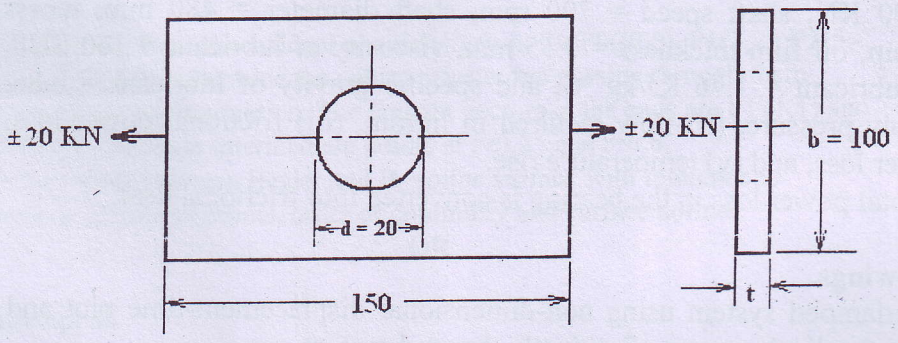

Fig. (B)

OR

Q.4 Attempt the followings.

(a) Explain different types of cyclic stresses with neat sketches. [3]

(b) A circular bar of 500 mm length is supported freely at its two ends. It is acted upon by a central concentrated cyclic load having a minimum value of 20 kN and a maximum value of 50 kN. Determine the diameter of bar by taking a factor of safety of 1.5. Size effect of 0.85, surface finish factor of 0.9. The material properties of bar are: ultimate strength of 650 MPa, yield strength of 500 MPa and endurance strength of 350 MPa. [7]

Q.5 Attempt the followings.

(a) Define reliability and explain meaning of reliable product with proper illustration. What is the relationship between reliability and quality of a product? [4]

(b) It has been observed that the yield strength of the material of a component is normally distributed with a mean of 230 N/mm^2 and standard deviation of 30 N/mm^2. The stress induced in the component is also normally distributed with a mean of 150 N/mm^2 and standard deviation of 15 N/mm^2. Determine the reliability used in designing the component. [6]

Q.5 Attempt the followings. [4]

(a) Explain the following terms:
(i) Mean life (ii) mean time to failure (iii) Mean time between failure and (iv) constant failure rate with respect to reliability theory.

(b) A mechanical component is subjected to a mean stress of 100 N/mm^2 and a standard deviation of 10 N/mm^2. The material of the component has a mean strength of 130 N/mm^2 and a standard deviation of 15 N/mm^2. [6]
(i) Find the probability of failure for the component.
(ii) If better manufacturing control reduces the standard deviation of material strength to 10 N/mm2, find the probability of failure.
(iii) If we consider only mean values of the data in design, find out the factor of safety.

Q.6 Attempt the followings.

(a) Draw creep curve and explain three stages of creep curve. [3]
(b) Enlist parameters affecting on creep. Explain any one parameter with sketch. [3]
(c) Define creep. Enlist the effect of high temperature on metals. Distinguish clearly between creep test and stress rupture test using neat sketches. [4]

Table 1: Radial and thrust factors for single –row deep groove ball bearing

F_a/C_0	$(F_a/VF_r) \leq e$		$(F_a/VF_r) > e$		e
	X	Y	X	Y	
0.025	1	0	0.56	2.0	0.22
0.04	1	0	0.56	1.8	0.24
0.07	1	0	0.56	1.6	0.27
0.13	1	0	0.56	1.4	0.31
0.25	1	0	0.56	1.2	0.37
0.5	1	0	0.56	1.0	0.44

Table 2: Dimensions and basic capacities of single-row deep-groove ball bearing

Bearing Number	Principal Dimensions			Basic Capacity	
	Bore 'd' mm	Outside Diameter 'D' mm	Width 'B' mm	Static 'C_0' kN	Dynamic 'C' kN
6002	15	32	9	2.5	5.59
6202	15	35	11	3.75	7.80
6302	15	42	13	5.40	11.40

Table 3: z-distribution (Normal curve area table)

	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

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