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12MMD/MDE333

Third Semester M.Tech. Degree Examination, June/July 2014

Design for Manufacture

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Use of approved data hand book allowed.***

1 a. Explain the major phases of design using a block diagram. **(10 Marks)**

b. The material of a solid cylindrical tie rod of cross-sectional area "A" and length "L" is to be selected for carrying a tensile load "P" with factor of safety "S". Explain the process of material selection as per cost per unit property method. **(10 Marks)**

2 a. Explain geometrical tolerances along with symbols. **(10 Marks)**

b. Define limits, fits and tolerances. Explain different types of fits and tolerances. **(10 Marks)**

3 a. Sketch and explain the selective assembly MODEL – I. **(10 Marks)**

b. The fit requirement between the pin and the bore of the arrangement shown in Fig.Q3(b) is given by 0.005 ± 0.008 mm. Assume that the hole basis system is followed and the basic size of the hole is 9 mm. It is required to achieve the above fit by following selective assembly procedure – specify the size range and tolerance for different mating parts that could satisfy the requirement of fit. Assume $g_h = g_s$. Show that size zones of hole and shaft components side by side.

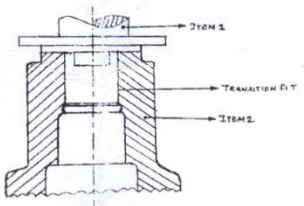

Fig.Q3(b) **(10 Marks)**

4 a. Explain the functional and manufacturing datum features in manufacturing component, with sketches and give the procedure for changing the datum. **(10 Marks)**

b. The location shaft [Fig.Q4(b)] is to be manufactured in batches of 100.

i) Prepare a suitable operation sequence layout for the shaft.

ii) Re-draw the shaft showing the appropriate manufacturing dimensions.

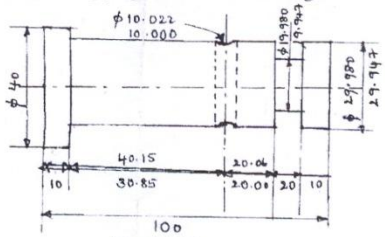

Fig.Q4(b) **(10 Marks)**

5 a. Explain the "simplification by separation" with example. **(08 Marks)**

b. Explain the following with sketch and example: i) Pattern, ii) Mould. **(08 Marks)**

c. What is process capability and skewness? **(04 Marks)**

6 a. Explain the following with examples:

i) Dowels and dowelling procedure

ii) Key-ways-Sunken and run-out **(10 Marks)**

b. Explain with sketches the specific design features to be provided on the following for case of machining:

i) External screw threads

ii) Internal screw threads

iii) Blind reamed holes

iv) Blind bored holes **(10 Marks)**

7 a. Explain zero positional tolerance at maximum material condition (MMC) along with an example. **(10 Marks)**

b. Design the gage for the part shown in Fig.Q7(b) as per the fixed fastener true position theory at MMC.

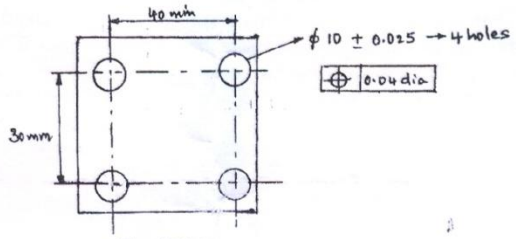

Fig.Q7(b) **(10 Marks)**

8 a. With a neat sketch explain Taylor's principle of gauge design. **(06 Marks)**

b. Design a "general type" GO and NO GO gauges for component having 25 H_7f_8 fit. 25 mm lies in the step of 18-30 mm. Upper deviation for "f" shaft = $-5.5\ D^{0.41}$. The tolerance for IT7 = 16i and IT8 = 25i where $i = 0.45\sqrt[3]{D} + 0.001\ D$. Also determine: i) Type of fit; ii) Allowance for the above fit. **(14 Marks)**

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12MMD/MDE31

Third Semester M.Tech. Degree Examination, Dec.2014/Jan.2015
Tribology and Bearing Design

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions.***
2. Use of data handbook permitted.

1 a. Derive an expression for the rate of flow between two parallel stationary plates. State the assumptions made in the derivation. **(10 Marks)**

b. The diameter of a capillary tube connecting two reservoirs is 0.025cm and its length is 160cm. The viscosity of oil filling the system is 24.1×10^{-3} Pa.s. Determine the difference between pressure in reservoirs A and B if the maximum velocity of flow at the centre line of capillary is equal to 8m/min. **(05 Marks)**

c. Discuss the effect of temperature on viscosity of oils. **(05 Marks)**

2 a. What is a lightly loaded bearing? Show that, for a lightly loaded bearing, coefficient of friction is inversely proportional to the unit load P, and directly proportional to viscosity of the lubricant and speed of the journal. **(12 Marks)**

b. What is pressure-induced flow? Discuss in detail, the mechanism of pressure development in converging oil film. **(08 Marks)**

3 a. With usual notations, derive an expression for the velocity of a converging oil film. Assume no end leakage from the bearing. **(10 Marks)**

b. A slider bearing with fixed shoe has the following specification:
Length of the bearing = 80mm
Width of the bearing = 60mm
Velocity = 2m/s
Velocity of the lubricant = 100×10^{-3} Pa.s
Minimum fluid film thickness = 0.02mm
Maximum fluid film thickness = 0.06mm.
Determine the load carrying capacity of the bearing. Also plot the distribution of pressure along the bearing. **(10 Marks)**

4 The following are specifications of a journal bearing:
Journal diameter = 30mm
Bearing length = 60mm
Journal speed = 2000rpm
Radial clearance = 0.02mm
Mean viscosity of the lubricant = 25×10^{-3} Pa.s
Eccentricity ratio of the bearing = 0.8
Inlet pressure = 0.3 Mpa.
Plot the pressure distribution diagram with the location of inlet hole at 300°. Are you satisfied with the pressure distribution thus obtained? If you feel some alterations are to be made, state what they should be giving reasons, and replot the pressure distribution diagram. Also determine the load carrying capacity of the journal bearing. **(20 Marks)**

5 a. Differentiate between capillary and orifice flow restrictors. **(05 Marks)**

b. Derive expression for i) Discharge; ii) Load carrying capacity; iii) Pumping power loss, for a hydrostatic circular step bearing. State the condition for minimum power loss. **(15 Marks)**

6 a. A hydrostatic step bearing has the following characteristics:
Shaft diameter = 130mm
Pocket diameter = 55mm
Shaft speed = 1800rpm
Inlet pressure = 3.75MPa
External pressure = 0 atmosphere
Expected mean oil film temperature = 60°C
Lubricating oil SAE = 60.
Desirable oil film thickness = 0.0875mm.
Determine: i) Load the bearing can support; ii) rate of oil flow through the bearing; iii) Power loss due to viscous friction. **(10 Marks)**

b. Explain Elasto-hydrodynamic lubrication, with examples. Discuss in brief, i) Different forms of EHL contacts; ii) Different regimes in EHL contacts. **(10 Marks)**

7 a. Discuss the advantages and disadvantages of i) Gas lubricated bearing; ii) Antifriction bearings. **(10 Marks)**

b. With a schematic sketch, explain the working principle of active magnetic bearing. **(10 Marks)**

8 Write short notes on any four of the following:

a. Couette-Hatscheck viscometer.
b. Types of wear.
c. Somerfield number.
d. Fretting phenomenon.
e. Analogy between electric and magnetic fields. **(20 Marks)**

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12MMD/MDE333

Third Semester M.Tech Degree Examination, Dec.2014/Jan.2015
Design for Manufacture

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer any FIVE full questions.***
2. ***Missing data, if any, may be suitably assumed.***
3. ***Use of data handbook is permitted.***

1 a. Explain clearly the process of material selection for an engineering application. Bring out clearly the considerations given in the selection of materials. **(08 Marks)**

b. Determine the index of cost per unit property in case of a i) bar of uniform diameter subjected to tension ii) Beam simply supported with a concentrated load at the mid span based on strength and stiffness. **(12 Marks)**

2 a. Explain why geometric tolerances have to be specified? Explain the meaning of the following with their symbols and suitable examples :
i) Flatness ii) Circularity iii) Perpendicularity iv) Run out. **(08 Marks)**

b. Why surface roughness values have to be indicated on specific surfaces of components? With an example show how surface roughness is indicated on a drawing. **(04 Marks)**

c. The clearance permitted between the stator and rotor of a motor assembly is 0.120mm and 0.280mm. Assuming the hole basis system, determine the design sizes for both stator and rotor to meet the above functional requirement. The nominal size of the stator may be taken as 200mm. Distribute the machining tolerances equally between the stator and rotor. **(08 Marks)**

3 a. A hole is dimensioned as 25.38 ± 0.075mm. The shaft diameter can be held to a tolerance of ± 0.050mm. Distribution of variations for both parts resembles a truncated normal curve with '1 σ' truncation. Find the mean diameter of the shaft to be specified on the drawing if the permissible proportion of assembly with a clearance of 0.025mm or less is to be 2%. **(10 Marks)**

b. The fit requirement between the pin and the bore of the arrangement shown in fig. Q3(b) is given by 0.005 ± 0.008mm. Assume that hole basis system is followed and the basic size of the hole is 9mm. It is required to achieve the above fit by following selective assembly procedure. Specify the size range and tolerance range for different mating groups that could satisfy the requirement of the fit. Assume $g_s = g_h$. Show the size zones of the hole and shaft components side by side. **(10 Marks)**

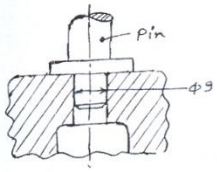
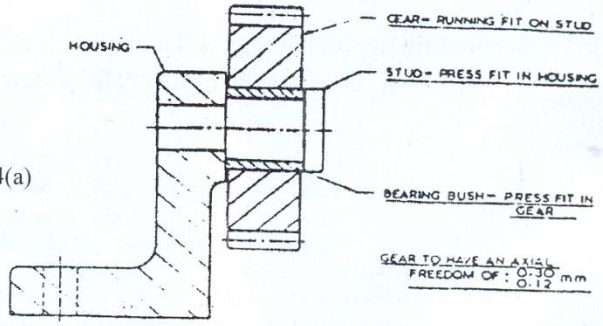


Fig.Q3(b)

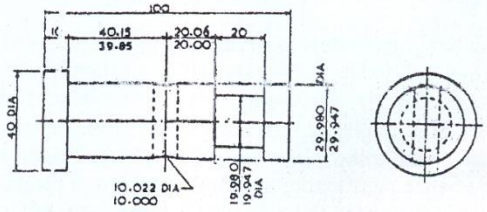
4 a. The carrier wheel assembly shown in fig. Q2(a) should provide an axial freedom of movement of the gear wheel on the stud ranging from 0.12mm minimum to 0-3mm maximum. Take the nominal length of the bush as 30mm. Determine the appropriate manufacturing limits of the connected components to achieve the required assembly tolerance. Draw the component drawings and show only the related dimensions on the drawing. **(10 Marks)**

Fig.Q4(a)



b. A location shaft shown in fig. Q4(b) is to be manufactured in batches of 100.
   i) Prepare a suitable operation sequence layout for the shaft.
   ii) Redraw the shaft showing appropriate manufacturing dimensions. **(10 Marks)**

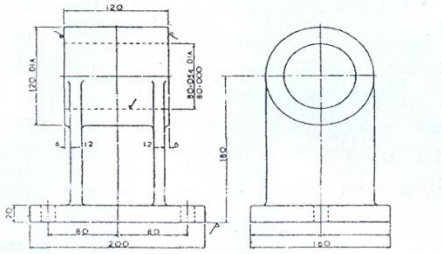
Fig.Q4(b)



LOCATION SHAFT-M S- √ALL OVER

5 a. Explain the considerations given in the selection of a parting line. **(03 Marks)**
   b. Distinguish clearly between a cored hole and a cast hole. **(03 Marks)**
   c. Fig. Q5(c) shows a cast iron support bracket. Identify two possible parting lines and the appropriate sand cores. Offer a design modification to remove the need for sand cores, retaining a similar weight of casting. **(14 Marks)**

Fig.Q5(c)



SUPPORT BRACKET – CAST IRON

6 a. What are the considerations in designing drilled holes to enable drill entry and run out? Explain with sketches. **(06 Marks)**
   b. Explain the design considerations given for the following :
   i) Blind reamed holes ii) Blind tapped holes. **(04 Marks)**
   c. Suggest a suitable operation sequence for the stub carrier shown in fig. Q6(c) and redraw the component drawing incorporating features to facilitate manufacture. The carrier is to be produced from steel casting and the symbol of indicates a ground surface for 30mm diameter with f8 limits. **(10 Marks)**

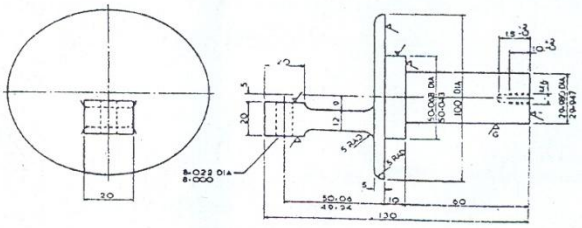


Fig.Q6(c)

7 a. Explain the following :
i) MMC ii) LMC iii) Virtual size. **(06 Marks)**

b. Two parts to be assembled are as shown in fig.Q7(b). Determine if the tolerance for the sides of the notch and the tab have been correctly done to ensure assembly. Determine the width of the tab on the gage for inspecting groove location. Also determine the width of the slot on the gage for inspecting the tab location. **(08 Marks)**

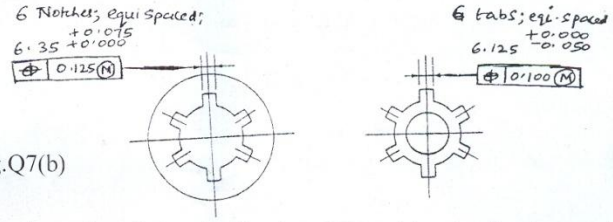


Fig.Q7(b)

c. Determine the value of maximum inclination accepted by the fixed gage designed for the part given in fig. Q7(c), when i) the hole is at MMC and ii) the hole is at LMC. **(06 Marks)**

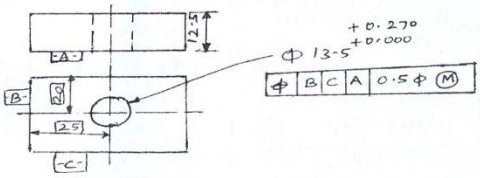


Fig.Q7(c)

8 a. Explain the term 'gage maker's tolerance'. Also explain why wear allowance should be provided to gages. **(06 Marks)**

b. With neat sketches, explain the following :
i) plug gage ii) snap gage. **(08 Marks)**

c. Explain the requirements for materials used for making gages. Enumerate the various materials used and different treatments given to manufacture gages. **(06 Marks)**

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