[03 – 3114]

III/IV B.E. DEGREE EXAMINATION.

First Semester

Mechanical Engineering

PRODUCTION DRAWING

(Common with Dual Degree Program in Mechanical Engineering)

(Effective from the admitted batch of 2006-2007)

Time : Three hours Maximum : 70 marks

Answer ALL questions.

(Tolerance tables are permitted)

1. Find the maximum and minimum limits for shafts and hole sizes for hole shaft pairs designated by $80H_6d_7$ and indicate the tolerance and allowance graphically. Indicate the type of fit it belongs.

2. (a) Explain the geometric tolerance frames indicated below:

(i)

↗	0.02	R

(ii)

⊥	0.06	A

(iii)

⌖	0.5	T

(iv)

≡	0.4	B

(b) Sketch the tolerance frames for the following:

(i) The flat face of a component should be contained between two parallel planes 0.02 mm apart.

(ii) The rollers of a sine bar are parallel within tolerance of 0.03 mm and the cylindricity of each roller is within 0.06 mm.

(iii) Axis of a hole is located within a cylinder of 0.7 mm at a distance of 20 mm and 30 mm from the datum surface S and Z respectively.

3. (a) How the following are represented?

(i) Butt weld

(ii) CAST Iron

(iii) Acme Thread

(iv) Helical gear.

(b) Draw various types of screw threads.

4. Draw:

(a) Hexagonal bolt with nut for the size M 30 × 120 mm,

(b) Hole ϕ 20 × CSK 5 and deep 5 mm,

(c) rectangular sunk key of size key 12 × 8 mm × length 80 mm

(d) M 12 square bolt of length 100 mm with Nut.

5. Indicate the following on component: surface roughness, surface treatment, sampling length, direction of lay, machining allowance and other roughness values. How the following are represented?

(a) Worm gear

(b) brass

(c) concrete

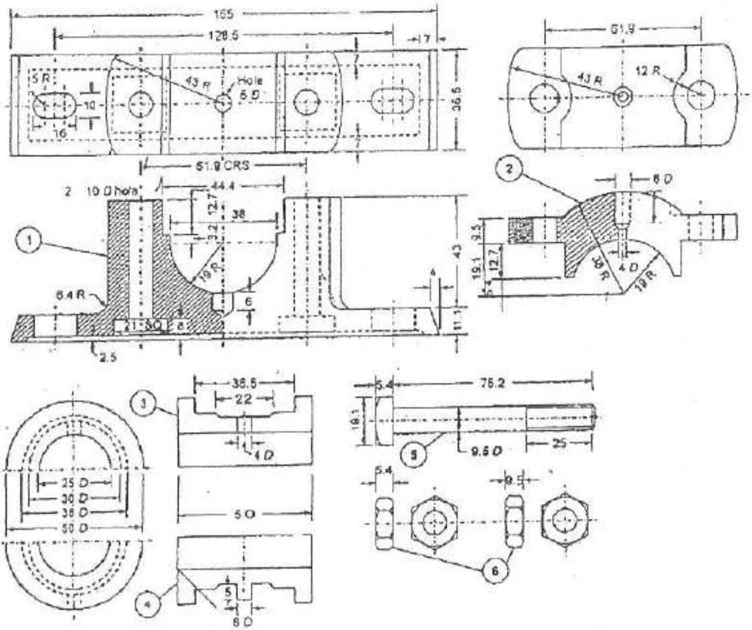
(d) Holes on circular pitch

(e) Double-V but weld

6. (a) Draw the pattern, design and draw the gating system for the part No. 3 (from figure 1)

(b) Draw a neat sketch of milling cutter and indicate nomenclature.

7. Prepare the process sheet for the bearing, Part 5 (from figure 1)



Details of plummer block

Figure 1

Part List

S.No	Part name	Material	No. off
1.	Body	C.I.	1
2.	Cap	C.I.	1
3.	Upper brass	G.M.	1
4	Lower brass	G.M.	1
5	SQ HD bolt	M.S.	2
6	Nut and locknut	M.S.	2 each

(iv) Strain in the element 2

(v) Strain energy of the system

(vi) Any one of the support reaction.

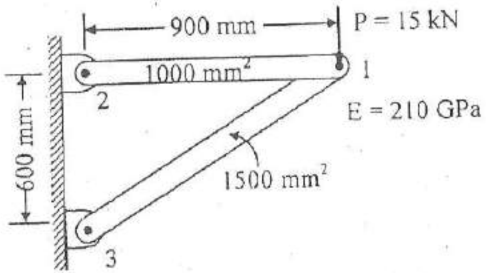


Figure 2.

5. (a) Clearly explain the finite element formulation for three noded triangular element with in plane and bending loading. Obtain the stress-strain relations for plane stress and plane strain problems with and without thermal effect.

(b) Determine the matrix relating strains and nodal displacements for three noded triangular element and compare the behaviour.

6. (a) Clearly explain the finite element formulation for an axisymmetric shell with an axisymmetric loading. Determine the matrix relating strains and nodal displacements for an axisymmetric triangular element.

(b) A steel bush of internal diameter 75 mm is shrunk on a solid rigid shaft of 75.5 mm diameter. The sleeve's axial length is 20 mm. Specify the boundary conditions to be used in this problem and show the finite element discretization.

7. (a) Derive the interpolation functions at all nodes for the quadratic serendipity element.

(b) Using a 2 × 2 rule, evaluate the integral

$$\iint_{\Omega} \left(x^2 + xy^2 + y^2 + yx^2\right) dx\, dy$$

by Gaussian quadrature where Ω denotes the region shown in Figure 3.

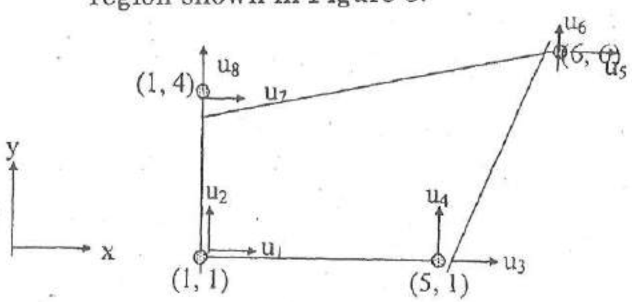


Figure 3

8. (a) At 20°C an axial load P = 300 × 10³ N is applied to the rod as shown in Figure 4. The temperature is then raised to 60°C. Assemble the element stiffness matrix and the element temperature force matrix (F). Again determine the nodal displacements and element stresses by considering linear and Quadratic Shape functions. Also find element strains.

Assume $E_1 = 70 \times 10^9 \, N/m^2$, $A_1 = 900 \, mm^2$

$\alpha_1 = 23 \times 10^{-6} /^\circ C$, $E_2 = 200 \times 10^9 \, N/m^2$

$A_2 = 1200 \, mm^2$, $\alpha_2 = 11.7 \times 10^{-6} /^\circ C$.

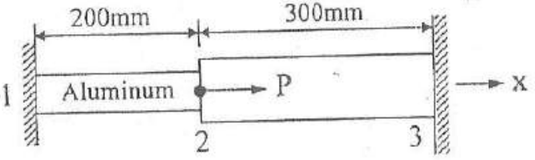


Figure 4

(b) Determine the deflection at the free end under its own weighs using two elements of bar as shown in Figure 5. Assume $E = 200\ GPa, \rho = 7800\ kg/m^3$.

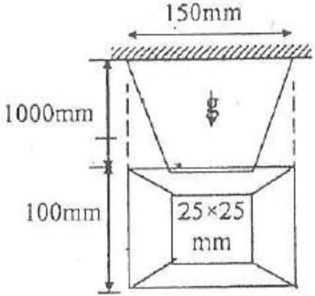


Figure 5