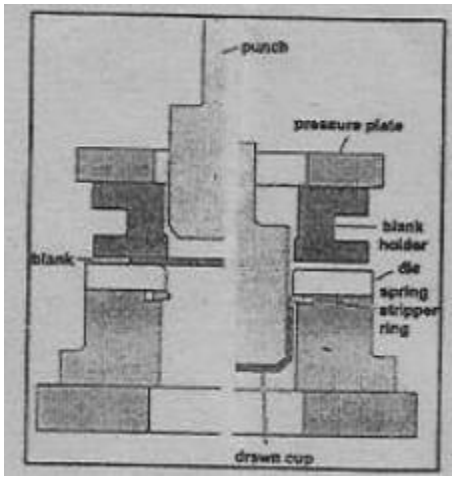
ED5153- Advanced Finite Element Analysis

Important 13mark questions

Unit- I

1. Enumerate the assumptions made in the thin plate and thick plate theories.
2. Give the strain Displacement relation and constitutive relation for thin plates. Indicate the stresses and lateral loads and associated moments on a neat sketch and give the expressions for moments and shear forces for the same.
3. What are the advantages of shear elements? Explain with sketches at least three examples in mechanical engineering where they are used?
4. Give the Displacement model for a linear triangular plate element and a rectangular plate bending moment.
5. A deep drawing process as shown in figure for producing cylindrical cups is to be simulated. Explain the modelling procedure for finite element simulation of the above process and discuss the various issues involved?



Unit- II

1. Differentiate between Geometric, Material and contact non-linearities. Give suitable examples when each of these occur. Explain the effect of material and geometric non linearity on the stiffness matrix?
2. Explain the modified Newton Raphson technique for solving nonlinear problem?
3. With the help of stress strain diagrams describe the following elastic perfectly plastic, rigid perfectly plastic, elastic-plastic with linear strain hardening, and elastic-plastic with multi linear strain hardening. Explain the salient features of each type with an example as to when you would resort to such models.
4. Distinguish between Isotropic and Kinematic strain hardening indicating the failure envelope.
5. Explain the solution procedure Application in Metal Forming Process and Contact problems

Unit- III

1. Determine the first natural frequency of longitudinal vibration of a steel bar fixed at one end and carrying a mass of 1000kg at one end. Plot the mode shapes corresponding to each of these two frequencies. E =210 GPa and p=0.78kg/cc. assume that area of the bar is 4cm^2 and length 120cm.
2. Differential between explicit and implicit techniques?
3. Discuss about the choice of critical time step in relation to various solution procedures for dynamic response analysis using FEA?
4. List the various Direct Integration Methods and explain in detail about the Newmark and Wilson θ method.
5. Explain the steps involved in computing the Eigen values using Subspace Iterative technique?

Unit- IV

1. Derive the thermal conduction matrix for two dimensional heat transfer for a linear triangular element?
2. Explain the need for the Crank Nicolson scheme for solving partial differential equations in heat transfer. How is it implemented?
3. Distinguish between Laminar flow and Turbulent flow?
4. Derive the partial differential continuity equation for a general 3-dimensional flow?
5. Distinguish between Newtonian fluids?

Unit- V

1. What are the various mesh quality criteria? Explain how it is evaluated?
2. Explain what is meant error estimate?
3. Delaunay Triangulation?
4. Adaptive meshing?
5. Mesh enrichment?
6. Discuss about the meshes given in figure a,b and c. Explain what has been done when going from mesh a to c. Why has such an analysis been done? What kind of mesh is this? Explain the steps needed to create such a mesh?