Design for Manufacturing - 17ME744

IAT 2

Answer all the 4 questions (80Marks)

06/11/2020 1.00 pm to 3.00pm

1 Explain the meaning of

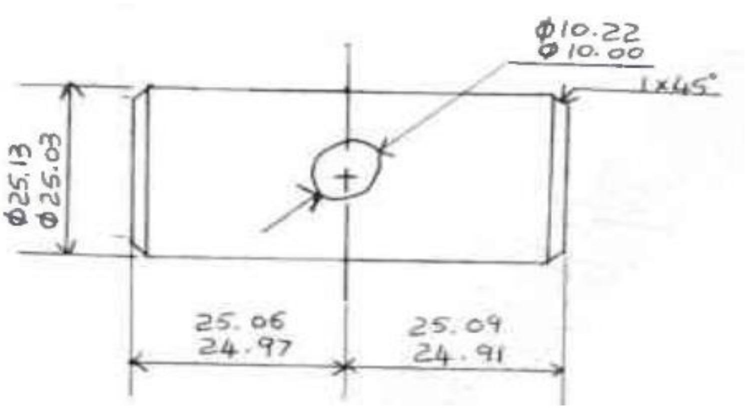
i. Functional Datum (2 Marks)

ii. Manufacturing Datum with an example. (4 Marks)

iii. Explain the process of changing the functional datum to manufacturing datum with an Example (4 Marks)

iv For Pin component as shown in Figure (a) List out the operation in sequence

(b) Redesign for manufacturing (10 Marks)



All dimensions are in mm

2. Explain with sketches, the specific design features to be provided on the following to facilite machining:

(i) Drilling - Entry and Run out (4 Marks)

(ii) End Milling Cutters (4 Marks)

(iii) Keyways - Sunken and Runout (4 Marks)

(iv) Simplification by separation (4 Marks)

(v) Simplification by amalgamation (4 Marks)

3. (i) Explain the design rules for redesign of castings based on parting line consideration. (10 Marks)

(ii) Explain with neat sketch the design consideration of castings. (10 Marks)

4. (i) Explain with neat sketch the different types of Parting lines. (10 Marks)

(ii) Explain with neat sketch the design consideration for welding. (10 Marks)

Q1. i> Functional Datum: A functional datum feature is a face or a hole in a component, which is of importance to the function of the component of the machine. In the preparation of component detail drawing from assembly drawing, it is necessary to identify necessary functional datum faces or holes which are critical in functioning of component.

ii> Manufacturing Datum: Face for the turning operation is the right hand end face of the component - a change of the datum face. When the datum face is changed there is, inevitably, a reduction in tolerance in one or more dimensions.

iii> Changing Datum: ① Decide the required manufacturing datum face. ② Decide the required manufacturing dimensions (which also involves deciding the omitted dimensions.
③ Determine the tolerances for each of the (new) manufacturing dimensions. ④ Set suitable limits for all, but one of the required dimensions. ⑤ Determine the limits for the final dimension.

example: ① The manufacturing datum face, for both process, is the right hand end face.
② Dimensions L turning; dimension G for groove depth, the 35.3 ~ 35.0 dimensions omitted.
③ Tolerances of omitted dimensions is 0.3. Let tolerance (limits) for G remains as 0.15. Therefore tolerance L is 0.15
④ Limits for G remains unaltered i.e 15.00, 14.85
⑤ Determine limits for L as follows.

iv. For the pin component 2 machining processes are there in the Sequence. The Sequence of the processes is turning first drilling second.

→ Because it is the tolerance of the omitted dimension that determines the tolerance for the shown dimensions, then when possible, it is the dimensions with the largest tolerance that is omitted. Therefore, for the pin the $\frac{25.09}{24.91}$ dimension is the omitted dimension.

The tolerance for L and R is 25.09 minus 24.91 = 0.18 and if the tolerance is equally distributed then, Tolerance for L and R = 0.09 each. Set Suitable new limits for R: Let R = $\frac{25.06}{24.97}$.

L_{min} = 24.91 + 25.06 = 49.97 mm

L_{max} = 25.09 + 24.97 = 50.06 mm.

[(a) when O is the minimum, then L is the min & R is max]
[(b) when O is the max, then L is the max & R is min].

Q2. ① Drilling - Entry and Run - Out.

° Insist drills should enter, and break through, normal to the surface to be drilled. Drilling at an angle to a surface can use deflection of the drill, possibly resulting in drill breakage.

② End milling cutter or a key sealing cutter produces such a key but because the cutter holder cannot approach nearer than the end of the shaft, a cutter length of at least would be needed.

③ Sunken keyways in a shaft can be machined only with a key sealing or slot drilling cutters. These cutters have two or sometimes 3 teeth. An open end keyway, at the end of a shaft, can be machined by an end milling cutter, which can have six or more teeth.

④. Simplication by Seperation: By producing component from 2 seperate place and finally joining 2 pieces.

(v) Simplification by Amalgamation: Designs assemblies and sub-assemblies should be critically analyzed with regard to the possibility of achieving economy by amalgating 2 or more components into a one piece unit for example the gear shaft assembly.

Q3. iii) (a) One of the shortest routes from raw material to finished part is a casting process. In casting, a molten metal is poured into a mold or cavity that approximates the shape of the finished part.

(b) Heat is extracted through the mold, and the molten metal solidifies into the final solid shape.

(c) The chief design issues for the mold are to provide an entry for the molten metal into the mold that creates continuous laminar flow through the sprue and runner, and to provide a source of molten metal.

(d) Cores are places to provide hollow features for the part.

(e) liquid metal shrinks on solidification. Supply of molten metal is available to compensate for the shrinkage.

Q3. i) Parting line: (a) Position of pattern in mold

(b) Length-width-breadth relations of pattern

(c) Sized of mold box available.

(d) pouring and venting points.

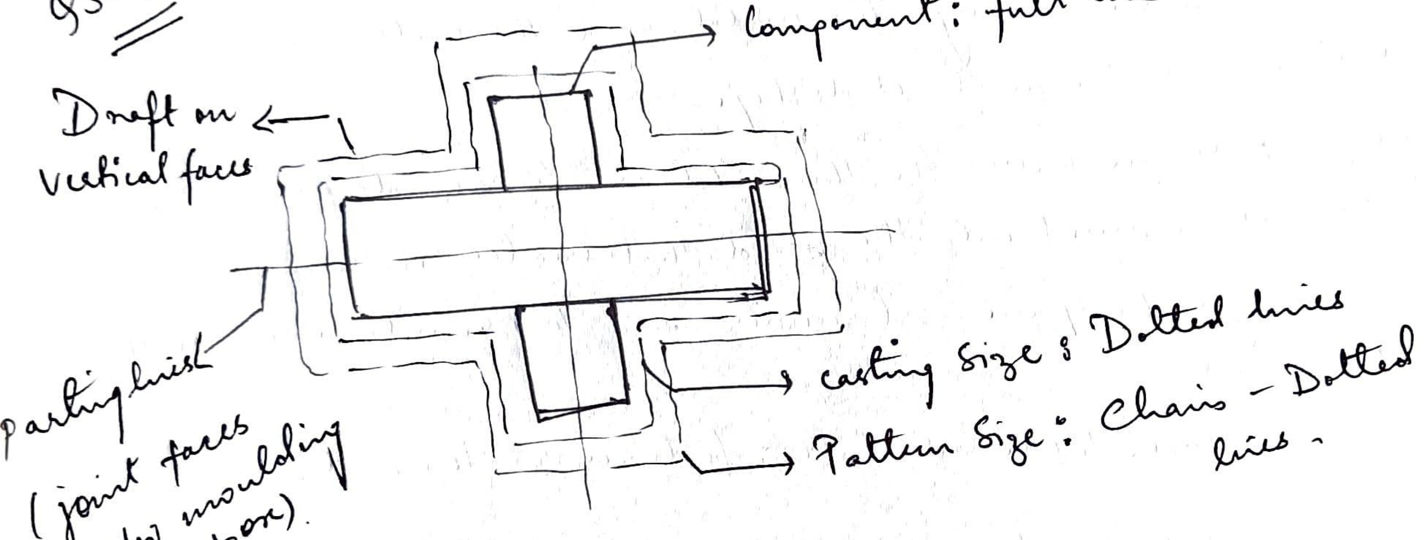
Q4. ii) The rate of welding as related to the size of the weld to be made, determines a great degree the economics of the process.

(b) The manual arc process is most versatile, but for large cast weld construction it is limited in the application because changing electrodes and other interruptions.

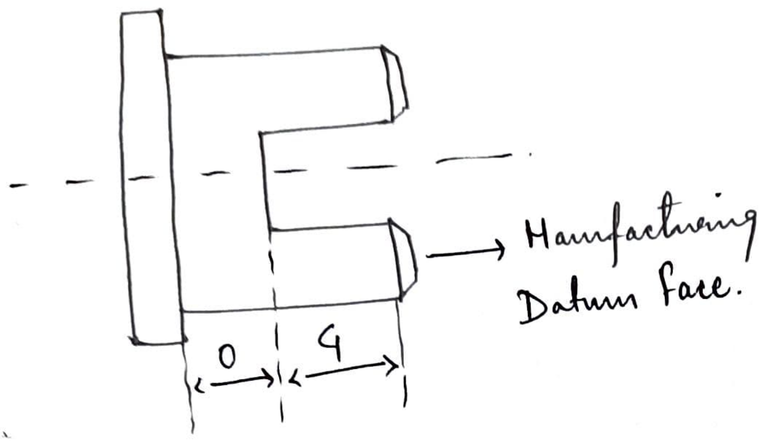
(c) The submerged arc process, on the other hand, due to its continuous operation with wire electrodes, deposits metal at a higher rates.

(d) Distortion of an assembly is another major consideration in selecting a welding process. Single pass procedures, such as electroslag welding, produce less distortion than multipass process.

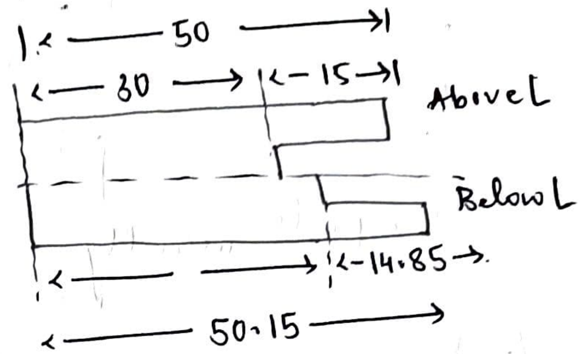
Q3. (iv)



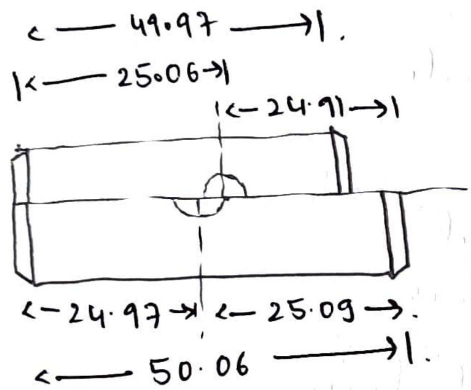
Q1. ii)

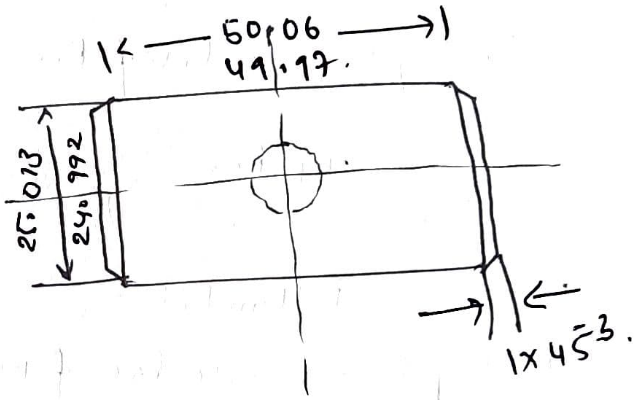


Q1. iii)

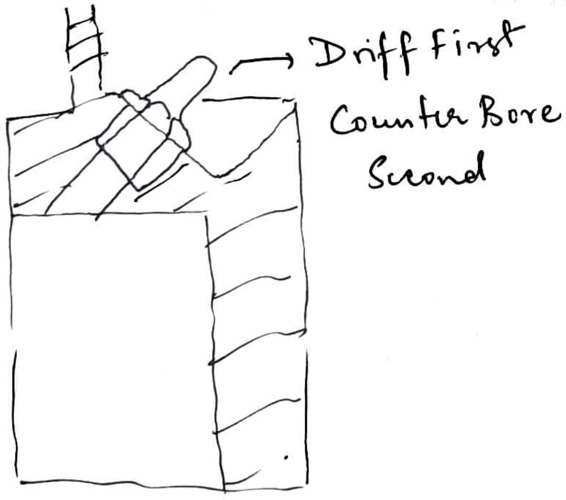


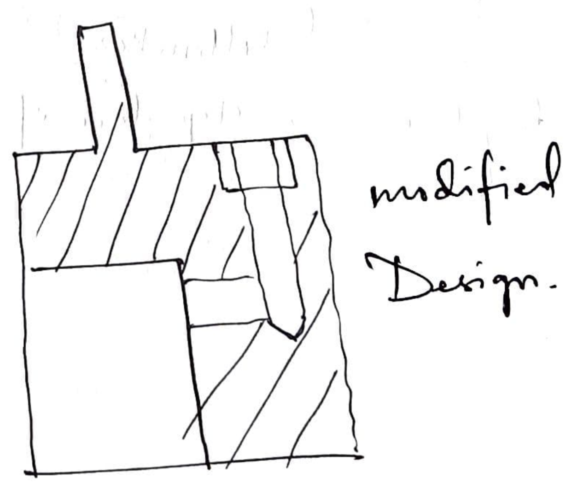
Q1. iv



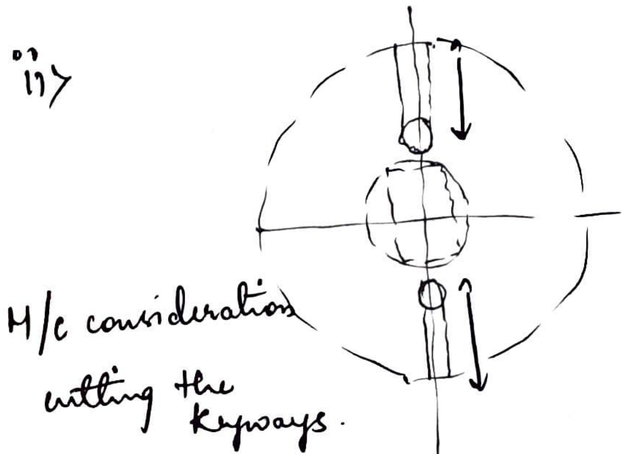


Q2. i)

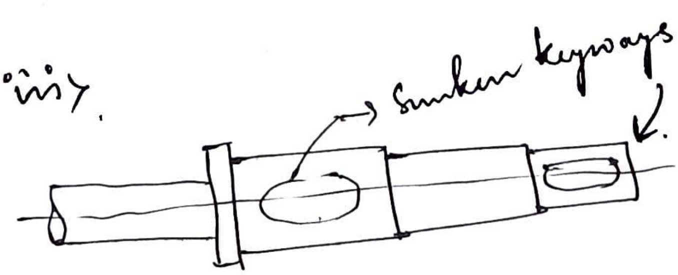




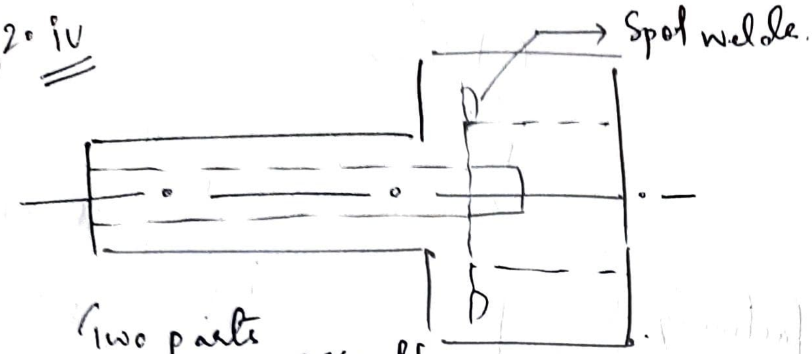
ii)



iii)

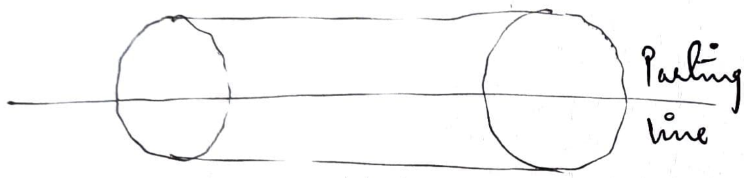


Q2. iv



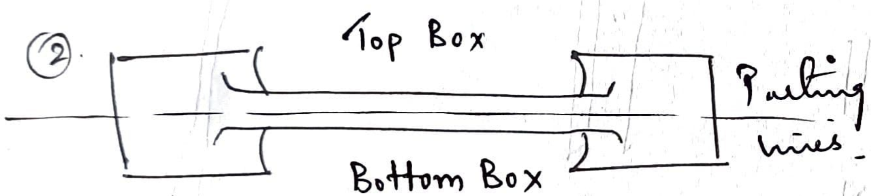
Two parts assembly.

Q4. ix.



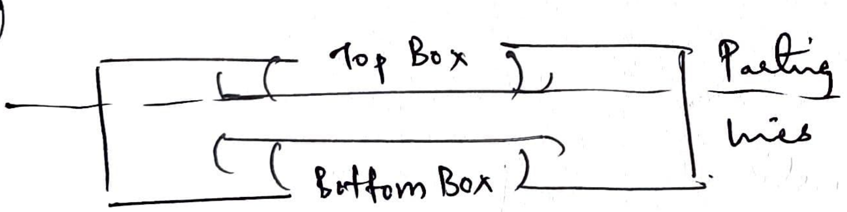
① Parting line – centre of Boss diameters

②



Parting line → centre of web thickness.

③



Parting lines → Top face of web.