Government Women College of engineering, Ajmer
Mechanical Engineering Department
Mid Term paper (March, 2018)

Semester:- VI
Subject:-NON DESTRUCTIVE TESTING

Answer any FOUR questions:- **(4*5=20)**

1) What are the different types of penetrants used? Explain the methods of cleaning the excess dye from the surface after dwell time in liquid penetrant test.

2) Explain the scientific principle used behind the liquid penetration test? Name and explain the phenomenon by which the liquid penetrate in upward and downward direction in a liquid penetrant test?

3) What are the three different methods of visual inspection to detect the flaws which could not be detected by normal optical vision. Explain any one of them.

4) What are the two methods of magnetization of a specimen in magnetic particle inspection? Explain any one method along with its different types.

5) Name the device used to find the magnitude of an optimized magnetization field to be applied on a specimen. Name and explain its different types.

6) Explain the principle behind the magnetic particle inspection? Explain the hysteresis curve.

Question 1

The penetrant comes in two types of liquids-visible dye (colored red) and fluorescent dye (colored green-yellow).

Method A - Water Washable: penetrants can be removed from the part by rinsing with water alone. These penetrants contain an emulsifying agent (detergent) that makes it possible to wash the penetrant from the part surface with water alone. Water washable penetrants are sometimes referred to as self-emulsifying systems.

Method B - Post-Emulsifiable, Lipophilic: the penetrant is oil soluble and interacts with the oil-based emulsifier to make removal possible.

Method C - Solvent Removable: they require the use of a solvent to remove the penetrant from the part.

Method D - Post-Emulsifiable, Hydrophilic: they use an emulsifier that is a water soluble detergent which lifts the excess penetrant from the surface of the part with a water wash.

Question 2

Capillary action is the movement of water within the spaces of porous materials due to the forces of adhesion, surface tension, and cohesion. Adhesion is how the water molecules like to stick together. Surface tension is what makes water stay in a puddle on a surface. Cohesion is how the water molecules like to stick to other objects.

Capillary action occurs when the water's adhesion to the walls of a crack are greater than the cohesion between the molecules. Surface tension limits the depth to which penetrant will seep into a crack.

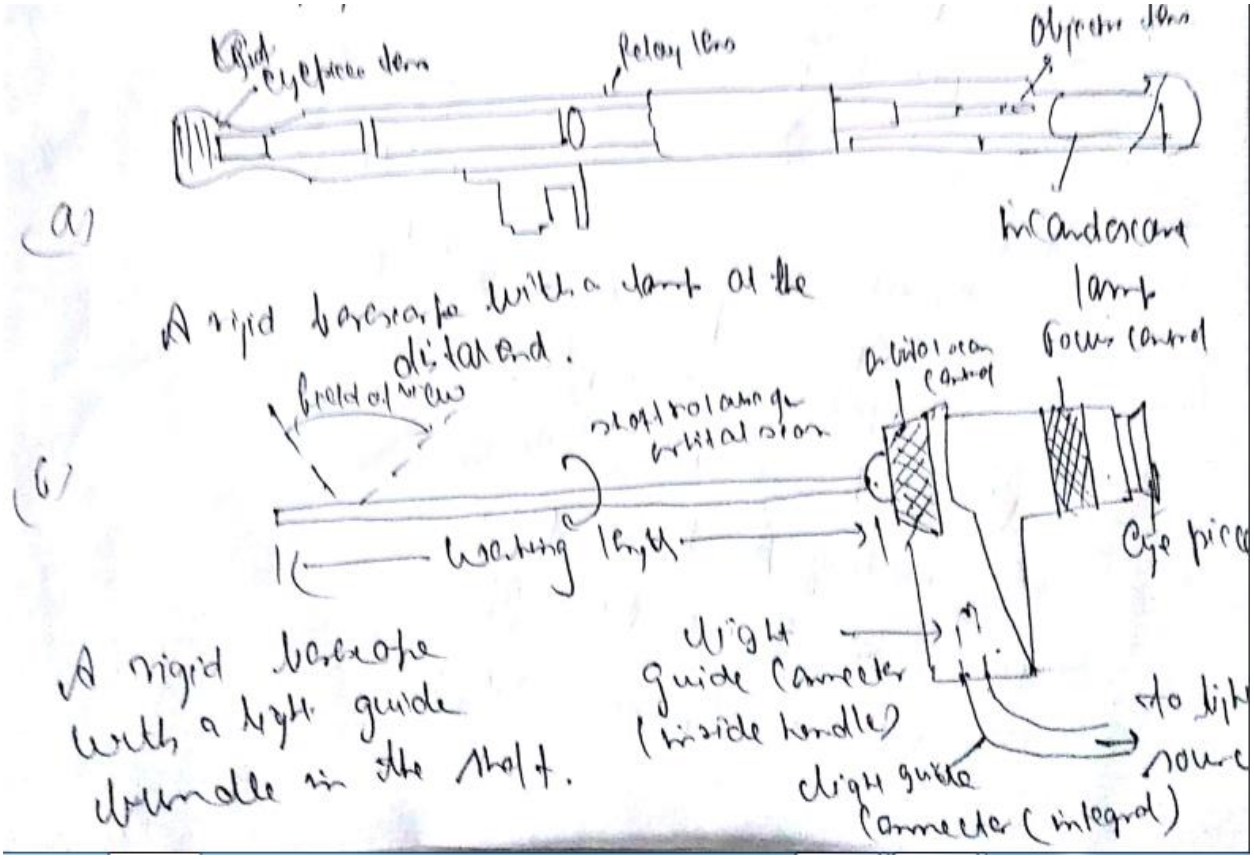
Question 3

The three methods of visual inspection to detect flaws are:-

a) By optical devices like microscope

b) By rigid borescope

c) By flexible borescope



A rigid borescope with a light at ~~the distal end~~ distal end :-

→ It will be having a light at the ~~distant~~ distal end that will illuminate the ~~area~~ area to be examined.

There is objective lens which will form the image of area to be examined

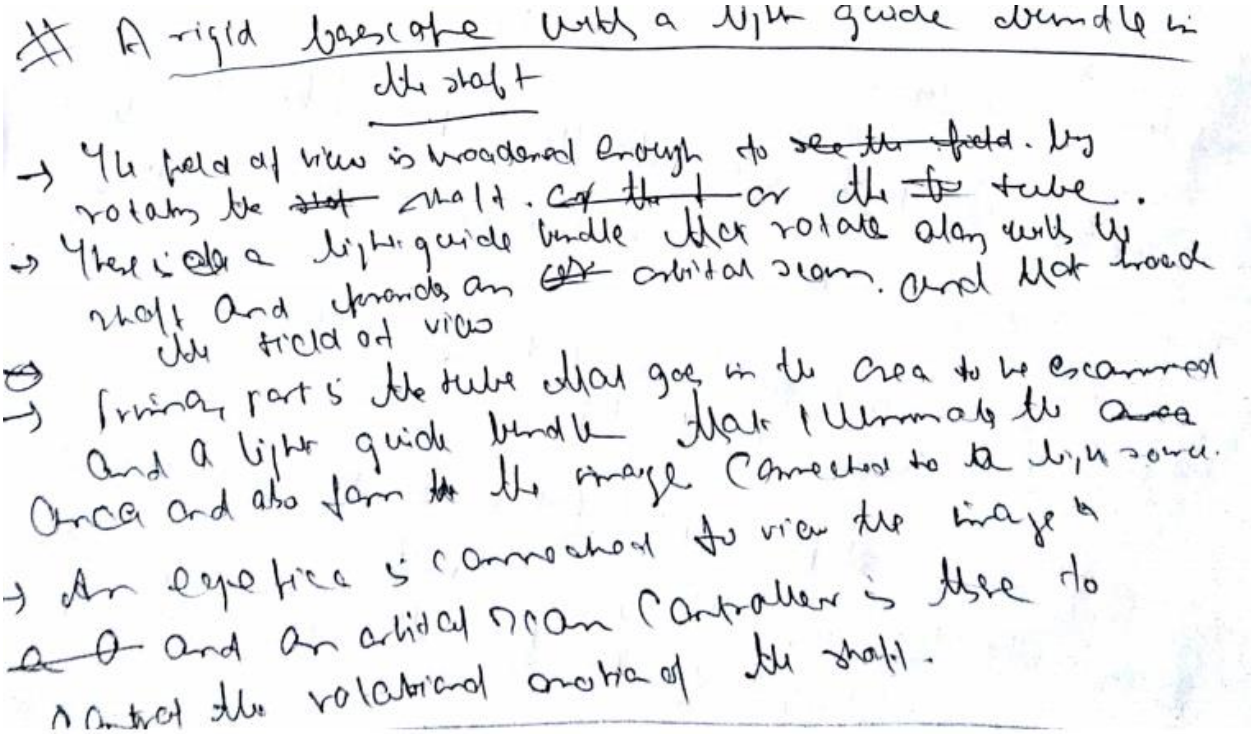
relay

There is a series of achromatic lens that helps to focus the light on the area to image i'd and the image will be sent to eye piece at the other end.

There is an ~~eyepiece~~ eyepiece to view the image.

→ The eyepiece is interchangeable so that we can apply same magnifying lenses.

This rod like part can't be bend & don't be moved.



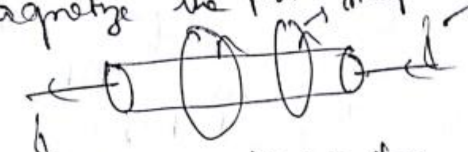
Question 4

Two methods of magnetization of specimens are :- direct contact and non contact method

CONTACT METHOD :

→ magnetizing current will pass through the part (object)

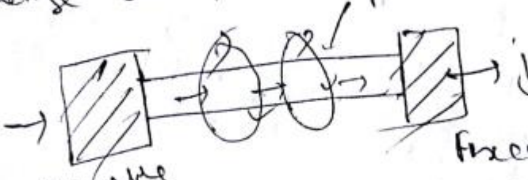
→ Connect the part b/w two electrodes & switch on which will magnetize the part, magnetic field



→ If the current flows from right to left, the direction of magnetic field will be anticlockwise.

→ which can be found out by thumb rule. (thumb pointing towards the direction of the current.

→ A circular magnetic field will be created. that will magnetize the part.

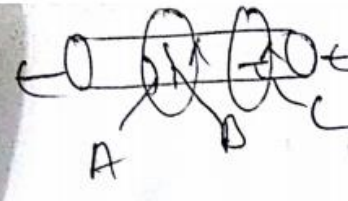


→ The field which is created has a particular direction.

→ The orientation of the crack with the magnetic field will affect the visibility of the particular crack

→ The best visibility will be when the field direction is ⊥ to the flaw.

→ This does not mean that other flaws not at 90° will not be visible.



← An regular crack — No/ minimum indication.

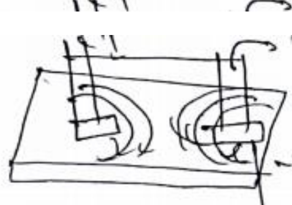
B → Weak indication.

C → strong indication.

Longitudinal crack (have best visibility)

magnetic current level depend upon size of the part i.e:
~~110~~ - 12 - 32A / mm of part dia.

Another method of producing magnetizing currents by using prods., the electrodes connected to the power source.



Prod → single fice / double

pressure against the parts so we used a pressure pad too.

→ Prods are connected to the part; & the current flows through it.

→ we can also use two prods at a time so that the magnetic field would cover the whole area.

→ The field then generated will detect the flaws mostly which are perpendicular to it.

→ The two prod could also be connected.

→ There must not be any ~~loose~~ loose points & hence we also ~~use~~ use the ~~pressure pads~~ pads too. to avoid the ~~electrical arcing~~ electrical arcing. Arcing.

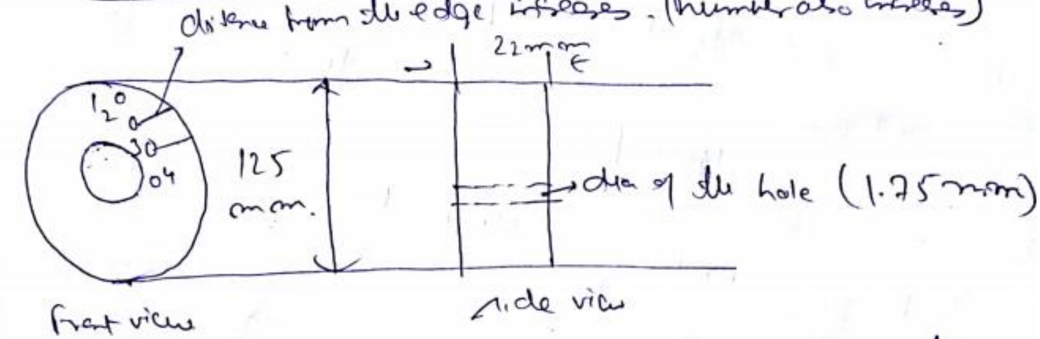
Question 5

Question 5 — Field indicators ([illegible] that you faced)

→ Indicate that level of magnetic fields is optimum & enough to magnetize the part.

→

Ketoz Ring



→ Put a conductor at the center and [illegible] the magnetizing current.

→ As you pass the current, it will be magnetized.

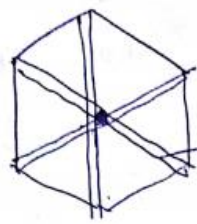
→ As you pass the current, it will be magnetized.

→ Now we apply the magnetic particle and will see that how many holes are indicated by the magnetic particle.

→ It depend upon the level of magnetizing current & the type of particles used.

Pie gage

It's a small coin made of highly permeable material divide to 6 or 8 parts



→ along the diagonals slots are cut.

→ ~~Slots filled with non magnetic material.~~

→ slots will act as artificial flaws. on one side of the coin & the flaws there on the other side of the coin.

→ when we apply the particles on the plane surface after the magnetizing current is applied, the indicator of the flaws will tell whether the fields enough or not. and it also tells the direction of the magnetic field.

→ The above indicator is suitable for single direction field and better not for multidirectional field.

of field any complex direction:- multidirectional field

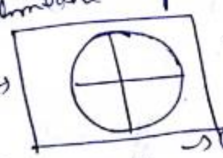
of field any [illegible]

- Circular flaws in complete direction :- suitable for multidirectional field

indicator

Quantitative Quality Indicator (QQI)

- very thin permeable magnetic material.



Area 2cm²

- Thin strip of flaw → carbon steel ~~f steel~~.
- thickness range should be. 0.05 mm to 0.1 mm
- etch out pattern in different direction.

It is placed on the part etched down.

- now we can apply the magnetizing current that will encounter the ~~[illegible]~~ multi-directional field
- whether indications are strong or not, that can be seen on the flat surface.

Shims

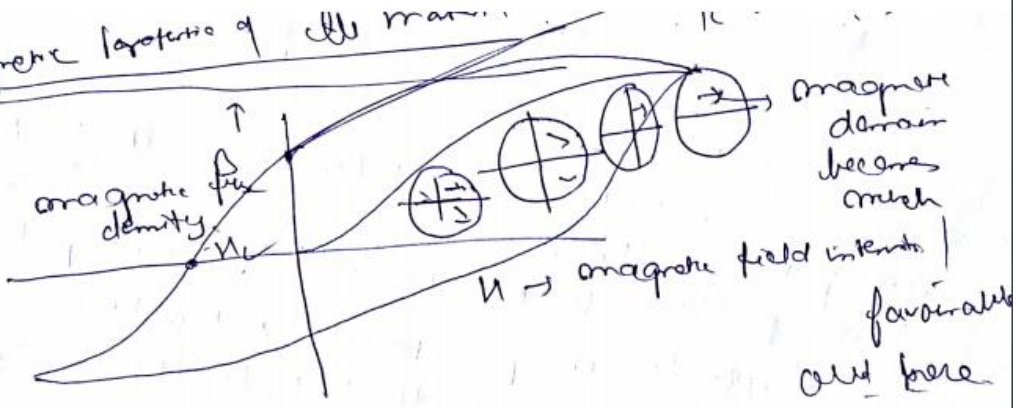
- An iron core covered by a non-magnetic material.
- An iron core of 0.1mm is encased in a brass coating of ~~0.05 mm~~ 0.05 mm non-magnetic material.
- slots are cut and it fitted with ~~[illegible]~~ particle that will
- ~~cut out some flaws and put~~

get attracted to these flaws. Flaws will act as

Question 6

Question 6

Magnetic hysteresis of the ma...



→ Continue to reduce the field, then it will go in reverse direction, and at a point the magnetic flux becomes zero, that point is called as coercivity

→ when we go in the reverse direct, it will follow as this called as Hysteresis.

→ from above we learn that applied field must be greater than ~~coercive field~~ coercive field.

also applied. so that it

field is removed then through magnetic ... must be remain...

* Theoretically we have come to know that how much magnetization field has been ~~applied~~ applied for magnetizing but practically we need an indicator that tells that the magnetization field is high enough to make the rat ~~magnetized~~. magnetized.

→ That is where field indicators come to the picture.