WINTER-16 EXAMINATION

Model Answer Subject Code **17555**

WINTER – 16 EXAMINATIONS

Subject Code: **17555** **Model Answer** Page No: ____/ N

Important Instructions to examiners:

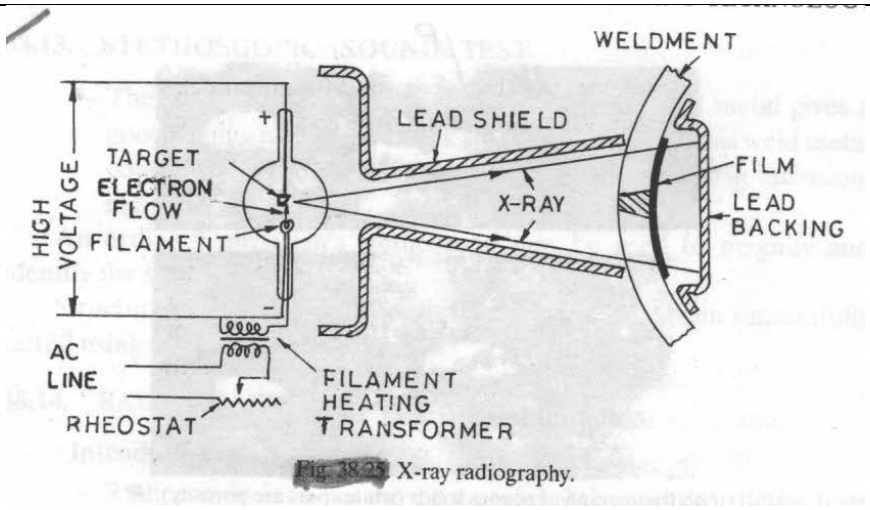
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling errors should not be given more importance. (Not applicable for subject English and Communication Skills)
4) While assessing figures, examiner may give credit for principal components indicated in the figure. The figures drawn by candidate and model answer may vary. The examiner may give credit for any equivalent figure drawn.
5) Credits may be given step wise for numerical problems. In some cases, the assumed constant values may vary and there may be some difference in the candidate's answers and model answer.
6) In case of some questions credit may be given by judgment on part of examiner of relevant answer based on candidate's understanding.
7) For programming language papers, credit may be given to any other program based on equivalent concept.

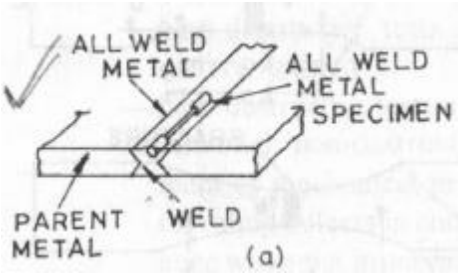
WINTER-16 EXAMINATION

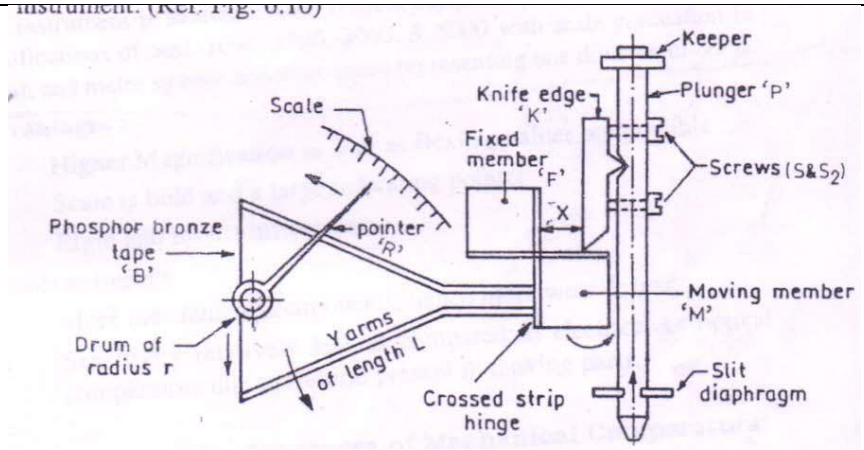
Model Answer Subject Code **17555**

<table>
<tr><th>`Q</th><th>MODEL ANSWER
. NO.</th><th>MARKS</th><th>TOTAL MARKS</th></tr>
<tr><td>1.</td><td>Attempt any FIVE of the following:</td><td></td><td>20</td></tr>
<tr><td>a)</td><td>
<table>
<tr><td>Parameters</td><td>Line standard</td><td>End standard</td></tr>
<tr><td>Accuracy of measurement</td><td>Limited to +- 0.2mm for high accuracy, scale have to be used in conjunction with microscope</td><td>Highly accurate for measurement of close tolerances upto +-0.001 mm.</td></tr>
<tr><td>Time measurement</td><td>Quick and easy</td><td>Time consuming</td></tr>
<tr><td>Effect of use</td><td>Scale marking not subjected to wear but end of the scale is worn.Thus,it may be difficult to assume zero of scale as atum</td><td>Measuring faces get worn out. To take care of this end piece can be hardened. And of protecting type.</td></tr>
<tr><td>Other errors</td><td>Parallax error can occur</td><td>Improper wringing of step gauges may introduce error change in lab.temperature may lead to some error.</td></tr>
<tr><td>Manufacture and cost of equipment</td><td>Simple and low</td><td>Complex process and high</td></tr>
<tr><td>Example</td><td>Meter and yard,etc</td><td>SlipGauges,Microometer, etc</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td><td>1mark per point</td><td>4 mark</td></tr>
<tr><td>b)</td><td>Quality of conformance: The quality of conformance is concerned with how well the manufactured product conforms to the quality of design.
Requirements for good quality conformance:
(i) Raw material, Measuring instrument,Operator's skill, Machine tool,Process
- The incoming raw materials are of adequate quality. The machines and tools for job and the measuring instruments are adequate for their purposes and are kept at high level of maintenance .
-Proper selection of the process and adequate process control -
- The operators should be well trained, experienced and motivated for quality consciousness.
- Proper care should be taken in shipment and storage of finished goods
- Inspection programme is such that it gives accurate measure of the</td><td>2mark mean

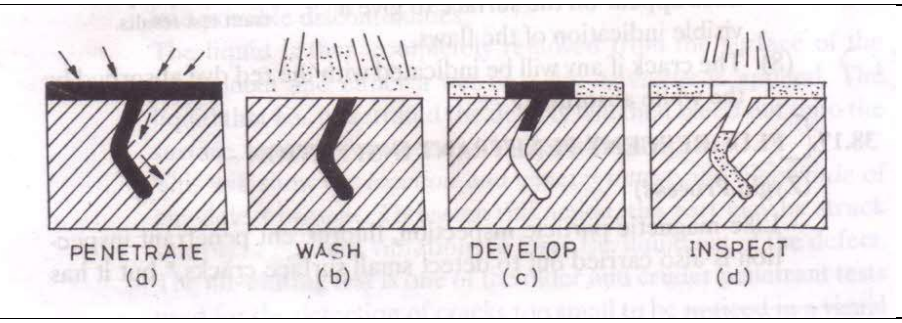
2m state</td><td>4m</td></tr>
</table>

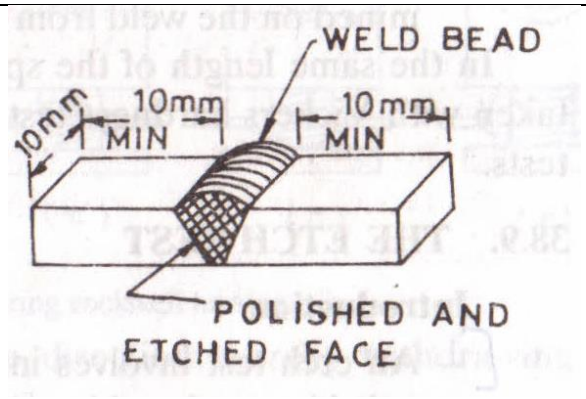
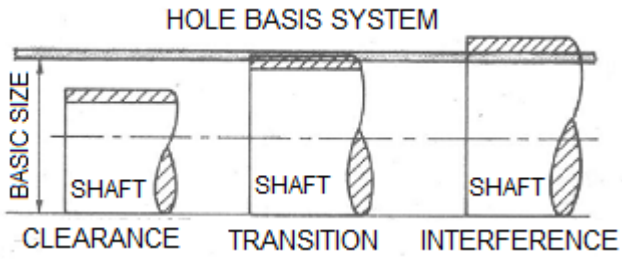
	efficiency or the whole systemand ensures to reduce and sort out defective products from the lot during processing. - Feedback from both the internal inspection and the customers, are obtained regarding quality for taking corrective action. - S.Q.C. techniques should be used to control variability in manufacturing process. - Higher quality of design usually costs more,higher quality of conformance usually costs less, by reducing the number of defective products produced.		
c)	Inspection planning: Inspection planning is an essential aspect in any industry, enough inspection is absolutely essential necessity: 1. A whole order will found unsellable if there is no proper planned inspection 2. Re-ordering materials and re-producing would take place if inspection at every stages is not planned 3. 100% inspection if required can be possible in planned inspection. 4. Re-working,re-issuing and other corrective actions can be done easily in planned inspection. 5. Planned Inspection is very important otherwise it may lead to production stop and loss to the company.	4mark (1m per point)	4mark
d)	 Fig. 38.25 X-ray radiography. X rays are produced in X ray tube where cathode produce electron which move towards the anode. A part of K.E.is converted to energy of radiation on X rays. 1. The portion of weld metal where defects are to be suspected is exposed to X rays emitted from the tube. 2. X-rays are produced in X-ray tube were a cathode produced	2m diag 2m exp	4 mark

	electrons which move towards anode.A part of K.E is converted to energy of rotation of x-rays 3. A cassetle containing X ray film is place behind and in contact with weldment perpendicular to the rays. 4. During expose X rays penetrated the welded object and thus affect welded X- ray film. 5. The X- Ray photograph shows the existence of flaw, internal crack,Leak or any deformity with their exact location.		
e)	A transverse Tensile Test specimen is cut from a welded butt joint at right angle to the weld direction and is used todetermine its transverse tensile strength. In an all-weld metal tensile test, the specimen is prepared from all-weld metal . This type of specimen is prepared by machining a groove in a plate of steel and then completely filling the groove with deposited weld metal. The surrounding steel is then machined away leaving a specimen of weld metal  All-weld Metal Tensile Test Specimen. -Tensile test is carried out by gripping the one end of the specimen in a tensile testing machine and applying and increasing pull on to the specimen till it fractures. - During the test, the tensile load as well as the elongation of a previously marked gauge length in the specimen is measured with the help of load dial of the machine and extensometer respectively. These readings help plotting stress-strain curve. - After fracture, the two pieces of the broken specimen are placed as if fixed together and the distance between two gauge marks and the area at that place of fracture are noted.	4m	4m
f)	INTERCHANEABILTY: The concept of interchangeability states that during such mass- production out of the different components produced, anyone component selected randomly should assemble correctly with its corresponding matching parts which are also selected randomly. When a system of this kind is ensured, it is termed as Interchangeable system.	2m def 2m adv	4m

	The specific advantage associated with this is: • Interchangeability ensures increased out put at reduced production. •It helps the the assembly to become faster & accurate. • It promotes standardization by virtue of which basic components in any assembly are always avalable at cheaper rates. • It results in mass production.		
g)	DIN: Deutsches Institute for Normung In English it means German institute for standardization.DIN is a german registered association head quarters in berlin.It is the German national organization for standardization.There are currently thirty thousand DIN standards, covering almost all fields of technology. ASTM Internationally, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development and delivery of international voluntary consensus standards. Today, some 12,000 ASTM standards are used around the world to improve product quality, enhance safety, facilitate market access and trade, and build consumer confidence	2m for DIN 2m for ASTM	4m
h)	Types of Bend Tests Bend tests may be categorized as (a) Free Bend Test (b)Guided Bend Test Bend tests may be further classified as (i)Transverse bend test - Face bend test -Root bend test (ii)Longitudinal bend test (iii)Side bend test.	4m	4m
2.	**Attempt any TWO of the following:**		**16**
a)	instrument. (Ref. Fig. 6.10)  1. The instrument uses a compound lever type system for magnification which can be of the order of 300 to 5000.	**2m diag 6m exp**	8m

	2. The instrument has as usual all the features of mechanical comparator in the form of plunger attached with sensing element, supports for spindle's frictionless movement, lever magnification arrangement, pointer, scale etc. 3. The plunger P is mounted on a pair of slit diaphragms to give frictionless movement. 4. A knife edge K pivots on its groove whose lower edge moves on the surfaces of a moving block M. 5. In fact a pair of fixed block F and moving block M constitute a flexible pivot such that if M is pushedor pressed, it results into angular rotation of M due to cross fixation of it by X with F. 6. An arm A with its other end extending into Y shape is attached to the moving member with effective length L .Now if the distance of flexible hinged pivot and edge is then first magnification= L/x 7. A phosphor bronze band or ribbon B is attached which passes around a small drum or both of radius r attached to pointer scale. 8. If the length of the pointer is R then second magnification is R/r 9. Over all magnification M=L/x X R/r		
b)	FLUORESCENT-PENETRANT INSPECTION - Like magnetic particle inspection, fluorescent penetrant inspection is also carried out to detect small surface cracks, but it has the advantage that it can be used for testing both ferrous and nonferrous welded jobs. Operational Steps involved:- (i) Clean the surfaces of the object to be inspected for cracks etc. (ii) Apply the fluorescent penetrant on the surface by either dipping, spraying or brushing. Allow a penetration time up to one hour. The fluorescent penetrant is drawn into crack by capillary action [Fig. (a)]. (iii) Wash the surface with water spray to remove penetrant from surface but not from crack [Fig. (b)]. (iv) Apply the developer. The developer acts like a blotter to draw Penetrant out of crack and enlarges the size of the area of penetrant indication [Fig. (c)]. (v) The surface is viewed under black light [having a wavelength of 3650 Angstrom (A) units (1A = 10 -8 cms)], which is between the visible and ultraviolet in the spectrum. Black light causes penetrant to glow in dark [Fig. (d)].	2m diag 6m exp	**8**

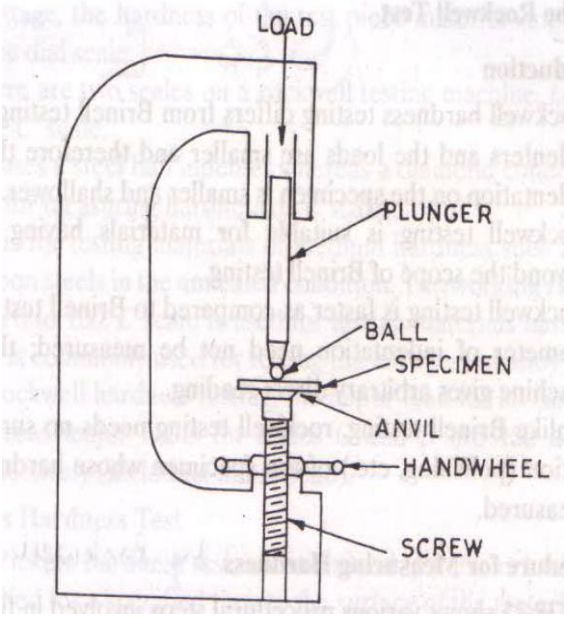
			
c)	An etch test involves inspecting the welded test specimen after polishing and etching the same with a chemical reagents e.g.,A dilute acid. <u>Preparation of Test Specimen</u> The specimen shall be the full thickness of the material at the welded joint and the weld-reinforcement and penetration bead shall be left intact. The specimen shall contain a length of the joint of at least 10 mm and shall extend on each side of the weld for a distance that includes the heat affected zone and some base metal portion (ii) Specimen after being cut from the plate is filed or ground to obtain flat surface on the specimen. (iii) Intermediate and fine grinding is carried out using emery papers of progressively finer grades (iv)Rough and fine polishing of the specimen is carried out on a rotating polishing wheel. Fine polishing removes the scratches and very thin distorted layer remaining on the specimen from the rough polishing stage. (v) Etching. The specimen is then etched in order to make visible the grain boundaries, heat affected zone, the boundary between the weld metal and parent metal, etc. Etching imparts unlike appearances to the metal constituents and thus makes metal structure apparent under the microscope. Etching is done either by (a) immersing the polished surface (of the specimen) in the etching reagent or by (b) rubbing the polished surface gently with a cotton swab wetted with the etching reagent.	**2m for def 6m for exp**	**8m**

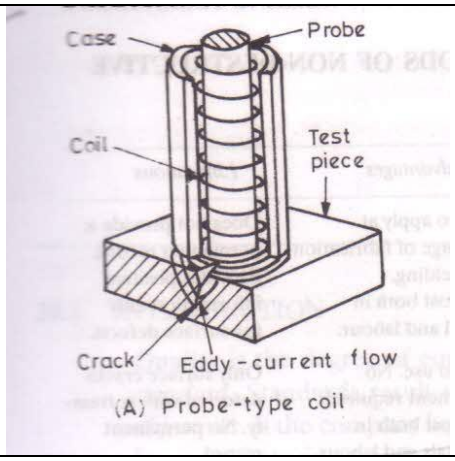
			
3.	**Attempt any FOUR of the following:**		**16**
a)	Hole Basesystem: 1) Hole is constant member and shaft dimension are varied to obtain the different type of fits. Lower deviation of the hole is zero. 2) It is mostly preferred in the mass production,it is easy, convenient and less costly to make holes of correct sizes as compared to shaft base system. 3) It is quite easy to vary the sizes shaft sizes according to the fit required as compared to shaft base system. 4) Checking of the shafts is easy and convenient as compared to shaft basis system 5) It requires less amount of capital and production accessories to manufacturer shafts of different sizes as compared to shaft basis system 	**2m for diag 2m for exp**	**4m**
b)	**TQM :** Total quality management refers to the total involvement of staff in an organization together with suppliers, distributors and even customers in bringing about quality satisfaction by promoting quality cultures through quality circles, job enrichment and effective purchasing. Importance of TQM 1. One of important thing in TQM is that it meets the customers requirement. 2. Continuous improvement of quality at every level at every place and at every stage 3. Reduce quality cost	2 mark-definition 2 mark objective (1m per point)	4 mark

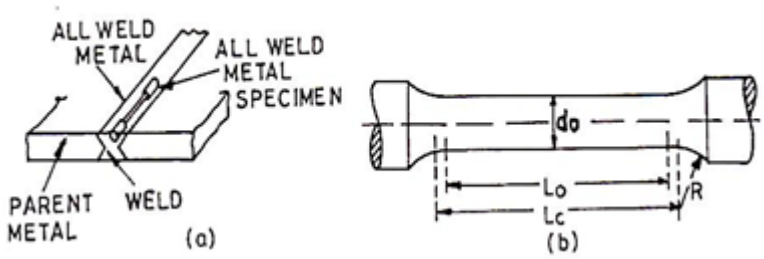
	4. Increase market share 5. Productivity improvement 6. Satisfying workers emotional and intellectual needs for providing them to have better working conditions which ultimately results in better quality of the product. (7) Maintaining a sound quality system, to ensure each task, is performed correct.		
c)	Duties of Inspector (1)Interpretation of specification (2)Measurement of product (3)Comparison with standards (4)Judging conformity (5)Recording data (6)Disposition of product	1mark-1 point	4mark
d)	Acoustic emission: Acoustic emission (AE) is defined as the class of phenomenon where by transients elastic waves are generated by the rapid release of energy from localized source like places of transient relaxation of stress and strain fields. AE signals generated by discontinuities in material under a stimulus such stress, temperature etc. Proper analysis of these signals can be providing information concerning detection. AE is occurring during the processes of *mechanical loading* of materials and structures accompanied by structural changes that generate local sources of elastic waves. Acoustic emission (AE) is the phenomenon of radiation of acoustic (elastic) waves in solids that occurs when a material undergoes irreversible changes in its internal structure, for example as a result of crack formation or plastic deformation .	4 mark	4 mark
e)	purpose of Macro-etch test : It gives a broad picture of the specimen by studying relatively large sectioned areas. - Macro-examination reveals in welded specimen (i) Cracks, (ii) Slag inclusion, (iii) Blowholes, (iv) Shrinkage porosity, (v) Penetration of the weld, (vi) The boundary between the weld metal and the base metal, etc.	4 mark	4 mark
f)	ASME Codes for pipes B31 Code for pressure piping, developed by American Society of Mechanical Engineers - ASME, covers Power Piping, Fuel Gas Piping, Process Piping, Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids, Refrigeration Piping and Heat Transfer Components and	1 CODE -1mark	4 mark

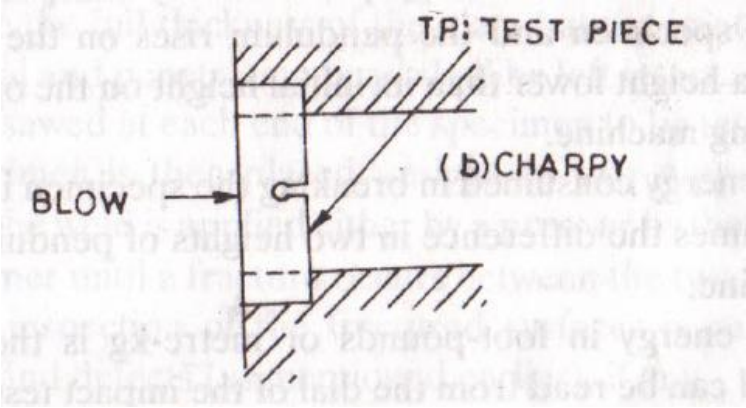
	Building Services Piping. ASME B31 was earlier known as ANSI B31. B31.1 - 2001 - Power Piping B31.2 - 1968 - Fuel Gas Piping B31.3 - 2002 - Process Piping B31.4 - 2002 - Pipeline Transportation Systems for Liquid Hydrocarbons and Other Liquids B31.5 - 2001 - Refrigeration Piping and Heat Transfer Components B31.8 - 2003 - Gas Transmission and Distribution Piping Systems B31.8S-2001 - 2002 - Managing System Integrity of Gas Pipelines B31.9 - 1996 - Building Services Piping B31.11 - 2002 - Slurry Transportation Piping Systems B31G - 1991 - Manual for Determining Remaining Strength of Corroded Pipelines **ANY CODES OTHER THAN ABOVE ARE ACCEPTED**		
4.	**Attempt any TWO of the following:**		**16**
a)	Various methods of NDT are 1. Visual inspection 2. Magnetic particle testing 3. Acoustic testing 4. Radiography 5. Liquid penetrant testing 6. Ultra sonic inspection 7. Eddy current testing Magnetic particle inspection method -When a piece of metal is placed in magnetic field and the lines of magnetic flux get intersected by a discontinuity such as a crack or slag inclusions in a job, magnetic poles are induced on either side of the discontinuity. -The discontinuity causes an abrupt change in the path of magnetic flux flowing through the job normal to the 'discontinuity, resulting a local flux leakage field and interference with the magnetic lines,of force. Procedural steps involved are, (a) Magnetising the component part. (b) Applying magnetic particles on the component part. (c) Locating the defects (a) Magnetising the Welded Plate Different methods employed for magnetisation may be classified as	2m for list 6m for exp	8m

	follows: • Continuous method. • Residual method. • Circular magnetisation. • Longitudinal magnetisation. • A.c. magnetisation. • D.C. magnetisation. b). Applying Magnetic (particles or) Powder - Magnetic particles may be applied during the passage of mag netising current or following the same when the residu magnetism is made use of in detecting cracks in welded object This method avoids the danger of oversaturationl - The magnetic powder of iron or black magnetic iron oxide base and having elongated individual particles is used for the purpose c) Locating the defect As soon the magnetic particles collect and gets piled up the defector discontinuity can be easily located		
b)	Need of hardness test - The hardness test gives an idea of the resistance to wear of the weld metal. This is important with respect to the components which have been built up and have to withstand abrasive wear. - Hardness values can give -information about the metallurgical changes caused by welding. - Hardness values indicate whether the correct welding technique and pre and post-heat-treatments have been carried out. The Brinell Test - It consists of pressing a hardened steel ball into a test specimen. - According to ASTM specifications, a 10 mm diameter ball is used for the purpose. Lower loads are applied for measuring hardness of soft materials and vice versa. Procedure of Hardness Testing; -Specimen is placed on the anvil; the hand wheel is rotated so that the specimen along with the anvil moves up and contacts with the ball. - The desired load is applied mechanically (by a gear driven screw) or hydraulically (by oil pressure) and the ball presses into the specimen. - The diameter of the indentation made in the specimen by thepressed ball is measured by the use of a micrometer microscope, having a transparent engraved scale in the field of view. The indentation diameter is measured at two places at right angles to each other, and the average of the two readings is taken. - The Brinell hardness number (BH) which is the pressure per unit surface area of the indentation in kg per square metre, is calculated as follows:	2mark-DIAGRAM 4 mark-brinell 2mark-need	8 mark

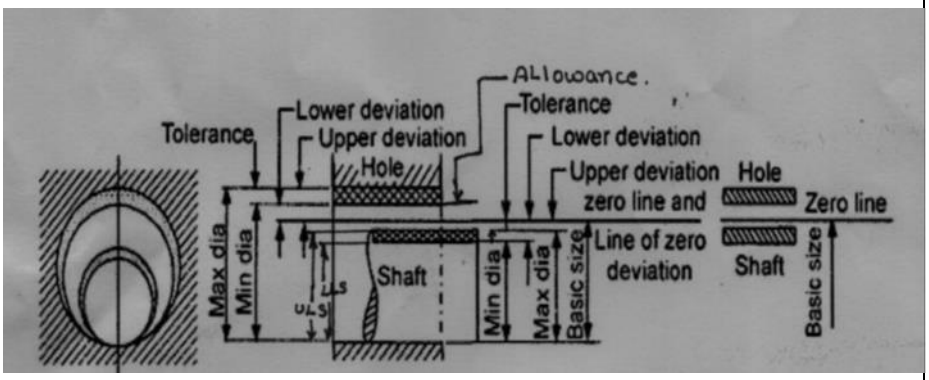
	Formula :BHN= W/[(πD /2)(D-√{D2-d2})] Where W is load on indenter, kg D is diameter of steel ball, mm d is average measured diameter of indentation, mm - Brinell hardness test is best for measuring hardness of gray cast iron consisting of soft flake graphite, iron and hard iron carbide.  		
c)	EDDY CURRENT TESTING Principle of Operation - An A.C. coil is brought up close to the weldment to be tested. - The A.c. coil induces eddy currents in the welded object. -These eddy currents produce their own magnetic field which opposes the field of the A.C. coil. -The result is an increase in the impedance (resistance) of the A.c. coil. Coil impedance can be measured. -If there is a flaw in the weldment, as soon as the coil passes over the flow, there is a change in the coil impedance which can be wired to give a warning light or sound and thus the flaw and its location can be determined. -Flaws at or close to the surface such as cracks, weld porosity, poor fusion or any linear discontinuity can be detected	2 mark-diag 6m exp	8 mark

	 (A) Probe-type coil		
5.	**Attempt any FOUR of the following:**		**16**
a)	Leak test under fluid pressure: <u>Procedure:</u> • Leak refers to an actual discontinuity or passage through which a fluid flows or permeates. • The welded vessel, after closing all its outlets; is subjected to internal pressure using water, oil, air or gas (e.g. CO2), • Hydraulic pressure, using water as the fluid, is the usual medium employed in this test. • Oil if it is thin/hot will penetrate leaks that do not show up with water under equal pressure. • Air will leak out more readily than water and gas (e.g. Hydrogen) will escape where air will not. • Where feasible, it is better to use water or oil because there will be very less tendency for the parts to be violently thrown out in case of a sudden release of pressure. • When using air/gas, failure of vessel can cause injuries to persons around.	4 m	4m
b)	All weld metal test: • A transverse Tensile Test specimen is cut from a welded butt joint(at right angle to the weld direction and is used to determine its transverse tensile strength. • In an all-weld metal tensile test, the specimen is prepared from all-weld metal [Fig. (a)]. • This type of specimen is prepared by machining a groove in a plate of steel and then completely filling the groove with deposited weld metal • The surrounding steel is then machined away leaving a specimen of weld metal.	SKETCH -2 MARK Explanation- 2 MARK	4m

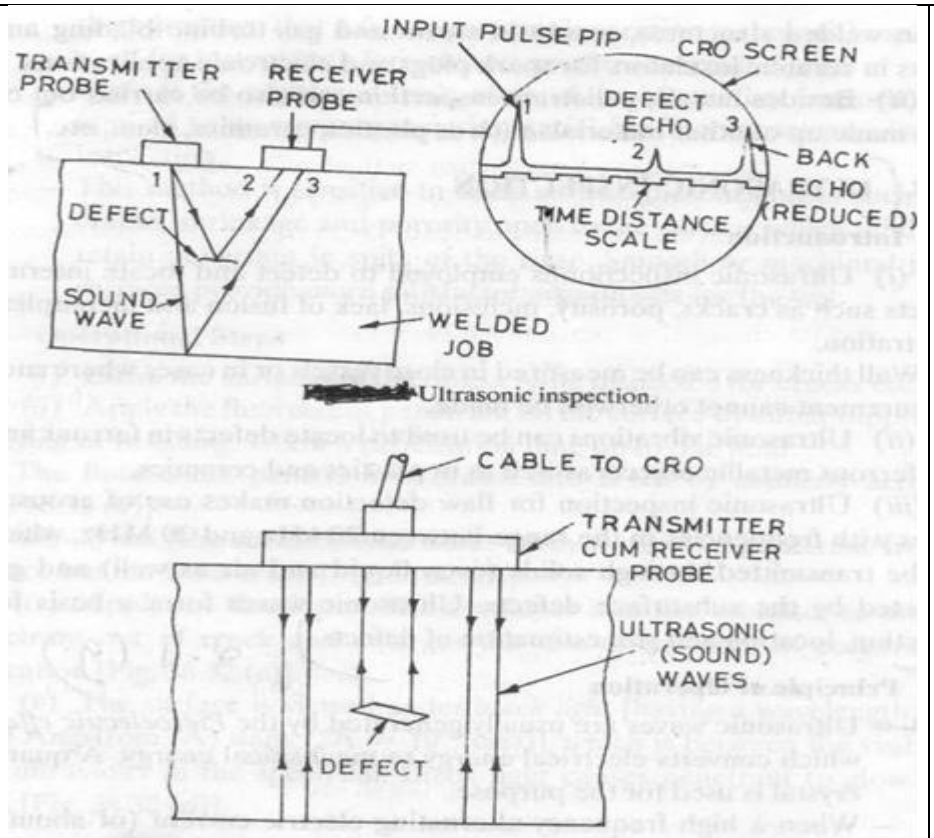
			
c)	Def An effective system for integrating the quality development, quality maintenance and quality improvement efforts of the various groups in an organization, so as to enable production and serive at the most economical levels which allow full customer satisfaction It can also be defined as the tools, devices or skills through which quality activities are carried out Aims or Objectives of Quality Control 1. To improve the company's income by making the product more acceptable to the customers by providing long life, greater usefulness (versatility), aesthetic aspects, maintainability, etc. 2. To reduce company's cost through reduction of the losses due to defects. For example, to achieve lower scrap, less rework, less sorting, fewer customer returns etc. 3. To achieve interchangeability of manufacture in large scale production. 4. To produce optimum quality at minimum price. 5. To ensure satisfaction of customers with products or services -ufirigb quality level, to build customers' goodwill, confidence and reputation of manufacturer. 6. To make inspection prompt to ensure quality control at proper stages to ensure production of non-defective products. 7. Judging the conformity of the process to the established standards and taking suitable action when there are deviations. 8. To improve quality and productivity by process COllum, elCpei~.joo and customers feedback. 9. Developing procedure for good vendor-vendee relations. 10. Developing quality consciousness in the Organisation.	2m def 2m objectiv e (1m per point)	4m
d)	1. Cost required for inspection is more. 2. Time required for inspection is more 3. Operator suffers from inspection fatigue 4. More staff is required for inspection 5. Due to more handling, chances of damage increases 6. 100% inspection not possible where destructive testing is required	1m per point	4m

<table>
<tr><td>e)</td><td>The two basic types ofImpact Tests are
(i) The Charpy (Beam) Test. (ii) The lzod (Cantilever) Test.
The Charpy specimen is placed in the vise so that it is just a simple beam supported at the ends whereas hod specimen is placed in the vise such that it is in the form of a cantilever. Fig. gives the dimensions of charpy test specimen,
Test Procedure (Refer to Figs.)
1. The swinging pendulum weight is raised to standard height depending upon the type of specimen to be tested.
 

2.With reference to the vise holding the specimen, the higher the pendulum, the more potential energy it has got.
3 As the pendulum, is released, its potential energy is converted into kinetic energy until it strikes the specimen.
4.. The Charpy specimen is hit behind the V notch while the Izod specimen, placed with the V notch facing the pendulum, will be hit above the V notch.
5. A portion of the energy possessed by the pendulum is used to rupture the specimen and the pendulum rises on the other side of the machine to a height lower than its initial height on the opposite side of the impact testing machine.
6. The energy consumed in breaking the specimen is the weight of the pendulum times the difference in two heights of pendulum on either side of the machine.
7. This energy in foot-pounds or metre-kg is the notched impact strength and can be read from the dial of th; impact testing machine.</td><td>1m diag
3m exp</td><td>4m</td></tr>
<tr><td>f)</td><td><table>
<tr><th></th><th>Gamma ray Radiography</th><th>X - ray Radiography</th></tr>
<tr><td>1</td><td>Gamma ray radiography can inspect more thicker section than that of by X-ray radiography</td><td>Less thicker section can be inspected by X – ray radiography than of gamma ray radiography</td></tr>
<tr><td>2</td><td>Section which varying in thickness can be easily</td><td>X – Ray radiography provided better result for welded section</td></tr>
</table></td><td>1mark-1 point</td><td>4mark</td></tr>
</table>

		satiation examinations by using Gamma rays	of uniform thickness.	
	3	Gamma rays are not counties to direct the smaller defect in the components	X – ray is better than gamma ray to detect smaller defect in section lesser than 50mm	
	4	Gamma ray radiography is a tome consuming method than X –ray radiography	X – ray radiography is rapid than gamma ray radiography	
	5	Number of objects can be inspected at a time	Only one part can be inspected at a time	
6.	**Attempt any TWO of the following:**			**16**
a)			**8m(2m per point)**	8m
b)	Principle of Operation: Ultrasonic waves are usually generated by the Piezoelectric effect which converts electrical energy to mechanical energy. A quartz crystal is used for the purpose. - When a high frequency alternating electric current (of about 1 million cycles per second) is impressed across tile faces of the quartz crystal, the crystal will expand during the first half of the cycle and contract when the electric field is reversed. In this manner the mechanical vibrations (sound waves) arc produced in the crystal. - The surface of job to be inspected by ultrasonic is made fairly smooth either by machining or otherwise so that ultrasonic waves can be efficiently transmitted from the probe into the job and even small defects can be detected properly. - Ultrasonic inspection employs separate probes (or search units), one for transmitting the waves and other to receive them after passage through the		**4 mark-Exp** **2 mark-Advantages** **2mark-Dis Advantages**	**8**

	welded jobs alternatively, since the ultrasonic waves are transmitted as a series of intermittent pulses, the same crystals may be employed both as the transmitter and receiver (Fig.) - Before transmitting ultrasonic waves, an oil film is provided between the probe and the job surface - For operation, ultrasonic wave is introduced into the metal and the time interval between transmission of the outgoing-and reception of the incoming signals is measured with a cathode ray oscilloscope (CRO). - The time base of CRO is so adjusted that the full width of the trace represents the section being examined. - To start with, as the wave is sent from the transmitter probe, it strikes the upper surface of the job and makes a sharp (peak) or pip (echo) at the left hand side of the CRO screen (Fig.). If the job is sound, this wave will strike the bottom surface of the same (Fig.), get reflected and indicated by a pip towards the right-hand end of CRO screen. Advantages 1. It is fast and realiable method of NDT 2. It involves low cost and high speed operation 3. Big weldments can be systematically scanned for initial detection of major defects 4. The sensitivity of ultrasonic flaw detection is extremely high Disadvantages • Skilled and trained operators required • Surface to be tested must be ground smooth and clean • Not suited to the examination of weldments of complex shapes		

			
c)i	ASME Codes for pressure vessels ASME:B36.19M stainless steel pipe this standard provides dimensions of welded and seamless wrought stainless steel pipe for high or low temperature and pressure application ASME B36.10M — Welded and Seamless Wrought Steel Pipe ASME B46.1 — Surface Texture (Surface Roughness, Waviness and Lay) ASME B18.2.2 --Square and Hex Nuts	1 CODE - 1mark	4
ii	ASTM A 516 M-0.6 Standard specification for pressure vessel plates,carbon steel for moderate and lower temperature service. DIN 2609:1991 Steel butt welding pipe fittings technical delivery conditons.	2m each	4m