SUMMER – 16 EXAMINATIONS

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

Important Instructions to examiners:

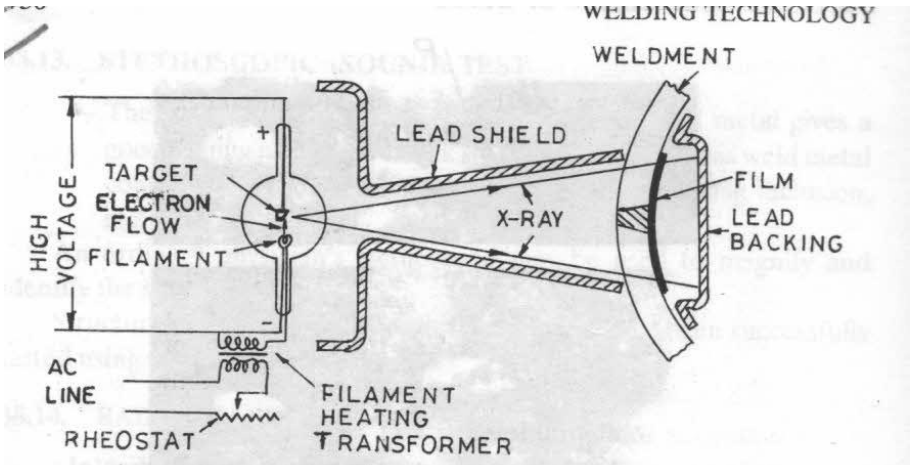
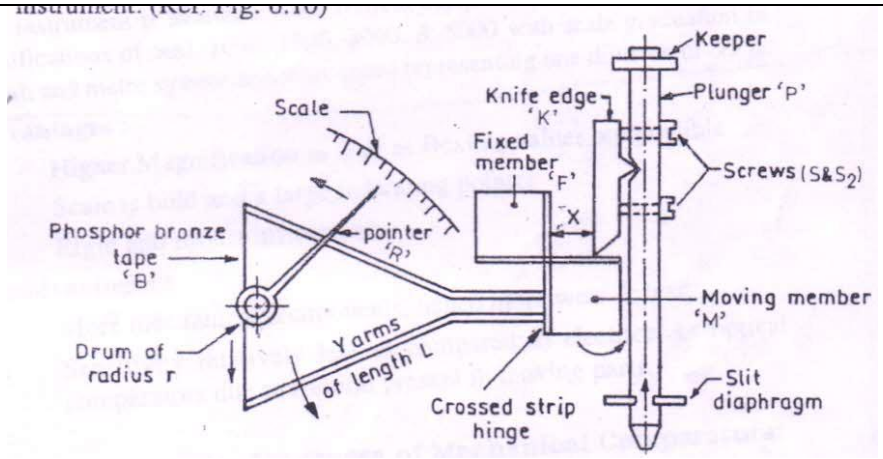
1) The answers should be examined by key words and not as word-to-word as given in the model answer scheme.
2) The model answer and the answer written by candidate may vary but the examiner may try to assess the understanding level of the candidate.
3) The language errors such as grammatical, spelling 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.

Q. No.	MODEL ANSWER	MARKS	TOTAL MARKS
1	**Attempt any five**	5 x 4	**20**
1.a	<u>Magnetic particle inspection</u> MPT is used for testing material which can be easily magnetized MPT required equipment is cheap and robust and can easily be handled by semiskilled personnel without requiring elaborate protection such as that needed for radiography. Principle: 1) When a specimen is magnetized the magnetic lines of force are periodically inside ferrous magnetic material. 2) The lines of magnetic flux get intersection by a discontinuity magnetic poles are induced either side of discontinuity. 3) When magnetic particles are sprinkled unto the specimen these particles are attendee by magnetic poles to create visual indication approximating the size and shape of flux. 4) The discontinuity causes an abrupt change in the path of magnetic flux. 5) A surface crack is indicated by a line of fine particles following the crack outline 6) A subsurface defect by fuzzy collection of the magnetic particles on the surface near the discontinuity 7) The colour of magnetic particles should be in good contract to color of surface of specimen for easy detection 8) For maximum sensitivity the flux density should be oriented 90^0 to the discontinuity	4 mark	4 mark
1.b	<u>purpose of Macro-etch test :</u> 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
c	Process Inspection: It is the inspection of raw material as it undergoes processing from one operation to another.in process inspection can be carried out as I. First piece inspection II. Floor inspection III. Centralised inspection IV. Last inspection Advantage: I. Wastage is minimising in the early stage so cost is reducing due to first piece inspection.	2 mark-definition 1 mark-Adv. 1 mark-Dis adv.	4 mark

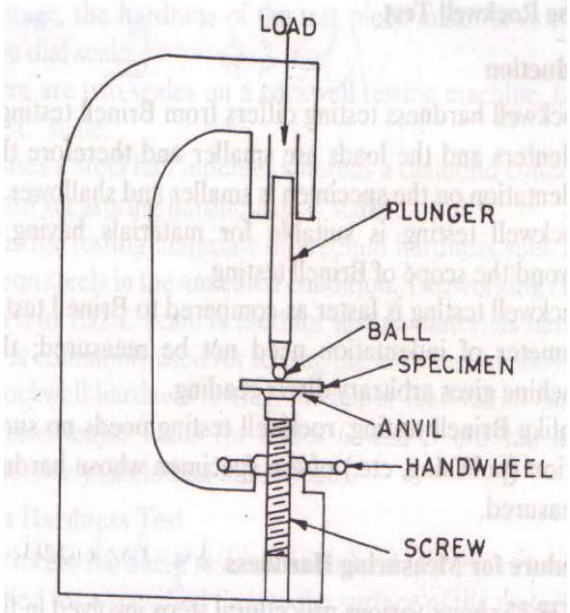
<table>
<tr><td></td><td>II. Defects may be quickly discovered and corrected
Disadvantage:
I. Production cannot be stated unless the piece is inspected.
II. Pressure on the workers to accept the job for correcting defects.</td><td></td><td></td></tr>
<tr><td>1.d</td><td>
<table>
<tr><th>Parameters</th><th>Line standard</th><th>End standard</th></tr>
<tr><td>1) 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>2) Time of measurement</td><td>Quick and easy</td><td>Time consuming</td></tr>
<tr><td>3) 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>4) 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>5) Manufacture and cost of equipment</td><td>Simple and low</td><td>Complex process and high</td></tr>
<tr><td>6) Example</td><td>Meter and yard,etc</td><td>Slip Gauges,Microometer,etc</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td><td>1mark-1 point</td><td>4 mark</td></tr>
<tr><td>1.e</td><td><u>Principle of Acoustic emission:</u>
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.

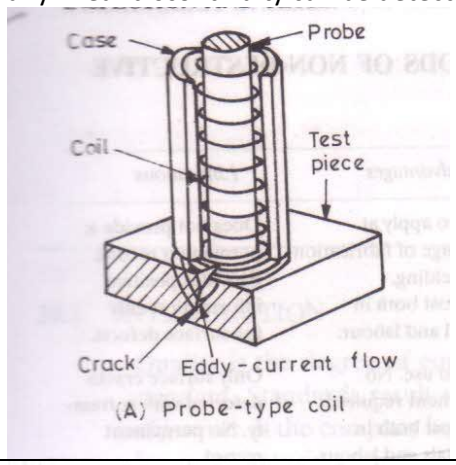
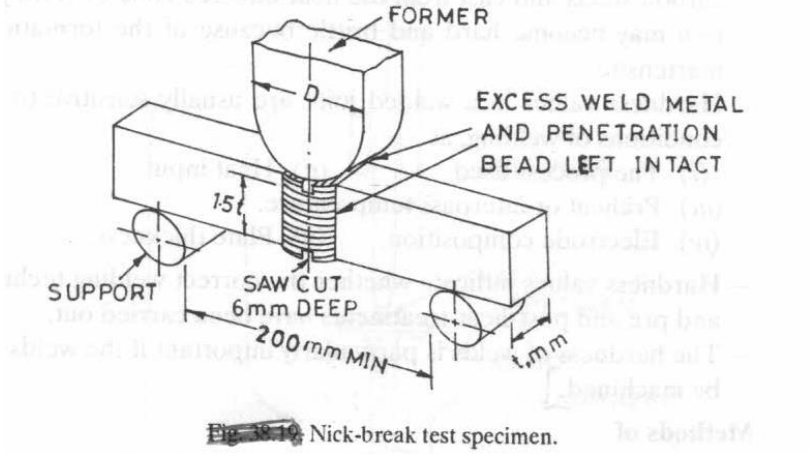
Principle of AET: AE signals generated by discontinuities in material under a stimulus such stress, temperature etc. Proper analysis of these signals can be providing information concerning detection.</td><td>4 mark</td><td>4 mark</td></tr>
<tr><td>1.f</td><td><u>TQM :</u>
Total quality management refers 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</td><td>2 mark-definition
2 mark-objective</td><td>4 mark</td></tr>
</table>

	quality circles, job enrichment and effective purchasing. Objectives of TQM (a) Team effort of all the constituents towards achieving the common goal of enrichment in the quality standard. (b) Satisfying workers emotional and intellectual needs for providing them to have better working conditions which ultimately results in better quality of the product. (c) Installing motivation system, to include collective achievement and quality excellence. (d) Integrating and coordinating the activities of various departments in the organization to attain the desired goals economically. (e) Maintaining a sound quality system, to ensure each task, is performed correct.		
1.g	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 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**	1 CODE - 1mark	4 mark
2	**Attempt any two**	2 x 8	**16**
2.a	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 suspendered is exposed to X rays emitted from the tube. 2) A cassette containing X ray film is place behind and in contact with weldment perpendicular to the rays. 3) During expose X rays penetrated the welded object and thus affect welded X- ray film.	4mark- DIAGRAM 4 mark- Procedure	8 mark

	4) The X- Ray photograph shows the existence of flaw, internal crack, Leak or any deformity with their exact location.  Fig. 38.25 X-ray radiography.		
2.b	 The instrument uses a compound lever type system for magnification which can be of the order of 300 to 5000. 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. However the magnification details inside will reveal clearly the working of the instrument. (Ref. Fig.) The plunger P is mounted on a pair of slit diaphragms to give frictionless movement. A knife edge K pivots on its groove whose lower edge moves on the surfaces of a moving block M. In fact a pair of fixed block F and moving block M constitute a flexible pivot such that if M is pushed or pressed, it results into angular rotation of M due to cross fixation of it by X with F. 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	2mark-DIAGRAM 4 mark-Procedure 1 mark-Adv. 1 mark-Dis adv.	8mark

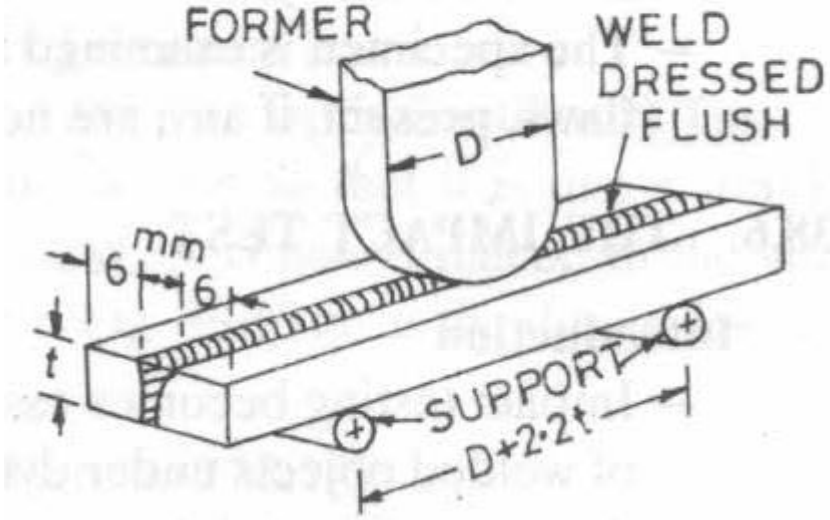
	At the top of phosphor bronze band or ribbon B is attached which Passes around a-small drum or bush of radius 'r' attached to pointer scale. If the length of the pointer is R, then second magnification is R/r and therefore overall magnification. M= l/s X R/g The magnification can be changed by effectively changing fulcrum distance x which can be done by either tightening or loosening the two screws SI &. S2 or by changing ratio of r/R i.e. Changing dia of drum of ribbon winding or pointer radius R. The instrument is available with vertical capacities of 15Q, 300, 600 mm and magnifications of 500. 1000. 1500, 3000, & 5000 with scale graduation in both British and metre system and least count representing one division of .25 µ <u>Advantages:</u> 1) Amplification so obtained is cheaper as compared to other comparators. 2) As there is no need of any external supply such as electricity or air and as such the variations in outside supplies do not affect the accuracy. 3) Usually the mechanical comparators have linear scale which is easily understood. 4) These are usually robust and compact and easy to handle. 5) For ordinary workshop conditions, these are suitable and being portable can be issued from a store. <u>Disadvantages:</u> 1) The mechanical comparators have got more moving parts than other types. Due to more moving parts, the friction is more and ultimately the accuracy is less. 2) Any slackness in moving parts reduces the accuracy considerably. 3) The mechanism has more inertia which makes instruments more sensitive to vibration. 4) The range of the instrument is limited as the pointer moves over a fixed scale. S) Error due to parallax is possible as the moving pointer moves over a fixed scale		

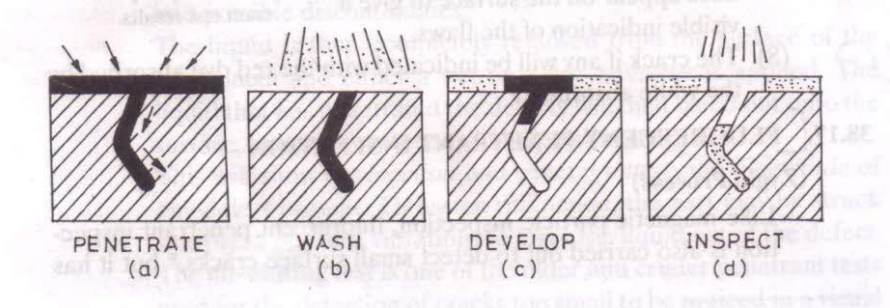
2.c	The Brinell Test - It consists of pressing a hardened steel ball into a test specimen. - According to ASTM specifications, a 10 mm diameter ball is used for the purpose. Lower loads are applied for measuring hardness of soft materials and vice versa. Procedure of Hardness Testing; -Specimen is placed 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 the pressed 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: 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.  	2mark-DIAGRAM 4 mark-Procedure 2mark-formula	8 mark

3	**Attempt any four**	4 x 4	**16**
3.a	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 proceduce 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 Indicated Flaws at or close to the surface such as cracks, weld porosity, poor fusion or any linear discontinuity can be detected  	4 mark	4 mark
3.b	 Fig. 3.10 Nick-break test specimen. Procedure - The test specimen shall be cut transversely to the welded joint and shall have the full thickness of the plate t at the joint. The excess weld metal and penetration bead shall be left intact. - Slots are sawed at each end of the specimen to be tested. - The specimen is then placed upright on two supports and the force on the weld is applied either by a press or by the sharp blows of a hammer until a	2mark-Diagram 2mark-Procedure	4 mark

<table>
<tr><td></td><td>fracture occurs between the two slots.
- A visual inspection of the fractured surfaces is carried out in order to find defects (as mentioned earlier), if any.
If any defect exceeds 1.5 mm in size or the number of gas pockets exceeds one per square cm, the piece has failed the test.</td><td></td><td></td></tr>
<tr><td>3.c</td><td>
<table>
<tr><th>Parameters</th><th>Inspection</th><th>Quality control</th></tr>
<tr><td>Scope</td><td>Inspection is a part of quality control.</td><td>Quality control is a broad term, it involves Inspection at particular stages.</td></tr>
<tr><td>Definition</td><td>Inspection is an act of checking materials, parts, components, or products at various stages in manufacturing and sorting out the faulty or defective items from good ones.</td><td>QC is an effective system for integrating Quality development, maintenance and improvement efforts of various groups 111 an organization to enable the productions to be carried out at most economic level.</td></tr>
<tr><td>Devices used</td><td>It involves use precision measuring devices like venire callipers, micrometre, etc. and devices such as tool maker's, microscope, profile projector, flaw detector, etc.</td><td>QC uses devices such as statistics, control charts, acceptance sampling, process capability study, YQR,YR, quality audits, etc.</td></tr>
<tr><td>Application</td><td>It is concerned with quality of past production to judge conference with specifications and sorting out defective items from good ones.</td><td>It is concerned with quality of future production. What is learnt from inspection is used as a basis to ascertain. Whether the quality meets the specifications or not.</td></tr>
</table>
</td><td>1mark-1 point</td><td>4mark</td></tr>
<tr><td>3.d</td><td>ASME - American Society of Mechanical Engineers is a 120,000-member professional organization focused on technical, educational and research issues of the engineering and technology community. ASME conducts one of the world's largest technical publishing operations, holds numerous technical conferences worldwide, and offers hundreds of professional development courses each year. ASME sets internationally recognized industrial and manufacturing codes and standards that enhance public safety.
ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development</td><td>2 mark-ASME
2 mark-ASTM</td><td>4 mark</td></tr>
</table>

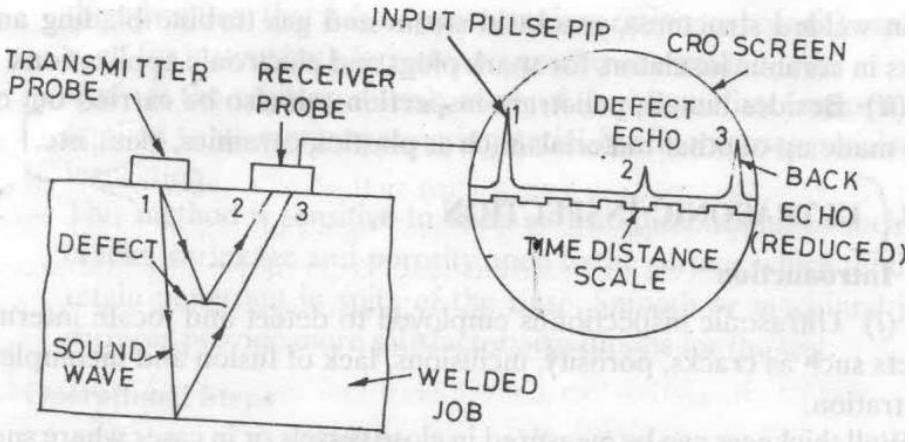
	and delivery of international voluntary consensus standards. Today, some 12,000 ASTM standards are used around the world to improve product quality, enhance safety, facilitate market access and trade, and build consumer confidence		
3.e	Requirement of good comparator. 1) The comparators must be of robust design and construction so as to withstand the effect of ordinary usage without impairing its measuring accuracy. 2) The indicating devices are such that readings are obtained in the least possible time. 3) Provision is made for maximum compensation for temperature effects. 4) The scale is linear and having straight line characteristic. 5) Measuring pressure is low and constant.	1mark-1 point	4mark
3.f a	Quality of design refers to the differences in the specification for products Which have the same use. Quality of conformance on the other hand refers to the ability to maintain the specified quality of design	2mark	4mark
3.f b	Quality of conformance: The quality of conformance is conceded with how well the manufactured product conforms to the quality of design. For the good quality of conformance, following factors are important. (i) Raw material. (ii) Measuring instrument (iii) Operator's skill, (iv) Machine tool (v) Process	2mark	
4	**Attempt any two**	2 x 8	**16**
4.a	Introduction and Purpose of bend test: - A Bend Test may be carried out on a tensile testing machine with the help of certain attachments as described later in this section. - A bend test is an easy and inexpensive test to apply. The method Is fast and shows most weld faults quite accurately. - Bend tests may be used to find a number of weld properties such as (i) Ductility of the welded zone (ii) Weld penetration (iii) Fusion (iv) Crystalline structure (of the fractured surface) (v) Strength. . The bend test assists in determining the soundness of the weld metal, the weld junction and the heat -affected zone. The test shows the quality of the welded joint. Any cracking of the metal will indicate false fusion or defective penetration. The stretching of the metal determines to some extent its ductility. Fractured surface shows the crystalline structure. Large crystals usually indicate wrong welding procedure or poor heat¬ treatment after welding. A good weld has small crystals.	4mark-purpose 2 mark-Diagram 2mark-procedure	8 mark

	To conclude, the bend .test is an easy and useful method of comparing one welded joint with another of the same type and of revealing abnormalities and defects at or near the surface in tension.  <u>Longitudinal Bend Test</u> - The problems of weld mismatch (as described in transverse bend test) can be avoided by using longitudinal bend specimens in which the weld runs the full length of the bend specimen (Fig. 3); the bend axis being perpendicular to the weld axis. In longitudinal bend test, all zones of the welded joint (i.e., weld, heat-affected zone and the base metal) are strained equally and simultaneously. This test is generally used for evaluations of joints in dissimilar metals. - Specimens for longitudinal bend test are prepared in the same manner as for transverse bend test;)		
4.b	FLUORESCENT-PENETRANT INSPECTION (Zyglo Process) - Like magnetic particle inspection, fluorescent penetrant inspection is also carried out to detect small surface cracks, but it has the advantage that it (i.e. Penetrant inspection technique) can be used for testing both ferrous and nonferrous welded jobs. - Zyglo is the registered trade mark of the Magnaflux corporation applied to its equipment and material for fluorescent penetrant inspection. - This method is sensitive to small surface discontinuities such as cracks, shrinkage and porosity open to the surface which tend to retain penetrant in spite of the rinse. Smooth or machined job surfaces provide more satisfactory conditions for the test. Operational Steps (i) Clean the surfaces of the object to be inspected for cracks etc. (ii) Apply the fluorescent penetrant on the surface by either dipping,	4mark-procedure 4 mark-Diagram	8 mark

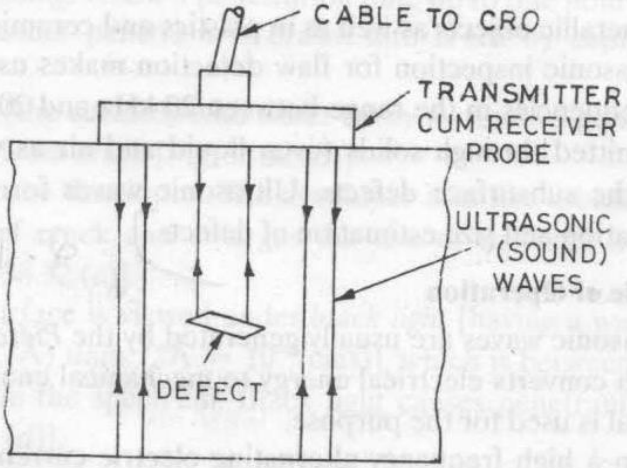
	spraying or brushing. Allow a penetration time up to one hour. The fluorescent penetrant is drawn into crack by capillary action [Fig. (a)]. (iii) Wash (the surface) with water spray to remove penetrant from surface but not from crack [Fig. (b)]. (iv) Apply the developer. The developer acts like a blotter 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)].  		
4.c	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 welded jobs (Fig.); 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; this ensures proper contact between them and better transmission of waves from the probe into the surface of the object to be tested. - 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	2 mark-PRINCIPLE 2 mark-Advantages 2mark-Dis Advantages 2 mark-Application	8 mark

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.



Ultrasonic inspection.



Ultrasonic inspection (single transmitter and receiver crystal).

Advantage:

1.It is a fast and reliable method of non-destructive inspection.

2. This method of locating flaws with metal objects is more sensitive than radiography.

3. The minimum flaw size which can be detected is equal to about 0.1% of the distance from the probe to the defect.

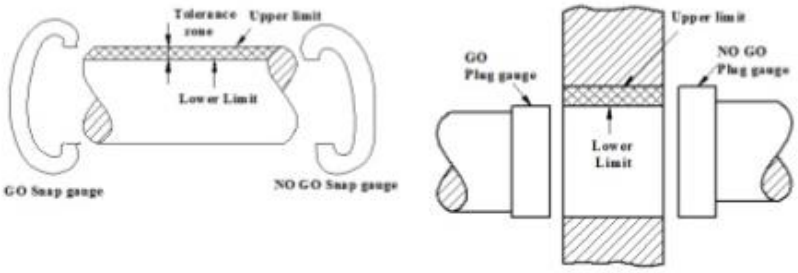
4. Big weldments can be systematically scanned for initial detection of major defects.

5. Ultrasonic inspection involves low cost and high speed of operation.

6. The sensitivity of ultrasonic flaw detection is extremely high, being at a maximum when using waves of highest frequency.

	Limitations 1. Surface to be tested must be ground smooth and clean. 2. Skilled and trained operator is required. 3. It is not suited to the examination of weldments of complex shape or configurations. Applications: 1. Inspection of large weldments, castings and forging, for internal soundness, before carrying out expensive machining operations. 2. Inspection of moving strip or plate (for laminations) as regards its thickness.		
5	**Attempt any four**	4 x 4	**16**
5.a	Etching reagents- any two. Given below are a few etching reagents : *1. Hydrochloric Acid*. The reagent contains equal parts by volume of concentrated HCl and water. Specimen is immersed in this reagent at or near the boiling point. This will usually enlarge gas pockets and dissolve slag inclusions, enlarging the resulting cavities. *2. Nitric Acid*. One part of concentrated nitric acid is added to three parts of water by volume. The reagent may be applied to the surface of the weld either with a glass stirring rod at room temperature or the weld be immersed in boiling reagent provided the room is well ventilated. This reagent is used on polished surfaces only to show the weld metal zone as well as the refined zone. *Nital* contains 2CC HNO_3 Conc. + 98CC absolute methyl alcohol. *3. Ammonium persulphate*. Mix one part of ammonium persulphate (solid) to nine parts of water by weight. The reagent thus prepared is rubbed vigorously on the surface of the weld with cotton saturated with this reagent. *4. Iodine and potassium iodide*. One part of powdered iodine (solid) is mixed with twelve parts of a solution of potassium iodide by weight. The latter solution should consist of one part of potassium iodide to five parts of water by weight. The reagent is brushed at room temperature on the surface of the weld.	2mark-one etching reagent	

5.b	Duties of Inspector; (1)Interpretation of specification: Product specification provide standard for test and inspection. It provides procedural instruction for the operation as how to test the component. So inspector must follow the specification for component or product reality performance, safety and fitness for use. (2)Measurement of product: It is the duty of inspector to segregate defective goods and thus ensures that the customers receive only goods of adequate quality. Inspector defects sources of weakness and trouble in the finished products and thus checks the work of designers. (3)Comparison with standards: It is the duty of the inspector to compare the quality manuals which is used for the inspection and mfg. the product with IS standard or BIS standard, so companies can mfg. the product as per standard, so uniformity can be maintained. (4)Judging conformity: Inspector must know the how many components from the lot are accepted through the sampling inspection plan. He should follow the quality manuals, standards and inspection plan and must be ensure that products which are shipped to the customers, work properly and perform satisfactory. (5)Recording data: ➢ Inspectors should maintain the records for evaluation of individual machine or worker performance. ➢ He should maintain records and information necessary for establishing inventory control and products scheduling. ➢ He maintains record and information to enable management to study and correct poor performance. (6)Disposition of product:Inspectors sort cut the defective parts; the aim is to establish the causes of scrap and rework. And disposition of product is also importance, so that inspectors must so these work as in future, eliminate the cause and ensure a better quality product.	1mark-1 point	4mark

5.c	Taylor's principle is applied in designing GO and NO GO gauges for checking maximum and minimum limits as - i) GO limit: This designation is applied to that limit of the two limits of size which corresponds to maximum material limit consideration, i.e. the upper limit of a shaft and lower limit of a hole. The form of the GO gauge should be such that it checks one feature of the component in one pass. ii) NO GO limit: This designation is applied to that limit of the two limits of size which corresponds to minimum material limit condition, i.e. the lower limit of a shaft and higher limit of a hole. “NO GO" gauges should check only one part or feature of the component at a time.  	4mark	4mark
5.d	ISO:-ISO (International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees') Each member body interested in a subject for whom a technical committee has been established, has the right to be represented on that committee. (International organizations, governmental and non - governmental, in liaison with ISO, also take part in the work. Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO council. They are approved in accordance with ISO procedures requiring at least 75% approval by the member bodies Voting. ISO-9000 :- Quality management and quality assurance standards :- Guidelines for select on and use. ISO-9000 gives an introduction about principal quality constraints and other ISO standards. <u>The purposes of ISO-9000 are :</u> 1) To classify the distinctions and inter-relationships among the principal quality concepts. 2) To provide guidelines for the selection and use of a series of International Standards on quality systems. These international standards can be used for internal quality management purposes (IS0-9004) and for external quality assurance purposes (ISO-9001, ISO-9002, and ISO-9003). ISO series do not standardize the quality systems implemented by organizations, but provide guidelines for the selection and use of International Series.	2mark-defination 2mark-purpose	4mark

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<table>
<tr><td></td><td>Gamma ray Radiography</td><td>X - ray Radiography</td></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 satiation examinations by using Gamma rays</td><td>X – Ray radiography provided better result for welded section of uniform thickness.</td></tr>
<tr><td>3</td><td>Gamma rays are not counties to direct the smaller defect in the components</td><td>X – ray is better than gamma ray to detect smaller defect in section lesser than 50mm</td></tr>
<tr><td>4</td><td>Gamma ray radiography is a time consuming method than X –ray radiography</td><td>X – ray radiography is rapid than gamma ray radiography</td></tr>
<tr><td>5</td><td>Number of objects can be inspected at a time</td><td>Only one part can be inspected at a time</td></tr>
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<td>1mark-1 point</td>
<td>4mark</td>
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<td>5.f</td>
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<u>Principal of COMPRESSION TEST</u>

Theoretically, compression test is merely the opposite of the tension test with respect to the reaction of applied stress.
The compression test can be done on the same machine on which the tension test is done like universal testing machine or some other machine which is designed specifically for the purpose.
In general, brittle materials are good in compression than in tension and therefore, they are used for compressive loads. Due to this, compression test is mainly used to test brittle materials such as cast irons, concrete, stones, bricks and ceramic products.
During testing, fracture occurs in brittle materials and therefore, the ultimate strength is determined corresponding to the fracture point; but no fracture occurs for ductile materials and hence ultimate strength is found out for some arbitrary amount of deformation)

</td>
<td>2 mark-PRINCIPLE
2 mark-diagram</td>
<td>4mark</td>
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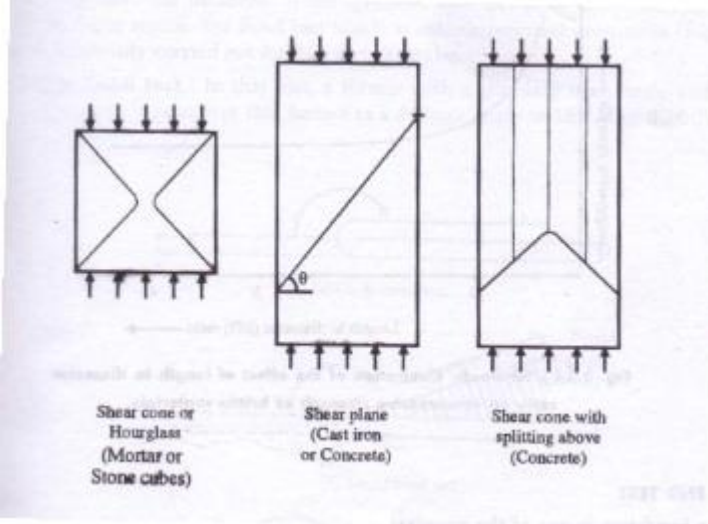
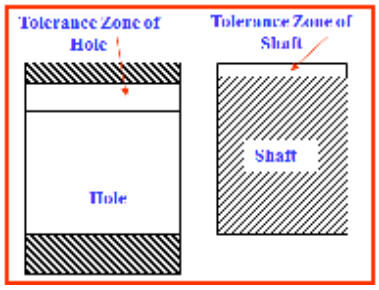
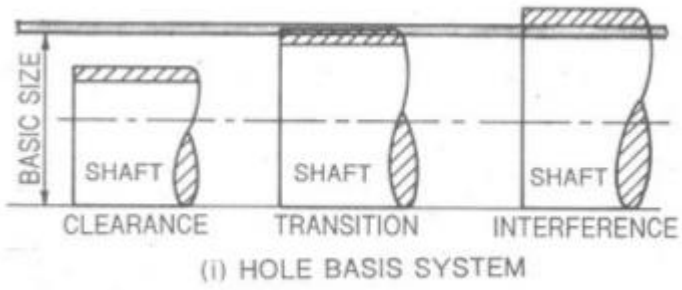
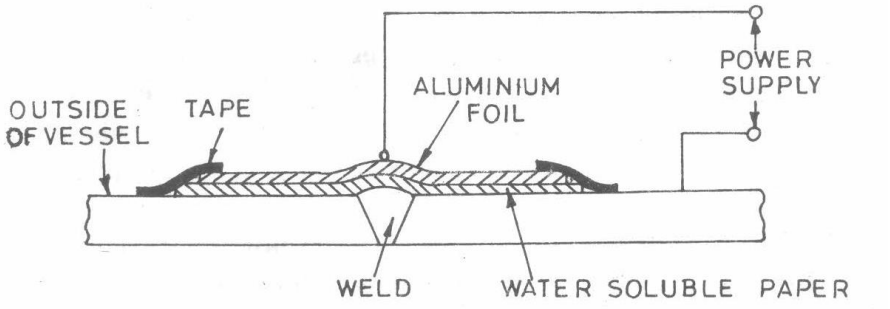
			
6	**Attempt any two**	2 x 8	**16**
6.a (i)	ASTM: 1) ASTM A516/A516 M.0.6.Standard specification for pressure vessel plates, carbon steel for moderate and lower temperature service. 2) ASTM E1139.Practical for continuous monitoring of acoustic emission from metal boundaries. 3) ASTEM E1001-84.Practice for detection and evaluation of the discontinuities by the immersed pulse-echo ultrasonic method using longitudinal waves. 4) ASTEM E309-87.Eddy current examination of steel tabular products using magnetic saturation. Any other code rather than above are accepted.	2mark-1 code	8mark
6.a (ii)	DIN: Deutsches Institute for Normung ➢ In English-German institute for standardization. ➢ It is the German national organization for standardization. ➢ There are currently thirty thousand DIN standards, covering almost all fields of technology. IBR : INDIAN BOILER REGULATION ➢ REG 1 – Regulation 1 is set for short title, extents ,application and commencement ➢ REG 8 - set for use of welding ➢ REG 7 - Boiler shells not in accordance with standard condition ➢ REG 15 – Tensile test piece ➢ REG 19 – Bend test	2 mark-DIN 2 MARK-IBR	
6.b (i)	Interference fit : Interference fit: - It is a fit which always provides interference. Here the tolerance zone of the hole will be below the tolerance zone of the shaft. e.g. 25 H7/p6. Maximum interference is the algebraic difference between the minimum hole and maximum shaft. Minimum interference is the	3 mark-define 1MARK-example	8mark

	algebraic difference between the maximum hole and minimum shaft.  The minimum permitted shaft size is larger than the maximum permitted hole size. e.g. Bearing bushes in their housing small end of connecting rod.		
6.b (ii)	Hole Base system: 1) Hole is constant member and shaft dimension are varied to obtain the different type of fits 2) Lower deviation of the hole is zero. 3) It is mostly preferred in the mass production.it is easy, convenient and less costly to make holes of correct sizes 4) It is quite easy to vary the sizes shaft sizes according to the fit required 5) Checking of the shafts is easy and convenient 6) It requires less amount of capital and production accessories to manufacturer shafts of different sizes  (i) HOLE BASIS SYSTEM	2mark-define 2mark-diagram	
6. C. (i)	Leak (or tightness) test: Concept: (1)Leak refers to an actual discontinuity or passage through which a fluid flows or permeates. (2)Leak testing is the determination of the rate at which a liquid or gas will penetrate from inside a tight component or assembly to the outside as a result of pressure differential between the two regions. Purpose: To test welded pressure vessels, tanks and pipelines to determine if leaks are present. Absolute tightness of all the welded joints can be tested this way.	4 mark	8 mark

	Procedure: 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.		
6. C. (ii)	Leak test by water soluble paper with Aluminium foil. In this method the vessel to be tested is pressurized with water and Al foil is laid over the widest strip of water soluble paper and bath are struck with a tape over a welded seam. If a leak exists the water soluble strip will dissolve and the Al foil strip will be in electrical contact with the vessel the flow of current indicates leakage in the pressure vessel.  	4 mark	