



Roll No.

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST 1

Sem AY: Odd Sem 2019-20

Course Code: MEC 323

Course Name: NON DESTRUCTIVE TESTING

Program & Sem: B.Tech (MEC) & V

Date: 27.09.2019

Time: 2:30PM to 3:30PM

Max Marks: 40

Weightage: 20%

Instructions:

- (i) *Read the question properly and answer accordingly.*
 - (ii) *Question paper consists of 3 parts.*
 - (iii) *Write neat diagram/sketches with pencil only.*
-

Part A [Memory Recall Questions]

Answer all the Question. Each Question carries one mark.

(5Qx1M=5M)

1. (i) A penetrant that is self-emulsifying is called

- a) Solvent removable b) Water washable c) Post-emulsified
- d) Dual sensitivity method

(ii) A leakage field is strongest when a discontinuity interrupts the magnetic flux lines at an angle of,

- a) Zero degrees b) 45 degrees c) 90 degrees d) 180 degrees

(iii) Which among the following is last step in Magnetic Particle test method

- a) Observation and inspection b) Circular magnetization
- c) Demagnetization d) Magnetization

(iv) A technique used to find transverse discontinuities at the ends of longitudinally Magnetized bars by the use of transient currents is called

- a) A coil shot technique b) A fast break technique c) A yoke technique
- d) A head shot

(v) In which type of test the Capillary action principle is used?

- a) Probe test b) Bend liquid test c) Dye penetrant test
d) None of the above

(Q.NO.i to v)(C.O.NO.1)[knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries five marks. (4Qx5M=20M)

2. Summarize on Direct and Indirect method of Magnetization.

(C.O.NO.2)[Comprehension]

3. Recall optical aids used for Visual Inspection. Explain anyone

(C.O.NO.1)[Knowledge]

4. Outline advantages and application of NDT.

(C.O.NO.1) [Knowledge]

5. Define the term "Dwell time" and Explain the principle of LPT.

(C.O.NO.1) [Knowledge]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries seven and half marks.

(2Qx7.5M=15M)

6. Discuss types of developers used in Liquid Penetrant technique and list desirable characteristics of developers used in LPT.

(C.O.NO.1) [Comprehension]

7. Discuss various Magnetization Techniques and explain with neat sketches any 3 techniques.

(C.O.NO.2)[Comprehension]



SCHOOL OF ENGINEERING

Semester: Odd Sem

Course Code: MEC323

Course Name: Non Destructive Testing

Branch & Sem: B.Tech & 5th Sem

Date: 27/09/2019

Time: 2:30pm to 3:30pm

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels					Thought provoking type [Marks allotted] Bloom's Levels	Total Marks
			K					C	
1	CO1,CO2	Module 1 & 2	1	1	1	1	1	-	5
2	CO2	Module 2	-					5	5
3	CO1	Module 1	5					-	5
4	CO1	Module 1	5					-	5
5	CO1	Module 1	5					-	5
6	CO1	Module 1	-					7.5	7.5
7	CO2	Module 2	-					7.5	7.5
Total Marks			20					20	40

K = Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

[I hereby certify that All the questions are set as per the above guidelines. Mr. Sreenivas
H T]

Reviewers' Comments



SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem

Course Code: MEC323

Course Name: Non Destructive Testing

Branch & Sem: B.Tech & 5th Sem

Date: 27/02/2019

Time: 2:30pm to 3:30pm

Max Marks: 40

Weightage: 20%

Part A

(5Q x1M = 5Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	B, C, C, A, C	Each question carries one mark	7 min

Part B

(4Q x5M =20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2.	<p>The direct method of magnetization is also called as current flow method, the magnetizing current flows through the part, thereby, completing the electric circuit. The magnetic field formed during this method as at right angles to the direction of current flow. Thus we can locate the defect at right angles to the applied magnetic field direction Eg: Head Shot technique.</p> <p>The indirect method of magnetization is also called as magnetic flow method. In this method the test part becomes a part of the magnetic circuit, thus bridging the part between the poles of a permanent magnet.</p>	<p>Explanation carries 2.5 marks = 5M</p>	8 min
3.	<p>The optical aids used for visual inspection are</p> <p>Magnifying Mirrors (small, angled mirrors)</p> <p>Magnifying glasses, eye loupes, multi-lens magnifiers, measuring magnifiers</p> <p>Microscopes(optical and electron)</p> <p>Borescopes</p> <p>Fiberscopes and videoscopes</p> <p>Telescopes</p> <p>Periscopes</p> <p>Optical comparators</p> <p>Optical flats(for surface flatness measurements)</p> <p>Photographic records</p> <p>Closed-circuit television (CCTV) systems</p> <p>Machine vision systems</p> <p>Image enhancement (computer analysis and enhancement)</p>	<p>Listing 2 marks</p> <p>Any 1 device explanation carries 3 marks , = 5M</p>	8 min
4.	<p>Advantages</p> <ul style="list-style-type: none"> ✓ The equipments are easy to handle ✓ Defects can be detected without damaging the components 		

	<ul style="list-style-type: none"> ✓ Methods are quick and accurate ✓ Components can be sorted out on the basis of electrical, magnetic or chemical properties ✓ Test results and other information can be conveniently recorded on paper films, cassettes, floppies, DVD, CD. etc <p>Applications:</p> <ol style="list-style-type: none"> 1. Aerospace: Typical Components that are checked by this method include Turbine, rotor disc, blades, aircraft wheels, Casting, forged parts and welded assemblies 2. Automobiles: Many automotive parts particularly aluminium castings and forging including pistons and cylinder heads are subjected to this form of quality checks before assembly 3. Railways: LPI to detect fatigue cracking is also used for the regular in service examination of the bogie frames of railway locomotive and the rolling stock 4. Tool and dies: field drilling rays, drill pipes, castings and drilling equipment's inspected by this methods 5. Inspection on reactors and tank: Tanks, vessels, reactors, piping, dyers in the chemical, petro-chemical industries. 	Explanation carries 2.5 marks each = 5M	7 min
5.	<p>Dwell time: it is the time period of applying penetrant to the specimen to be tested and removal of penetrant at the end of operation.</p> <p>In penetrant testing, a liquid with high surface wetting characteristics is applied to the surface of a component under test.</p> <p>The penetrant (mixture of organic solvent) “penetrates” into surface breaking discontinuities via capillary action. Excess penetrant is removed from the surface and a developer is applied to pull trapped penetrant back the surface. With good inspection technique, visual indications of any discontinuities present become apparent. After inspection, the developer and residual penetrant are removed by post cleaning</p>	Dwell defn= 2 M Principle of LPT =3M	8 min

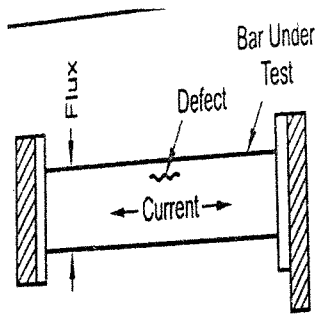
Part C

(2Q x7.5M = 15Marks)

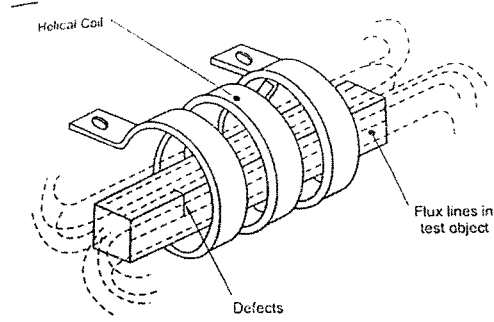
Q No	Solution	Scheme of Marking	Max. Time required for each Question
6.	<p>Types of developer</p> <ol style="list-style-type: none"> 1. Dry Powder Developers 2. Water Suspendable developers 3. Water soluble developers 4. Non-aqueous developers <p>It should have good absorption characteristics It should have a good contrast background</p>	Explanation for 4 types 1.5 marks each= 1.5 marks for characteristics = 7.5 M	10 min

It should be able to uniformly cover the surface with the thin smooth Coating
 It should be chemically inert with test material
 It should provide a good contrast background for bright and clean indications
 It should be non-toxic
 It should be easy to remove after inspection

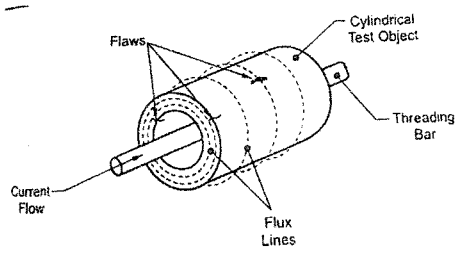
Head shot technique



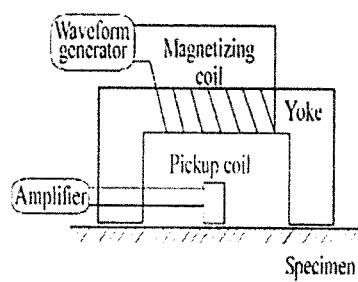
Coil shot technique



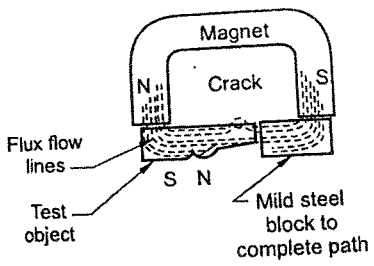
Central conductor Technique



Using yoke



Using Magnet



7.

Explanation for 3 types 2 marks each, discussion 1.5 marks = 7.5 M

12 min



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**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

TEST – 2

Semester: Odd Sem. 2019-20

Date: 16.11.2019

Course Code: MEC 323

Time: 2:30 PM to 3:30 PM

Course Name: NON DESTRUCTIVE TESTING

Max Marks: 40

Program & Sem: B.Tech. (MEC) & V DE

Weightage: 20%

Instructions:

- I. Read the question properly and answer accordingly.
- II. Question paper consists of 3 parts.
- III. Write neat diagram/sketches with pencil only.

Part A [Memory Recall Questions]

Answer all the Questions. Each sub Question carries one mark. (5Qx1M=5M)

1.

I. In the transverse wave, the particles oscillate at, (C.O.NO.3) [Knowledge]

- (a) Right angle to wave direction
- (b) Parallel to wave direction
- (c) Longitudinal direction
- (d) None of the above

II. Acoustic impedance (Z) is, (C.O.NO.3) [Knowledge]

- (a) $Z = \rho V$ (b) $Z = \rho V$ (c) $Z = \rho + V$ (d) $V = Z\rho$

III. In normal beam testing, the sound beam is introduced into the test article at, (C.O.NO.3) [Knowledge]

- (a) 90 Degree (b) 45 Degree (c) 0 Degree (d) None of the above

IV. A radiation producing device which emits radiation of one or a few discrete wavelengths is, (C.O.NO.4) [Knowledge]

- (a) An X ray machine (b) A linear accelerator (c) A gamma ray source
(d) A betatron.

V. A term which refers to the sharpness of the radiographic image is,
(C.O.NO.4) [Knowledge]

- (a) Sensitivity (b) Halo effect (c) Shadow effect (d) Definition

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries five marks. (4Qx5M=20M)

2. Discuss the characteristics of Ultrasonic waves. (C.O.NO.3) [Knowledge]
3. List and explain types of Radiation. (C.O.NO.4) [Comprehension]
4. Explain data presentation in Ultrasonic testing. (C.O.NO.3) [Comprehension]
5. List and explain the criteria for good quality Radiography. (C.O.NO.4) [Knowledge]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries seven and half marks.

(2Qx7.5M=15M)

6. With neat Sketch Explain principal of operation of Ultrasonic testing.
(C.O.NO.3) [Comprehension]
7. List inspection techniques in Radiography and explain anyone.
(C.O.NO.3) [Comprehension]



SCHOOL OF ENGINEERING

Semester: Odd Sem

Course Code: MEC323

Course Name: Non Destructive Testing

Branch & Sem: B.Tech & 5th Sem

Date: 16/11/2019

Time: 2:30pm to 3:30pm

Max Marks: 40

Weightage: 20%

Extract of question distribution [outcome wise & level wise]

Q.NO.	C.O.NO	Unit/Module Number/Unit /Module Title	Memory recall type [Marks allotted] Bloom's Levels					Thought provoking type [Marks allotted] Bloom's Levels	Total Marks
			K					C	
1	CO3,CO4	Module 3 & 4	1	1	1	1	1		5
2	CO3	Module 3	5						5
3	CO4	Module 4						5	5
4	CO3	Module 3						5	5
5	CO4	Module 4	5						5
6	CO3	Module 3						7.5	7.5
7	CO4	Module 4						7.5	7.5
Total Marks			10					30	40

K =Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all type of questions the general guidelines is that about 60% of the questions must be such that even a below average students must be able to attempt, about 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only bright students must be able to attempt.

[I hereby certify that all the questions are set as per the above guidelines. Dr.Arptha G R]

Reviewer's Comments



SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem

Course Code: MEC323

Course Name: Non Destructive Testing

Branch & Sem: B.Tech & 5th Sem

Date: 16/11/2019

Time: 2:30pm to 3:30pm

Max Marks: 40

Weightage: 20%

Part A

(5Q x1M = 5Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	A,B,A,C,D	Each question carries one mark	10 min

Part B

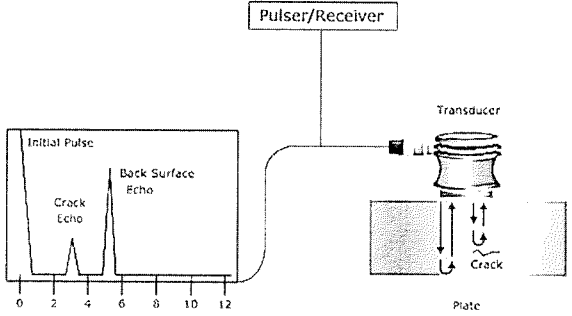
(4Q x5M =20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2.	<ul style="list-style-type: none"> • The ultrasonic waves cannot travel through vacuum. • These waves travel with speed of sound in a given medium. • Their velocity remains constant in homogeneous media. • These waves can weld certain plastics, metals etc. • These can produce vibrations in low viscosity liquids. • The ultrasonic waves are reflected and refracted just like light waves • The speed of ultrasonic waves/acoustic waves is more in more dense media 	Each point 1 mark = 5M	7 min
3.	1.X-ray Radiation 2.Gamma Ray Radiation 3.Neutron Radiation	Each point 3 marks Explanation 2 marks = 5M	8 min
4.	Ultrasonic data can be collected and displayed in a number of different formats. The three most common formats are known in the NDT world as	3 data 1 mark each and brief	7 min

	<ul style="list-style-type: none"> ➤ A-scan, ➤ B-scan ➤ C-scan presentations 	explain 2 marks= 5M	
5.	<p>The quality of a radiograph is generally assessed using four criteria they are.</p> <ul style="list-style-type: none"> • Density • Contrast • Definition • Sensitivity 	Each point 4 marks explanation 2 marks = 5M	8 min

Part C

(2Q x7.5M = 15Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6.	<p>Whenever there is a change in the medium, the ultrasonic waves are reflected. Thus, from the intensity of the reflected echoes, the flaws are detected without destroying the material.</p> 	Explanation carries 5 marks sketch 2.5 marks = 7.5M	10 min
7.	<ol style="list-style-type: none"> 1. Single wall Single Image (SWSI) Flat Surfaces/Plates/sheets/Large Pipe Joints (Dia > 8") Film Inside, Source Outside 2. Single Wall Single Image (SWSI) – Panoramic Film Outside, Source Inside 3. Double Wall Single Image (DWSI) Film Outside, source outside (External Exposure), Dia of Pipe > 3inch 4. Double Wall Double Image (DWDI) Film Outside, source outside (Elliptical Exposure), Dia of Pipe < 3inch 	Each point 4 marks, explanation 2.5marks	10 min



Roll No

**PRESIDENCY UNIVERSITY
BENGALURU**

SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Semester: Odd Semester: 2019 - 20

Course Code: MEC 323

Course Name: NON DESTRUCTIVE TESTING

Program & Sem: B.Tech (MEC) & V (DE-II)

Date: 23 December 2019

Time: 9:30 AM to 12:30 PM

Max Marks: 80

Weightage: 40%

Instructions:

(i) Read the all questions carefully and answer accordingly.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 2 marks.

(5Qx2M=10M)

1. List any two advantages of using magnetic particle testing used in nondestructive evaluation method. (C.O.No.2) [Knowledge]
2. What are the objectives of using Non Destructive Testing? (C.O.No.1) [Knowledge]
3. Outline any four characteristics of ultrasonic waves? (C.O.No.3) [Knowledge]
4. Mention any four factors influencing eddy current nondestructive testing method. (C.O.No.5) [Knowledge]
5. List any four safety measures to be taken while using radiographic testing method of nondestructive testing. (C.O.No.4) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 5 marks.

(4Qx10M=40M)

6. Discuss the ultrasonic nondestructive testing method using pulse echo system? (C.O.No.3) [Comprehension]
7. With a neat diagram explain the working of real time radiography using X-ray radiation for testing materials through nondestructive evaluation. (C.O.No.4) [Comprehension]
8. On what basis do we interpret data collected from an ultrasonic inspection method using C scan? (C.O.No.3) [Comprehension]
9. Discuss briefly about Single Wall Single Image technique method used in radiographic nondestructive testing. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks.

(2Qx15M=30M)

10. With a neat diagram, explain the working of eddy current testing method used in nondestructive evaluation of materials.

(C.O.No.5) [Comprehension]

11. Explain the following terms used in eddy current inspection method of nondestructive testing of materials.

(i) Lift off effect (ii) Standoff effect (iii) Edge effect

(C.O.No.5) [Comprehension]



SCHOOL OF ENGINEERING

END TERM FINAL EXAMINATION

Extract of question distribution [outcome wise & level wise]

Q.NO	C.O.NO (% age of CO)	Unit/Module Number/Unit /Module Title	Memory recall type	Thought provoking type	Problem Solving type [Marks allotted]	Total Marks
			[Marks allotted]	[Marks allotted]		
			Bloom's Levels	Bloom's Levels		
			K	C	A	
1	2	2	2			2
2	1	1	2			2
3	3	3	2			2
4	5	5	2			2
5	4	4	2			2
6	3	3		10		10
7	4	4		10		10
8	3	3		10		10
9	4	4		10		10
10	5	5			15	15
11	5	5			15	15
	Total Marks		10	40	30	80

K = Knowledge Level C = Comprehension Level, A = Application Level

Note: While setting all types of questions the general guideline is that about 60%

Of the questions must be such that even a below average students must be able to attempt, About 20% of the questions must be such that only above average students must be able to attempt and finally 20% of the questions must be such that only the bright students must be able to attempt.

I hereby certify that all the questions are set as per the above guidelines.

Faculty Signature: Voddy
12-12-19

Reviewer Commend:

Format of Answer Scheme



SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem. 2019-20
 Course Code: MEC323
 Course Name: NON DESTRUCTIVE TESTING
 Program & Sem: B.Tech & V Sem

Date: 23.12.2019
 Time: 3 HOURS
 Max Marks: 80
 Weightage: 40%

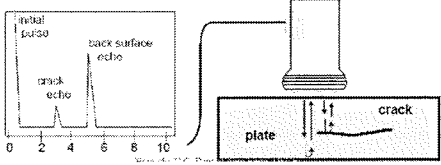
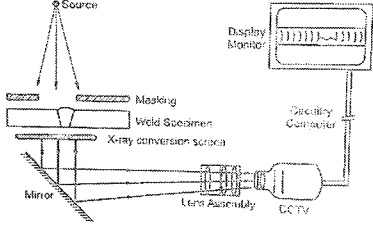
Part A

(5Q x 2M = 10Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1	<ul style="list-style-type: none"> ▪ It is quick and relatively uncomplicated ▪ It gives immediate indications of defects ▪ It shows surface and near surface defects, and these are the most serious ones as they concentrate stresses 	Any 2 Each 1 mark (1 x 2=2)	8 min
2	Any four objectives ✓ Material sorting ✓ Material characterization ✓ Property monitoring ✓ Thickness measurement	Any 4 Each 0.5 marks (0.5 x 4=2)	8 min
3	<ul style="list-style-type: none"> ➤ Ultrasonic waves cannot travel through vacuum. ➤ These waves travel with speed of sound in a given medium. ➤ Their velocity remains constant in homogeneous media. ➤ These waves can weld certain plastics, metals etc. 	Any 4 Each 0.5 marks (0.5 x 4=2)	8 min
4	The factors influencing eddy current testing are 1) Conductivity 2) Permeability 3) Resistivity 4) Inductance 5) Inductive Reactance	Each 0.5 marks (0.5 x 4=2) Any 4	8 min
5	<ul style="list-style-type: none"> • Monitoring radiation dosage • Protection of personal • Using dosimeters • Real time monitoring devices 	Any 4 Each 0.5 marks (0.5 x 4=2)	8 min

Part B

(4Q x 10M =40 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	<ul style="list-style-type: none"> In pulse-echo testing, a transducer sends out a pulse of energy and the same or a second transducer listens for reflected energy (an echo). Reflections occur due to the presence of discontinuities and the surfaces of the test article. The amount of reflected sound energy is displayed versus time, which provides the inspector information about the size and the location of features that reflect the sound.  <p>The pulse-echo technique allows testing when access to only one side of the material is possible, and it allows the location of reflectors to be precisely determined.</p>	<p>Diagram 4 marks</p> <p>Explanation 6 marks</p>	20 min
7	<ul style="list-style-type: none"> Real time radiography also known as fluoroscopy, is a technique in which the X-ray radiation is converted into light by using a fluorescent screen in the place of the film. The process of the image of the object by converting the X-rays into light on the fluorescent screen is known as fluoroscopy or real time radiography.  <ul style="list-style-type: none"> In this method, the radiation after passing through the material is recorded on the fluorescent screen. The image of the test piece which is obtained by the fluorescent screen, is received by CCTV, then amplified using the amplification circuit associated with the camera. The amplified circuit is then processed by the computer. The processed image is then displayed on the monitor. The monitor is operated by means of a remote from the X-ray source to avoid the exposure to radiation. 	<p>Explanation 5 marks</p> <p>Diagram 5 marks</p>	20 min
8	<p>The C-scan presentation is a type of presentation that is possible for automated two-dimensional scanning systems that provides a plan-type view of the location and size of</p>	Explanation 7 marks	20 min

test specimen features.

- The plane of the image is parallel to the scan pattern of the transducer.
- C-scan presentations are typically produced with an automated data acquisition system, such as a computer controlled immersion scanning system.

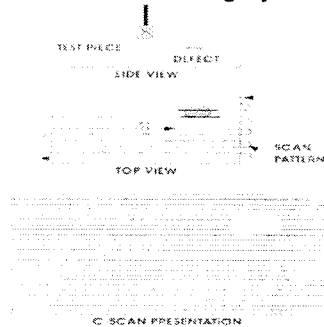
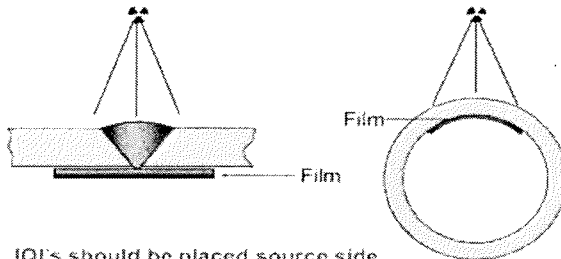


Diagram 3 marks

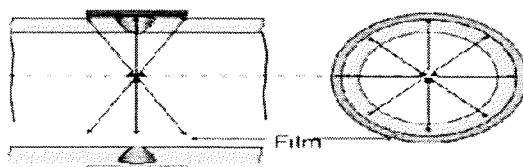
- 9 Single wall single image (SWSI) Technique
 This applicable in case when the material to be inspected in in the form of cylinders
 Eg:- pipes, shells, etc. there are two ways to do the inspection. They are
1. To keep the radiographic source outside and the film inside- Flat technique
 2. To keep the radiographic source inside and the film outside- Panoramic technique

Explanation 7 marks

20 min



IQI's should be placed source side

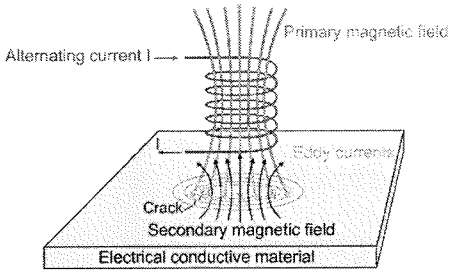


- IQI's are placed on the film side
- Source inside film outside (single exposure)

Diagram 3 marks

Part C

(2Q x 15M = 30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
10	<p>In eddy current testing, an AC of Frequency 1Khz – 2Khz Is made to flow in a coil which in turn, produces an alternating magnetic field around it. This coil when brought close to the electrically conducting surface of a metallic material to be inspected, induces an eddy current flow in the material due to electromagnetic induction shown in the figure below.</p>  <ul style="list-style-type: none"> • Eddy currents are created through a process called electromagnetic induction. When alternating current is applied to the conductor, such as copper wire, a magnetic field develops in and around the conductor. • This magnetic field expands as the alternating current rises to maximum and collapses as the current is reduced to zero. If another electrical conductor is brought into the close proximity to this changing magnetic field, current will be induced in this second conductor. • Eddy currents are induced electrical currents that flow in a circular path. 	<p>Explanation 10 marks</p> <p>Diagram 5 marks</p>	30 min

<p>11</p>	<p>(i)</p> <ul style="list-style-type: none"> • The distance between a surface coil and test surface is called as proximity or lift off. • Since flux density decreases exponentially with distance from the test coil, the amount of lift off or separation between the coil and test specimen has a significant effect on sensitivity • The closer the coupling between the coil and the test specimen, the denser the eddy current field that can be developed, and thus more sensitivity to any material variable. • Similarly close coupling increases the sensitivity to lift off effect, noise due to probe nozzles, when encircling coils are used. <p>(ii)</p> <ul style="list-style-type: none"> • This refers to the effect that the components edge or Sharpe changes in geometry due to the eddy currents. • This can be neglected by placing a balancing probe near to the edge and scanning at that distance • Edge effect is phenomenon that occurs when an inspection coil is at the end of the test piece. • At that instance, eddy current flow is distorted as currents cannot flow at the edge <p>(iii)</p> <ul style="list-style-type: none"> • In eddy current testing, end effect is defined as the disturbance of the magnetic field eddy distribution, impedance due to proximity of the coil to an abrupt change in geometry. • The end effect is common for cylindrical parts being inspected with encircling or inner diameter coils. 	<p>Explanation for each 5 marks</p> <p>(5 x 3= 15)</p>	<p>30 min</p>
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