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) & VII DE

Date: 27.09.2019
Time: 9:30AM to 10:30AM
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 Questions. Each Question carries one mark. (5Qx1M=5M)

1. (i) A liquid which reacts with a penetrant to render it water washable is called

a) Developer b) Emulsifier c) Aqueous scrubber d) Non-aqueous cleaner

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

(ii) Non-destructive testing is used to determine

a) Location of defects b) Chemical composition c) Corrosion of metal
d) All of these

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

(iii) The best method of inducing a circular field in a tube is by a

a) Central conductor b) Head shot c) Coil d) Prod technique

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

(iv) Which of the following cannot be detected using Visual Inspection

a) Blowholes b) Crack within the cast c) Tears d) Rattails

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

(v) Penetrant can be applied by

a) Dipping b) Brushing c) Spraying d) All of the above

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

Part B (Thought Provoking Questions)

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

2. Discuss the objectives of Non-destructive testing. (C.O.NO.1) [Knowledge]
3. In order to maintain consistency and control, name the checking devices used during Magnetic Particle Inspection. (C.O.NO.2) [Comprehension]
4. Identify the stages of Liquid Penetrant Testing and Explain. (C.O.NO.1) [Comprehension]
5. Outline Destructive testing and Non-destructive testing. (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. Define Magnetizing Force, Permeability, Flux Density, Residual Magnetism, Hysteresis Loop and polarity. (C.O.NO.2) [Comprehension]
7. Discuss the properties of good penetrant. (C.O.NO.1) [Comprehension]

SCHOOL OF ENGINEERING

Semester: Odd Sem | **Date**: 27/09/2019

Course Code: MEC323 | **Time**: 9:30am to 10:30am

Course Name: Non Destructive Testing | **Max Marks**: 40

Branch & Sem: B.Tech & 7th Sem | **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	CO1	Module 1	5	-	5
3	CO2	Module 2	-	5	5
4	CO1	Module 1	-	5	5
5	CO1	Module 1	5	-	5
6	CO2	Module 2	-	7.5	7.5
7	CO1	Module 1	-	7.5	7.5
Total Marks			15	25	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 guide lines. 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 & 7th Sem

Date: 27/09/2019

Time: 9:30am to 10:30am

Max Marks: 40

Weightage: 20%

Part A (5Q x1M = 5Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
1.	B, A, A, B, 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.	Material sorting Material characterization Property monitoring Aid in better product design Control manufacturing process and cost involved Defect detection/ location	Objective 5 point 1 mark each = 5M	7 min
3.	**Settling test:** Is also called as suspension concentration test. The purpose is to assure that the proper concentration of particles is being maintained in the liquid carrier **Ketos ring:** The ketos ring is a device made of tool steel and is designed to show the effectiveness of the MPI and the relative penetration based on the number of holes that display indications **Field indicator:** Field indicator is used to check the presence of residual magnetism on the system (video)	Explanation carries 2.5 marks = 5M	8 min
4.	1. Clean & Dry Component 2. Apply Penetrant 3. Remove Excess 4. Apply Developer 5. Examination and Evaluation 6. Post Clean component	Each stage 1 mark = 5M	7 min
5.	*NON DESTRUCTIVE TEST*: Used for finding out defects of materials; Load is not applied on the material *DESTRUCTIVE TEST*: Used for finding out the properties of the material; Load is applied on the material	5 points 1 mark each =5M	8 min

	No load applications, so no chance for material damage	Due to load application, material gets damaged		
	No requirement of special equipment's	Special equipment's are required		
	Non expensive	Expensive		
	Less skill	Skill is required		
	e.g: dye penetrate test, ultrasonic, radiography, etc	e.g: tensile test, compression test, hardness test, etc		

Part C (2Q x7.5M = 15Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
6.	***Polarity:*** Polarity refers to the orientation of north and south poles space ***Permeability***: Permeability is the case with which a material can be magnetized. ***Flux Density:*** Flux density is defined as the number of lines of force per unit area. Measured in Gauss (B) ***Magnetizing Force:*** The total number of line of force making up a magnetic field determines the strength of the force of attraction or repulsion that can be exerted by magnet. Symbol-(H) ***Hysteresis Loop:*** By exposing a magnetized piece to magnetic current. We can plot the flux density B of the field induced by the applied magnetizing force H and the resultant curve is called the hysteresis loop. ***Residual Magnetism:*** It is defined as the amount of magnetism left behind after removing the eternal magnetic field from the circuit.	Each explanation 1.5 mark each =6 M For polarity defn = 0.5M For permeability defn = 1M	10 min
7.	Capillarity, viscosity, specific gravity, cohesion and adhesion, flammability, contact angle, surface tension	Explanation for 7 properties 1 marks each = 7.5 M	10 min

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PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING

TEST – 2

Sem & AY: Odd Sem. 2019-20
Course Code: MEC 323
Course Name: NON DESTRUCTIVE TESTING
Program & Sem: B.Tech. (MEC) & VII DE

Date: 16.11.2019
Time: 9:30 AM to 10:30 AM
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 Questions. Each sub Question carries one mark. (5Qx1M=5M)

1. (i) An oscilloscope display in which the screen base line is adjusted to represent the one way distance in a test piece is called, (C.O.NO.3) [Knowledge]

(a) A scan display (b) B scan display (c) C scan display (d) D scan display

(ii) Sound waves which travel on the surface of a solid in a manner similar to waves on a water surface are called, (C.O.NO.3) [Knowledge]

(a) Rayleigh waves (b) Shear waves (c) Primary waves (d) Compression waves

(iii) As ultrasonic frequency increases, (C.O.NO.3) [Knowledge]

(a) Wavelength increases (b) Wavelength decreases (c) Sound velocity increases (d) Sound velocity decreases

(iv) 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

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

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

Part B [Thought Provoking Questions]

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

2. Discuss about various ways of data interpretation in Ultrasonic Testing.

(C.O.NO.3) [Knowledge]

3. Describe Radiographic testing principle with sketch.

(C.O.NO.4) [Comprehension]

4. Summarize the properties of X ray and gamma rays.

(C.O.NO.4) [Comprehension]

5. Briefly explain with suitable sketch, working principle of Ultrasonic testing

(C.O.NO.3) [Knowledge]

Part C [Problem Solving Questions]

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

(2Qx7.5M=15)

6. What is mean by film contrast, explain the steps in film processing.

(C.O.NO.4) [Comprehension]

7. Illustrate with neat sketch about the angle beam testing in UT.

(C.O.NO.3) [Comprehension]

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

Semester: Odd Sem
Course Code: MEC323
Course Name: Non Destructive Testing
Branch & Sem: B.Tech & 7th Sem

Date: 16/11/2019
Time: 9:30am to 10:30am
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	CO4	Module 4		5	5
5	CO3	Module 3	5		5
6	CO4	Module 4		7.5	7.5
7	CO3	Module 3		7.5	7.5
Total Marks			15	25	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. Mr. Sreenivas H T]

Reviewer's Comments

SCHOOL OF ENGINEERING

SOLUTION

Semester: Odd Sem

Course Code: MEC323

Course Name: Non Destructive Testing

Branch & Sem: B.Tech & 7th Sem

Date: 16/11/2019

Time: 9:30am to 10:30am

Max Marks: 40

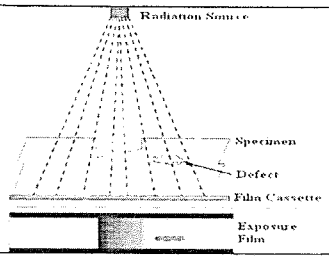
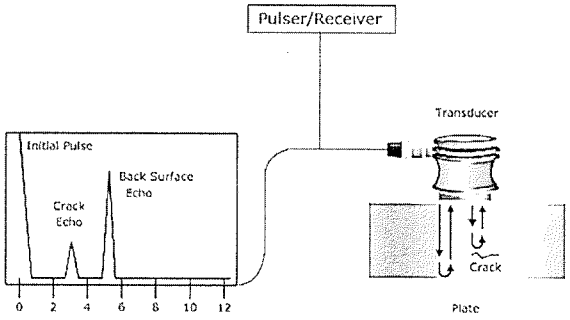
Weightage: 20%

Part A (5Q x1M = 5Marks)

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

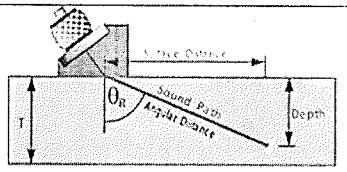
Part B (4Q x5M =20 Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
2.	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 ➢ A-scan, ➢ B-scan ➢ C-scan presentations	3 data1 mark each and brief explain 2 marks= 5M	7 min
3.	X-rays are generated in an X-ray tube when a beam of electrons is accelerated on to a target by a high voltage and stopped suddenly on striking the target. The X-rays produced have different wavelengths and different penetrating powers according to the accelerating voltage. Gamma-rays have the same physical nature as X-rays and are emitted by certain radioactive substances.	Explanation carries 3 marks sketch 2 marks = 5M	8 min

			
4.	• They are invisible and travels at the speed of the light. • They propagate in a straight line and pass through space • They are not affected by electric and magnetic fields • They are capable of ionizing gases and also changes the electrical properties of solids and liquids • They are capable of blackening photographic film • They can damage and kill living cells and produce genetic mutations • They exhibit wave properties and are reflected, refracted, diffracted & polarized	Each point 1 mark = 5M	7 min
5.	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. 	Explanation carries 3 marks sketch 2 marks = 5M	8 min

Part C (2Q x7.5M = 15Marks)

Q No	**Solution**	**Scheme of Marking**	**Max. Time required for each Question**
6.	**Film contrast** describes the differences in photographic density in a radiograph. The contrast between different parts of the image is what forms the image and the greater the contrast, the more visible features become. Radiographic contrast has two main contributors: subject contrast and detector (film) contrast. 1. **Development -** The developing agent gives up electrons to convert the silver halide grains to metallic silver. Grains that have been exposed to the radiation develop more rapidly, but given enough time the developer will convert all the silver ions into silver metal. Proper temperature control is needed to convert exposed grains to pure silver while keeping unexposed grains as silver halide crystals. 2. **Stopping the development -** The stop bath simply stops the development process by diluting and washing the developer away with water.	defn = 1.5M Each explanation 1.5 mark each =6 M	10 min

	3. **Fixing** - Unexposed silver halide crystals are removed by the fixing bath. The fixer dissolves only silver halide crystals, leaving the silver metal behind. 4. **Washing** - The film is washed with water to remove all the processing chemicals. 5. **Drying** - The film is dried for viewing.		
7.	 θ_R = Angle of Refraction T = Material Thickness Surface Distance = $\sin\theta_R$ x Sound Path Depth (i.e. leg) = $\cos\theta_R$ x Sound Path In angle beam testing, the sound beam is introduced into the test article at some angle other than 90. In this technique, the refracted beam is used to inspect angle beam transducers and wedges are used to introduce a refracted shear wave in to the test material. An angles sound path allows the sound beam to come in from the side thereby improving detectability of deflects and flaws in and around test specimen. The choice between normal and angle beam inspection usually depends on two considerations: -The orientation of the feature of interest – the sound should be directed to produce the largest reflection from the feature. -Obstructions on the surface of the part that must be worked around.	Explanation 5 marks sketch 2.5marks	10 min

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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) & VII (DE-III)

Date: 20 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.
(ii) Use pencil to draw sketches.

Part A [Memory Recall Questions]

Answer all the Questions. Each Question carries 2 marks. **(5Qx2M=10M)**

1. Define Dwell time in LPT. (C.O.No.1) [Knowledge]
2. Define Ketos ring. (C.O.No.2) [Knowledge]
3. What is the frequency range used in Ultrasonic testing method. (C.O.No.3) [Knowledge]
4. What are the safety requirement to work in Radiation based areas. (C.O.No.4) [Knowledge]
5. Define Lift off Effect in Eddy current Testing. (C.O.No.5) [Knowledge]

Part B [Thought Provoking Questions]

Answer all the Questions. Each Question carries 10 marks. **(4Qx10M=40M)**

6. Illustrate with suitable sketch about working principle of Pulse Echo method. (C.O.No.3) [Comprehension]
7. List and explain types of Ultrasonic waves. (C.O.No.3) [Comprehension]
8. With neat sketch explain Real Time Radiography. (C.O.No.4) [Comprehension]
9. Define Cold Lap, enumerate advantages, disadvantages and application of Radiographic Testing. (C.O.No.4) [Comprehension]

Part C [Problem Solving Questions]

Answer both the Questions. Each Question carries 15 marks. (2Qx15M=30M)

10. Explain the principle of Eddy current with neat sketch. Write Impedance plane diagram for Magnetic material and explain. (C.O.No.5) [Comprehension]
11. List and explain the factors influencing Eddy current Testing. (C.O.No.5) [Comprehension]

GAIN MORE KNOWLEDGE
REACH GREATER HEIGHTS

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 [Marks allotted] Bloom's Levels	Thought provoking type [Marks allotted] Bloom's Levels	Problem Solving type [Marks allotted]	Total Marks
			K	C	A	
1,2,3, 4,5	CO1 to CO5	1, 2, 3, 4, 5	10 (2+2+2+2+2)	-	-	10
6	CO3	3	-	10	-	10
7	CO3	3	-	10	-	10
8	CO4	4	-	10	-	10
9	CO4	4	-	10	-	10
10	CO5	5	-	15	-	15
11	CO5	5	-	15	-	15
	Total Marks		10	70	-	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: 11/12

Reviewer Comment:

Format of Answer Scheme

SCHOOL OF ENGINEERING

GAIN MORE KNOWLEDGE REACH GREATER HEIGHTS

SOLUTION

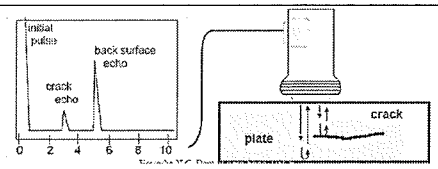
Semester: Odd Sem. 2019-20
Course Code: MEC323
Course Name: Non Destructive Testing
Program & Sem: B.Tech 7th sem (DE-III)

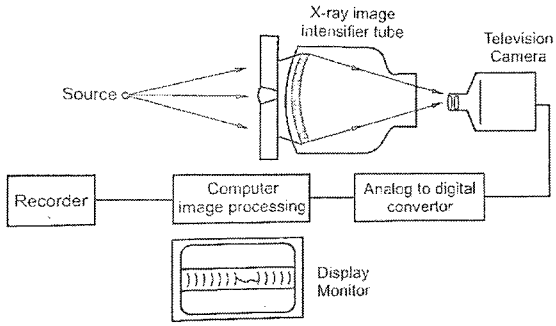
Date: 20.12.2019
Time: 3 hrs.
Max Marks: 80
Weightage: 40%

Part A (5Q x 2M = 10Marks)

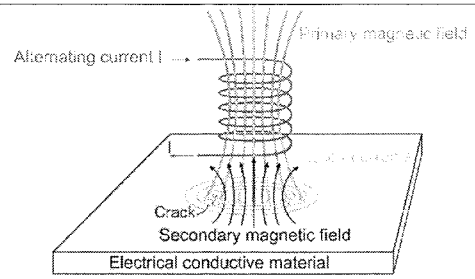
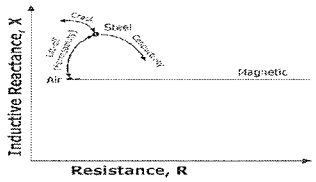
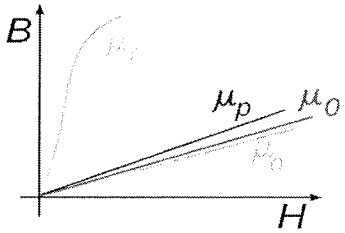
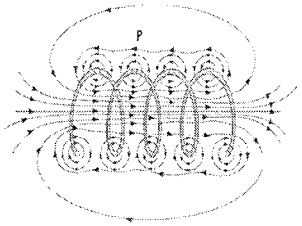
Q No	Solution	Scheme of Marking	Max. Time required for each Questic
1	**Dwell Time**: Sufficient time is allowed for the penetrant to enter any discontinuity open to the surface	Explanation 2M	10 min
2	The Ketos ring is a device made of tool steel and is designed to show the effectiveness of the MPI and the relative penetration based on the number of holes that display indications	Explanation 2M	10 min
3	Range from 0.5 to 20 MHz	Explanation 2M	10 min
4	Two main aspects of safety 1. Monitoring radiation dosage 2. Protection of personal	Explanation 2M	10 min
5	The distance between a surface coil and test surface is called as proximity or lift off	Explanation 2M	10 min

Part B (4Qx10M =40Marks

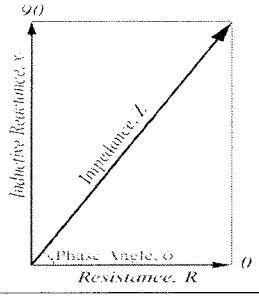
Q No	Solution	Scheme of Marking	Max. Time required for each Question
6	 In pulse-echo testing, a transducer sends out a pulse of energy and the same or a second transducer listens for reflected energy (an echo). Reflections occur due to the presence of discontinuities and the surfaces of the test article. 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.	Diagram 5M+ Explanation 5M	15 min

7	▪ Longitudinal wave ▪ Transverse or Shear wave ▪ Surface or Rayleigh waves ▪ Lamb or Plate waves In solids, sound waves can propagate in four principle modes that are based on the way the particles oscillate. Sound can propagate as longitudinal waves, shear waves, surface waves, and in thin materials as plate waves. ***Longitudinal and shear waves are the two modes of propagation most widely used in ultrasonic testing.***	Listing 2M+ Explanation 2M each	15 min
8	 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 and is 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. The image obtained using this method is usually faint and the sensitivity is very low. Therefore, to improve the quality of image, should employ the image intensifier equipment.	Diagram 5M+ Explanation 5M	15 min
9	**Cold lap** is a condition where the weld filler metal does not properly fuse with the base metal or the previous weld pass material Advantages: ✓ Technique is not limited by material type or density. ✓ Can inspect assembled components. ✓ Minimum surface preparation required. ✓ Sensitive to changes in thickness, corrosion, voids, cracks, and material density changes. Disadvantages: ✓ Many safety precautions for the use of high intensity radiation. ✓ Many hours of technician training prior to use. ✓ Access to both sides of sample required. ✓ Orientation of equipment and flaw can be critical. Applications ✓ Can be used in most types of solid materials both ferrous and non-ferrous as well as non-metallic and composites. ✓ This is used for castings , Weldments and forgings ✓ Used for semiconductor devices for detection of cracks, broken wires.	Definition 1M+ Advantages, disadvantages, application 3M each	15 min

Part C (2Q x15M =30Marks)

Q No	Solution	Scheme of Marking	Max. Time required for each Question
10	 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. **Eddy Current Impedance Plane Responses**  In an eddy current testing instrumentation, eddy current circuits usually have only resistance and reactance components. During inspection, eddy current signals generated during testing of components are displayed by impedance plane diagram. The strength of the eddy currents and the magnetic permeability of the test material causes the eddy current signal on the impedance plane.	Working principle 5M+sketch of impedance 5M+explanation 5M	35 min
11	1) Conductivity 2) Permeability  3) Resistivity 4) Inductance  5) Inductive Reactance	Listing 3M + Explanation 2M each 6 factors	35 min

6) Impedance


90
Inductive Reactance, X
Impedance, Z
Phase Angle, θ
0
Resistance, R