SRM VALLIAMMAI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

(M.E- STRUCTURAL ENGINEERING)

QUESTION BANK

II Semester

ST3263 - EXPERIMENTAL TECHNIQUES AND INSTRUMENTATION

Regulation: 2023

Academic Year: 2024-25

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DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

SUBJECT : ST3263-EXPERIMENTAL TECHNIQUES ANDINSTRUMENTATION

SEM / YEAR: II/ FIRST

UNIT I FORCES AND STRAIN MEASUREMENT

Choice of Experimental stress analysis methods, Errors in measurements - Strain gauge, principle, types, performance and uses. Photo elasticity - principle and applications - Hydraulic jacks and pressure gauges – Electronic load cells – Proving Rings – Calibration of Testing Machines – Long-term monitoring – vibrating wire sensors– Fibre optic sensors.

PART - A

Q.No	Questions	BT	Competence
1.	Define Gauge Length?	BT-1	Remembering
2.	List four basic characteristics of measuring devices?	BT-2	Understanding
3.	Define strain gauge.	BT-1	Remembering
4.	Define electronic load cell.	BT-2	Understanding
5.	Define range.	BT-1	Remembering
6.	Label the Wheatstone bridge circuit to compensate the temperature effects while measuring tensile stress in a steel specimen?	BT-3	Applying
7.	Discuss the characteristics of strain gauge	BT-2	Understanding
8.	Outline the basic characteristics of strain gauge?	BT-1	Remembering
9.	Discuss about different types of pressure gauges	BT-1	Remembering
10.	Why Long term monitoring is important?	BT-3	Applying
11.	What is proving ring?	BT-1	Remembering
12.	Show the principle of optical strain gauge?	BT-3	Applying
13.	What is the need for Calibration of Testing Machines?	BT-2	Understanding
14.	Compare any two points between isoclinic & isochromatic.	BT-1	Remembering
15.	Explain about fiber optic sensor	BT-1	Remembering
16.	Classify the different types of errors in measurement?	BT-2	Understanding
17.	Explain hydraulic jack?	BT-2	Understanding
18.	Write the uses and applications of strain gauge	BT-1	Remembering
19.	Compare vibrating wire sensors and Fibre optic sensors?	BT-2	Understanding
20.	What is meant by photo elasticity?	BT-1	Remembering
21.	Write any two application of photo elasticity.	BT-3	Applying
22.	What are the different types of strain gauge?	BT-2	Understanding
23.	Define accuracy.	BT-3	Applying
24.	Write any two principle of photo elasticity?	BT-3	Applying
25.	What are the types of errors in measurements?	BT-2	Understanding

PART - B

1.	Define strain gauge. Classification, principle and its application.	BT-3	Applying
2.	Describe any one method used for the calibration of materials used for Photo elasticity investigation	BT-4	Analysing
3.	Explain in detail with neat sketches about the principal of Pressure gauges.	BT-3	Applying
4.	Explain the laboratory setup of circular polariscope.	BT-3	Applying
5.	What is Photo elasticity? Explain about the principle with neat sketch?	BT-5	Evaluating
6.	Differentiate between Load cell and Proving Ring in detail.	BT-5	Evaluating
7.	Discuss the associated instrumentation for measuring (i) Static strain (ii) Dynamic strain	BT-1	Remembering
8.	Illustrate working principle of electronic load cell briefly.	BT-5	Evaluating
9.	Classify the different types of pressure measuring devices briefly with neat sketch?	BT-4	Analysing
10.	Write in detail the need the procedure of calibrating a UTM using a Standard Proving Ring?	BT-4	Analysing
11.	Explain in detail the calibration of testing machines and proving ring?	BT-4	Analysing
12.	Discuss any two types fibre optic sensors with suitable sketches in details.	BT-5	Evaluating
13.	Design the working principle of optical strain gauge	BT-4	Analysing
14.	Explain with the neat sketch the measurement using Hydraulic jacks and Pressure Gauge?	BT-3	Applying
15.	Write the difference between Isoclinic and Isochromatic	BT-3	Applying
16.	Analyse the compensation methods in photo elasticity and explain in detail two methods of compensation in polariscope?	BT-5	Evaluating
17.	Explain in detail about Long term monitoring and its important?	BT-3	Applying

UNIT-II: MEASUREMENT OF VIBRATION AND WIND FLOW

Characteristics of Structural Vibrations – Linear Variable Differential Transformer (LVDT) – Transducers for velocity and acceleration measurements. Vibration meter – Seismographs – Vibration Analyzer – Display and recording of signals – Cathode Ray Oscilloscope – XY Plotter – wind tunnels – Flow meters – Venturimeter – Digital data Acquisition systems.

PART - A

1.	Define LVDT.	BT-1	Remembering
2.	Name the Instruments used to measure the speed of wind flow	BT-3	Applying
3.	Define the term harmonic frequency?	BT-1	Remembering
4.	Define orifice meter	BT-1	Remembering
5.	Define Vibration analyzer	BT-3	Applying
6.	Define Venturimeter	BT-2	Understanding
7.	Outline the characteristics of Structural Vibrations?	BT-2	Understanding
8.	Differentiate the use of XY plotter from conventional printer?	BT-3	Applying
9.	Differentiate seismogram and seismograph	BT-1	Remembering
10.	Distinguish between frequency domain and time domain analysis of vibration measurement	BT-3	Applying
11.	Discuss Vibration meter	BT-2	Understanding
12.	Illustrate the importance of wind tunnel study.	BT-1	Remembering
13.	Examine wind Tunnel?	BT-1	Remembering
14.	State the working principle of seismograph	BT-2	Understanding
15.	Classify the types of accelerometers?	BT-2	Understanding
16.	Explain Pressure transducers?	BT-2	Understanding
17.	Explain accelerometer	BT-1	Remembering
18.	Describe any two applications of LVDT and evaluate it.	BT-1	Remembering
19.	Explain Seismographs	BT-2	Understanding

20.	Recommend the necessity of temperature compensation.	BT-3	Applying
21.	What is Digital data Acquisition systems?	BT-2	Understanding
22.	Define Display and recording of signals.	BT-3	Applying
23.	What are the instruments used for measuring discharge?	BT-2	Understanding
24.	State the characteristics of structural vibration.	BT-3	Applying
25.	What is acceleration measurements?	BT-3	Applying

	PART - B		
1.	Define X-Y Plotter and explain its working principle.	BT-4	Analysing
2.	Describe in detail the principle of working, uses & limitations of a Linear Variable differential transformer?	BT-5	Evaluating
3.	What is seismograph? Explain with a neat sketch.	BT-4	Analysing
4.	Write notes on : (i) Single channel data acquisition system (ii) Cathode ray oscilloscope	BT-4	Analysing
5.	Discuss the following (i) Importance of transducers in flow measurements (ii) Use of sound level and Venturimeter (iii) Direct Model analysis	BT-4	Analysing
6.	Summarize the functioning of vibration-analyzer and brief how digital data Acquisition systems is utilized for the same	BT-3	Applying
7.	Explain the effect of stressed model in a plane polariscope in dark-field set up?	BT-4	Understanding
8.	Examine the different types of accelerometer and explain the types and its principles	BT-5	Evaluating
9.	Explain the principle of operation & working of the following pressure Transducer? (i) Piston type diaphragm (ii) bellows for double cantilever operation (iii) cantilever type pressure transducer (iv) Strain gauge pressure transducer	BT-2	Understanding
10.	Explain briefly the working principle of LVDT	BT-5	Evaluating
11.	Explain in detail about seismic recording Cathode Rays Oscilloscope	BT-2	Understanding
12.	Explain how LVDTs are constructed, its output voltage characteristics and how null voltage of LVDTs can be improved.	BT-4	Analysing
13.	Prepare the working principle for vibration meter and flow meter	BT-3	Applying
14.	Construct the block diagram of digital data acquisition systems and explain the operation?	BT-2	Understanding
15.	Draw the circuit diagram of LVDT and explain its working principles and its application.	BT-3	Analysing
16.	Explain in detail about the structure and working principle of wind Tunnel with neat sketch?	BT-4	Analysing
17.	Explain the application of vibration analyzer.	BT-4	Understanding

UNIT-III: DISTRESS MEASUREMENTS AND CONTROL

Diagnosis of distress in structures – Crack observation and measurements – corrosion of reinforcement in concrete – Half cell, construction and use – damage assessment – controlled blasting for demolition – Techniques for residual stress measurements – Structural Health Monitoring.

	PART - A		
1.	Define Geometric similitude?	BT-2	Understanding
2.	Define Demolition by implosion Techniques	BT-1	Remembering
3.	List any two uses of NDT Methods	BT-2	Understanding

4.	Name any four signs of distress in concrete structures	BT-1	Remembering
5.	Define half-cell.	BT-2	Understanding
6.	List the characteristics of Half cell?	BT-2	Understanding
7.	Differentiate Structural and Non Structural distress in building?	BT-2	Understanding
8.	Discuss the principle of sound level meter?	BT-2	Understanding
9.	Distinguish between dry & wet corrosions?	BT-3	Applying
10.	Predict Structural health Monitoring?	BT-1	Remembering
11.	Classify the different types of cracks?	BT-2	Understanding
12.	Illustrate controlled blasting	BT-2	Understanding
13.	Examine Eddy current?	BT-1	Understanding
14.	Classify the types of residual stresses	BT-1	Remembering
15.	Classify the various types of strengthening for concrete distress?	BT-1	Remembering
16.	Analyse the corrosion measurement of reinforcement in concrete?	BT-1	Remembering
17.	Create the factors that influence the corrosion initiation?	BT-3	Applying
18.	Choose the techniques used in residual stress measurement?	BT-2	Understanding
19.	Explain implosive technique.	BT-1	Remembering
20.	Mention the uses of Brittle coating.	BT-1	Remembering
21.	What is dry corrosions?	BT-3	Applying
22.	What is wet corrosions?	BT-1	Remembering
23.	Define residual stress.	BT-3	Applying
24.	What is Structural distress in building?	BT-3	Applying
25.	Define damage assessment	BT-2	Understanding
	PART - B		
1.	Describe the various types of damages to structures due to corrosion and Explain the steps involved to repair those damages.	BT-2	Understanding
2.	Identify detail about the demolition Techniques for Controlled blasting.	BT-5	Evaluating
3.	Discuss the potential mapping on RCC structures by using Half-cell potential measurements?	BT-4	Analysing
4.	How do you measure corrosion of rebars in structures? Explain their functioning and limitations with neat sketches.	BT-6	Creating
5.	(i) Explain how will you diagnose dilapidated structure. (iii) Discuss the factors Which influence the corrosion of steel in concrete	BT-3	Applying
6.	Discuss the following : (i) Carbonation and its effects in concrete structures. (ii) Explain the term catholic protection and its importance. (iii) Structural health Monitoring	BT-4	Analysing
7.	Estimate the techniques for residual stress measurements and explain the damage assessment procedures?	BT-3	Analysing
8.	Explain a detailed note on diagnosis of structural health monitoring.	BT-5	Evaluating
9.	Demonstrate the methods of residual stress determinations and explain how the residual stresses are determined by X-ray diffraction method?	BT-4	Analysing
10.	Analyse the causes of distress in structures? and explain the corrosion of reinforcement in concrete?	BT-4	Analysing
11.	Explain any two factors which affects the process of corrosion in RC structures?	BT-2	Understanding
12.	What are the different types of crack? How to measure the cracks.	BT-4	Analysing
13.	Invent the various types of strengthening techniques adopted for structural distress	BT-3	Applying

14.	Measured the natural frequency of a bride deck also elaborately discuss the various corrosion prevention methods of RCC structures?	BT-2	Understanding
15.	Explain how to demolish a column damaged due to corrosion.	BT-3	Applying
16.	Explain the term catholic protection and its importance.	BT-3	Applying
17.	Explain theApplication of Half cell in distress measurement control	BT-3	Applying

UNIT-IV: NON DESTRUCTIVE TESTING METHODS

Load testing on structures, buildings, bridges and towers – Rebound Hammer – acoustic emission– ultrasonic testing principles and application – Holography – use of laser for structural testing – Brittle coating, Advanced NDT methods – Ultrasonic pulse echo, Impact echo, impulse radar techniques, GECOR ,Ground penetrating radar (GPR).

PART - A

1.	Classify the Various types of NDT.	BT-1	Remembering
2.	Discuss about Brittle coating and its Principle.	BT-1	Remembering
3.	When do you for Brittle Coating Techniques?	BT-2	Understanding
4.	Define GECOR.	BT-4	Analysing
5.	Select which NDT method is used to assess the surface and core strengths of a concrete	BT-4	Analysing
6.	Estimate the uses of Holography.	BT-1	Remembering
7.	Illustrate the factors that influence the results of rebound hammer	BT-4	Analysing
8.	Examine the principle of rebar locator?	BT-2	Understanding
9.	Show the grading rebound hammer number on Concrete quality	BT-2	Understanding
10.	Examine the principle of GECOR?	BT-2	Understanding
11.	Invent the use of laser in Structural Testing?	BT-4	Analysing
12.	List out the five names of equipments used in NDT techniques?	BT-1	Remembering
13.	Discuss about acoustic emission?	BT-3	Applying
14.	Define holography.	BT-4	Analysing
15.	What is GPR?	BT-2	Understanding
16.	List any three of advantages of NDT?	BT-2	Understanding
17.	Justify the Purpose of Load testing on Structures	BT-4	Analysing
18.	Discuss about Ultrasonic principle	BT-5	Evaluating
19.	Explain the application of Impact echo.	BT-2	Understand
20.	List of application of Ultrasonic principle.	BT-1	Remembering
21.	Define Load testing on Structure.	BT-1	Remembering
22.	Enlist the types Load on buildings	BT-2	Understanding
23.	List the types Load on towers	BT-5	Evaluating
24.	What is impulse radar techniques?	BT-1	Remembering
25.	Write the application of GRCOR.	BT-4	Analysing

PART - B

1.	Explain in detail of ultrasonic testing principle , components and its applications with neat sketch	BT-5	Evaluating
2.	Experimentally brief on load testing on structures, towers and bridges	BT-1	Remembering
3.	Compare the Destructive testing and non Destructive testing procedure on Structures	BT-2	Understanding
4.	Describe Holography and brief the uses of laser for structural testing?	BT-2	Understanding
5.	Differentiate between Rebound hammer and UPV method with reference to procedure Limitation and its applications?	BT-4	Analysing
6.	Estimate the various characteristics used to evaluate a brittle coating? Discuss various application of brittle coating?	BT-1	Remembering

7.	Discuss how flow identification and qualitative assessment strength of concrete are possible by using ultrasonic pulses?	BT-2	Understanding
8.	(i) Explain the application of acoustic emissions (ii) Explain the principle of UPV and its application	BT-3	Applying
9.	Construct with neat sketch explain the principle and construction of film anemometer?	BT-5	Evaluating
10.	Explain the various methods of NDT of concrete and explain any one method in detail?	BT-5	Evaluating
11.	Describe about the Principles and Application of the following: (i) GECOR (ii) GPR (iii) Impact echo (iv) Ultrasonic pulse echo	BT-4	Analysing
12.	Explain in brief the various advanced non-destructive testing procedures with their specific utility.	BT-4	Analysing
13.	Explain the principle and working of Ground Penetration Radar.	BT-4	Analysing
14.	Explain how Holography is useful in structural operation purpose.	BT-1	Remembering
15.	Application of GPR and GECOR Techniques	BT-1	Remembering
16.	Prepare the report on Laser in Structural testing	BT-4	Analysing
17.	Analyse the advance of Brittle coating in Structural member	BT-3	Applying

UNIT-V: MODEL ANALYSIS

Model Laws – Laws of similitude – Model materials – Necessity for Model analysis – Advantages – Applications – Types of similitude – Scale effect in models – Indirect model study- Direct model study - Limitations of models – investigations – structural problems –Usage of influence lines in model studies.

1.	Difference between direct and indirect modeling	BT-1	Remembering
2.	Analyse Structural Problem	BT-3	Applying
3.	Discuss the assumptions made in direct model analysis	BT-2	Understanding
4.	Invent the disadvantages of Model analysis	BT-2	Understand
5.	Define model law	BT-6	Creating
6.	Discuss the assumptions made in indirect model analysis	BT-6	Creating
7.	When the model analysis required?	BT-4	Analysing
8.	Arrange the limitations of model study?	BT-2	Understanding
9.	Recommend the usage of influence line?	BT-4	Analysing
10.	Define Laws of similitude	BT-4	Analysing
11.	Define Model materials	BT-1	Remembering
12.	Estimate the Advantages of Model analysis	BT-2	Understanding
13.	Applications of Model analysis write any two points	BT-3	Applying
14.	Plan the methodology of indirect model analysis	BT-1	Remembering
15.	Classify the types of similitude	BT-2	Understanding
16.	Measure the Scale effect in models	BT-1	Remembering
17.	Define Indirect model study	BT-1	Remembering
18.	Explain Direct model study	BT-3	Applying
19.	Examine the investigations of Model analysis	BT-3	Applying
20.	Rate the structural problems in Model analysis	BT-2	Understanding
21.	Enlist the necessity for Model analysis	BT-2	Understanding
22.	Write the application of Model analysis	BT-1	Remembering
23.	Examine the Scale effect in models	BT-2	Understanding
24.	List the uses of Influence line.	BT-3	Applying
25.	Write the Usage of influence lines in model studies	BT-1	Remembering
PART - B			
1.	Discuss the Following :	BT-2	Understanding

	(i)Model Materials (ii) Usage of influence line in model study		
2.	Explain in Detail about the Necessity, Advantages & Applications of Indirect Model analysis?	BT-2	Understanding
3.	Classify the types of similitude and explain it detail	BT-1	Remembering
4.	A cantilever beam of span 5m is loaded with a concentrated load of 25kN at the free end. The cross section of beam is 110mmx350mm and the young's modulus is 350Gpa.Design a single model made of aluminium with young's modulus 70Gpa and determine the load to be applied to the model. Derive the π terms to be used in the model analysis	BT-2	Understanding
5.	Explain in Detail about the Necessity, Advantages & Applications of direct Model analysis?	BT-2	Understanding
6.	Discuss various methods available for determining the natural frequency and dumping coefficient of a structural system?	BT-1	Remembering
7.	A rectangular RC beam of cross section 250 x 450mm with simply supported span of 3 m is to be tested with concentrated load of 10KN the maximum deflection was 8mm.(E=35000N/mm2, Poisson ratio = 0.16). A 1:5 scale model of plaster of paris is made ($E=10x10^3N/mm^2$), Poisson ratio=0.215, Density =1.10. find the different scale ratio and the corresponding to be applied and its deflection	BT-1	Remembering
8.	Describe in detail about the scale effect in Model analysis	BT-3	Applying
9.	Explain Model law and discuss the laws of similitude in model analysis	BT-3	Applying
10.	Conclude the Advantages and Disadvantages of Model analysis	BT-3	Applying
11.	Prepare the in detail report on limitations, investigations and necessity of structural problems.	BT-2	Understanding
12.	Explain dimensional homogeneity principle and give examples. How does this principle help in the analysis of dimensional analysis	BT-2	Understanding
13.	Analyse in detail about the necessity for model analysis. Give a flow chart for model analysis. What is scale effect?	BT-1	Remembering
14.	(i) Explain the principal of structural similitude to be followed in the direct method of analysis. (ii) Write short note on scale effect in model	BT-3	Applying
15.	Evaluate the limitations and constrains in Model analysis	BT-1	Remembering
16.	Influence lines in Model study-Assess	BT-5	Evaluating
17.	Application of Model analysis in Structural member	BT-1	Remembering