SRM VALLIAMMAI ENGINEERING COLLEGE

(AN AUTONOMOUS INSTITUTION)

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

(M.E- STRUCTURAL ENGINEERING)

QUESTION BANK

II Semester

1917202 - EXPERIMENTAL TECHNIQUES

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QUESTION BANK

SUBJECT : 1917202 - EXPERIMENTAL TECHNIQUES

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 – Longterm monitoring – vibrating wire sensors– Fibre optic sensors.

PART - A

Q.No	Questions	BT	Competence
1.	List four basic characteristics of measuring devices?	BT-1	Remember
2.	Define Stress Optic law.	BT-1	Remember
3.	Define strain gauge. State its types	BT-1	Remember
4.	Define electronic load cell.	BT-1	Remember
5.	Define range & accuracy?	BT-1	Remember
6.	Label the Wheatstone bridge circuit to compensate the temperature effects while measuring tensile stress in a steel specimen?	BT-1	Remember
7.	Discuss the characteristics of strain gauge	BT-2	Understand
8.	Outline the basic characteristics of strain gauge?	BT-2	Understand
9.	Discuss about different types of pressure gauges	BT-2	Understand
10.	Why Long term monitoring is important?	BT-2	Understand
11.	Show the principle of load measurement using proving ring.	BT-3	Apply
12.	Show the principle of optical strain gauge?	BT-3	Apply
13.	Examine Calibration of Testing Machines?	BT-3	Apply
14.	Compare any two points between isoclinic & isochromatic.	BT-4	Analyse
15.	Explain about fiber optic sensor	BT-4	Analyse
16.	Classify the different types of errors in measurement?	BT-4	Analyse
17.	Explain hydraulic jack?	BT-4	Analyse
18.	Write the uses and applications of strain gauge	BT-5	Evaluate
19.	Compare vibrating wire sensors and Fibre optic sensors?	BT-6	Create
20.	What is meant by photo elasticity? Write any two application	BT-6	Create
	PART - B		
1.	Define strain gauge. Classification, principle and its application.	BT-1	Remember
2.	Describe any one method used for the calibration of materials used for Photo elasticity investigation	BT-1	Remember
3.	Explain in detail with neat sketches about the principal and working of a mechanical and optical extensometers.	BT-1	Remember
4.	(i)Explain the laboratory setup of circular polariscope (8) (ii)write the difference between Isoclinic and Isochromatic (5)	BT-1	Remember
5.	What are piezo-resistive strain gauges? What are the factors considering in	BT-2	Understand

	selecting a strain gauge? A good gauge material should possess which properties? Also discuss about steps followed in strain gauge application.		
6.	Differentiate between Load cell and Proving Ring in detail.	BT-2	Understand
7.	Discuss the associated instrumentation for measuring (i) Static strain (ii) Dynamic strain	BT-2	Understand
8.	Illustrate working principle of electronic load cell briefly.	BT-3	Apply
9.	Classify the different types of pressure measuring devices briefly with neat sketch?	BT-3	Apply
10.	(i) The strain measurements at a point with an equiangular rosette gave the following readings: E_d = 500µcm/cm, E_b = 380 µcm/cm, E_c= 200µcm/cm. Rosette A is lying along the X axis. Determine the principal strains, principal stresses and maximum shear stress at the point. E = $2x10^5$ N/mm^2 and Poisson's ratio = 0.286. (9) (ii) Explain the procedure of using Mohr fringes for stress analysis (4)	BT-3	Apply
11.	Explain in detail the calibration of testing machines and proving ring?	BT-4	Analyse
12.	Explain with neat sketches the construction and working of Huggenberg extensometer	BT-4	Analyse
13.	Design the working principle of optical strain gauge	BT-5	Evaluate
14.	Explain with the neat sketch the measurement using Hydraulic jacks and Pressure Gauge?	BT-6	Create
	PART - C		
1.	Enumerate in detail the needs, procedure of calibrating a UTM using a standard proving ring	BT-2	Understand
2.	Describe the expressions for principal strains ,principal stresses and max shear stresses for a Delta Rosette	BT-2	Understand
3.	Measure the errors in experiments and explain how it will nullified	BT-3	Apply
4.	Analyse the compensation methods in photo elasticity and explain in detail two methods of compensation in polariscope ?	BT-4	Analyze
	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	Remember
2.	Name the Instruments used to measure the speed of wind flow	BT-1	Remember
3.	Define the term harmonic frequency?	BT-1	Remember
4.	Define orifice meter	BT-1	Remember
5.	Define Vibration analyzer	BT-1	Remember
6.	Define Venturimeter	BT-1	Remember
7.	Outline the characteristics of Structural Vibrations?	BT-2	Understand
8.	Differentiate the use of XY plotter from conventional printer?	BT-2	Understand
9.	Differentiate seismogram and seismograph	BT-2	Evaluate
10.	Distinguish between frequency domain and time domain analysis of vibration measurement	BT-2	Understand
11.	Discuss Vibration meter	BT-2	Understand
12.	Illustrate the importance of wind tunnel study.	BT-3	Apply
13.	Examine wind Tunnel?	BT-3	Apply
14.	State the working principle of seismograph	BT-3	Apply
15.	Classify the types of accelerometers?	BT-4	Analyse
16.	Explain Pressure transducers?	BT-4	Analyse
17.	Explain accelerometer	BT-4	Analyse
18.	Describe any two applications of LVDT and evaluate it.	BT-5	Evaluate
19.	Explain Seismographs	BT-6	Create

20.	Recommend the necessity of temperature compensation.	BT-6	Create

	PART - B		
1.	Define X-Y Plotter and explain its working principle.	BT-1	Remember
2.	Describe in detail the principle of working, uses & limitations of a Linear Variable differential transformer?	BT-1	Remember
3.	(i) What is seismograh? Explain with a neat sketch. (8) (ii) Explain the application of vibration analyzer. (8)	BT-1	Remember
4.	Write notes on : (i) Single channel data acquisition system (ii) Cathode ray oscilloscope	BT-1	Remember
5.	Discuss the following (i) Importance of transducers in flow measurements (ii) Use of sound level and Venturimeter (iii) Direct Model analysis	BT-2	Understand
6.	Summarize the functioning of vibration-analyzer and brief how digital data Acquisition systems is utilized for the same	BT-2	Understand
7.	Explain the effect of stressed model in a plane polariscope in dark-field set up?	BT-2	Understand
8.	Examine the different types of accelerometer and explain the types and its principles	BT-3	Apply
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-3	Apply
10.	Explain briefly the working principle of LVDT	BT-4	Analyse
11.	Explain in detail about seismic recording Cathode Rays Oscilloscope	BT-4	Analyse
12.	Explain how LVDTs are constructed, its output voltage characteristics and how null voltage of LVDTs can be improved.	BT-4	Analyse
13.	Prepare the working principle for vibration meter and flow meter	BT-5	Evaluate
14.	Construct the block diagram of digital data acquisition systems and explain the operation?	BT-6	Create
	PART - C		
1.	Summarize Case Study on LVDT techniques	BT-2	Understand
2.	Application of Digital data Acquisition systems	BT-3	Apply
3.	Analyse the Seismic valve by Seismograph instruments in structural member	BT-4	Analyse
4.	Evaluate the instruments used for wind flow measurements	BT-5	Evaluate
	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-1	Remember
2.	Define Demolition by implosion Techniques	BT-1	Remember
3.	List any two uses of NDT Methods	BT-1	Remember
4.	Name any four signs of distress in concrete structures	BT-1	Remember
5.	Define half-cell.	BT-1	Remember
6.	L characteristics Half cell?	BT-1	Remember
7.	Differentiate Structural and Non Structural distress in building?	BT-2	Understand
8.	Discuss the principle of sound level meter?	BT-2	Understand
9.	Distinguish between dry & wet corrosions?	BT-2	Understand
10.	Predict Structural health Monitoring?	BT-2	Understand
11.	Classify the different types of cracks?	BT-3	Apply

12.	Illustrate controlled blasting	BT-3	Apply
13.	Examine Eddy current?	BT-3	Apply
14.	Classify the types of residual stresses	BT-4	Analyse
15.	Classify the various types of strengthening for concrete distress?	BT-4	Analyse
16.	Analyse the corrosion measurement of reinforcement in concrete?	BT-4	Analyse
17.	Create the factors that influence the corrosion initiation?	BT-5	Evaluate
18.	Choose the techniques used in residual stress measurement?	BT-5	Evaluate
19.	Explain implosive technique.	BT-6	Create
20.	Explain implosive technique.	BT-6	Create
PART - B			
1.	Describe the various types of damages to structures due to corrosion and Explain the steps involved to repair those damages.	BT-1	Remember
2.	Identify detail about the demolition Techniques for Controlled blasting.	BT-1	Remember
3.	Discuss the potential mapping on RCC structures by using Half-cell potential measurements?	BT-1	Remember
4.	How do you measure corrosion of rebars in structures? Explain their functioning and limitations with neat sketches.	BT-1	Remember
5.	(i) Explain how will you diagnose dilapidated structure. (ii) Explain how to demolish a column damaged due to corrosion. (iii) Discuss the factors Which influence the corrosion of steel in concrete	BT-2	Understand
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-2	Understand
7.	Estimate the techniques for residual stress measurements and explain the damage assessment procedures?	BT-2	Understand
8.	Explain a detailed note on diagnosis of structural health monitoring.	BT-3	Apply
9.	Demonstrate the methods of residual stress determinations and explain how the residual stresses are determined by X-ray diffraction method?	BT-3	Apply
10.	Analyse the causes of distress in structures ?and explain the corrosion of reinforcement in concrete?	BT-4	Analyse
11.	Explain any two factors which affects the process of corrosion in RC structures?	BT-4	Analyse
12.	What are the different types of crack? How to measure the cracks.	BT-4	Analyse
13.	Invent the various types of strengthening techniques adopted for structural distress	BT-5	Evaluate
14.	Measured the natural frequency of a bride deck also elaborately discuss the various corrosion prevention methods of RCC structures?	BT-6	Create
PART - C			
1.	Prepare the Case study on controlled blasting of demolition Techniques	BT-2	Understand
2.	Application of Half cell in distress measurement control	BT-3	Apply
3.	Evaluate the Crack in structures and explain how to control	BT-4	Analyse
4.	Measure Corrosion of reinforcement in concrete and explain how to control	BT-6	Create
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-4	Analyse

2.	Discuss about Brittle coating and its Principle.	BT-2	Understand
3.	When do you for Brittle Coating Techniques?	BT-1	Remember
4.	Define GECOR.	BT-1	Remember
5.	Select which NDT method is used to assess the surface and core strengths of a concrete	BT-6	Create
6.	Estimate the uses of Holography.	BT-2	Understand
7.	Illustrate the factors that influence the results of rebound hammer	BT-3	Apply
8.	Examine the principle of rebar locator?	BT-3	Apply
9.	Show the grading rebound hammer number on Concrete quality	BT-3	Apply
10.	Examine the principle of GECOR?	BT-4	Analyse
11.	Invent the use of laser in Structural Testing?	BT-5	Evaluate
12.	List out the five names of equipments used in NDT techniques?	BT-1	Remember
13.	Discuss about acoustic emission?	BT-2	Understand
14.	Define holography.	BT-1	Remember
15.	Explain GPR	BT-4	Analyse
16.	List any three of advantages of NDT?	BT-1	Remember
17.	Justify the Purpose of Load testing on Structures	BT-6	Create
18.	Discuss about Ultrasonic principle	BT-2	Understand
19.	Explain the application of Impact echo.	BT-4	Analyse
20.	List of application of Ultrasonic principle.	BT-1	Remember
PART - B			
1.	Explain in detail of ultrasonic testing principle , components and its applications with neat sketch	BT-4	Analyse
2.	Experimentally brief on load testing on structures, towers and bridges	BT-3	Apply
3.	Compare the Destructive testing and non Destructive testing procedure on Structures	BT-4	Analyse
4.	Describe Holography and brief the uses of laser for structural testing?	BT-1	Remember
5.	Differentiate between Rebound hammer and UPV method with reference to procedure Limitation and its applications?	BT-2	Understand
6.	Estimate the various characteristics used to evaluate a brittle coating? Discuss various application of brittle coating?	BT-2	Understand
7.	Discuss how flow identification and qualitative assessment strength of concrete are possible by using ultrasonic pulses?	BT-2	Understand
8.	(i) Explain the application of acoustic emissions (ii) Explain the principle of UPV and its application	BT-3	Apply
9.	Construct with neat sketch explain the principle and construction of film anemometer?	BT-6	Create
10.	Explain the various methods of NDT of concrete and explain any one method in detail?	BT-5	Evaluate
11.	Describe about the Principles and Application of the following: (i) GECOR (ii) GPR (iii) Impact echo (iv) Ultrasonic pulse echo	BT-1	Remember
12.	Explain in brief the various advanced non-destructive testing procedures with their specific utility.	BT-1	Remember
13.	Explain the principle and working of Ground Penetration Radar.	BT-1	Remember
14.	Explain how Holography is useful in structural operation purpose.	BT-3	Apply
PART - C			
1.	Case study on NDT Techniques for structural member	BT-2	Understand
2.	Application of GPR and GECOR Techniques	BT-3	Apply
3.	Prepare the report on Laser in Structural testing	BT-5	Evaluate
4.	Analyse the advance of Brittle coating in Structural member	BT-4	Analyse

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-2	Understand
2.	Analyse Structural Problem	BT-4	Analyse
3.	Discuss the assumptions made in direct model analysis	BT-2	Understand
4.	Invent the disadvantages of Model analysis	BT-5	Evaluate
5.	Define model law	BT-1	Remember
6.	Discuss the assumptions made in indirect model analysis	BT-2	Understand
7.	When the model analysis required?	BT-1	Remember
8.	Arrange the limitations of model study?	BT-4	Analyse
9.	Recommend the usage of influence line?	BT-6	Create
10.	Define Laws of similitude	BT-1	Remember
11.	Define Model materials	BT-1	Remember
12.	Estimate the Advantages of Model analysis	BT-2	Understand
13.	Applications of Model analysis write any two points	BT-3	Apply
14.	Plan the methodology of indirect model analysis	BT-5	Evaluate
15.	Classify the types of similitude	BT-3	Apply
16.	Measure the Scale effect in models	BT-3	Apply
17.	Define Indirect model study	BT-4	Analyse
18.	Explain Direct model study	BT-4	Analyse
19.	Examine the investigations of Model analysis	BT-3	Apply
20.	Rate the structural problems in Model analysis	BT-1	Remember
	PART - B		
1.	Discuss the Following : (i)Model Materials (ii) Usage of influence line in model study	BT-2	Understand
2.	Explain in Detail about the Necessity, Advantages & Applications of Indirect Model analysis?	BT-4	Analyse
3.	Classify the types of similitude and explain it detail	BT-3	Apply
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-5	Evaluate
5.	Explain in Detail about the Necessity, Advantages & Applications of direct Model analysis?	BT-6	Create
6.	Discuss various methods available for determining the natural frequency and dumping coefficient of a structural system?	BT-2	Understand
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 ($E=10x10^3 N/mm^2$), Poisson ratio=0.215, Density =1.10. find the different scale ratio and the corresponding to be applied and its deflection	BT-1	Remember
8.	Describe in detail about the scale effect in Model analysis	BT-1	Remember
9.	Explain Model law and discuss the laws of similitude in model analysis	BT-4	Analyse
10.	Conclude the Advantages and Disadvantages of Model analysis	BT-2	Understand
11.	Prepare the in detail report on limitations, investigations and necessity of structural problems.	BT-1	Remember
12.	Explain dimensional homogeneity principle and give examples. How does this principle help in the analysis of dimensional analysis	BT-3	Apply
13.	Analyse in detail about the necessity for model analysis. Give a flow chart for model analysis. What is scale effect?	BT-4	Analyse

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-1	Remember
PART - C			
1.	Analyse the Structural problem by direct model study	BT-4	Analyse
2.	Evaluate the limitations and constrains in Model analysis	BT-6	Create
3.	Influence lines in Model study-Assess	BT-6	Create
4.	Application of Model analysis in Structural member	BT-3	Apply