SRM VALLIAMMAI ENGINEERING COLLEGE

An Autonomous Institution

SRM Nagar, Kattankulathur – 603 203

DEPARTMENT OF CIVIL ENGINEERING

QUESTION BANK

II SEMESTER

1917207–INDUSTRIAL STRUCTURES

M.E STRUCTURAL ENGINEERING

Regulation – 2019

Academic Year 2019 – 20

Prepared by

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DEPARTMENT OFCIVIL ENGINEERING

QUESTION BANK

SUBJECT : 1917207–INDUSTRIAL STRUCTURES

SEM / YEAR : II/ I

UNIT-I

PLANNING AND FUNCTIONAL REQUIREMENTS

Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration - Guidelines of Factories Act.

PART-A

Q.No	Questions	BT Level	Competence
1.	List the major components of an industrial building.	BT-3	Application
2.	List the types of fire hazards.	BT-1	Remember
3.	Define Ventilation.	BT-1	Remember
4.	Sketch a typical layout of a steel industry and mark its salient features.	BT-5	Evaluate
5.	Write down the precautions to be undertaken for controlling vibration.	BT-6	Create
6.	Criticize about "Resonance".	BT-4	Analyze
7.	Criticize how protection against noise can be done in industrial buildings?	BT-4	Analyze
8.	Describe classification of industrial structures.	BT-2	Understand
9.	State any four preventive measures against fire in industries.	BT-2	Understand
10.	List the factors that govern the site selection for an industrial building.	BT-1	Remember
11.	Define the terms Frequency & Amplitude.	BT-1	Remember
12.	Evaluate the significance of factories act.	BT-5	Evaluate
13.	How can be vibrations are measured?	BT-1	Remember
14.	Classify the different types of structural systems.	BT-2	Understand
15.	Discuss the minimum front open space is to be provided for factory building as per NBC.	BT-2	Understand
16.	How can noise originating from mechanical vibrations be controlled?	BT-4	Analyze
17.	State any two requirements for cement industry	BT-1	Remember

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18.	Illustrate the causes for fire in Industrial Buildings.	BT-3	Application
19.	Write the sources of noise in Industries.	BT-3	Application
20.	Write about factors influencing plant layout.	BT-6	Create
	PART-B		
1.	Examine in brief the planning, types and elements of an industrial building.	BT-4	Analyze
2.	Classify the industries based on the ownership and investment. Explain with suitable example.	BT-2	Understand
3.	Explain the classification of industries based on NSSO & NBC.	BT-4	Analyze
4.	Demonstrate the major guidelines of factories act which forms the base for the industrial structure.	BT-3	Application
5.	a) What are the classifications of industrial fire? b) Discuss about the various fire extinguishing agents and extinguishers in detail.	BT-1	Remember
6.	Describe the guidelines for industrial buildings from Factories Act.	BT-1	Remember
7.	Explain (i) Methods of providing Ventilation. (6) (ii) Protection against noise and Vibration in Industrial Buildings. (7)	BT-2	Understand
8.	Demonstrate briefly how the planning for layout requirement is done for an industrial building. Supplement your answer with sketches.	BT-3	Application
9.	Explain in detail about the objective, importance and principles of Plant layout	BT-1	Remember
10.	State the various methods of providing lighting for industrial buildings.	BT-1	Remember
11.	(i) Plan and write the safety measures to be used to minimize noise and vibration in industries? (6) (ii)Discuss about the firefighting equipment types and its uses. (7)	BT-5	Evaluate
12.	(i) Draw a typical layout plan for a steel manufacturing industry. (6) (ii) Also explain how ventilation can be planned in an industrial building? (7)	BT-3	Application
13.	Draw and explain the layout of the Garment factory layout	BT-6	Create
14.	Discuss in detail about the heat or ignition sources	BT-2	Understand
	PART-C		
1.	List about the technical criteria for the design and basic principles for planning a good layout in a project.	BT-1	Remember
2.	Plan a layout for a cement industry which should satisfy all the requirements.	BT-3	Application
3.	Explain about the classification of lightning? What are the points to be considered for providing natural lighting and ventilation?	BT-2	Understand

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4.	Explain in detail about the different types of layout.	BT-6	Create
	UNIT-II **INDUSTRIAL BUILDINGS** Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs – Design of Staircase.		
1.	State about gantry girder.	BT-1	Remember
2.	Write the minimum rise and tread in residential buildings.	BT-6	Create
3.	Write about crane girders.	BT-6	Create
4.	Explain the loads to be considered for the design of gantry girder.	BT-4	Analyze
5.	Describe corbel and its advantages.	BT-2	Understand
6.	Evaluate the formula for checking the bending stress in corbel.	BT-5	Evaluate
7.	Evaluate why impact factor is considered in the computation of loads acting on gantry girder?	BT-5	Evaluate
8.	Summarize the major components of an industrial building.	BT-2	Understand
9.	List the various effects of cranes to be considered under imposed loads in the design of gantry girder.	BT-1	Remember
10.	Which section is recommended for gantry girder? Why?	BT-1	Remember
11.	How will you calculate the load effects on a stairs waist slab spanning in the longitudinal direction?	BT-3	Application
12.	Draw a neat sketch by marking the structural components of staircase.	BT-3	Application
13.	Define (i) Tread (ii) Rise (iii) Going	BT-1	Remember
14.	Classify the types of staircases.	BT-2	Understand
15.	State the functions of corbels.	BT-1	Remember
16.	Differentiate corbel and nibs S	BT-2	Understand
17.	Draw the stress - strain diagram of corbel for the evaluation of internal force.	BT-4	Analyze
18.	Sketch and point out the reinforcement detailing of a corbel.	BT-4	Analyze
19.	Sketch the reinforcements in nibs with large loads.	BT-3	Application
20.	Define drag force.	BT-1	Remember
	PART-B		
1.	What is a gantry girder? Explain its components and loading considerations in detail.	BT-1	Remember
2.	Find the suitable design for a gantry girder to be used in an industrial building carrying an EOT crane for the following data:		

	Crane capacity = 200 kN. Total self weight of all components = 240 kN. Minimum approach at the carne hook of gantry girder = 1.2m Wheel base = 3.5m C/C distance between gantry rails = 16m C/C distance between columns = 8m Self weight of rail section = 300 N/m Yield stress = 250 N/mm^2 Design the main gantry section. Connection design not required.	BT-6	Create
3.	An industrial building is to be provided with a hand operated 50 kN crane facility. The details of the building and the gantry girders are: Longitudinal spacing of columns = 6m, Centre to Centre distance of gantry girders= 12m, Wheel spacing = 3m, Edge distance = 1m, Weight of crane girder = 40 kN, Weight of trolley car = 10 kN. Solve the gantry girder for bending and shear.	BT-3	Application
4.	Arrive at a proper sectional design of a simply supported gantry girder (main section) to carry one electric overhead travelling crane, Given that Span of GG = 6.5m Span of crane crane girder = 16m Crane capacity = 250kN Self weight of crane girder excluding trolley = 200kN Self weight of trolley = 50kN Minimum hook approach = 1m Distance between crab wheels = 3.5m Self weight of rails = 0.3kN/m	BT-2	Understand
5.	A Longitudinal type of a staircase spans a distance of 3.75 m c/c of beams. The flight consists of 15 steps. Take rise = 175 mm, tread is 250 mm. Assuming grade25 concrete and Fe 415 steel, examine the staircase for a live load of 5 kN/m^2. Assuming the breadth of the staircase as 1.4m (i)Design the staircase (10) (ii)Sketch the reinforcement details (3)	BT-1	Remember
6.	An intermediate flight of a staircase is supported only at the edges of landing (support-Perpendicular to the direction of the flight). Height between landings is 1.5m. The Flight has steps consisting of 10 risers (each rise=150mm) and a treads (each tread=250mm). The steps are supported on a waist slab. Landing is 1 m width. Support width is 300 mm each. Examine the waist slab and landing for bending moment alone. Use M20 concrete and Fe 415 steel. Live load on stair is 3.0kN/m^2. Width of flight = 1.5 m. (i) Design the staircase (10) (ii) Sketch the reinforcement details (3)	BT-4	Analyze
7.	Mention the components and explain different types of stair case in detail with neat sketch	BT-1	Remember
8.	Explain about Corbel and under what circumstances would you use them? Sketch the reinforcement details.	BT-2	Understand

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9.	Estimate a corbel to support a factored load of 400 kN at a distance of 200mm from the face of the column. The dimension of the column is 300mm x 400mm. Use M25 and Fe 415 steel.	BT-5	Evaluate
10.	Reproduce the design of a RCC corbel to carry a factored load of 500 kN at a distance 200 mm from the face of a 300 x 300 RCC Column. Use M35 concrete and Fe 415 steel.	BT-1	Remember
11.	Design a continuous nib (beam support) projecting from an RCC wall to support a prefabricated slab unit transmitting a service shear froce of 15kN/m, given that the following data Projection of nib = 200mm A_v = 100mm M30 and Fe415 grade of materials.	BT-4	Analyse
12.	Develop a corbel design for a 350mm square column to support an ultimate vertical load of 600kN with its line of action 200mm from the face of the column. Use M20 grade concrete and Fe 415 grade steel.	BT-3	Application
13.	In what way corbel differ from nib. Justify your answer.	BT-1	Remember
14.	Explain about Nib and under what circumstances would you use them? Sketch the reinforcement details in Nibs with a) Light loads(6) b) Large loads.(7)	BT-2	Understand
	PART-C		
1.	Reproduce the design of a gantry girder for a manufacturing industry for the following data: Crane capacity=250kN Weight of crane (excluding crab) = 200 kN Weight of crab girder= 50kN Mini. Hook approach=1.2m Wheel base distance= 3.5m C/C Spacing of Columns= 8m C/C Spacing of gantry rail= 16 m Self-weight of rail section= 300 N/m Depth of rail section=75mm Take fy = 250 N/mm^2, E = 2 x 10^{5}N/mm^2	BT-1	Remember
2.	Discuss the design procedure of a gantry girder as per codal provisions.	BT-2	Understand
3.	A flight of a dog-legged staircase has the following details: Going =2.25 m Landing width = 1.25 m Raise of a flight = 1.5 m Support width = 300 mm Choosing appropriate dimensions for rise and tread, and taking the flight to span longitudinally between the supports, design the flight. Assume live load as 3 kN/m^2. (i) Design the staircase with data's provided (10)	BT-5	Evaluate

	(ii) Sketch the reinforcement details (3)		
4.	Write down the design procedure for CORBEL & NIBS.	BT-4	Analyse
UNIT-III **POWER PLANT STRUCTURES** Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting structures			
PART-A			
1.	Explain about the nuclear containment structures?	BT-2	Understand
2.	Evaluate the theories that are adopted for the design of silos.	BT-5	Evaluate
3.	State reasons for the use of elevated steel storage tanks.	BT-1	Remember
4.	Write the Cooling Tower Design Consideration in practice.	BT-1	Remember
5.	Write the various loads considered in pipe supporting structures.	BT-6	Create
6.	List the types of cooling towers.	BT-1	Remember
7.	Choose the minimum grade of concrete and steel to be used for nuclear containment structures?	BT-3	Application
8.	Memorize and state the points to be considered while constructing nuclear containment structures?	BT-1	Remember
9.	Distinguish between bunker and silo.	BT-2	Understand
10.	Sketch a typical cooling tower model and name the components.	BT-2	Understand
11.	Evaluate the precautionary measures to be considered while constructing nuclear containment structures?	BT-5	Evaluate
12.	Differentiate between free vibration and forced vibration.	BT-4	Analyse
13.	List the different types of power plants	BT-1	Remember
14.	List few power companies in India	BT-1	Remember
15.	Examine the structural elements of bunker with neat sketch.	BT-4	Analyse
16.	Illustrate the theories used for calculation vertical weight carried by the wall due to compression in silos.	BT-3	Application
17.	Explain about the stresses that the RCC chimney is subjected.	BT-4	Analyse
18.	Write the steps involved in design of rectangular bunkers.	BT-6	Create
19.	Identify the assumptions made in the design of silos by Janssen's theory.	BT-2	Understand
20.	Draw a neat sketch of a bin and list its components.	BT-3	Application

PART-B			
1.	Draw the typical layout of nuclear power plant structures.	BT-3	Application
2.	Explain the design procedure of cooling tower.	BT-2	Understand
3.	Explain the various factors increasing the bin loads.	BT-2	Understand
4.	Show the design procedure of silos in detail.	BT-4	Analyse
5.	In what way, bunker differs from a silo? Explain in detail.	BT-1	Remember
6.	Show the design procedure of bunkers in detail.	BT-3	Application
7.	Describe the factors to be borne in mind while designing nuclear containment structures.	BT-1	Remember
8.	Describe about cooling towers and its types.	BT-3	Application
9.	Write about power plant structures and its types in detail.	BT-6	Create
10.	Describe about the construction methodologies and related aspects of power plant structures.	BT-1	Remember
11.	Design a circular cylindrical bunker to store 20 t of coal. Density of coal is 9 kN/m^3. Angle of repose is 30˚. Adopt M 20 grade of concrete and Fe 415 steel. & Sketch the details of reinforcements.	BT-5	Evaluate
12.	What do you mean by cross flow & counter flow in cooling towers?	BT-1	Remember
13.	Analyze the concept of AIRY'S Theory for the design of bunkers and silos	BT-4	Analyse
14.	Discuss about JANSSEN'S Theory for the design of bunkers and silos	BT-2	Understand
PART-C			
1.	A rectangular cylindrical bunker is to be designed to store 300 kN of coal having a unit weight of 8 kN/m^3. The stored coal is to be surcharged at an angle of repose which is 25˚ for coal. Design the side walls and hopper bottom. Sketch the details of reinforcements. Adopt M 20 grade of concrete and Fe 415 steel.	BT-3	Application
2.	Explain about Containment structures & its construction methodology.	BT-2	Understand
3.	Design a circular steel silo of 12m height and 4m internal diameter to store a cement of bulk density 15.50kN/m^3 with an angle of internal friction 25^o. the dimensions of the silo is 4m diameter, cylindrical portion height is 12m and hopper bottom height is 3m with the diameter of hopper at the bottom as 0.6m , 8mm thick plate with stiffeners ISA 65x65x6mm	BT-5	Evaluate
4.	Briefly discuss the use and function of pipe supporting structure in power plant with salient features.	BT-2	Understand

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UNIT-4

TRANSMISSION LINE STRUCTURES AND CHIMNEYS

Analysis and design of steel monopoles, transmission line towers – free standing and guyed towers – Design of self-supporting and guyed chimney, Design of Chimney bases.

1.	List the components of power cables.	BT-1	Remember
2.	Classify the types of chimneys.	BT-2	Understand
3.	Draw a neat sketch of a single diagonal braced tower.	BT-3	Application
4.	Justify why is lining provided for chimneys?	BT-6	Create
5.	Discuss the factors for the stress developed in Chimney.	BT-2	Understand
6.	Define sag in towers.	BT-1	Remember
7.	Evaluate the factor of safety adopted for the design of structural members of steel transmission line towers?	BT-5	Evaluate
8.	Write the types of structures which support the electric power transmission lines.	BT-6	Create
9.	Define the term: wind span and Weight span	BT-1	Remember
10.	List the types of towers recommended as per the codal provisions.	BT-2	Understand
11.	Describe what do you understand by broken wire condition?	BT-1	Remember
12.	Criticize the transmission line towers?	BT-4	Analyse
13.	Write short notes on guyed chimneys.	BT-3	Application
14.	Write the different types of power cables?	BT-3	Application
15.	Explain about the requirements of substation structures	BT-4	Analyse
16.	List the points to be considered while selecting a site for substation	BT-1	Remember
17.	Examine the advantages of fire brick lining in RC Chimneys.	BT-4	Analyse
18.	Estimate the wind forces on 60m high tower with a basic wind speed of 45m/sec.	BT-2	Understand
19.	List the materials used for constructing substation structures.	BT-1	Remember
20.	Mention the components of self-supporting chimney with neat sketch.	BT-5	Evaluate
	PART-B		
1.	Illustrate with sketches describe the various lattice tower configurations with bracing systems.	BT-2	Understand
2.	Enlist and explain in detail about the Main Components of Transmission	BT-2	Understand

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	Tower.		
3.	Discuss about the design data guidelines for transmission line towers.	BT-4	Analyse
4.	Explain the following a) Self-supporting tower b) Guyed towers c) Monopole	BT-3	Application
5.	Show and explain the forces acting on steel chimney	BT-3	Application
6.	Explain about loading and load combinations in transmission line towers?	BT-6	Create
7.	Summarize the different bracing systems adopted in transmission line tower.	BT-5	Evaluate
8.	List and explain the step by step design procedure of Chimney.	BT-1	Remember
9.	Reproduce the design of a self-supporting steel chimney for a height of 40 m above foundation with diameter of cylindrical portion 2 m. Assume thickness of lining as 100 mm and wind pressure as 1.5 kN/m^2.	BT-1	Remember
10.	A self-supporting steel chimney is 80 m high and 3 m diameter at top. Identify the thickness of plate required at 30 m and 60 m from top. Assume wind pressure as 1.5 kN/m^2	BT-1	Remember
11.	Distinguish in what way design of self-supporting chimney and guyed chimney differ?	BT-2	Understand
12.	Analyze and design a transmission line tower with sag-tension calculation with a example.	BT-4	Analyse
13.	Describe the behavior of RC and Steel chimney.	BT-1	Remember
14.	Discuss about power cables & control cable in transmission line towers.	BT-3	Application
	PART-C		
1.	Generalize the concept of substation structures in detail.	BT-6	Create
2.	A concrete chimney of height 80m with external diameter of shaft being 4m at top and 5m at bottom is required in a place where wind intensity is 1.5kN/m^2. Thickness of fire lining is 10 cm. temperature differences between inside and outside of the shaft is 75^0C. Permissible bearing pressure on soil at site is 150kN/m^2. Adopt M25 and Fe415 and design the base of the chimney.	BT-5	Evaluate
3.	Explain the following a) Along & Across wind loads on SS chimney b) Dynamic component of wind gusts & vortex shedding	BT-4	Analyse
4.	Explain the various methods adopted for testing of towers.	BT-4	Analyse
	UNIT-5		

FOUNDATION

Design of foundation for Towers, Chimneys and Cooling Towers - Machine Foundation - Construction techniques for foundation of rotary machines.

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1.	State the general requirements of machine foundations?	BT-1	Remember
2.	Illustrate the points to be considered in the design of foundation for towers?	BT-3	Application
3.	Evaluate the various parameters influencing the design of a machine foundation.	BT-5	Evaluate
4.	Describe about turbo-generator foundation.	BT-1	Remember
5.	Categorize the types of loads to be considered for tower foundation	BT-4	Analyse
6.	List and name the methods used for dynamic investigation of soil at the site.	BT-1	Remember
7.	How the safety of tower foundation is checked against uplift?	BT-3	Application
8.	List the types of machine foundation.	BT-1	Remember
9.	Discuss the IS codes to be followed for the satisfactory performance of a cooling tower foundation?	BT-4	Analyse
10.	Discuss about foundation used for self-supporting steel chimney?	BT-2	Understand
11.	Enlist critical parameters of transmission line towers.	BT-5	Evaluate
12.	Discuss the factors to be checked on tower foundation?	BT-2	Understand
13.	Write the formula used for checking the uplift capacity of tower foundation.	BT-2	Understand
14.	Which types of foundation is well suited for turbo generator machines.	BT-1	Remember
15.	Indicate the general design criteria for the satisfactory performance of a tower foundation.	BT-2	Understand
16.	Define solidity ratio.	BT-1	Remember
17.	Explain the method of selecting a proper type of foundation for transmission.	BT-4	Analyse
18.	Write the types of tower foundation?	BT-6	Create
19.	Demonstrate the stability analysis for tower foundation.	BT-6	Create
20.	Write about Pad Foundation.	BT-3	Application

PART-B

1.	Discuss the design criteria involved while designing foundation for reciprocating machine foundation.	BT-2	Understand
2.	Explain in detail different types of machine foundation.	BT-4	Analyse
3.	Enumerate the step by step design criteria for turbo generator foundation.	BT-6	Create
4.	Recall the method of selecting a proper type of foundation?	BT-1	Remember
5.	Describe the important codal stipulations for R.C.C Tower foundations?	BT-2	Understand
6.	Design the foundation for a lathe. Which has the following characteristics. Weight of machine = 150 kN Base area = 1.2mx5.0m, Height of CG of machine = 0.9m The machine supported by 3 pairs of bolts @ 2.5mc/c Allowable amplitude = 0.1mm Use M20 grade concrete and Fe415 steel Speed of the machine =1200rpm Mass moment of Inertia I_{mm} = 7500 kg/m^3 Vertical Excitation Force F_z =50 kN Allowable Bearing Stress = 110kN/m^2	BT-3	Application
7.	Employ how stability against overturning, uplift and lateral thrust is checked in tower foundation design.	BT-1	Remember
8.	Write down the design procedures adopted for the foundation of chimneys.	BT-3	Application
9.	Explain design principles adopted for foundation of cooling towers.	BT-5	Evaluate
10.	Write in detail about the Masts and Trestles.	BT-1	Remember
11.	Outline the general philosophy in the design of Concrete Pad & chimney foundation.	BT-2	Understand
12.	Give the necessary Basic Concept and forces action on Transmission Tower Foundation.	BT-4	Analyse
13.	Examine the vibration effects to be considered in design of machine foundation.	BT-1	Remember
14.	Record the bulb of pressure concept proposed by "Balakrishna Rao" for the design of Machine foundations.	BT-3	Application
PART-C			
1.	Take a heavy industrial building having larger number of vibrating machines. Discuss the type of foundation to be adopted for the machines. Illustrate with example.	BT-3	Application
2.	Sketch and discuss in detail the various types of foundations used for towers.	BT-3	Application

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<table>
<tr>
<td>3.</td>
<td>Design a suitable foundation for a 20^o angle tower to be used in a double circuit 132 kV transmission line. The foundation is located in medium dense sand with $\phi = 30^o$ and 17kN/m3. Depth of groundwater table is 5.0 m below the ground level. Use overload factors of 2 and 1.5 for normal and broken wire conditions respectively. The foundation is subjected to the following loadings.
<table>
<tr><th>Nature of load</th><th colspan="2">Load in kN under Conditions</th></tr>
<tr><td></td><td>N.C</td><td>B.W.C</td></tr>
<tr><td>Downward</td><td>400</td><td>450</td></tr>
<tr><td>Uplift</td><td>300</td><td>380</td></tr>
<tr><td>Shear in transverse direction</td><td>3.3</td><td>25</td></tr>
<tr><td>Shear in longitudinal direction</td><td>-</td><td>16</td></tr>
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</td>
<td>BT-1</td>
<td>Remember</td>
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<tr>
<td>4.</td>
<td>Describe the steps in the design of tower foundations and its salient features.</td>
<td>BT-4</td>
<td>Analyse</td>
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