MIZORAM PUBLIC SERVICE COMMISSION

DEPARTMENTAL EXAMINATIONS FOR JUNIOR GRADE OF M.E.S. (AE/SDO)
UNDER PUBLIC WORKS DEPARTMENT,
GOVERNMENT OF MIZORAM, JULY, 2022.

CIVIL ENGINEERING PAPER – I

Time Allowed : 3 hours   FM : 100   PM : 40

Marks for each question is indicated against it.
Attempt all questions.

PART – A (50 MARKS)

1. (a) (i) "The use of higher grade cement such as Grade-43 & Grade – 53 is absolutely unnecessary and in fact detrimental for most of the structures we built everyday". Justify the statement whether agreed or not. **(10)**

   (ii) Discuss Sedimentary rock, Metamorphic rock and Igneous rock in terms of their respective strength and durability. **(5)**

   OR

   (b) (i) Discuss the effects of Carbon content in cast irons and steel in their mechanical properties and uses. **(10)**

   (ii) Explain how seasoning of Timber is affected by relative humidity and temperature. **(5)**

2. (a) (i) Compare Masonry and Concrete as construction material of structures. What is Initial Rate of Absorption (IRA) of Brick and how does the IRA property of Bricks affect the water retentivity of mortars for Brick masonry? **(5+2+3=10)**

   (ii) Explain Orientation of a Building with reference to the Aspect and Prospect consideration. **(10)**

   OR

   (b) (i) What do you think would be the rational approach while considering repairing of an existing building? Explain Repair, Rehabilitation and retrofitting of a structures. **(4+6=10)**

   (ii) Draw a typical drawing (Dimensions not required) of Formwork for (i) Beam-Slab construction for monolithic casting and (ii) Circular shell roof. **(4+6=10)**

3. (a) (i) Define Shear stress. Explain single shear and double shear with example. **(2+3=5)**

   (ii) Explain deformation of ductile material with the help of stress – strain curve. **(5)**

   (iii) The relationship between the elastic constants, Elastic modulus ϵ, Modulus of rigidity (G), Bulk modulus (K) and Poisson's ration (μ) is given by, $3K = E(1-2\mu)$. Discuss what will happen if (1) $\mu > \frac{1}{2}$ and (ii) $\mu = \frac{1}{2}$. **(2.5+2.5=5)**

   OR

   (b) Discuss the failure of Brittle material such as cement concrete under compression. How the Geometry of the specimen (height/width ratio) affects the compressive strength of the specimen (cement concrete). Illustration may be given with suitable diagram. **(5+5+5=15)**

PART – B (50 MARKS)

4. (a) (i) What is the difference between degree of saturation and moisture content of soil sample ? Define Adsorbed water and how it can be removed ? **(5+1=6)**

   (ii) Discuss the bore pilling method of construction of stone columns for improvement of soil technique. **(4)**

   (iii) What are Compression piles and Tension piles ? **(3+2=5)**

   OR

   (b) (i) What is the minimum depth for all foundations as stipulated by IS:1904-1986? What are the principal factors to be considered while deciding the depth of foundations? **(1+5=6)**

   (ii) The Terzaghi's equation for bearing capacity of soil is given by :-

   $$q_{ult} = CN_cS_c + qN_qS_q + \frac{1}{2} \gamma B N_\gamma S_\gamma$$

   Where,
   q_{ult} = Ultimate bearing capacity
   C = Cohesion of soil
   q = Effective surcharge equals to γD_f in absence of surcharge
   D_f = Depth of footing
   γ = Unit weight of sub-soil
   B = Width (Diameter) of footing
   N_c, N_q, N_γ = bearing capacity factors due to cohesion, surcharge and weight of sub-soil
   S_c, S_q, S_γ = Shape factors

   What are the influence of Ground water table in the above equation. **(4)**

   (iii) Explain why an un-drained tri-axial test (Quick test) is used as standard test for temporary excavation and bearing capacity of foundations. **(5)**

5. (a) (i) What are the loads needed to be considered in in the design of Roof Trusses ? **(4)**

   (ii) What is erection load and how it is to be taken care of in steel structures as per IS:800-2007? **(2+2=4)**

   OR

   (b) (i) What are the advantages of welded joints in steel structures? **(4)**

   (ii) What are the load combinations for design purposes of steel structures and how the wind load and earthquake load are assumed to be considered as per IS:800-2007? **(3+1=4)**

6. (a) (i) When the RCC Structure is said to have reached its limit state ? **(3)**

   (ii) Define Characteristic load and Characteristic strength of RCC structures. **(1.5+1.5=3)**

   (iii) How is the limit state of durability of an RCC structure is ensured with respect to its exposure? **(6)**

   OR

   (b) (i) Describe the mechanism of flexural crack formation in an RCC Beam. **(3)**

   (ii) What are the factors affecting crack width in RCC Beam ? **(3)**

(iii) An RCC beam of size 300mm X 600 mm having span of 5.00 m is to be constructed in a seismic zone-V location. Grade of concrete is M25 and that of steel is Fe415. As per relevant clauses of IS : 13920 – 2016, (i) check the adequacy of member size (ii) calculate the minimum and maximum re-inforcement (other necessary data, if required may be suitably assumed). **(2+4=6)**

7. Write short note on *any three* (3) of the followings. **(3×5=15)**

   (a) The Environmental and Economic impact of Rain water harvesting in Buildings.

   (b) Different type of plumbing system in Building drainage.

   (c) Comparison and Contrast on cost estimate and valuation of the property.

   (d) Importance of correct measurement of items of work in Civil Engineering projects.

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