**STEEL COMPULSORY EXAM**

**2021.**

1. Classification of cross-sections. The stability problem handled by the classification. The technique of the classification.
2. Cross-sectional resistances in case of simple loading. (Elastic and plastic calculation.) The calculation of the geometric datas of welded I sections.
3. Defining the cross-sectional resistance in case of combined loading (N+V+M). Elastic calculation method.
4. Defining the cross-sectional resistance in case of combined loading (N+V+M). Plastic calculation method.
5. Stability failure modes of structural elements. Buckling resistance of steel structural elements. Defining of the imperfection factor. Methods for defining the buckling length factor. Relation of the relative slenderness and the buckling reducing factor.
6. Stability failure modes of structural elements. Lateral torsional buckling of steel structural elements. General and simplified method. Limits of the simplified method. The effect of the position of the loading. The effect of the shape of the moment diagram. Methods for defining the critical moment value.
7. Examining the stability failure mode of a structural element under complex loading (N+M). General criteria. Way of defining the interactional factors and equivalent uniform moment factors.
8. Frames made of I sections. Typical cross-sections along the frame. Usage of wedged beams. Static model of frames. Defining the structural elements in FEM programs. Defining the parameters in the program. Analysis of the results.
9. Basics of bolted connections. Types of bolted connections. Geometric restrictions on the bolt positions. Design of centric and eccentric bolted connections under shear. Defining the resistance of „Class A” bolt.
10. Basics of welded connections. Types of welded connections. Defining throat thickness in case of fillet and butt welds. Calculating the stress components in the weld. Design of centric welded connections with the use of the general and the simplified method.
11. Design of end-plated and base-plate connections. Modeling of the behavior of the connection. Component method. Moment-rotation relation. Failure modes of an end-plated connection.
12. Defining the resistance of class „D” bolt. Defining the effective length of the “T” element. Defining the resistance of the “T” element with the „prying force” taken into account.
13. Typical connections of frames made of I sections. Defining the stiffness of the connections. The method and the effect of defining the calculated stiffnesses in the FEM model.
14. Global imperfections of a typical hall building. Analyze the effects of the imperfections. What are the differences between the linear and nonlinear calculation.
15. Bracing system solutions of a typical hall building. Effects on the bracing system. Types and calculation of the connections of the bracing system.
16. Editing rules on trusses. Types of bracing. Trusses as a part of a frame. Modelling and stability questions.
17. Internal forces in the elements of the truss. Defining the resistances. Extra moments because of the excentric brace rod connection. On site connections in trusses made of more manufacturing units. Calculation of these connections.
18. Welded connections between RHS chord and RHS brace rods. Failure modes, editing rules. Calculation of the connections. Reinforcement possibilities.
19. Fire check of steel structures. ISO fire curve. The change of the effects and resistances during the fire. Special conditions by the classification, cross-sectional resistance calculation and by the stability checks. Calculation of the joint resistances. Fire protection of steel structures.
20. The check of the class 4 cross-sections for combined loading. Method of defining the effective cross-section. The specialities of the cross-sectional resistances and stability checks.
21. Defining the stress diagram of a composite beam in elastic state. Defining the plastic moment resistance of the same beam element. (There are some students who haven’t learned about the composite structures, they will get a new question.)