STEEL AND TIMBER DESIGN SOLVED PROBLEMS

Steel and Timber Design Solved Problems

Question 1: Design a simply supported steel beam to carry a uniformly distributed load of 5 kN/m over a span of 6m. The beam is made of Grade 300 steel.

Answer:

- Select a wide flange section from the American Institute of Steel Construction (AISC) database with a moment capacity greater than the applied moment.
- Assume a W12x26 section.
- Calculate the allowable moment capacity: M = ?Mp = 0.9(129 kN-m) = 116.1 kN-m
- Check the actual moment: Ma = (5 kN/m)(6 m)^2/8 = 135 kN-m
- Ma > M, so the section is not adequate.
- Select a W14x26 section: M = 172.8 kN-m > Ma, therefore the section is adequate.

Question 2: Design a timber column to carry an axial load of 150 kN. The column is made of Douglas Fir-Larch and has a length of 3m.

Answer:

- Determine the effective length factor: K = 1.0 for pinned-pinned columns.
- Calculate the effective length: Le = K*L = 3m

- From tables, find the allowable compressive stress for Douglas Fir-Larch: F'c = 11.5 MPa
- Calculate the required column area: A = P/F'c = 150 kN/11.5 MPa = 13.04 cm^2
- Select a 150x150mm square column: A = 150mm * 150mm = 225 cm^2 > A, therefore the column is adequate.

Question 3: Design a composite steel-concrete beam to carry a uniformly distributed load of 10 kN/m over a span of 8m. The beam consists of a W18x35 steel section with a 100mm thick concrete slab.

Answer:

- Calculate the transformed section properties:
    - Concrete slab: A_c = 100mm * 1000mm = 10,000 mm^2
    - Steel beam: A_s = 2160 mm^2
    - Transformed area: A_t = A_c + n*A_s = 10,000 mm^2 + 10*2160 mm^2 = 33,760 mm^2
    - Moment of inertia: I_t = 7,820 * 10^6 mm^4
- Calculate the allowable moment capacity: M = ?Mp = 0.9(808 kN-m) = 727.2 kN-m
- Check the actual moment: Ma = (10 kN/m)(8 m)^2/8 = 800 kN-m
- Ma < M, therefore the section is adequate.

Question 4: Design a steel-reinforced concrete slab to carry a point load of 100 kN. The slab is made of concrete with a compressive strength of 25 MPa and steel reinforcement with a yield strength of 500 MPa.

Answer:

- Calculate the required moment capacity: M = P*L/4 = 100 kN* 2 m / 4 = 50 kN-m
- Assume a slab thickness of 150mm.

- Design the reinforcement:
    - Calculate the required steel area: A_s = M/(f_y*d) = 50 kN-m / (500 MPa 100mm) = 100 mm^2
    - Use 10mm diameter bars spaced at 150mm centers: A_s = 78.54 mm^2 > 100 mm^2, therefore the reinforcement is adequate.

Question 5: Design a steel truss to carry a point load of 50 kN at the center of a 6m span. The truss is made of Grade 50 steel.

Answer:

- Assume a Warren truss configuration.
- Calculate the forces in the truss members:
    - Top chord: T = 25 kN
    - Bottom chord: B = 50 kN
    - Diagonal members: D = 25 kN
- Select appropriate steel sections for each member:
    - Top chord: L2x2x1/4
    - Bottom chord: L2x2x1/4
    - Diagonal members: L1x1x1/8
- Check the adequacy of the sections:
    - Top chord: M = T*L/4 = 25 kN* 3 m / 4 = 18.75 kN-m
    - Bottom chord: M = B*L/4 = 50 kN* 3 m / 4 = 37.5 kN-m
    - Diagonal members: M = D*L/2 = 25 kN* 3 m / 2 = 37.5 kN-m
    - All sections are adequate for the applied moments.

Test Project 3: Third Edition, Unit 4 (HS Kang)

Paragraph 1: Question

What are the main topics covered in Unit 4 of the Test Project 3: Third Edition?

Answer

Unit 4 focuses on the following topics:

- The Role of Evidence in Social Science Research
- Survey Research: Concept and Types
- Questionnaire Design and Development

Paragraph 2: Question

Describe the three main types of surveys discussed in Unit 4.

Answer

The three main types of surveys are:

- **Cross-sectional surveys:** Measure variables at a single point in time.
- **Longitudinal surveys:** Measure variables over time, allowing for the study of change.
- **Panel surveys:** Involve repeated surveys of the same sample over time.

Paragraph 3: Question

What are some of the key considerations in designing a questionnaire?

Answer

Key considerations include:

- **Validity:** Ensuring that the questionnaire measures what it intends to measure.
- **Reliability:** Ensuring that the questionnaire yields consistent results over time and across different researchers.
- **Clarity:** Using language that is easy to understand and avoid ambiguity.
- **Bias:** Avoiding questions that may lead to biased responses.

Paragraph 4: Question

Discuss the strengths and weaknesses of survey research.

Answer

Strengths:

- Large sample sizes provide generalizable results.
- Data can be collected from a diverse population.
- Ability to measure both objective and subjective variables.

Weaknesses:

- Potential for sampling bias.
- Social desirability bias (respondents may give answers that are socially acceptable rather than accurate).
- Lack of depth and context compared to other research methods.

Paragraph 5: Question

How can the limitations of survey research be addressed?

Answer

Potential solutions to address the limitations of survey research include:

- Careful sample selection to minimize bias.
- Use of randomized controlled trials to reduce social desirability bias.
- Triangulation with other research methods, such as interviews or observations, to provide a more comprehensive understanding.

The Nikon Creative Lighting System (CLS)

What is the Nikon Creative Lighting System?

The Nikon Creative Lighting System is a system of flashes and accessories that work together to provide photographers with greater control over their lighting. The system includes a variety of flashes, from the entry-level SB-600 to the professional

SB-910, as well as a range of accessories, such as the R1C1 Commander.

How does the CLS work?

The CLS uses a series of wireless radio signals to communicate between the camera and the flashes. This allows photographers to control the flashes remotely, even when they are not in direct line of sight. The CLS also allows photographers to use multiple flashes simultaneously, which can create more complex and dramatic lighting effects.

What are the benefits of using the CLS?

There are many benefits to using the Nikon CLS, including:

- **Greater control over lighting:** The CLS gives photographers more control over the direction, intensity, and quality of their lighting. This can help to create more professional-looking results.
- **Wireless operation:** The CLS allows photographers to control their flashes remotely, which gives them more flexibility and freedom of movement.
- **Multiple flash capability:** The CLS allows photographers to use multiple flashes simultaneously, which can create more complex and dramatic lighting effects.

What are the different types of CLS flashes?

There are a variety of CLS flashes available, each with its own features and capabilities. The following is a brief overview of the most popular CLS flashes:

- **SB-600:** The SB-600 is an entry-level CLS flash that is ideal for beginners. It offers a variety of basic features, such as TTL metering and wireless operation.
- **SB-700:** The SB-700 is a mid-range CLS flash that offers more features than the SB-600. It includes a zoom head, a built-in bounce card, and a variety of advanced features.
- **SB-800:** The SB-800 is a professional-grade CLS flash that offers the most features and capabilities. It includes a high-power output, a weather-

resistant design, and a variety of advanced features.

- **SB-900:** The SB-900 is the current top-of-the-line CLS flash. It offers the same features as the SB-800, but with a more powerful output and a more advanced feature set.
- **R1C1:** The R1C1 is a CLS Commander that allows photographers to control CLS flashes remotely. It can be used to trigger flashes, adjust their power output, and change their mode of operation.

How do I choose the right CLS flash for me?

The best way to choose the right CLS flash for you is to consider your needs and budget. If you are a beginner, the SB-600 is a good option. It offers a variety of basic features at a reasonable price. If you need more features, the SB-700 is a good choice. It offers a zoom head, a built-in bounce card, and a variety of advanced features. If you need a professional-grade flash, the SB-800 or SB-900 is a good option. They offer high power output, weather-resistant design, and a variety of advanced features.

The Mode of Antibacterial Action of Essential Oils

Essential oils are natural compounds derived from plants that have been used for centuries for their medicinal properties. In recent years, there has been growing interest in the potential of essential oils as antibacterial agents.

How do essential oils work against bacteria?

Essential oils can inhibit the growth of bacteria in a number of ways. One way is by damaging the bacterial cell membrane. The lipids that make up the cell membrane are arranged in a bilayer, and essential oils can disrupt this bilayer, causing the cell to leak its contents and die.

Another way that essential oils can kill bacteria is by inhibiting the synthesis of proteins and DNA. Proteins are essential for the growth and reproduction of bacteria, and DNA is the genetic material that contains the instructions for making proteins. By inhibiting the synthesis of these molecules, essential oils can prevent bacteria from multiplying and spreading.

Are essential oils effective against all bacteria?

No, essential oils are not effective against all bacteria. Some bacteria are more susceptible to essential oils than others. For example, Gram-negative bacteria are generally more resistant to essential oils than Gram-positive bacteria.

What are some of the most effective essential oils for antibacterial activity?

Some of the most effective essential oils for antibacterial activity include:

- Tea tree oil
- Lavender oil
- Eucalyptus oil
- Oregano oil
- Cinnamon oil
- Clove oil

How can I use essential oils to fight bacteria?

Essential oils can be used in a number of ways to fight bacteria. Some common methods include:

- Adding essential oils to a diffuser or humidifier
- Applying essential oils to the skin, diluted in a carrier oil
- Taking essential oils internally, in capsule form or mixed with honey or olive oil
- Using essential oils in cleaning products

Conclusion

Essential oils are a powerful natural antibacterial agent that can be used to fight a variety of bacterial infections. By damaging the bacterial cell membrane and inhibiting the synthesis of proteins and DNA, essential oils can prevent bacteria from multiplying and spreading.

> *test project 3 third edition unit 4 hskang*, *the nikon creative lighting system using the sb 600 sb 700 sb 800 sb 900 sb 910 and r1c1 flashes*, *the mode of antibacterial action of essential oils*

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