



Course Specifications

| | |
|----------------------|----------------------------|
| Course Title: | Steel Design |
| Course Code: | CE 422 |
| Program: | B.Sc. in Civil Engineering |
| Department: | Civil Engineering |
| College: | Jubail University College |
| Institution: | Jubail University College |

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A. Course Identification

| | |
|---|---|
| 1. Credit hours: | 3 |
| 2. Course type | |
| a. | University <input type="checkbox"/> College <input type="checkbox"/> Department <input checked="" type="checkbox"/> Others <input type="checkbox"/> |
| b. | Required <input type="checkbox"/> Elective <input checked="" type="checkbox"/> |
| 3. Level/year at which this course is offered: | Level 6, Third Year (Elective) Level 7, Fourth Year (Elective) |
| 4. Pre-requisites for this course (if any): | CE 309 Structural Analysis I |
| 5. Co-requisites for this course (if any): | None |

6. Mode of Instruction (mark all that apply)

| No | Mode of Instruction | Contact Hours | Percentage |
|----|-----------------------|---------------|------------|
| 1 | Traditional classroom | ✓ | 100 |
| 2 | Blended | | |
| 3 | E-learning | | |
| 4 | Correspondence | | |
| 5 | Other | | |

7. Contact Hours (based on academic semester)

| No | Activity | Contact Hours |
|----------------------|-------------------|---------------|
| Contact Hours | | |
| 1 | Lecture | 30 |
| 2 | Laboratory/Studio | 45 |
| 3 | Tutorial | 0 |
| 4 | Others (specify) | 0 |
| | Total | 75 |

B. Course Objectives and Learning Outcomes

1. Course Description

CE 422 Steel Design (2-3-3)

Pre-requisite: CE 309

Properties of structural steel; steel sections and introduction to load resistance factor design (LFRD), design of tension members, compression members and capacity calculations; laced columns width-thickness ratios; design of beams with and without lateral supports; design of members under combined axial and bending loads; design and details of simple bolted and welded connections, and an introduction to common building connections; use of software for design of elements and overall design of frames.

2. Course Main Objective

The main purpose of this course is to prepare students for analysis and design of different steel members (tension, compression and flexural members, bolting, welding, and column/beam base connection) as per the standard code of practice.

3. Course Learning Outcomes

| CLOs | | Aligned PLOs |
|------|---|--------------|
| 1 | Knowledge and Understanding | |
| | N/A | |
| 2 | Skills | |
| 2.1 | Evaluate the capacity of steel members and connections | 1 |
| 2.2 | Design the steel members and connections for a certain load as per the code of practice | 2 |
| 2.3 | Communicate the details of structural design. | 3 |
| 2.4 | Function effectively on a team to achieve the goals of design project | 5 |
| 3 | Values | |
| | N/A | |

C. Course Content

| No | List of Topics | Contact Hours |
|----|--|---------------|
| 1 | <u>Unit 1. Introduction:</u> 1.1. Introduction: properties of structural steel; 1.2. Steel sections and introduction to load resistance factor design (LFRD); 1.3. Assigning different steel project to each student; 1.4. Comprehensive discussion about the preparation of the project. | 10 |
| 2 | <u>Unit 2. Tension members:</u> 2.1. Evaluation of net area; 2.2. Effect of staggered holes on net area; 2.3. Strength and design calculation of different steel sections. 2.4 Design of tension members; | 10 |
| 3 | <u>Unit 3. Bolted Connections:</u> 3.1. Different types of bolted connections; 3.2. Various possible failure modes; 3.3. Bearing; spacing and edge-distance requirements; 3.4. Analysis and Design of bolted connections; | 13 |
| 4 | <u>Unit 4. Beams:</u> 4.1. Elastic bending, 4.2. Elastic section modulus; 4.3. Plastic section modulus; 4.4. Lateral stability, compact beams, lateral bracing, and moment 4.5. Gradient factor and design of beams. 4.6. Analysis and design of beams. | 15 |
| 5 | <u>Unit 5. Compression members:</u> 5.1. Critical buckling load, Euler buckling formula, and effective slenderness ratio; 5.2. Column design requirements, local and total buckling; 5.3. Capacity calculations; LRF design of column; | 12 |

| | | |
|--------------|--|-----------|
| | 5.4. Effective length factor-real conditions; 5.5. Built-up column section. | |
| 6 | Unit 6. Welded Connections: 6.1. Basic welding process; 6.2. Types of welds and welded joints; 6.3. Effective area of groove weld, fillet weld and nominal strength of welds; 6.4. LRFD-welds; 6.5. Capacity of fillet welds, design of groove welds, design of fillet welds; 6.6. Balanced welded connection, Eccentric shear welded connection. | 10 |
| 7 | Unit 7. Beam-column base plate: 7.1. Beam-column base plate design; 7.2. Study of the following cases: 7.2.1. where no moment—no uplift; 7.2.2. small moment without uplift; 7.2.3. maximum moment without uplift; 7.2.4. moment with uplift and specification requirements | 5 |
| Total | | 75 |

D. Teaching and Assessment

1. Alignment of Course Learning Outcomes with Teaching Strategies and Assessment Methods

| Code | Course Learning Outcomes | Teaching Strategies | Assessment Methods |
|------|---|--|--|
| 1.0 | Knowledge and Understanding | | |
| | N/A | | |
| 2.0 | Skills | | |
| 2.1 | Evaluate the capacity of steel members and connections | Interactive learning Self-directed learning Collaborative learning | Assignments, Written Exams (Quiz, Midterm, Final), Project |
| 2.2 | Design the steel members and connections for a certain load | | |
| 2.3 | Communicate the details of structural design. | Independent Learning Collaborative learning | Project |
| 2.4 | Function effectively on a team to achieve the goals of design project | Collaborative learning | Project |
| 3.0 | Values | | |
| | N/A | | |

2. Assessment Tasks for Students

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|---|------------------|----------|--------------------------------------|
| 1 | Quiz 1 | 4 | 5% |
| 2 | Assignment 1 | 6 | 5% |
| 3 | Mid-term LT | 8 | 20% |
| 4 | Mid-term LB | 9 | 5% |
| 5 | Quiz 2 | 12 | 5% |
| 6 | Assignment 2 | 14 | 5% |
| 7 | Project | 15 | 5% |
| 8 | Performance Lab | 15 | 10% |
| 9 | Final Exam LB | 16 | 10% |

| # | Assessment task* | Week Due | Percentage of Total Assessment Score |
|----|------------------|----------|--------------------------------------|
| 10 | Final Exam LT | 17-19 | 30% |

*Assessment task (i.e., written test, oral test, oral presentation, group project, essay, etc.)

E. Student Academic Counseling and Support

Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice :

- Office hours 4 hr/week; students can go in times of office hours for teacher to explain what could not be understood from the lesson.
- Students can communicate with a staff member outside the official working hours by email.
- Students are also encouraged to visit their academic advisors.

F. Learning Resources and Facilities

1. Learning Resources

| | |
|---------------------------------------|---|
| Required Textbooks | Salmon C. G, Johnson J. E. and Malhas F. A. (2009), <i>Steel Structures- Design and Behavior</i> , USA: Pearson Prentice. |
| Essential References Materials | Segui, W. T. (2013), <i>Steel Design</i> , USA: Cengage Learning. McCormac, J. C. (2008), <i>Structural Steel Design</i> , USA: Person. |
| Electronic Materials | American Institute of Steel Construction: http://www.aisc.org/ Steel Construction and design: http://www.steelconstruction.info/Design |
| Other Learning Materials | STAAD Pro. <i>Software for Structural Analysis and Design</i> <i>The American Institute of Steel Construction (AISC) (2005), Steel Construction Manual</i> , USA: AISC. |

2. Facilities Required

| Item | Resources |
|--|--|
| Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.) | Lecture rooms with a capacity of at least 25 students and fitted with multimedia projector and a computer. |
| Technology Resources (AV, data show, Smart Board, software, etc.) | STAAD Pro <i>Software for Structural Analysis and Design</i> |
| Other Resources (Specify, e.g. if specific laboratory equipment is required, list requirements or attach a list) | None |

G. Course Quality Evaluation

| Evaluation Areas/Issues | Evaluators | Evaluation Methods |
|---|--|--|
| Effectiveness of teaching and assessment as per QMS-Policy-006 Feedback Survey, QMS-QAP-116 Monitoring Students' Satisfaction | Students | Indirect: Analyzing the results of the following surveys Course Evaluation Survey(CES), Program Evaluation Survey (PES), Student Experience Survey (SES) |
| Quality of Exam papers and Verifying Standards of Student Achievement as per QMS-Policy-004 Policy for Examinations and Marking, QMS-ACP-102 Procedure for Marking Examinations | Examination Committee | Direct: Peer review of examination papers and review or double check a minimum of three or 10% of answer papers. Verifying the entries in the Activity Mark Sheet. |
| Achievement of learning outcomes as per QMS-Policy-001 Course Review, QMS-CDP-106, QMS-CDP-112 Curriculum Review | Faculty | Direct: Course Report (Section B-3) |
| Implementation of the action plans based on previous semester as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course Review, QMS-CDP-112 Procedure for Curriculum Review | Faculty | Direct and Indirect: Course report (Section G-1, G-2) |
| Monitoring Teaching and Learning as per QMS-Policy-005 Monitoring of Teaching and Learning | Chairperson/Program Director/Course Director | Indirect: Feedback by Chairperson/Program director/Course director. Program Delivery Record. |
| Effectiveness of planned Teaching Strategies QMS-Policy-001 Course Review | Faculty | Indirect: Course Report (Section B-4) |
| Course effectiveness and planning for improvement as per QMS-Policy-001 Course Review, QMS-CDP-106 Procedure for Course Review, QMS- CDP-112 Procedure for Curriculum Review | Faculty | Direct and Indirect: Course report (Section G-3) |
| Verifying Standards of Student Achievement and Quality of Exam papers as per QMS-ACP-119 External Assessment Review | Assessment External Reviewer | Direct: Report of assessment external reviewer. Review of sample of ten or 10% of student's assessments and coursework scripts. |

Evaluation areas (e.g., Effectiveness of teaching and assessment, Extent of achievement of course learning outcomes, Quality of learning resources, etc.)

Evaluators (Students, Faculty, Program Leaders, Peer Reviewer, Others (specify))

Assessment Methods (Direct, Indirect)

H. Specification Approval Data

| | |
|----------------------------|--------------------------------------|
| Council / Committee | Civil Engineering Department Council |
| Reference No. | REG MIN-CED-10 |
| Date | 27-04-2020 |

Appendix A Revision Details

| Revision no. | DESCRIPTION | Reference MoMs | | | |
|--------------|---|----------------|---|-----|---|
| | | DC | | CDC | |
| | | Sem | # | Sem | # |
| 1 | Revision of Course Teaching Strategies and action verbs based on the comments of NCAAA reviewer | 392 | 4 | 392 | 4 |
| 2 | Course Specification Template 2018 | 402 | | | |