The University of Southern Queensland

Course specification

The current and official versions of the course specifications are available on the web at <http://www.usq.edu.au/coursespecification/current>.
Please consult the web for updates that may occur during the year.

Description: Structural Analysis

Subject	Cat-nbr	Class	Term	Mode	Units	Campus
CIV	3505	86311	1, 2009	EXT	1.00	Toowoomba

Academic group: FOENS
Academic org: FOES03
Student contribution band: 2
ASCED code: 030903

STAFFING

Examiner: Karu Karunasena
Moderator: Thiru Aravinthan

REQUISITES

Pre-requisite: MEC2402 or Students must be enrolled in one of the following Programs: GCEN or GDET or METC or MEPR

SYNOPSIS

This subject is intended to provide students with a clear and thorough understanding of how to idealize and analyse simple structures such as trusses, beams and frames. These days the analyses of most structures are carried out with the aid of computer programs based on the stiffness method or so-called matrix method of structural analysis. Stiffness method is a subset of the more general analysis method called the finite element method. Engineers cannot simply rely on the generated output from a computer program when designing a structure as there could be many sources of errors such as input data errors (due to misunderstanding of input parameters) and modelling errors. Classical methods of analysis provide means of checking computer generated outputs. Practice in applying classical methods of structural analysis will develop in students a deeper understanding of how basic principles of statics and mechanics of materials are used in the analysis. The course materials in this subject are presented starting with classical methods and then gradually leading up to the stiffness method and the more general finite element method. Modules 1 and 2 review the topics learnt in statics and stress analysis subjects. Module 3 deals with determination of deflections of statically determinate beams, trusses and frames using different classical methods. Module 4 introduces students to analysis of statically indeterminate structures by the force method. Slope deflection equations and moment distribution method, which fall under the general category of displacement method of analysis, are introduced in module 5. Modules 6 to 8 cover the stiffness method of analysis applicable to both statically determinate and indeterminate structures. Students will be introduced to structural analysis computer programs in these modules. Finally, module 9 will introduce students to finite element modelling of structures. Finite element modelling of plane stress, plane strain, plate bending and axisymmetric problems using Strand7 finite element software package will be covered in this module.

OBJECTIVES

The course objectives define the student learning outcomes for a course. The assessment item(s) that may be used to assess student achievement of an objective are shown in parenthesis. On completion of this course, students should be able to:

1. identify, formulate and solve structural engineering problems (Assignment 1 and 2, Exam);
2. analyse forces in statically determinate trusses, beams and frames (Assignment 1, Exam);
3. calculate deflections using classical methods (Assignment 1, Exam);
4. analyse forces in statically indeterminate structures by the force method (Assignment 1, Exam);
5. determine displacements and forces in statically determinate or indeterminate beams and frames using the displacement methods of analysis (Assignment 2, Exam);
6. solve a variety of truss, beam and frame problems using the stiffness method (Assignment 2, Exam);
7. use structural analysis software packages to solve truss, beam and frame problems (Assignment 2);
8. understand the fundamentals of the finite element method (Assignment 2, Exam);
9. model and analyse a given structure and check results (Assignment 1 and 2, Exam).

TOPICS

	Description	Weighting (%)
1.	Review of statics	5.00
2.	Review of statically determinate trusses, beams and frames	5.00
3.	Deflections using double integration, moment-area, conjugate beam and virtual work methods	15.00
4.	Analysis of statically indeterminate beams, frames and trusses by the force method	15.00
5.	Displacement method of analysis: Slope deflection equations and moment distribution method	15.00
6.	Truss analysis using the stiffness method - computer applications	10.00
7.	Beam analysis using the stiffness method - computer applications	10.00
8.	Frame analysis the stiffness method - computer applications	10.00
9.	Introduction to the finite element method	15.00

TEXT and MATERIALS required to be PURCHASED or ACCESSED

ALL textbooks and materials are available for purchase from USQ BOOKSHOP (unless otherwise stated). Orders may be placed via secure internet, free fax 1800642453, phone 07 46312742 (within Australia), or mail. Overseas students should fax +61 7 46311743, or phone +61 7 46312742. For costs, further details, and internet ordering, use the 'Textbook Search' facility at http://bookshop.usq.edu.au click 'Semester', then enter your 'Course Code' (no spaces).

A programmable pocket calculator capable of performing advanced matrix calculations. (This is NOT made available from USQ bookshop due to the choice available to student to acquire different

brands/varieties of new or used calculators from other sources. Students will need this calculator to perform computations related to assessment 2 and final exam questions from modules 6 to 9.)

Hibbeler, RC 2006, *Structural analysis*, 6th edn, Pearson-Prentice Hall, UK.

(in SI Units)

REFERENCE MATERIALS

Reference materials are materials that, if accessed by students, may improve their knowledge and understanding of the material in the course and enrich their learning experience.

Cook, RD, Malkus, DS & Plesha, ME [et al] 2002, *Concepts and applications of finite element analysis*, 4th edn, John Wiley & Sons, New York.

Ghali, A, Neville, AM & Brown, TG 2008, *Structural analysis: a unified classical and matrix approach*, 5th edn, Spon, London.

Hibbeler, RC 2004, *Mechanics of materials*, 6th edn, Pearson-Prentice Hall, Singapore.

(International edition)

Hutton, DV 2004, *Fundamentals of finite element analysis*, McGraw Hill, Boston.

Kassimali, A 2005, *Structural analysis*, 3rd edn, Nelson Thomson Learning, Singapore.

Logan, DL 2002, *A first course in the finite element method*, 3rd edn, Brooks/Cole, Pacific Grove, CA.

West, HH & Geschwindner, LF 2002, *Fundamentals of structural analysis*, 2nd edn, John Wiley & Sons, New York.

STUDENT WORKLOAD REQUIREMENTS

ACTIVITY	HOURS
Assessments	35.00
Directed Study	52.00
Examinations	2.00
Private Study	66.00

ASSESSMENT DETAILS

Description	Marks out of	Wtg (%)	Due date
ASSIGNMENT 1	200.00	20.00	20 Apr 2009 (see note 1)
ASSIGNMENT 2	200.00	20.00	27 May 2009
2 HOUR RESTRICTED EXAMINATION	600.00	60.00	END S1 (see note 2)

NOTES

1. Only assignments that are typed or neatly handwritten in ink will be marked.
2. Student Administration will advise students of the dates of their examinations during the semester.

IMPORTANT ASSESSMENT INFORMATION

1 Attendance requirements:
There are no attendance requirements for this course. However, it is the students' responsibility to study all material provided to them or required to be accessed by them to maximise their chance of meeting the objectives of the course and to be informed of course-related activities and administration.

2 Requirements for students to complete each assessment item satisfactorily:
To satisfactorily complete an assessment item a student must achieve at least 50% of the marks or a grade of at least C-. Students do not have to satisfactorily complete each assessment item to be awarded a passing grade in this course. Refer to Statement 4 below for the requirements to receive a passing grade in this course.

3 Penalties for late submission of required work:
If students submit assignments after the due date without extenuating circumstances then a penalty of 5% of the assigned mark may apply for each working day late up to a maximum of ten working days at which time a mark of zero can be recorded for that assignment.

4 Requirements for student to be awarded a passing grade in the course:
To be assured of receiving a passing grade in a course a student must obtain at least 50% of the total weighted marks for the course.

5 Method used to combine assessment results to attain final grade:
The final grades for students will be assigned on the basis of the weighted aggregate of the marks (or grades) obtained for each of the summative assessment items in the course.

6 Examination information:
In a Restricted Examination, candidates are allowed access to specific materials during the examination. The only materials that candidates may use in this restricted examination for this course are: writing materials (non-electronic and free from material which could give the student an unfair advantage in the examination); a hand-held, battery-operated, programmable calculator with matrix algebra capabilities (students must indicate on their examination paper the make and model of any calculator(s) they use during the examination). A formula sheet will be supplied with the exam paper.

7 Examination period when Deferred/Supplementary examinations will be held:
Any Deferred or Supplementary examinations for this course will be held during the examination period at the end of the semester of the next offering of this course.

8 University Regulations:
Students should read USQ Regulations 5.1 Definitions, 5.6. Assessment, and 5.10 Academic Misconduct for further information and to avoid actions which might contravene University Regulations. These regulations can be found at the URL http://www.usq.edu.au/corporateservices/calendar/part5.htm or in the current USQ Handbook.

ASSESSMENT NOTES

1 The due date for an assignment is the date by which a student must despatch the assignment to the USQ. The onus is on the student to provide proof of the despatch date, if requested by the Examiner.

2 Students must retain a copy of each item submitted for assessment. This must be produced within five days if required by the Examiner.

3 In accordance with University's Assignment Extension Policy (Regulation 5.6.1), the examiner of a course may grant an extension of the due date of an assignment in extenuating circumstances.

4 The Faculty will normally only accept assessments that have been written, typed or printed on paper-based media.

5 The Faculty will NOT accept submission of assignments by facsimile.

6 Students who do not have regular access to postal services or who are otherwise disadvantaged by these regulations may be given special consideration. They should contact the examiner of the course to negotiate such special arrangements.

7 In the event that a due date for an assignment falls on a local public holiday in their area, such as a Show holiday, the due date for the assignment will be the next day. Students are to note on the assignment cover the date of the public holiday for the Examiner's convenience.

8 Students who have undertaken all of the required assessments in a course but who have failed to meet some of the specified objectives of a course within the normally prescribed time may be awarded one of the temporary grades: IM (Incomplete - Make up), IS (Incomplete - Supplementary Examination) or ISM (Incomplete -Supplementary Examination and Make up). A temporary grade will only be awarded when, in the opinion of the examiner, a student will be able to achieve the remaining objectives of the course after a period of non directed personal study.

9 Students who, for medical, family/personal, or employment-related reasons, are unable to complete an assignment or to sit for an examination at the scheduled time may apply to defer an assessment in a course. Such a request must be accompanied by appropriate supporting documentation. One of the following temporary grades may be awarded IDS (Incomplete - Deferred Examination; IDM (Incomplete Deferred Make-up); IDB (Incomplete - Both Deferred Examination and Deferred Make-up).

OTHER REQUIREMENTS

1 Students will require access to e-mail and internet access to USQConnect for this course. A broadband internet connection with a speed of at least 256 kbps will be required to externally access Strand7 finite element software package used in modules 6 to 9 of this subject.
