

CAMOSUN COLLEGE School of Trades and Technology Department of Civil Engineering Technology

> ENGR 262 Analytical Methods Fall - 2019

# **COURSE OUTLINE**

Please note: This outline will not be kept indefinitely. It is recommended students keep this outline for their records, especially to assist in transfer credit to post-secondary institutions.

### **1** Instructor Information

Instructor	Ross Gibbs				
Office hours	Please see schedule posted outside office.				
Office	TEC 265				
Phone	Please use email	Alternative:			
E-mail	Gibbs@camosun.bc.ca				
Website	See course Google Group.				

### 2 Prerequisites and Co-requisites

٠

### 3 Hours and Credits

### **Course Activity**

- ☑ Lecture (Direct Instruction)
- Seminar (Direct Instruction)
- ☐ Lab /Collaborative Learning
- Supervised Field Practice
- Workplace Integrated Learning (Coop, Internship, etc.)
- Other\*(please note):

Credits = 3

### 4 Short Description

This course will cover methods in structural and fluids engineering, review statics and analysis of structure, and area properties, and include internal loads, shear and bending moment diagrams for structure, products of inertia and Mohr's circle for inertia. Topics may include force and displacement methods and fluid mechanics.

Hours / Week	Instruction – No of Weeks (Q=11; S=14; "P or S" = 7)			
3.0	14			
2.0	14			

# 5 Intended Learning Outcomes

Upon successful completion of this course a student will be able to:

- > Demonstrate the fundamental principles of engineering structural analysis by:
  - Preparing shear and bending moment diagrams and deflected shape of beams and frames under load,
  - Using slope deflection and moment distribution method to analyze statically indeterminate beams and frames,
  - Using matrix methods to analyze statically indeterminate 2D trusses, and
  - Determining the principal moments of inertia for common structural shapes
- > Demonstrate the fundamental principles of engineering fluid mechanics by:
  - Calculating forces on partially of fully submerged plane and curved areas,
  - Applying Archimedes' Principle to analyze buoyancy and stability conditions with respect to floating and submerged bodies,
  - Predicting friction and minor losses for laminar and turbulent flow,
  - Selecting pumps for piping systems, and
  - Determining flow rates and pressure losses in piping systems.

### 6 Course Content and Schedule

See last page of this outline.

# 7 Recommended Materials to Assist Students to Succeed Throughout the Course

a) See last page of this outline.

### 8 Basis of Student Assessment

Component	Weighting %	Comments			
Assignments					
Mid-term Exam					
Quizzes					
Labs					
TOTAL	0	See last page of this outline.			

# 9 College Supports, Services and Policies



### Immediate, Urgent, or Emergency Support

If you or someone you know requires immediate, urgent, or emergency support (e.g. illness, injury, thoughts of suicide, sexual assault, etc.), **SEEK HELP**. Resource contacts @ <u>http://camosun.ca/about/mental-health/emergency.html</u> or <u>http://camosun.ca/services/sexual-violence/get-support.html#urgent</u>

### **College Services**

Camosun offers a variety of health and academic support services, including counselling, dental, disability resource centre, help centre, learning skills, sexual violence support & education, library, and writing centre. For more information on each of these services, visit the **STUDENT SERVICES** link on the College website at <u>http://camosun.ca/</u>

### **College Policies**

Camosun strives to provide clear, transparent, and easily accessible policies that exemplify the college's commitment to life-changing learning. It is the student's responsibility to become familiar with the content of College policies. Policies are available on the College website at <a href="http://camosun.ca/about/policies/">http://camosun.ca/about/policies/</a>. Education and academic policies include, but are not limited to, Academic Progress, Admission, Course Withdrawals, Standards for Awarding Credentials, Involuntary Health and Safety Leave of Absence, Prior Learning Assessment, Medical/Compassionate Withdrawal, Sexual Violence and Misconduct, Student Ancillary Fees, Student Appeals, Student Conduct, and Student Penalties and Fines.

### 10 Grading System

- Standard Grading System (GPA)
- □ Competency Based Grading System

See <u>Camosun Grading Policy E-1.5</u>

### **11 Class Policies**

- You must pass the final exam to pass the course
- Out of class course communication will be via a mailing list.

Week      Session      Loct (h)      Tut (h)      Eval      Chapter      Sections      from to      count      totals        1      3-Sep      2      RisA      4      4      4        9-Sep      1.5      Admin + ASMD Frames      4      4        2      10-Sep      2      TBA      5      4        13-Sep      1.5      Stope Defl      4      555      52        3      16-Sep      1.5      Stope Defl      4      555      53        20-Sep      1.5      Stope Defl      4      55      52      9        3      17-Sep      2      Mathcad<-trent/com/Shearl      1      4      6        20-Sep      1.5      Stiffness - Truss      5 - 8      76      122      4        4      24-Sep      2      Mathcad: Ten/Com/Shearl      1      1      1        3      30-Sep      1.5      Stiffness - Truss      5 - 8      76      122      47        4      40-Cet      3      1 - 5      47											
1      3-Sep      2      RISA      1      1        9-Sep      1.5      Admin + ASMD Frames      1      1        1      3-Sep      1.5      Admin + ASMD Frames      1      1        10-Sep      2      TBA      1      1      1      1        10-Sep      2      TBA      1      <	Week	Session	Lect (h)	Tut (h)	Eval	Chapter	Sections	from	to	count	totals
1    3-Sep    2    RISA    Image: constraint of the second seco	1	2-Sep				DAY					
6-Sep      1.5      Admin + ASMD <sup>5</sup> Frames      Image: Constraint of the symbol of		3-Sep		2		RISA					
9-Sep      1.5      ASMO Frames      Image: constraint of the second		6-Sep	1.5			Admin + ASMD' Frames					
2      10-Sep      2      TBA      1      5        13-Sep      1.5      Slope Defl (SD) <sup>(1)</sup> 1 - 3      524      555      32        3      17-Sep      2      Mathcad - Introduction      4      555      563      9        20-Sep      1.5      Slope Defl      4      1 - 3      525      563      9        4      23-Sep      1.5      Slope Defl      1      1      1      1        23-Sep      1.5      Slope Defl      1      1      1      1      1        4      24-Sep      1.5      Slope Defl      1 <t< td=""><td></td><td>9-Sep</td><td>1.5</td><td></td><td></td><td>ASMD Frames</td><td></td><td></td><td></td><td></td><td></td></t<>		9-Sep	1.5			ASMD Frames					
13-Sep      1.5      Slope Defl (SD) <sup>11</sup> 1 - 3      524      555      32        3      17-Sep      1.5      Slope Defl      4      555      663      9        4      24-Sep      1.5      Slope Defl      1      1      1        4      24-Sep      2      Mathcad - Introduction      1      1      1        4      24-Sep      1.5      Slope Defl      1      1      1        4      24-Sep      2      Mathcad - Introduction      1-3      48      67      20        5      1-Oct      2      Mathcad Ten/Com/Shear II      1      1      1        4-Oct      1.5      Stiffness - Truss      5 - 8      76      122      47        6      8-Oct      2      Mathcad - Axial      1      1      1      1        7      15-Oct      2      Mathcad - Torsion      1      1      5      2        7      15-Oct      1.5      Moment Dist      1      1      1      1      1	2	10-Sep		2		ТВА					
16-Sep      1.5      Slope Deff      4      555      563      9        3      17-Sep      2      Mathcad - Introduction      1      1      1        4      23-Sep      1.5      Slope Deff      1      1      1        4      24-Sep      2.      Mathcad. Ten/Con/Shear I      1      1      1        24-Sep      1.5      Slope Deff      1      3      48      67      20        30-Sep      1.5      Stiffness - Truss      5      6      1.6      1		13-Sep	1.5			Slope Defl (SD) <sup>(1)</sup>	1-3	524	555	32	
3    17-Sep    1.5    2    Mathcad - Introduction    1    0.00    0.00    0      20-Sep    1.5    Slope Defi    1    1    1    1    1      4    24-Sep    1.5    Slope Defi    1    1    1    1      3    0.5ep    1.5    Slope Defi    1    1    1    1      4    24-Sep    1.5    Slope Defi    1    1    1    1      3    0.5ep    1.5    Stiffness - Truss    5 - 8    76    122    47      7    1.5    Stiffness - Truss    5 - 8    76    122    47      7    1.5    Stiffness - Truss    1    1    105      44-Oct    1.5    Stiffness - Truss    1    105      7    15-Oct    1.5    Moment Dist    1    1      1    1.90ct    1.5    Moment Dist    1    1      8    22-Oct    1.5    Moment Dist    1    1      9    29-Oct    1.5    Moment Dist    1		16-Sep	1.5			Slope Defl	4	555	563	9	
20.Sep      1.5      Slope Deft      Image: Constraint of the state of the s	3	17-Sep	1.0	2		Mathcad - Introduction		000	000	<u> </u>	
1      1.5      1.5      Slope Deft      1.5        4      23-Sep      1.5      Slope Deft      1      1        27-Sep      1.5      Slope Deft      1      1      1        30-Sep      1.5      Slope Deft      1      1      1      1        4      0.5      1.5      Stiffness - Truss <sup>(2)</sup> 13      48      67      20        5      1-Oct      2      Mathcad: Ten/Com/Shear II      1      1      1      1      1        4-Oct      1.5      Stiffness - Truss      5 - 8      76      122 47        6      8-Oct      2      Mathcad - Axial      1      1      1        11-Oct      1.5      Stiffness - Truss      1      108      1<	Ŭ	20-Sep	1.5			Slope Defl					
4    24-Sep    1.0    2    Mathcad: Ten/Con/Shear I    1      30-Sep    1.5    Stiffness - Truss    1 - 3    48    67    20      5    1.Oct    2    Mathcad: Ten/Con/Shear II    1    1    3    48    67    20      6    8-Oct    1.5    Stiffness - Truss    5 - 8    76    122    47      6    8-Oct    2    Mathcad - Axial    1    1    122    47      6    8-Oct    2    1.5    Stiffness - Truss    1    1    124    47      7    15-Oct    2    1.5    Mithcad - Axial    1	4	23-Sep	15			Slope Defl					
1.5      2      Mathcad      Slope Defi      1      3      48      67      20        5      1Oct      2      Mathcad      Ten/Com/Shear II      1      3      48      67      20        4.Oct      1.5      Stiffness - Truss      5      8      76      122      47        6      8-Oct      2      Mathcad      Axial      1      1      1        11-Oct      1.5      Stiffness - Truss      1      1      1      1        11-Oct      1.5      Stiffness - Truss      1      1      1      1      1      1        11-Oct      1.5      Mathcad - Axial      1 <td>24-Sep</td> <td>1.0</td> <td>2</td> <td></td> <td>Mathcad: Ten/Com/Shear I</td> <td></td> <td></td> <td></td> <td></td> <td></td>		24-Sep	1.0	2		Mathcad: Ten/Com/Shear I					
Loop      1.5      Stiffness - Truss <sup>(2)</sup> 1 - 3      48      67      20        5      1-Oct      1.5      Stiffness - Truss      5 - 8      76      122      47        6      8-Oct      1.5      Stiffness - Truss      5 - 8      76      122      47        6      8-Oct      2      Mathcad - Axial      1      1      1        7      15-Oct      1.5      Stiffness - Truss      1      1      1        7      15-Oct      2      Mathcad - Axial      1      1      1        7      15-Oct      2      1.5      M      1      5      108        7      15-Oct      2      1.5      Moment Dist      1      1      1        8      22-Oct      1.5      Moment Dist      1      1      1      1      1      1      1      1      12        9      29-Oct      1.5      Moment Dist      1      1      1      1      1      1      1      1      1      1 <td>-</td> <td>27-Sep</td> <td>1.5</td> <td>_</td> <td></td> <td>Slope Defl</td> <td></td> <td></td> <td></td> <td></td> <td></td>	-	27-Sep	1.5	_		Slope Defl					
5  0.0000  1.30  0  1.00  20    6  4-Oct  1.5  0  1.5  0  1.22    6  8-Oct  1.5  0  1.5  1.22  47    7  1.5  0  1.5  0  1.22  47    11-Oct  1.5  0  1.5  0  1.22  47    6  8-Oct  2  Mathcat russ  0  0  1.23    7  1.5-Oct  2  1.5  0  1.02  1.02    11-Oct  1.5  0  Mithcat russ  0  0  1.02    8  22-Oct  2  1.5  Moment Dist  0  0    25-Oct  1.5  0  Moment Dist  0  0  0    9  29-Oct  2  0  Mathcat: Stresses in Beams  0  0    10  5-Nov  1.5  0  Moment Dist  0  0    11  12-Nov  1.5  0  Moment Dist  0  0    11  12-Nov  1.5  0  Moment Dist  0  0    11  12-Nov  1.5  0  Moment Dist  0  0		30-Sep	1.5			Stiffness Truss <sup>(2)</sup>	1_3	/18	67	20	
0    1-Oct    1.5    Instituted. Terms    5 - 8    76    122    47      6    8-Oct    1.5    Stiffness - Truss    1    1    108      7    11-Oct    1.5    Stiffness - Truss    1    1    108      7    15-Oct    2    Mathcad - Axial    1    1    108      7    15-Oct    2    1.5    MT    1    1    1      18-Oct    1.5    Moment Dist    1    1    1    1    1      8    22-Oct    1.5    Moment Dist    1	5	1 Oct	1.5	2		Mathcad: Ten/Com/Shear II	1-0	-0	07	20	
4-00t  1.5  0  102  47    6  8-Oct  2  Mathcad - Axial  1  1    7  15-Oct  1.5  Stiffness - Truss  1  1    7  15-Oct  2  1.5  MT  1  1    8  22-Oct  2  1.5  MT  1  1    18-Oct  1.5  Moment Dist  1  1  1    18-Oct  1.5  Moment Dist  1  1  1    8  22-Oct  1.5  Moment Dist  1  1    25-Oct  1.5  Moment Dist  1  1  1    9  29-Oct  1.5  Moment Dist  1  1    10  5-Nov  1.5  Moment Dist  1  1    10  5-Nov  2  Mathcad: Stress Transformation  1  1    11  12-Nov  1.5  Moment Dist  1  1    11  12-Nov  1.5  Moment Dist  1  1    11  12-Nov  1.5  Moment Dist  1  1    12  19-Nov  1.5  Moment Dist  1  1    13  25-Nov  1.5  Moment	Ŭ	1-0ct	15	2		Stiffness - Truss	5 9	76	100	47	
6    A:Oct    2    Mathcad - Axial    108      7    15-Oct    1.5    Stiffness - Truss    108      7    15-Oct    2    1.5    108      8    22-Oct    2    1.5    Moment Dist    1-5      8    22-Oct    1.5    Moment Dist    1-5    487      9    22-Oct    1.5    Moment Dist    1-5    108      9    29-Oct    1.5    Moment Dist    1-5    10      10    5-Nov    1.5    Moment Dist    1-5    10      10    5-Nov    2    Mathcad: Stresses in Beams    1-5    1-6      11    12-Nov    1.5    Moment Dist    1-5    1-6      10    5-Nov    2    Stiffness - MATLAB    1-6      11    12-Nov    1.5    Moment Dist    1-6      11    12-Nov    1.5    Moment Dist    1-6      11    12-Nov    1.5    Moment Dist    1-6      12    19-Nov    1.5    Moment Dist    1-6      13    26-		4-001	1.5			Stiffpoor Truce	5-0	70	122	47	
0      0-00000000000000000000000000000000000	6	7-0ct	1.5	2		Mathcad - Avial					
11-000    1.5    0 mmost russ    100      7    15-Oct    2    1.5    MT    0    0      18-Oct    1.5    0    Moment Dist <sup>(3)</sup> 1 - 5    487    515    29      8    22-Oct    1.5    0    Moment Dist    0    0    0      22-Oct    1.5    0    Moment Dist    0    0    0    0      22-Oct    1.5    0    Moment Dist    0    0    0    0      28-Oct    1.5    0    Moment Dist    0    0    0    0    0      1-Nov    1.5    0    Moment Dist    0    0    0    0    0      10    5-Nov    2    Mathcad: Stress Transformation    0    0    0    0      11    12-Nov    1.5    0    Moment Dist    0    0    0      11    12-Nov    1.5    0    Moment Dist    0    0    0      12    19-Nov    1.5    0    0    0    0    0    0 <td>0</td> <td>0-001</td> <td>15</td> <td>2</td> <td></td> <td>Stiffness - Truss</td> <td></td> <td></td> <td></td> <td></td> <td>108</td>	0	0-001	15	2		Stiffness - Truss					108
Theore    2    1.5    MT    1    1      18-Oct    1.5    1.5    Moment Dist <sup>(3)</sup> 1 - 5    487 515    29      8    22-Oct    1.5    Moment Dist    1    1    1    1      9    22-Oct    2    Mathcad: Torsion    1    1    1      9    22-Oct    1.5    Moment Dist    1    1    1      9    29-Oct    2    Mathcad: Stresses in Beams    1    1      10    5-Nov    1.5    Moment Dist    1    1      10    5-Nov    1.5    Moment Dist    1    1      11    12-Nov    1.5    Moment Dist    1    1      11    12-Nov    2    Stiffness - MATLAB    1    1      11    12-Nov    2    Stiffness - MATLAB    1    1      12    19-Nov    2    TBA    1    1    1      13    25-Nov    1.5    Moment Dist    1    1    1      14    3-Dec    1.5    Moment Dist </td <td></td> <td>11-Oct</td> <td>1.5</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>100</td>		11-Oct	1.5								100
13-Oct    1.5    1.3    Min    1    5    487    515    29      8    21-Oct    1.5    2    Mathcad: Torsion    1    1    1    1      8    22-Oct    2    Mathcad: Torsion    1    1    1    1      9    28-Oct    1.5    3    Moment Dist    1    1    1      9    28-Oct    1.5    487    1.5    1    1    1      10    1.Nov    1.5    Moment Dist    1    1    1    1      10    5-Nov    2    Mathcad: Stress ransformation    1    1    1      11    12-Nov    1.5    Moment Dist    1	7	15 Oct		2	1.5	MT					
18-Oct    1.5    1000000000000000000000000000000000000		13-0cl	1 5	2	1.0	Moment Dist <sup>(3)</sup>	1 5	407	E 4 E	20	
8    21-Oct    1.5    Moment Dist    Image: constraint of the second		18-001	1.5			Moment Dist	1-5	407	515	29	
8    22-Oct    2    Mathcad: Torsion    Image: Constraint of the second seco		21-Oct	1.5			Moment Dist					
25-Oct    1.5    Moment Dist    Image: Constraint of the second sec	8	22-Oct		2		Mathcad: Torsion					
9 $28$ -Oct    1.5    Moment Dist    Image: constraint of the second secon		25-Oct	1.5			Moment Dist					
9    29-Oct    2    Mathcad: Stresses in Beams    Image: Constraint of the stress of the s		28-Oct	1.5			Moment Dist					
1-Nov    1.5    Moment Dist    Image: Constraint of the second seco	9	29-Oct		2		Mathcad: Stresses in Beams					
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		1-Nov	1.5			Moment Dist					
10    5-Nov    2    Mathcad: Stress Transformation    Image: Constraint of the stress of t		4-Nov	1.5			Moment Dist					
8-Nov    1.5    Moment Dist    Image: Constraint of the second seco	10	5-Nov		2		Mathcad: Stress Transformation					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		8-Nov	1.5			Moment Dist					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		11-Nov									
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	11	12-Nov		2		Stiffness - MATLAB					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		15-Nov	1.5			Moment Dist					
12    19-Nov    2    TBA    Image: constraint of the second sec		18-Nov	1.5			Moment Dist					
22-Nov    1.5    Moment Dist    Image: Constraint of the state of th	12	19-Nov		2		TBA					
$\begin{array}{c c c c c c c c c c c c c c c c c c c $		22-Nov	1.5			Moment Dist					
13  1.5  Inertia <sup>(4)</sup> 1.0  933  970  10    26-Nov  2  ACAD + Influence Lines  Image: Constraint of the state of th		25 Nov				Centroids and Moments of	1.6	055	070	16	
13    26-Nov    2    ACAD + Influence Lines    Image: Constraint of the state of t	10	25-1100	1.5			Inertia <sup>(4)</sup>	1-0	900	970	10	
29-Nov  1.5  Moments of Inertia  7 - 9  971  979  9    14  3-Dec  1.5  Moments of Inertia  Image: Constraint of the state of the	13	26-Nov		2		ACAD + Influence Lines					
2-Dec  1.5  Moments of Inertia    14  3-Dec  2  1  Lab Test + Q&A    6-Dec  1.5  Q&A  1    Total (h)  37.5  28.0  2.5    65.5  Total page count  54    162  162		29-Nov	1.5	_		Moments of Inertia	7-9	971	979	9	
14  3-Dec  2  1  Lab Test + Q&A    6-Dec  1.5  Q&A  1    Total (h)  37.5  28.0  2.5    65.5  Total page count  54    Topic  Mark    Midterm  30    Final  00	14	2-Dec	1.5			Moments of Inertia	, ,	071	010	<u> </u>	
G-Dec      1.5      Q&A        G-Dec      1.5      Q&A        Total (h)      37.5      28.0      2.5        65.5      Total page count      162        Topic      Mark      30        Final      00		3-Dec		2	1	Lab Test + Q&A					
Total (h)      37.5      28.0      2.5      54        65.5      Total page count      162        Topic      Mark      30      54        Final      00      00		6-Dec	1.5	-	,	Q&A					
Topic  Mark    Midterm  30	L	Total (h)	37.5	28.0	2.5		1	1		1	54
Topic Mark Midterm 30		(••)		65.5			Total page count 16			162	
Midterm 30		Tonic	Mark	50.0					90		
		Midterm	30 20								
		Final	50 60								

Out of class course communication will be via a Google mailing list.

All students must subscribe at:

10 100

Lab Test

- ASMD Axial, Shear and Moment Diagram
  Chapter 15 Structural Analysis 2E, A Kassimali beams, frames without sidesway
- (1) Chapter 13 Structural Analysis 2E, A Rassimali beams, names without sides
  (2) Chapter 3 Matrix Analysis of Structures 1E, A Kassimali trusses only
- (3) Chapter 12 Structural Analysis 8E, RC Hibbeler beams, frames without and with sidesway
- (4) Chapter 12 Mechanics of Materials, 8E, B Goodno; JM Gere