



Basics of Drilling Engineering I (Module I – IV)

1.0 Course Faculty Information

Name: Prof. Dr. M. Enamul Hossain
NSRIC Chair Professor in Sustainable Energy
NSRIC Inc.,
London, Ontario, Canada

2.0 Course Information

Course Code and Title	ENG-M-C00025, ENG-M-C00263, ENG-M-C00101 and ENG-M-C00102
Class Days	Follow posting in NSRIC LMS system
Class Time	Follow posting in NSRIC LMS system
Course Credit Hours	3
Class Location	NSRIC online platform
Prerequisites and/or co-requisites	n/a
Level /A, E, H, I, K12, M, P, S, T, U, V, W	Mid-level courses / M

Note: The below classification of courses is related any areas of knowledge:

A: Advanced level academic level courses; **C:** Canadian immigration and training courses; **E:** Executive courses; **H:** Higher-level courses (i.e., graduate courses); **I:** Intermediate courses (i.e., university preparatory courses – Grade XII+); **K12:** Foundational, and lower-level courses; **M:** Mid-level courses (i.e., undergraduate courses); **P:** Professional courses; **S:** Short/seminar courses; **T:** Training courses; **U:** Tutorial Courses; **V:** Vocational training courses; and **W:** Workshop courses.

3.0 Professor Information

Name	Prof. Dr. M. Enamul Hossain
Title	NSRIC Chair Professor in Sustainable Energy
Contact Information	enamulh@nsric.ca ; ceo@nsric.ca ; dr.mehossain@gmail.com
Office Location	NSRIC online platform
Office Hours	10: 30 am – 11:30 am EST (Monday) by email appointment

4.0 Target Audiences

- Diploma and vocational training student
- University undergraduate and preparatory level student

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- Any student who is interested in drilling engineering.

5.0 Course Module Description and Keywords

Module I:

This module is intended for beginners who are ready to learn the basics of petroleum units, field unit, definitions of drilling engineering, rotary and cable tools rig, rig type, rig operations, rig components, well control and monitoring system, control of influx, type of influx and kick analysis. In addition, simple workout examples related to field operations are also covered. The course contains four modules (Module I – IV) and each module covers six lectures. Students are strongly advised to complete the bundled courses program title “Basics of Drilling Engineering Program I” by Prof. M. Enamul Hossain at NSRIC Platform to understand this course content.

Keywords: petroleum units, field unit, definitions of drilling engineering, rotary and cable tools rig, rig type, rig components, rig operations, well control, monitoring system, control of influx, type of influx, kick analysis, blowout, blowout preventer.

Module II:

This module is intended for beginners who are ready to learn the basics of drilling fluid, mud types, mud system, functions of drilling fluid, mud rheology, mud laboratory testing, and cementing job. The module discusses the fundamentals of cementing job, functions, different stages and placement of cementing, cement properties and additives. In addition, simple workout examples related to field operations are also covered. Six lectures cover the course contents of Module II. The course contains four modules (Module I – IV) and each module covers six lectures. Students are strongly advised to complete the bundled courses program title “Basics of Drilling Engineering Program I” by Prof. M. Enamul Hossain at NSRIC Platform to understand this course content.

Keywords: drilling fluid, mud rheology, mud laboratory testing, ECD, pH, gel strength, cementing, cement functions, cement additives, rheology of cement, slurry density, thickening time, comprehensive strength, Portland cement.

Module III:

This module is intended for beginners who are ready to learn the basics of drilling hydraulics, importance, types of fluid, different fluid models, flow, flow regimes and frictional pressure losses. The module also discusses the pore and formation pressure, types of formation pressure, pore pressure and mechanisms of pore and formation pressure. In addition, simple workout examples related to field operations are also covered. Six lectures cover the course contents of Module III. The course contains four modules (Module I – IV) and each module covers six lectures. Students are strongly advised to complete the bundled courses program title “Basics of Drilling Engineering Program I” by Prof. M. Enamul Hossain at NSRIC Platform to understand this course content.

Keywords: Newtonian fluid, non-Newtonian fluid, Bingham plastic fluid, drilling hydraulics, laminar flow, turbulent flow, mechanism of pore and formation pressure, underground stresses,

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overburden pressure, precipitation, epeirogenic movements, potentiometric surface, faulting.

Module IV:

This module is intended for beginners who are ready to learn the basics of casing, collapse pressure, burst pressure, collapse strength, collapse pressure with axial stress, and bottom-hole assembly (BHA). The module also discusses the common drilling problems (e.g., hole stability and lost circulation). In addition, simple workout examples related to field operations are also covered. Six lectures cover the course contents of Module IV. The course contains four modules (Module I – IV) and each module covers six lectures. Students are strongly advised to complete the bundled courses program title “Basics of Drilling Engineering Program I” by Prof. M. Enamul Hossain at NSRIC Platform to understand this course content.

Keywords: casing, functions of casing, conductor casing, surface casing, liner, classification of casing, bottom hole assembly, collapse pressure, burst pressure, collapse strength, drilling bit, diamond bit, IADC bit, classifications of bit, kelly, kelly bush, drillstring, MWD.

6.0 Course Learning Outcomes

Upon successful completion of this course, students will be able to:

- CLO1: Become familiar with drilling rigs and different rig components.
- CLO2: Understand the well control and monitoring system.
- CLO3: Ability to understand types of drilling fluids, functions, and properties of drilling fluids.
- CLO4: Understand the basics of cementing concepts.
- CLO5: Ability to understand hydrostatic and formation pressure concepts.
- CLO6: Understand the basics of casing and Bottom-hole assembly (BHA)
- CLO7: Familiarize with common drilling problems (e.g., hole stability and lost circulation).

7.0 How the course supports the attainment of the student outcomes

Student Learning Outcomes (1-6)						
1	2	3	4	5	6	7
Moderate	Moderate	Moderate	Low	Moderate	Moderate	

8.0 Course Materials

Online course materials

- 1) Online PowerPoint presentation slides in pdf form, and video/audio recording of lectures
- 2) Online tutorial and meeting with students

Textbook and resources (If any)

- 1) **Hossain, M.E.** and Al-Majed, A.A. (2015). Fundamentals of Sustainable Drilling

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Engineering. ISBN 978-0-470878-17-0, John Wiley & Sons, Inc. Hoboken, New Jersey, and Scrivener Publishing LLC, Salem, Massachusetts, USA, pp. 786.

- 2) **Hossain, M.E.** (2016). Fundamentals of Drilling Engineering: MCQs and Workout Examples for Beginners and Engineers. ISBN: 978-1-119083-56-6, John Wiley & Sons, Inc. Hoboken, New Jersey, and Scrivener Publishing LLC, Salem, Massachusetts, USA, pp. 854.
- 3) **Hossain, M.E.** and Islam, M.R. (2018). Drilling Engineering Problems and Solutions: A Field Guide for Engineers and Students. John Wiley & Sons, Inc. Hoboken, New Jersey, and Scrivener Publishing LLC, Salem, Massachusetts, USA, ISBN: 978-1-118-99834-2, Jul 2018, pp. 642.

9.0 Academic Integrity

Students are encouraged to have a look at the NSRIC’s statement of academic integrity at NSRIC website. It is noted that by signing this syllabus, you will acknowledge that you have understood that any detected plagiarism should be reported.

10. Assessment for Grade

This course is an academic course (i.e., K12, and university level courses) and thus based on individual and team performance, students are evaluated followed by Table 1. Therefore, the program courses contain only assignments for assessment. Student will receive a “Certificate of completion” after successful completion of the course.

Table 1: NSRIC grading system

Type of Assessment	Grade %
Participation/Engagement/Performance	10%
Assignments	15%
Quizzes	10%
Research Project	20%
Midterm Exam I	15%
Midterm Exam II	15%
Final Exam	15%
Total	100%

Important Note:

- i) The below classified courses (i.e., academic courses) will only be evaluated based on the grade system shown in Table 2. A grade and certificate will be issued for the student(s) and participant(s).

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K12: Foundational, and lower-level courses; **M:** Mid-level courses (i.e., undergraduate courses).

ii) The below classified courses will **not** be evaluated based on the grade system shown in Table 2. A certificate will be issued for the student(s) and participant(s).

E: Executive courses; **P:** Professional courses; **S:** Short/seminar courses; **T:** Training courses; **U:** Tutorial Courses; **V:** Vocational training courses; and **W:** Workshop courses.

At the end of the term, the below Table 2 will be used for translating your marks into a “Latter Grade” based on NSRIC grading policy.

Table 2: NSRIC grading system

Marks	Letter Grade	Points	Description
≥ 93	A+	4.00	Outstanding
≥ 90	A	3.75	
≥ 87	A-	3.50	Excellent
≥ 84	B+	3.25	Very good
≥ 81	B	3.0	
≥ 78	B-	2.75	Moderately Good
≥ 75	C+	2.50	Good
≥ 72	C	2.25	
≥ 69	C-	2.0	Moderately Good
≥ 66	D+	1.75	Pass
≥ 63	D	1.50	
≥ 60	D-	1.25	Poor Pass
< 60	F	0	Failing

Participation/Engagement/Performance

Your participation in every aspect of the course is important for the learning process. Your engagement in every discussion in the course, due delivery of all assignments, quizzes, and research projects will be fruitful. These efforts from your side will reflect your performance in the course delivery and your commitments. This performance is the reflection of your dream grade!!

Assignments

You will be given total of **eight assignments** during the bundled courses delivery. The due dates for assignments are specified in the course content and schedule section. The assignments will be given time to time to solve/answer during the term. Assignments will be posted through NSRIC online platform at least one week before they are due. Due dates are given in course schedule (tentative schedule). However, in case of any special circumstance, the date will be posted beforehand or announced in class.

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Quizzes

A **Maximum of eight** quizzes (maximum of **five MCQ @ five minute**) will be taken based on class lectures and performance. The quiz will be taken in the beginning of the lecture through NSRIC online platform. If you miss the quiz without any valid official excuse, you will receive **zero** for the non-attended quiz. If any student fails to attend the quiz, he/she must submit a valid reason to the instructor. In such case, he/she should appear another quiz or may be averaged on the quizzes that he/she attended. It will depend on the situation and instructor.

11.0 Advice and additional requirements

I advise you to:

- Please contact me if you need any help.
- Students are expected to attend all scheduled online lecture classes.
- Students are expected to study from the course materials and/or textbooks which will help to easily read and understand.
- Students are encouraged to write their own notes during lectures/presentations (pdf PowerPoint presentations, and additional materials if any).
- Students are encouraged to attend online platform classes on time because late-attendee disrupts the flow of the class for both the instructor and the other students.

Additional information (During Online Course offering Period)

- The PowerPoint course materials, and video lectures will be available at the NSRIC Platform.
- There will be scheduled discussion/tutorial sessions on **every Sunday** at the class scheduled time. All students must attend this session.
- There will be an office hour for students on Sunday from 10:30 am – 11:30 am, Toronto, Canada time. Students need to send an email request so that a zoom meeting can be arranged. In addition, any time student can set up an online appointment (i.e., phone, zoom, and/or other mode of communications) based on availability of the course instructor. However, student should send an email request for setting up this type of meeting.

12.0 Course Topics

- Introduction to drilling engineering and petroleum engineering units
- Drilling rig systems, planning and managing, drilling operations
- Well control and monitoring system
- Drilling fluids composition and rheology
- Drilling fluid hydraulics
- Formation pore and fractures pressure estimation
- Cementing.
- Basic concepts of casing and its properties.
- Basic concepts of rotary drilling bit, and classification.

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- Fundamental concepts of drillstring and bottom-hole assembly.
- Drilling problems, safety, and environmental issues.

Bundled Program Description

These bundled courses program is course is designed for the audiences who are interested to learn the fundamental concepts of drilling engineering in petroleum (i.e., oil and gas industry) operations. The course content is designed for the beginners who is willing to learn the different topics to drilling engineering in a logical and sequential manner. The course covers petroleum engineering units, the basic principles of drilling engineering, concepts of drilling operations, rig types, rig components, basic drilling tools, wellhead equipment, drilling fluids, practices of well drilling, drilling techniques, well control and monitoring equipment, kick and blowout. In addition, simple workout examples related to field operations are also covered in each module. The course contains four modules (Module I – IV) and each module covers six lectures. Students are strongly advised to complete the bundled courses program title “Drilling Engineering Program II” by Prof. M. Enamul Hossain at NSRIC Platform to understand this course content.

Materials Included

- All lectures are in pdf PowerPoint presentation slides
- pdf form assignments and quizzes in the MLS system
- pdf reading materials

Requirements/Instructions

Students are advised to register the Module 4

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13.0 Course Contents and Schedule

Lec. No.	Module	Topics	Remarks
Module I			
01	Introduction	Course overview, setting expectations, and Introduction to drilling engineering and petroleum engineering units. (1)	
02	Drilling rig	Drilling rig systems and components, rig types, rig selection. (1)	Quiz 1
03	Drilling rig	Drilling rig systems and components, rig types, rig selection. (2)	Assignment 1
04	Drilling rig	Drilling rig systems and components, rig types, rig selection. (3)	
05	Drilling rig	A summary and problem/workout example session (4)	Quiz 2
06	Well control	Well control and well monitoring systems. (1)	Assignment 2
Module II			
07	Drilling fluid	Drilling fluids composition and rheology. (1)	
08	Drilling fluid	Drilling fluids composition and rheology. (2)	Quiz 3
09	Drilling fluid	A summary and problem/workout example session (3)	Assignment 3
10	Cementing	Cementing: composition and testing of cement. (1)	
11	Cementing	Cementing: composition and testing of cement. (2)	Quiz 4
12	Cementing	A summary and problem/workout example session (3)	Assignment 4
Module III			
13	Drilling hydraulics	Drilling fluid hydraulics (wellbore hydraulics). (1)	
14	Drilling hydraulics	Drilling fluid hydraulics (wellbore hydraulics). (2)	Quiz 5
15	Drilling hydraulics	A summary and problem/workout example session (3)	Assignment 5
16	Formation pressure	Formation pore and fractures pressure estimation (abnormal pressures prediction). (1)	
17	Formation pressure	Formation pore and fractures pressure estimation (abnormal pressures prediction). (2)	Quiz 6
18	Formation pressure	A summary and problem/workout example session Pore pressure calculations (3)	Assignment 6
Module IV			
19	Casing	Basic concepts of casing and its properties (1)	
20	Casing	Basic concepts of casing and its properties (2)	Quiz 7
21	Drilling bits	Basic concepts of rotary drilling bits (1)	Assignment 7
22	Drilling bits	Basic concepts of rotary drilling bits (2)	
23	Drillstring	Fundamental concepts of drillstring and bottom-hole assembly (1)	Quiz 8
24	Drilling Problem	Drilling problems, safety, and environmental issues (1)	Assignment 8

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Prepared by Dr. M. Enamul Hossain, NSRIC Chair Professor in Sustainable Energy, Dept. of Petroleum Engineering, OE Division, NSRIC Inc., London, ON, Canada.

Subtitle

The fundamental concepts of drilling engineering for undergraduate students, beginners and other practicing engineers interested in learning drilling engineering and enough practical workout examples.



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