KOMAR UNIVERSITY OF SCIENCE AND TECHNOLOGY
(KUST)

UNCERTAINITY AND RISK ANALYSIS SYLLABUS			
Course Title	**Uncertainty and Risk Analysis**		
Course Code	**PTE 4375**	**No. of Credits**	**3 CR**
Department	**Petroleum Engineering**	**College**	**College of Engineering**
Pre-requisites Course Code	**PTE 3315C**	**Co-requisites Course Code**	
Course Coordinator(s)	**Hiwa Sidiq**		
Email	**hiwa.sidiq@komar.edu.iq**	**IP No.**	**134**
Other Course Teacher(s)/Tutor(s)	**None**		
Class Hours	**MON//WED: 14:00 – 15:30 Room: 203**		
Contact Hours	**TUE: 13:00 - 16:00 Room: 308**		
Course Type	**Departmental Requirement**		
Offer in Academic Year	**Fall 2015**		

COURSE DESCRIPTION

This course provides fundamental concept of uncertainty analysis in an engineering project using probabilistic methods. Predicting reservoir performance with a probabilistic approach facilitates the quantification of the impact of uncertainties and risk in terms of the estimates of cumulative oil produced, recovery factor or reserves. This quantification will help to obtain the magnitude of the risk associated with the economics of the project.

COURSE OBJECTIVES

On completion of this course students are expected to understand the concepts of uncertainty and statistical treatment of risks. This knowledge will help the understanding of the influence of random phenomena and provides a thorough knowledge of the possibilities offered by and algorithms found in certain software packages.

COURSE LEARNING OUTCOMES

After participating in the course, students should be able to:

1. Understand and apply basic probabilistic methods to solve a problem. (ABET A and E)
2. Determine probabilities in risk analysis. (ABET K and D)
3. Analyse and identify uncertainties associate in reservoir modeling (ABET A and E)
4. Distribute and choose random variables using uniform and non-uniform approach. (ABET E)
5. Apply fitting distribution to gathered data. (ABET A and E)
6. Understand Bayesian inference and its application in geomodelling (ABET E)
7. Identify and screen the quality of measured data. (ABET K)
8. Discuss and presents current issues in uncertainty and risk analysis. (ABET G and J)

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RELATED PROGRAM OUTCOMES:	
A	An ability to apply knowledge of mathematics, science, and engineering
D	An ability to function on multidisciplinary teams
E	An ability to identify, formulate, and solve engineering problems
G	An ability to communicate effectively
J	A knowledge of contemporary issues
K	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Reference: http://www.abet.org/eac-criteria-2014-2015/

GUIDELINES ON GRADING POLICY

Points	*Percentage Scores*	*Grade*
A	*95–100*	*4.0*
A-	*90-94*	*3.7*
B+	*87–89*	*3.3*
B	*83-86*	*3.0*
B-	*80-82*	*2.7*
C+	*75–79*	*2.3*
C	*70-74*	*2.0*
C-	*65-69*	*1.7*
D+	*60–64*	*1.3*
D	*55-59*	*1.0*
D-	*50-54*	*0.7*
F	*0–49*	*0*
I	*Incomplete Course Work*	
W	*Official Withdrawal*	
Passing Grade is 65% or above		

COURSE CONTENTS

Course topics include:

- Basic probability techniques
- Probabilities in risk analysis
- Distributions and random variables
- Fitting distributions to data
- Economic analysis
- Conditional distributions with applications
- Introduction to Bayesian inference
- Intensities and Poisson Models

Note: Adding more chapters is governed by the time.

Course Teaching and Learning Activities:

Lectures: during week, the theoretical and practical lectures will be presented throughout the semester; the discussion of practical work within lab will be organized and illustrated with activities.

Assignments: after the lectures, the assignment will be explained and given to students. It is expected to be done on fortnightly bases.

Quizzes: the contents of each lecture will be discussed during class for open question and answer to make sure every student will participate and active.

Test: In class test on the subjects have been studied during the course.

In class brainstorming sessions: provide students with enough sources and background knowledge briefly within the topics during class to top up their challenge packs to be more active.

CLASS REQUIREMENT

- A Scientific Calculator
- Notebook

***Note: Students must bring a notebook, a pen, notebook, calculator, and the periodic table to every class**

Assessment Tool	Description	Weight
Assignment and Homework	Assignments within the updated topics (ABET G and D)	15%
Presentation and Discussion	Presenting assignment results and group discussion (ABET D, G and J)	10 %
Tests	Two tests before and after midterm exam	15%
Quizzes	The open questions and answer during class (ABET A and E)	10%
Midterm Exam	Examination questions from lectures W1 to W7 (ABET A and K)	20%
Final Exam	Examination questions from all lectures and topics (ABET A, E and K)	30%

ESSENTIAL READINGS: (Journals, textbooks, website addresses etc.)

Textbooks:

Probability and Risk Analysis, Igor Rychlik. Elsevier, ISBN 10 3-540-24223-6

An Introduction to Risk Analysis, Robert E Megill. Elsevier, 2nd Edition. ISBN 978-0878142576

References:

- Uncertainty Modeling and Analysis in Engineering and the Sciences. Bilal M. Ayyub, Chapman. ISBN 1-58488-644-7
- Reservoir Engineering Handbook. Tarek Ahmed. Elsevier, 4th Edition. ISBN 978-1-85617-803-7

COURSE POLICY *(including plagiarism, academic honesty, attendance etc)*

KUST Academic Policy
http://sar.komar.edu.iq/files/Student%20hand%20Book%202013.pdf

Attendance:

- Students are expected to attend all lectures and must attend all examinations, quizzes, and practical exercises.
- There is no make-up work for students who miss classes without official permission.
- Student must arrange with the faculty to make-up the missed class.
- Students are subject to the regulation and policies mentioned in the KUST Student Handbook.
- KUST guidelines for lateness are as follows: Three occasions of lateness count as one absence. (You can be considered late the first minute of the lecture time).

GUIDELINES FOR SUCCESS

1. Be able to work independently and in groups,
2. Pay-attention in the classes is the guarantee of success,
3. Extend your knowledge beyond the given textbooks to master the subject, and
4. Try not to miss the classes

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Course calendar: Please check the academic calendar for 2015/2016

Week	Beg/End Dates	Topics	Assessment
1	28 Sep – 1 Oct	- Basic probability Sample, space and events Independence Counting variable Conditional probability and the law of total P Event tree analysis	
2	4– 8 Oct	- Probabilities in Risk Analysis Baye's formula Recursive updating of odds Stream events Intensities of stream	Quiz 1
3	11– 15 Oct	- Distribution and random variable Properties of distribution functions Scale and location parameters Independent random variables Averages-Law of large number	
4	18– 22 Oct	Group discussion case studies from SPE papers on uncertainty in geo-modelling	Test 1
5	25– 29 Oct	- Fitting distribution to data Estimate of Fx Choosing model of Fx Maximum likelihood estimates Analyse of estimation error Confidence intervals Uncertainty of quantiles	Assignment 1
6	1– 5 Nov	- Conditional distribution with applications Dependent observation Two dimensional distribution Conditional distribution and densities Application of conditional probabilities	Quiz 2
7	8– 12 Nov	- Bayesian inference Some examples Compromising between data & prior knowledge Bayesian inference Conjugated Priors Large number of observation: Likelihood Predicting frequency of rare accident	
15– 19 Nov Midterm Exam			
8	22– 26 Nov	- Intensities and Poisson model Time to first occurrence	Assignment 2

		Absolute risk **Poisson model for count** **The Poisson model process**	
9	29– 3 Dec	- **Failure probabilities and safety index** **Linear and nonlinear function** **Safety index** **Gaussian approximation**	Quiz 3
10	6– 10 Dec	**Group discussion case studies from SPE papers on uncertainty in reservoir modelling**	Test 2
11	13– 17 Dec	- **Estimation of quantiles** **Analysis of characteristic strength** **The peaks over threshold** **Quality of component**	Assignment 3
12	20– 24 Dec	- **Design loads and extreme values** **Extreme values** **Finding the 100 year load** **Uncertainty analysis of St some examples** **Uncertainty in design-load estimates**	Quiz 4
27– 31 Dec New Year Holiday			
13	3– 7 Jan	**Group discussion case studies from SPE papers on reservoir uncertainty software**	
14	10– 14 Jan	- **Economic analysis** **Evaluation criteria and cashflow analysis** **Price variation case** **Present value and ROI** **Risk analysis**	Quiz 5
15	17 Jan – 21 Jan	**Review Week**	
24 -28 Jan Final Exam			