King Fahd University of Petroleum and Minerals

College of Sciences, Earth Sciences Department

GEOP 604, Geophysical Signal Analysis

Course Syllabus

Second Semester 182

Meeting Time	UT (Sunday & Tuesday) from 18:45 – 20:00
Meeting Location	Building 76, Room 1129
Instructor	Panteleimon Soupios
Office Location	B76, R 2245
E-Mail	panteleimon.soupios@kfupm.edu.sa

1. Course Description:

Review of Seismic Data Processing (Introduction, Mathematical Background, Conventional Seismic Data Processing Workflow), Diversity and weighted stacking, Radon transforms, wavelet shaping, multiple suppression, interferometric processing, velocity model building, Application of time series analyses and image processing techniques to large geophysical data sets; sampling of data and problems of aliasing; one and two dimensional Fourier transforms; the Z transformation; spectral analysis, filtering, and deconvolution; application of 1D and 2D filtering.

2. Course Prerequisites:

GEOP510. It is important to prepare yourself for this course through a review of the prerequisite material.

3. Course Objectives and Expected Learning Outcomes:

This course emphasizes the application of time series analysis and image processing techniques to large geophysical data sets. The covered topics include sampling of data and problem of aliasing, 1D and 2D Fourier transforms, the Z transformation, spectral analysis, inversions, filter and deconvolution. By the time a student completes the course he should be well versed in signal processing methods.

Lecture outline (time only approximate):
- Fourier series and transform
- Discrete Fourier transform
- Z-transform
- Digital signals: aliasing and Nyquist concepts
- Convolution and deconvolution
- Inverse filtering and theory

- Principle value decomposition
- Signal enhancement and applications

4. **Official Textbook and Recommended or Optional Learning Resources:**

Blackboard will be used as the formal channel of communication when appropriate to deliver course materials, messages…etc. Textbooks provided as part of previous courses (e.g. GEOP …etc) might be utilized when appropriate. The official textbook for the course is:

Reflection Seismology: Theory, Data Processing and Interpretation *by Yang Wencai (2013)*

Supplementary Reading
1. Statistical and Transform Methods for Geophysical Processing, By M. D. Sacchi, online book
2. Seismic Data Processing, O. Yilmaz, Society of Exploration Geophysicists, ISBN: 0-931830-41-9 (Volume 1)
3. Digital Signal Processing, By A. V. Openheim, and R. W Schafer. ISBN: 0132146355
4. Numerical Recipes in Fortran, Press et al, 1992, University of Cambridge Press.
5. MORE….

5. **Grade Evaluation:**
1. Assignment: 40% (4-5 over the term)
2. Literature review presentation: 15%
3. Midterm Exam: 20% (TBA)
4. Final Exam OR Final Project: 25%

Grades are unofficial until approved by the Faculty offering the course.

Student's presentation should demonstrate the ability to develop and focus on a topic and presenting ideas in an organized, logical and coherent form using Standard English grammar, punctuation, spelling and usage. The oral presentation will be appraised based on some standards that will be explained in class. Students grades will be assessed based on these and other criteria which will be communicated throughout the semester. The grading scheme (A^+ through F) followed in this course is that of the University and is described in the Undergraduate Bulletin (UB):

http://regweb.kfupm.edu.sa/docs/UG_06-09_En.pdf

Attendance policy and ethic of conduct and other relevant information can be found in the UB. Students are expected to have read and understood their responsibilities and adhered to them as described in the therein. Since a major component of the final grade is dedicate to the final report it must be emphasized that *Pilgrims will not be tolerated and will result in a grade of F*.

6. **Comments:**

Below are some important comments in regard to the course:

- Be careful with time! One of the most common problems confronted in this course is that students do not take the time issue seriously and find themselves not able to deliver the oral presentation in time. It is the student's responsibility to ensure that he fulfills his duties towards all of his registered courses.
- Always use your KFUPM e-mail to communicate either through the KFUPM Portal or Blackboard.
- Cell phones are to be turned off during lectures, labs and seminars. Cell phones are not to be brought to exams.
- Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes has elapsed. Electronic equipment cannot be brought into examination rooms (unless the Instructor allow it).
- A student who cannot write the term examination or complete a term assignment or the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination.
- Further comments will be communicated when necessary throughout the course. For example, marking scheme for the final report and oral presentation.

Disclaimer: Any typographical errors in this Course Outline are subject to change and will be announced in class. The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this syllabus.