King Fahd University of Petroleum and Minerals
Department of Mathematics and Statistics
**SYLLABUS**
Semester II: 2012-2013(**122**)

**Coordinator:**  Dr. A. Bonfoh
**Course #:**  MATH 470
**Title:**  Partial Differential Equations
**Textbook:**  Beginning Partial Differential Equation. by P. O'Neil. (Second Edition, 2008)

| Week | Date | Sec. | Topics | Suggested Homework Problems |
|---|---|---|---|---|
| 1 | Jan 26 –30 | 1.1 1.2 | Introduction, Linear first order PDEs, Characteristics | 2, 4, 7, 8 p3-4 10, 11, 12 p11 |
| 2 | Feb 2 – 6 | 1.3 1.4 | Quasilinear first order equations, The Cauchy problem, Characteristic method, General solutions | 1, 3, 5 p15-16, 1, 3, 5, 7, 9, p22 |
| 3 | Feb 9 – 13 | 2.1 2.2 2.3 2.4 2.5 2.6 | Second order PDEs in two variables: Classification The Hyperbolic canonical form The Parabolic canonical form The Elliptic canonical form Some equations of mathematical physics Second order Cauchy problem | 1, 3, 5, 7, 9 p25 2(a, c), 3 p29 2, 3 p32-33 1, 3, 5, 6, 7, 9p36-37 1 p45 1, 2, 6, 7p48-49 |
| 4 | Feb 16 – 20 | 2.7 4.1 4.2 4.3 4.4 | Characteristics and the Cauchy problem The wave equation : d'Alembert's solution of the the Cauchy problem D'Alembert solution as a sum of waves The characteristic triangle domain of dependence and range of influence, Well-posedness. The wave equation on a half-line | 1, 2, 3, 4p55 3, 5, 9,10, 13p116117 1, 2, 3, 4p125-126 1, 2 p130 1, 2, 3,7, 8p134 |
| 5 | Feb 23– 27 | 4.6 4.8 4.9 4.10 | A non homogeneous problem on half real line Fourier series solutions on a closed interval A non homogeneous problem on a closed interval The Cauchy problem by Fourier integral | 1, 2, 5, 10p140 1 , 5, 11, 14, 15 p157-159 2, 3, 7, 10, 11p164-167 1, 2, 3, 7, 8, 9p171-172 |
| | | | **First Exam: Sunday, February 24, 6:00–8:00pm** | |
| 6 | Mar 2– 6 | 4.11 4.12 4.13 | The wave equation in two space dimensions The Kirchoff-Poisson solution Hadamard's method of descent | 1, 2, 3p176 2, 3p181 1p183 |
| 7 | Mar 9 – 13 | 5.1 5.2 5.3 | The Cauchy problem and Initial conditions The weak maximum principle Solutions on bounded intervals | 1, 4 p187-188 2 p192 1, 3, 8, 9, 10, 11, 16p205-206 |
| 8 | Mar 16– 20 | 5.4 5.5 | The heat equation on the real line The heat equation on the half-line | 4, 5, 9, 12p215-217 1, 4, 8, 12p222-223 |
| | | | **Midterm Vacation: Thursday, March 21 – Friday, March 29, 2012** | |
| 9 | Mar 30 – Apr 3 | 5.7 5.8 | The non homogeneous heat equations The heat equation in two space variables | 6, 8p233-234 1, 3, 5p236-237 |
| 10 | Apr 6 –10 | 6.1 6.2 | Dirichlet and Neumann :setting of the problem Some harmonic functions | 1, 2, 8 p246 3, 4, 5, 6 p250 |
| | | | **Second Exam: Tuesday, April 9, 6:00--8:00pm** | |
| 11 | Apr 13– 17 | 6.3 6.4 | Representation theorems Maximum principle, Mean value property | 1, 2p257 2, 4, 4, 5, 6 p261-262 |
| 12 | Apr 20 –24 | 6.5 6.6 6.7 6.8 | Existence, Uniqueness and Well-posedness Dirichlet problem for a rectangle Dirichlet problem for a disk Poisson's integral representation for a disk | 1 p266 1, 2, 6p268-269 4, 6, 7, 8 p271 3, 4, 7p275 |
| 13 | Apr 27 – May 1 | 6.9 6.10 6.11 | Dirichlet problem for the upper half-plane Dirichlet problem for the right quarter-plane Dirichlet problem for a rectangular box | 1, 4 p279 1 p282 1 p284 |

| 14 | May 4 – 8 | 6.12 | The Neumann problem | 4, 5, 7 p287 |
|----|-----------|------|---------------------|--------------|
| | | 6.13 | The Neumann problem for a rectangle | 1, 4 p290 |
| | | 6.14 | The Neumann problem for a disk | 1, 4 p293-294 |
| | | 6.15 | The Neumann problem for the upper half-plane | 1, 3, 5 p295 |
| 15 | May11 – 15 | 6.16 | Green's function for a Dirichlet problem | 1, 2, 5, 6, 12, 16p301-302 |
| | | | Review and catch-up | |
| **Final Exam: Wednesday, May 22, 2013 at 8:00am** | | | | |

# Policies

## Exams:

- Any student **missing a major exam** with or without excuse **will not be given a Make-Up Exam**.

  However, a student missing an Exam with an official excuse from the "Deanship of Students Affairs" will be compensated according to the following policy.

  **Exam Missed by the Student:** Grade to be compensated := ExM,     Ave of Exam: AveM

  **Exam taken by Student:** Grade obtained = ExT,     Ave of Exam: Ave T

  **Final Exam:** Grade obtained:= ExT,     Ave of Exam: Ave F

  **ExM = AveM + [10(ExT-AveT)+14(ExT-AveF)]/24**

- **Home work (20%)**
- **1-section presentation (5%)**
- **Class participation + Attendance (5%)**
- **Major 1 and 2 (20% each)**
- **Final Exam  (30%):** The final exam will be comprehensive.

## Attendance:

- Attendance is compulsory. KFUPM policy with respect to attendance will be strictly enforced.
- Any student accumulating **9 unexcused absences** will be awarded DN Grade in the course.