

King Fahd University of Petroleum and Minerals  
Department of Mathematical Sciences

**SYLLABUS**

Math 467 - Graph Theory  
Semester II, 2019-2020 (192)

**Instructor:** Dr. Mohammad Zuheir Abu-Sbeih  
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**E-mail:** [abusbeih@kfupm.edu.sa](mailto:abusbeih@kfupm.edu.sa) (The best way to reach me)  
**Office hours:** 11:00 – 11:50 AM – Sunday, Tuesday and Thursday (Also by appointment)  
**Textbook:** Graphs & Digraphs by G. Chartrand and L. Lesniak, 5<sup>th</sup> edition, 2011.  
**Office:** 5-309/401

**Course description:** Graphs and digraphs. Degree sequences, paths, cycles, cut-vertices, and blocks. Eulerian graphs and digraphs. Trees, incidence matrix, cut-matrix, circuit matrix and adjacency matrix. Orthogonality relation. Decomposition, Euler formula, planar and nonplanar graphs. Menger's theorem. Hamiltonian graphs.

**Prerequisite:** MATH 208 or MATH 225 or MATH 302

**Final Exam: Tuesday May 12, 2020----- 9:00 PM**  
**The Final Exam is comprehensive**

**Evaluation (grades):**

|                       |             |
|-----------------------|-------------|
| (1) Exam I            | 15%         |
| (2) Exam II           | 15%         |
| (3) Exam III          | 15%         |
| (4) Homework          | 20%         |
| <u>(5) Final Exam</u> | <u>35%</u>  |
| <b>Total</b>          | <b>100%</b> |

**There will be no “make-ups” for exams.** *Unless a valid excuse is presented in advance, a missed exam or homework will receive the score 0. Of course, family vacations, commercial travel schedules, etc. are NOT acceptable excuses for missing scheduled classes.* Students must look at this syllabus carefully and *plan well ahead.*

**Homework:** A number of problems will be assign regularly. It is recommended that you try to work out these problems after the lecture. The problems in the exams will be similar to the homework problems. You are encouraged to come to my office hours or make an appointment to discuss any difficulties related to the course, including the homework problems. Remember that **“The best way to learn Mathematics is to do Mathematics.” Working as a group is recommended. However, each student needs to write his own solution.**

**Attendance:** KFUPM policy with regard to attendance will be enforced. Students are expected to attend all class meetings and are responsible for all of the material covered. Any changes in this syllabus or in the scheduling of exams, homeworks, etc. will be announced during class meetings. Students who miss a class meeting should copy a classmate’s notes for that meeting.

**Help:** Individuals’ questions regarding the course work should be directed to the lecturer, either immediately after class or during scheduled office hours.

| Week   | Date             | Sec. #              | Topics  |
|--|------------------|---------------------|---|
| 1  | Jan 19 – 23      | 1.1                 | Graphs and Subgraphs  |
| 2  | Jan 26 – 30      | 1.2<br>1.3          | Degree Sequences<br>Connected Graphs and Distance   |
| 3  | Feb 2 – 6        | 1.4<br>2.1          | Multigraphs and Digraphs<br>Nonseparable Graphs   |
| 4  | Feb 9 – 13       | 2.2<br>2.3          | Trees<br>Spanning Trees   |
|  |                  |                     |   |
| 5  | Feb 16 – 20      | ---<br>---<br>2.4   | Review and/or catching up<br><b>Exam I is on Tuesday, Feb. 18, 2020 (1.1-2.3)</b><br>Connectivity and Edge-Connectivity |
| 6  | Feb 23 – 27      | 2.5<br>3.1          | Menger's Theorem<br>Eulerian graphs   |
| 7  | Mar 1 – 5        | 3.2                 | Hamiltonian Graphs  |
| 8  | Mar 8 – 12       | 3.3                 | Powers of Graphs and Line Graphs  |
| 9  | Mar 15 – 19      | 4.1<br>4.2          | Strong Digraphs<br>Tournaments  |
| 10   | Mar 22 – 26      | 4.3<br>5.2<br>----- | Flows in Networks<br>The Automorphism Group of a Graph<br><b>Exam II – Sunday March 22 (2.4-4.1)</b>                    |
| 11   | Mar 29 – April 2 | Extra notes         | Matrices of Graphs  |
| 12   | April 5 – 9      | 6.1<br>6.2          | The Euler Identity<br>Planarity versus Nonplanarity   |
| 13   | April 12 – 16    | 6.3<br>6.4          | The Crossing number of Graphs<br>Hamiltonian Planar Graph   |
| 14   | April 19 – 23    | 10.1<br>-----       | Matching and Independence in Graph<br><b>Exam III – Tuesday April 21 (4.2-6.4)</b>                                      |
| 15   | April 26 – 30    | 10.2                | Factorization   |
| Final Exam: Comprehensive: <b>Follow the registrar final schedule on his webpage</b> |                  |                     |   |

## Homework Exercises:

| Section | Exercises      | Hand Ins                 |
|---------|----------------|--------------------------|
| 1.1     | 8,12,13,14,21  | 7,18                     |
| 1.2     | 1,3,6(a),8,    | 7,9,11                   |
| 1.3     | 4,11,17,20,27  | 10(a), 13, 14, 26, 37    |
| 1.4     | 3,8,15,16      | 7,11,14                  |
| 2.1     | 1,10           | 5,8,9                    |
| 2.2     | 1,10,14,16,19  | 8,11,17                  |
| 2.3     | 1,2,5,15,17,18 | 3,12,13,16,25            |
| 2.4     |                | 2,5,9,11,14              |
| 2.5     | 5,14           | 4,6,10,15                |
| 3.1     | 5,6            | 3,4,7,8                  |
| 3.2     | 4,5,14,20,27   | 2,3,7,8,13,16,18,22,26   |
| 3.3     | 1,2,19         | 3,7,12,14                |
| 4.1     | 14,18          | 4,8,9,12,16,17,19        |
| 4.2     | 3,8,17,23      | 5,6,11,16,18, 21, 26, 27 |
| 4.3     | 6              | 3, 10b                   |
| 5.2     |                | 4,7,8                    |
| 6.1     | 2,5,7,10       | 4,8,9,11,14              |
| 6.2     | 8,16           | 7,11,12,15               |
| 6.3     |                | 4,6,7                    |
| 6.4     |                | 1,2,4                    |
| 10.1    |                | 2,4,5,13,15              |
| 10.2    |                | 3,9                      |