**ATTACHMENT 2 (e)**

**Course Specifications**

**Kingdom of Saudi Arabia**

**The National Commission for Academic Accreditation & Assessment**

**Course Specifications**
**(CS)**

# Algebraic Topology (Math 571-1)

# (An Elective course)

## Course Specifications

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|---|---|
| Institution King Saud University | Date of Report 27 – Feb – 2017 |
| College/Department College of Sciences / Mathematics department | |

### A. Course Identification and General Information

1. Course title and code: Algebraic Topology (Math 571 – 1)

2. Credit hours 4 Credit Hours

3. Program(s) in which the course is offered.
(If general elective available in many programs indicate this rather than list programs)

Master of Science in Mathematics

4. Name of faculty member responsible for the course

Dr. Tahsin Mustafa Ghazal and Others

5. Level/year at which this course is offered

Fourth Level

6. Pre-requisites for this course (if any)
None

7. Co-requisites for this course (if any)
None

8. Location if not on main campus

9. Mode of Instruction (mark all that apply)

| | | | |
|---|---|---|---|
| a. Traditional classroom | | What percentage? | |
| b. Blended (traditional and online) | X | What percentage? | 100% |
| c. e-learning | | What percentage? | |
| d. Correspondence | | What percentage? | |
| f. Other | | What percentage? | |

Comments:

**B Objectives**

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| 1. What is the main purpose for this course?<br>**The main purpose for this course is to introduce the following concepts:**<br>• Singular Homology.<br>• Attaching Spaces<br>• Applications..<br>• Singular Cohomology |
| 2. Briefly describe any plans for developing and improving the course that are being implemented. (e.g. increased use of IT or web based reference material, changes in content as a result of new research in the field)<br>• Using computers in teaching to support presenting the material.<br>• Creating a Website for the material to be available to all students at any time.<br>• Weekly Home works. |

**C. Course Description (Note: General description in the form to be used for the Bulletin or handbook should be attached)**

| 1. Topics to be Covered | | |
|---|---|---|
| List of Topics | No. of Weeks | Contact Hours |
| **Homology**: Singular Homology Group, Homotopy Axiom, Exact Sequences, Mayer -Vetories Sequence, Homology of Spheres, | 4 | 16 |
| **Applications:** Brower Fixed Point, Degree of a Map. | 1 | 4. |
| **Attaching spaces:** Equivalence Relations, Attaching Cells, Relative Homology Groups, Excision, Reduced Homology Groups, Relative Homeomorphism Theorem, CW-Complexes, Cellular homology, Euler Characteristic. | 6 | 24 |
| **Cohomology:** Tensor Products, Universal Coefficient Theorem, Eilenberg Steenrod Axioms, Singular Cohomology, Homotopy Axiom, Excision , Eilenberg Steenrod Axioms for Cohomology. | 4 | 16 |

| 2. Course components (total contact hours and credits per semester): | | | | | | |
|---|---|---|---|---|---|---|
| | Lecture | Tutorial | Laboratory | Practical | Other: | Total |
| Contact Hours | 60 | 0 | | | | 60 |
| Credit | 4 | 0 | | | | 4 |

| 3. Additional private study/learning hours expected for students per week. | 8 |
|---|---|

4. Course Learning Outcomes in NQF Domains of Learning and Alignment with Assessment Methods and Teaching Strategy

Course Learning Outcomes, Assessment Methods, and Teaching Strategy work together and are aligned. They are joined together as one, coherent, unity that collectively articulate a consistent agreement between student learning, assessment, and teaching.

The ***National Qualification Framework*** provides five learning domains. Course learning outcomes are required. Normally a course has should not exceed eight learning outcomes which align with one or more of the five learning domains. Some courses have one or more program learning outcomes integrated into the course learning outcomes to demonstrate program learning outcome alignment. The program learning outcome matrix map identifies which program learning outcomes are incorporated into specific courses.

On the table below are the five NQF Learning Domains, numbered in the left column.

**First**, insert the suitable and measurable course learning outcomes required in the appropriate learning domains (see suggestions below the table). **Second**, insert supporting teaching strategies that fit and align with the assessment methods and intended learning outcomes. **Third**, insert appropriate assessment methods that accurately measure and evaluate the learning outcome. Each course learning outcomes, assessment method, and teaching strategy ought to reasonably fit and flow together as an integrated learning and teaching process. **Fourth**, if any program learning outcomes are included in the course learning outcomes, place the @ symbol next to it.

Every course is not required to include learning outcomes from each domain.

| | NQF Learning Domains And Course Learning Outcomes | Course Teaching Strategies | Course Assessment Methods |
|---|---|---|---|
| **1.0** | **Knowledge** | | |
| 1.1 | Outline the construction of singular homology. | • At the beginning of each lecture a discussion is conducted with the students about what have been done in the previous lecture in order to establish a link with the current lecture.<br>• Encouraging students to develop some examples and contribute to the discussion of the proofs of the theorems, propositions and lemmas. | • Hold Class discussion, quizzes and student's presentation. |
| 1.2 | Write Mayer -Vetories Sequence, and use it to calculate the homology groups of some spaces. | | |
| 1.3 | Define attaching spaces and describe some spaces by attaching cells in certain dimensions. | | |
| 1.4 | Define CW – complexes and cellular homology groups. | | |
| 1.5 | Outline the construction of singular cohomology.groups. | | |
| 1.6 | State Eilenberg Steenrod axioms for Cohomology. | | |
| **2.0** | **Cognitive Skills**<br><br>**After finishing this course the student should be able to:** | | |
| 2.1 | Define the homology group of a topological space and proof the related theorems. | • Discussion during lecture.<br>• Give extensive examples during lecture.<br>• Give homework assignments.<br>• Give problem sheets to be discussed during lectures. | • Have discussions during lectures<br>• Discuss the students' homework assignments.<br>• Give quizzes, mid-term exams and final exam. |
| 2.2 | Calculate the homology groups of some spaces. | | |
| 2.3 | Describe some spaces as attaching spaces. | | |
| 2.4 | Write the definition of CW-complexes and give examples of CW- complexes. | | |
| 2.5 | Define the cohomology group of a topological space and proof the related theorems. | | |
| 2.6 | Calculate the cohomology groups of some spaces. | | |

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| **3.0** | **Interpersonal Skills & Responsibility** | | |
| 3.1 | To study, learn and work independently. | • Homework assignments.<br>• Discussions in the classes<br>• The use of available information technology<br>• Assign a seminar to each student. | Group discussion. |
| 3.2 | To work effectively in teams. | | Assessment of the project essays. |
| 3.3 | To meet deadlines and manage time properly. | | Give homework assignments. |
| 3.4 | To exhibit ethical behaviour and respect different points of view. | | |
| **4.0** | **Communication, Information Technology, Numerical** | | |
| 4.1 | Use the computer for graphing and viewing some homeomorphic spaces. | • Write project essays.<br>• Incorporating the use and utilization of computer in the course requirements. | Evaluate the project essays. |
| 4.2 | Writing essays. | | |
| **5.0** | **Psychomotor** | | |
| 5.1 | Not applicable | | |

**Suggested Guidelines for Learning Outcome Verb, Assessment, and Teaching**

| NQF Learning Domains | Suggested Verbs |
|---|---|
| | |
| **Knowledge** | list, name, record, define, label, outline, state, describe, recall, memorize, reproduce, recognize, record, tell, write |
| **Cognitive Skills** | estimate, explain, summarize, write, compare, contrast, diagram, subdivide, differentiate, criticize, calculate, analyze, compose, develop, create, prepare, reconstruct, reorganize, summarize, explain, predict, justify, rate, evaluate, plan, design, measure, judge, justify, interpret, appraise |
| **Interpersonal Skills & Responsibility** | demonstrate, judge, choose, illustrate, modify, show, use, appraise, evaluate, justify, analyze, question, and write |
| **Communication, Information Technology, Numerical** | demonstrate, calculate, illustrate, interpret, research, question, operate, appraise, evaluate, assess, and criticize |
| | demonstrate, show, illustrate, perform, dramatize, employ, manipulate, |

| | |
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| **Psychomotor** | operate, prepare, produce, draw, diagram, examine, construct, assemble, experiment, and reconstruct |

Suggested ***verbs not to use*** when writing measurable and assessable learning outcomes are as follows:

Consider Maximize Continue Review Ensure Enlarge Understand
Maintain Reflect Examine Strengthen Explore Encourage Deepen

Some of these verbs can be used if tied to specific actions or quantification.

**Suggested assessment methods and teaching strategies are:**

According to research and best practices, multiple and continuous assessment methods are required to verify student learning. Current trends incorporate a wide range of rubric assessment tools; including web-based student performance systems that apply rubrics, benchmarks, KPIs, and analysis. Rubrics are especially helpful for qualitative evaluation. Differentiated assessment strategies include: exams, portfolios, long and short essays, log books, analytical reports, individual and group presentations, posters, journals, case studies, lab manuals, video analysis, group reports, lab reports, debates, speeches, learning logs, peer evaluations, self-evaluations, videos, graphs, dramatic performances, tables, demonstrations, graphic organizers, discussion forums, interviews, learning contracts, antidotal notes, artwork, KWL charts, and concept mapping.

Differentiated teaching strategies should be selected to align with the curriculum taught, the needs of students, and the intended learning outcomes. Teaching methods include: lecture, debate, small group work, whole group and small group discussion, research activities, lab demonstrations, projects, debates, role playing, case studies, guest speakers, memorization, humor, individual presentation, brainstorming, and a wide variety of hands-on student learning activities.

5. Schedule of Assessment Tasks for Students During the Semester

| | Assessment task (e.g. essay, test, group project, examination, speech, oral presentation, etc.) | Week Due | Proportion of Total Assessment |
|---|---|---|---|
| 1 | First midterm exam | 6 | 20% |
| 2 | Second midterm exam | 12 | 20% |
| 3 | Quizzes and Short talk | During semester | 20% |
| 4 | Final exam | 16 | 40% |

**D. Student Academic Counseling and Support**

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| 1. Arrangements for availability of faculty and teaching staff for individual student consultations and academic advice. (include amount of time teaching staff are expected to be available each week)<br><br>• Office hours: 6 hr/week<br>• Academic supervision: 5 hr/week |

**E. Learning Resources**

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| 1. List Required Textbooks<br><br>J. W. Vick, *Homology Theory*, Springer Verlag, New York Inc,, 1994 |
| 2. List Essential References Materials (Journals, Reports, etc.)<br><br>E. Spanier, *Algebraic Topology*, Springer Verlag, New York Inc., 1994. |
| 3. List Recommended Textbooks and Reference Material (Journals, Reports, etc)<br><br>C. R. F. Maunder, *Algebraic Topology*, Dover Publications; Mineola , New York; Constable and Co. , London 1996. |
| 4. List Electronic Materials (eg. Web Sites, Social Media, Blackboard, etc.)<br><br>• Internet sites relevant to the course.<br>• Math 571 - 1 instructors' sites. |
| 5. Other learning material such as computer-based programs/CD, professional standards or regulations and software.<br><br>• Some computer programs exists relevant to course materials'. |

**F. Facilities Required**

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| Indicate requirements for the course including size of classrooms and laboratories (i.e. number of seats in classrooms and laboratories, extent of computer access etc.) |
| 1. Accommodation (Classrooms, laboratories, demonstration rooms/labs, etc.)<br><br>• A classroom, which accommodates 15 students, equipped with usual blackboard and smart board. |

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| 2. Computing resources (AV, data show, Smart Board, software, etc.)<br><br>• Computer lab equipped with relevant software. |
| 3. Other resources (specify, e.g. if specific laboratory equipment is required, list requirements or attach list)<br><br>• Securing the textbooks in the university book stores.<br>• Securing the book references in the university central libraries. |

## G Course Evaluation and Improvement Processes

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| 1 Strategies for Obtaining Student Feedback on Effectiveness of Teaching<br><br>• Through evaluating the midterm exams, quizzes, and final exam.<br>• Dedicating last lecture for open discussion with the students about all aspects concerning the course.<br>• An evaluation sheet for the course to be filled by the students at the end of each semester. |
| 2 Other Strategies for Evaluation of Teaching by the Program/Department Instructor<br><br>Colleagues' opinions about students' performance in this course. |
| 3 Processes for Improvement of Teaching<br><br>• Workshops on teaching and learning methods conducted by the deanship of skills development.<br>• Discussing the teaching methods by the group of faculty members teaching the course at the beginning of each semester.<br>• Encouraging students to get involved in the lecture.<br>• Encouraging the students to read about the subject. |
| 4. Processes for Verifying Standards of Student Achievement (e.g. check marking by an independent member teaching staff of a sample of student work, periodic exchange and remarking of tests or a sample of assignments with staff at another institution)<br><br>• Check marking by an independent faculty member of a sample of student work. |

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| 5 Describe the planning arrangements for periodically reviewing course effectiveness and planning for improvement.<br><br>• Reviewing the course contents every five years.<br>• Providing reviews to develop the assigned textbooks contents.<br>• Providing a discussion for the course subject by a specialized committee.<br>• View other math departments in well-known universities. |

**Faculty or Teaching Staff:** **Dr. Tahsin Ghazal**

**Signature:** *TAHSINGHAZAL* **Date Report Completed** **27 – Feb. -2017**

**Received by: _____** **Dean/Department Head**

**Signature: _____** **Date: _____**