The University of Jordan

Accreditation & Quality Assurance Center

COURSE Syllabus

Course Name: Advanced Calculus
1. **Course title**: Advanced Calculus

2. **Course number**: (0331301)

3. **Credit hours (theory, practical)**: 3
   **Contact hours (theory, practical)**: 3

4. **Prerequisites/corequisites**: (0301201)

5. **Program title**: B.Sc.

6. **Program code**: The University of Jordan

7. **Faculty**: Science

8. **Department**: Mathematics

9. **Level of course**: College requirement

10. **Year of study and semester (s)**: all Semesters

11. **Final Qualification**: B.Sc. in Mathematics

12. **Other department (s) involved in teaching the course**: None

13. **Language of Instruction**: English

14. **Date of production/revision**: 1.11.2017

16. **Course Coordinator**:
   Office numbers, office hours, phone numbers, and email addresses should be listed.

   Dr. Mohammed Al-Horani

17. **Other instructors**:
   Office numbers, office hours, phone numbers, and email addresses should be listed.

18. **Course Description**:

   Vector differential calculus: gradient, divergence, curl, curvilinear coordinates; vector integral calculus: line integral, surface integral volume integral, Green’s theorem, Stoke’s theorem, divergence theorem; implicit and inverse function theorems; Leibnitz theorem; calculus of variations (functionals of one variable).
19. Course aims and outcomes:

A- Aims:

1. Evaluate the line integral (work) in several ways.
2. Recognize conservative fields, In case the field is conservative, student should be able to find its potential the work does by this field any path.
3. Use Green’s theorem to compute the work.
4. Compute the surface integral over famous surfaces.
5. Use the divergence theorem and stocker Theorem.
6. Apply implicit and inverge function Theorems.

B- Intended Learning Outcomes (ILOs):

Successful completion of the course should lead to the following outcomes:

A. Knowledge and Understanding Skills: Student is expected to

A1. Learn about scalar fields and vector fields and recognize real life quantities that are scalar fields or vector fields such as the temperature of an object in space, the force, and the velocity.
A2. Use the famous differential operators: Gradient, Divergence, Curl, and Laplacian and explain the importance of these operators.

B. Intellectual Analytical and Cognitive Skills: Student is expected to

B1. Investigate several examples and recognize that a vector field is conservative if and only if its curl is equal to zero.

C. Subject-Specific Skills: Student is expected to

C1. Introduce the line integral of a vector field. Compute the line integral over various types of paths.
C2. Use Green’s Theorem.

D. Creativity/Transferable Key Skills/Evaluation: Student is expected to

D1. Evaluate surface integrals (flux) over various types of surfaces.
D2. Utilize the Divergence Theorem in computing the flux through a surface by computing the triple integral of the divergence of the vector field over the solid inside that surface, and use it to evaluate the flux.
D3. Apply Stokes's Theorem to compute some of the line integrals in space.
20. Topic Outline and Schedule:

<table>
<thead>
<tr>
<th>Topic</th>
<th>Week</th>
<th>Instructor</th>
<th>Achieved ILOs</th>
<th>Evaluation Methods</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions of several variables (limits, continuity,</td>
<td>1-4</td>
<td></td>
<td>A1</td>
<td></td>
<td>Exam</td>
</tr>
<tr>
<td>and partial derivatives)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The three linear operators: (i) gradient, (ii)</td>
<td>5-8</td>
<td></td>
<td>A2, B1</td>
<td></td>
<td>Exam</td>
</tr>
<tr>
<td>divergence, (iii) curl</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Different types of integrals: (i) line integral, (ii)</td>
<td>9-12</td>
<td></td>
<td>C1</td>
<td></td>
<td>Exam</td>
</tr>
<tr>
<td>surface integral, (iii) volume integral</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Six main theorems</td>
<td>13-14</td>
<td></td>
<td>C2, D1, D2,</td>
<td></td>
<td>Exam</td>
</tr>
<tr>
<td>a- Greens Theorem.</td>
<td></td>
<td></td>
<td>D3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b- Stokes Theorem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>c- Divergence Theorem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>d- Implicit Function Theorem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>e- Inverse mapping Theorem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>f- Leibnitz Theorem</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calculus of variation: Functional of one variable</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
<td>Exam</td>
</tr>
</tbody>
</table>

21. Teaching Methods and Assignments:

Development of ILOs is promoted through the following teaching and learning methods:

In order to succeed in this course, each student needs to be an active participant in learning – both in class and out of class.

- The instructor will spend most of the class time on presenting the new material as well as on discussing homework problems.
- Group work in this class is encouraged.
- To actively participate in class, you need to prepare by reading the textbook and to do all assigned problems before class. (Problems will be assigned each class period, then to be discussed the following period).
- You should be prepared to discuss your homework at each class meeting.
- You are encouraged to work together with other students and to ask questions and seek help from your professor, both in and out of class.
- Students are also encouraged to use graphing calculators extensively and to use computer software supplements.

22. Evaluation Methods and Course Requirements:

Opportunities to demonstrate achievement of the ILOs are provided through the following assessment methods and requirements:

<table>
<thead>
<tr>
<th>ILO/s</th>
<th>Learning Methods</th>
<th>Evaluation Methods</th>
<th>Related ILO/s to the program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Lectures</td>
<td>Exam</td>
<td>A1, A4, B1, D1</td>
</tr>
</tbody>
</table>
23. Course Policies:

1. Attendance is absolutely essential to succeed in this course. You are expected to attend every class; please notify your instructor if you know you are going to be absent. All exams must be taken at the scheduled time. Exceptions will be made only in extreme circumstances, by prior arrangement with the instructor.
2. If a student is absent for more than 10% of lectures without an excuse of sickness or due to other insurmountable difficulty, then he/she shall be barred from the final examination also he/she will get a failing grade in this course.
3. Medical certificates shall be given to the University Physician to be authorized by him. They should be presented to the Dean of the Faculty within two weeks of the student’s ceasing to attend classes.
4. Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.
5. Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on homeworks.

24. Required equipment:

Data Shows

25. References:

A- Required book (s), assigned reading and audio-visuals:


B- Recommended books, materials, and media:


26. Additional information:
Name of Course Coordinator: Dr. Mohammed Al-Horani Signature: ---------------- Date: 1/1/2016

Head of curriculum committee/Department: Dr. Emad Abu Osba Signature: ------------------------

Head of Department: Dr. Baha Alzalg Signature: -------------------------------

Head of curriculum committee/Faculty: Dr. Amal Al-Aboudi Signature: -----------------------------

Dean: Dr. Sami Mahmoud Signature: -------------------------------

Copy to:
Head of Department
Assistant Dean for Quality Assurance
Course File