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|---|---|---|
| **Form: Course Syllabus** | **Form Number** | EXC-01-02-02A |
| | **Issue Number and Date** | 2/3/24/2022/2963 05/12/2022 |
| | **Number and Date of Revision or Modification** | |
| | **Deans Council Approval Decision Number** | 2/3/24/2023 |
| | **The Date of the Deans Council Approval Decision** | 23/01/2023 |
| | **Number of Pages** | 09 |

| | | |
|---|---|---|
| **1.** | **Course Title** | **Special Functions** |
| **2.** | **Course Number** | 0301424 |
| **3.** | **Credit Hours (Theory, Practical)** | 3 |
| | **Contact Hours (Theory, Practical)** | 3 |
| **4.** | **Prerequisites/ Corequisites** | 0301221 |
| **5.** | **Program Title** | B.Sc. |
| **6.** | **Program Code** | |
| **7.** | **School/ Center** | Science |
| **8.** | **Department** | Mathematics |
| **9.** | **Course Level** | Optional Specialization requirement |
| **10.** | **Year of Study and Semester (s)** | Fourth year |
| **11.** | **Other Department(s) Involved in Teaching the Course** | None |
| **12.** | **Main Learning Language** | English |
| **13.** | **Learning Types** | ■Face to face learning ☐Blended ☐Fully online |
| **14.** | **Online Platforms(s)** | ■Moodle ■Microsoft Teams |
| **15.** | **Issuing Date** | Nov. 6, 2024 |
| **16.** | **Revision Date** | |

**17. Course Coordinator:**

Name: Dr.Salam Alnabulsi Contact hours:10:30-12:30

Office number: 302 Phone number:22100

Email:s.alnabulsi@ju.edu.jo

**18. Other Instructors:**

| |
|---|
| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |
| Name: |
| Office number: |
| Phone number: |
| Email: |
| Contact hours: |

**19. Course Description:**

| |
|---|
| Series solutions of differential equations. Gamma and Beta functions, Legendre polynomials and functions, Bessel functions, Hermite and Laguerre polynomials, Chebyshev polynomials, Hyper geometric functions. Other special functions. Hyper-geometric functions. Other special functions. |

**20. Program Student Outcomes (SO's):**

(To be used in designing the matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program)

1. Identify, formulate, and solve broadly-defined technical or scientific problems by applying knowledge of Mathematics and Science and/or technical topics to areas relevant to the discipline.
2. Formulate or design a system, process, procedure or program to meet desired needs.
5. Reflect the impact of technical and/or scientific solutions in economic, environmental, and societal contexts. Function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.
7. Utilize research methods, critical and creative thinking skills to assess and analyze information) to solve problems properly, then draw valid reasoning and logical conclusions leading to true consequences.
8. Utilize techniques, skills, and modern scientific tools such as mathematical packages, statistical software, graphing calculators, and online resources necessary for professional practice.

**21. Course Intended Learning Outcomes (CLO's):**

(Upon completion of the course, the student will be able to achieve the following intended learning outcomes)

1. To solve some differential equations using special functions
2. To evaluate some integrals using special functions.
3. To prove some properties of the special functions.
4. To prove some recurrence relations.

| Course CLOs | The learning levels to be achieved | | | | | |
|---|---|---|---|---|---|---|
| | Remembering | Understanding | Applying | Analysing | evaluating | Creating |
| 1 | • | | | • | | |
| 2 | • | • | • | | | |
| 3 | • | • | | | | |
| 4 | | | | | • | • |

**22. The matrix linking the intended learning outcomes of the course with the intended learning outcomes of the program:**

| Program SO's / Course CLO's | SO (1) | SO (2) | SO (3) | SO (4) | SO (5) | SO (6) | SO (7) | SO (8) |
|---|---|---|---|---|---|---|---|---|
| CLO (1) | • | • | | | • | | | |
| CLO (2) | • | • | | | • | | | |
| CLO (3) | | | | | | | • | |
| CLO (4) | | | | | | | • | |

**23. Topic Outline and Schedule:**

| Week | Lecture | Topic | CLO/s Linked to the Topic | Learning Types<br>Face to Face (FF)<br>Blended (BL)<br>Fully Online (FO) | Platform Used | Synchronous (S)<br>Asynchronous (A) | Evaluation Methods | Learning Resources |
|---|---|---|---|---|---|---|---|---|
| **1** | 1.1 | Factorials and Binomial Coefficients. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 1.2 | Infinite Series. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 1.3 | Factorials and Binomial Coefficients. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| **2** | 2.1 | **Gamma, Beta and Error Functions** | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 2.2 | Definition of Gamma function. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 2.3 | Integral representation of GammaFunction. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| **3** | 3.1 | Definition of Beta function with examples. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 3.2 | Stirling's formula. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| | 3.3 | Error function. | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |
| **4** | 4.1 | Gamma, Beta and Error Functions | 2 | FF | Moodle<br>Microsoft Teams | S | | Text book |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 4.2 | Definition of Gamma function. | 2 | FF | Moodle Microsoft Teams | S | | Text book |
| | 4.3 | Integral representation of GammaFunction. | 2 | FF | Moodle Microsoft Teams | S | | Text book |
| **5** | 5.1 | Definition of Beta function with examples. | 2 | FF | Moodle Microsoft Teams | S | | Text book |
| | 5.2 | Stirling's formula. | 2 | FF | Moodle Microsoft Teams | S | | Text book |
| | 5.3 | Error function. | 2 | FF | Moodle Microsoft Teams | S | | Text book |
| **6** | 6.1 | Legendre Polynomials | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 6.2 | The generating polynomial. | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 6.3 | Recurrence relations. | 3, 4 | FF | Moodle Microsoft Teams | S | First exam | Text book |
| **7** | 7.1 | Legendre Polynomials | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 7.2 | The generating polynomial. | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 7.3 | Recurrence relations. | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **8** | 8.1 | Legendre's differential equations. | 1 | FF | Moodle Microsoft Teams | S | | Text book |
| | 8.2 | Rodrigues formula. | 1 | FF | Moodle Microsoft Teams | S | | Text book |
| | 8.3 | Orthogonality property. | 1 | FF | Moodle Microsoft Teams | S | | Text book |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **9** | 9.1 | Other orthogonal polynomials | 1 | FF | Moodle Microsoft Teams | S | | Text book |
| | 9.2 | Hermitian polynomials. | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 9.3 | definition by generating functions. | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **10** | 10.1 | Recurrence relations | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 10.2 | Hermite's equation | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 10.3 | Orthogonal property | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **11** | 11.1 | Orthogonal property | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 11.2 | Laguerre polynomials | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 11.3 | The generating function | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **12** | 12.1 | Recurrence relations and Lagurre's equation | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 12.2 | Orthogonality property | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 12.3 | Rodrigue formula | 3, 4 | FF | Moodle Microsoft Teams | S | Midtearm | Text book |
| **13** | 13.1 | Bessel Functions | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 13.2 | Bessel functions of first kind and generating functions | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 13.3 | Bessel functions of non-integral order | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **14** | 14.1 | Recurrence formulas | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 14.2 | Bessel's differential equations | 1 | FF | Moodle Microsoft Teams | S | | Text book |
| | 14.3 | Integrals of Bessel's functions | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **15** | 15.1 | Orthogonality | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 15.2 | Bessel functions of second kind and recurrence formulas | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| | 15.3 | Bessel Functions | 3, 4 | FF | Moodle Microsoft Teams | S | | Text book |
| **16** | | | | | | | Final Exam | |

**24. Evaluation Methods:**

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

| Evaluation Activity | Mark | Topic(s) | CLO/s Linked to the Evaluation activity | Period (Week) | Platform |
|---|---|---|---|---|---|
| **First Exam** | 20 | 1-3 | 1,2, | 6 | On Campus |
| **Mid Term** | 30 | 3-5 | 3,4 | 12 | On Campus |
| **Final Exam** | 50 | All topics | 1,2,3,4 | 16 | On Campus |

**25. Course Requirements:**

- Computer
- Account on Microsoft Teams

**26. Course Policies:**

**A-** Attendance policies: 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

**B-** Absences from exams and submitting assignments on time: 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

**C-** Health and safety procedures: 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

**D-** Honesty policy regarding cheating, plagiarism, misbehavior: Cheating is prohibited. The University of Jordan regulations on cheating will be applied to any student who cheats in exams or on home works.

**E-** Grading policy: Test papers shall be returned to students after correction. His/her mark is considered final after a lapse of one week following their return.

**F-** Available university services that support achievement in the course:

**27. References:**

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

Special Functions of mathematics for engineers

**B-** Recommended books, materials, and media:

Special Functions by Leon M. Hall

**28. Additional information:**

| | | |
|---|---|---|
| Name of the Instructor or the Course Coordinator:<br>**Dr.Salam Alnabulsi** | Signature:<br>…… | Date:<br>6/11/2024 |
| Name of the Head of Quality Assurance Committee/ Department:<br>**Prof. Manal Ghanem** | Signature:<br>…… | Date:<br>…… |
| Name of the Head of Department:<br>**Prof. Baha Alzalg**. | Signature:<br>…… | Date:<br>…… |
| Name of the Head of Quality Assurance Committee/ School of Science:<br>**Prof. Emad A. Abuosba** | Signature:<br>…… | Date:<br>…… |
| Name of the Dean or the Director:<br>**Prof. Mahmoud I. Jaghoub** | Signature:<br>…… | Date:<br>…… |