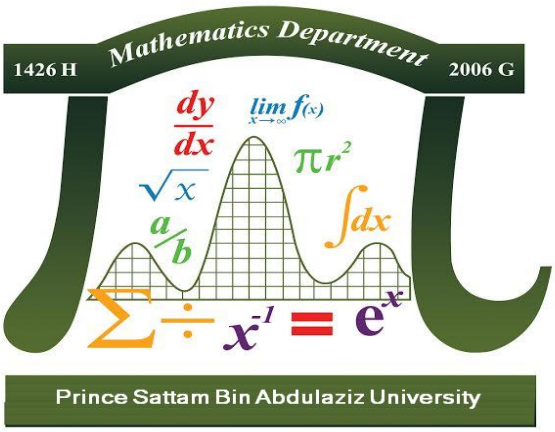
Kingdom of Saudi Arabia
Ministry of Education
Prince Sattam bin Abdulaziz University
College of Science & Humanity Studies
Department of Mathematics

المملكة العربية السعودية
وزارة التعليم
جامعة الأمير سطام بن عبدالعزيز
كلية العلوم والدراسات الإنسانية
قسم الرياضيات



Master of Science in Mathematics
Program Handbook
2023-2024

Contents

Chairman's Message (To check)

In the name of God, the Most Gracious, the Most Merciful.
Praise be to God, the Creator of the Universe, and may peace and blessings be upon the most honorable of all prophets and messengers, our Prophet Muhammad, his family, and his companions.

Since its inception, the Department of Mathematics has taken confident and deliberate strides to guide students in applying logical methods, understanding correct mathematical concepts, and honing their skills. These efforts are made possible through the dedicated work of a distinguished team of faculty members specializing in diverse mathematical fields.

Our department plays a pivotal role in advancing scientific research, contributing to the dissemination of knowledge through the publication of peer-reviewed articles in prestigious international journals and active participation in global conferences. We offer both Bachelor's and Master's degree programs in Mathematics to equip students for advanced doctoral as well as professional studies at esteemed national and international institutions.

We are proud to have received conditional accreditation from the National Commission for Academic Accreditation and Assessment at the national level. Additionally, the department plays a key role in program delivery across the university, offering Mathematics courses to students enrolled in various programs beyond those specifically provided by our department. In alignment with Prince Sattam Bin Abdulaziz University's strategic objectives, we strive to establish our university as a world-class leader in education and research through strong collaboration with the community.

Looking ahead, we are excited about several initiatives in the pipeline, including a Ph.D. program in Mathematics, a B.Sc. in Mathematics with a specialization in Data Science, a Bachelor of Science in Actuarial Science, a Professional Master's program in Statistics and Data Science, and a minor program in Data Science. These additions aim to meet the evolving needs of students and the global job market.

Our achievements are reflected in our ranking as the second-highest in Mathematics specialization according to the Shanghai Rankings. Furthermore, eight of our esteemed faculty members are featured in the global top 2% list of highly cited researchers. Our graduates find employment across a broad spectrum of domains, including education, banking, finance, IT, and marketing, contributing significantly to various industries.

We hope this handbook provides valuable insight into the department's vision, mission, goals, academic programs, research endeavors, and faculty achievements. Your feedback is invaluable in enhancing the quality of education and fostering growth.

May God continue to bless us in our efforts, and may peace and blessings be upon the Prophet Muhammad and his companions.

Sincerely,
Dr. Fahad AlJuaydi
Chairman, Department of Mathematics
Prince Sattam Bin Abdulaziz University

About the Department

- The Department of Mathematics is one of the oldest and largest departments of the College of Science, as the department was established with the inception of the college in 1426 AH as one of the affiliated colleges of the King Saud University. In the year 1430 H it joined the University of Al-Kharj, then in 1432 H it became one of the departments in the college of science and humanities affiliated to Prince Sattam bin Abdulaziz University. Since then, the department has been providing teaching services to large number of male and female students in various faculties of the university, as mathematics is the language of applied sciences.
- The department consists of two branches: a male branch in the College of Science and Human Studies and a female branch located in the College of Science (Girls Branch) in Al-Kharj. The department comprise of an elite group of distinguished faculty members of all scientific ranks (Professor, Associate Professor, Assistant Professor, Lecturer and Teaching Assistants) who have vast experience in teaching and research in all areas of Mathematics, such as Pure Mathematics, Applied Mathematics, Engineering Mathematics, Statistics and Operations Research.
- The faculty members of the department are actively involved in Research and report their research findings in peer reviewed scientific journals of repute. Not only that, they also take part in arbitration and the review process of some prestigious journals.
- The Department offers Bachelors and Master Degree Program in Mathematics and at the same time shoulders the responsibility of delivering courses in Mathematics and Statistics in other departments within the College of Science such as Physics and Chemistry and also programs offered by other faculties such as Engineering, Computer Science, Business, Medicine, Applied Medical Science, …., etc.

Vision-Mission-Objectives

Vision

- Excellence in Mathematical Science and its applications to serve the community.

Mission

- To provide a stimulating academic environment for education and research in various branches of Mathematics and its applications to serve the labor market and the community and inculcate human values among students thus producing well qualified and competent graduates as per national and international standards.

Objectives

- To provide quality education in Mathematics that is relevant to present day changes and challenges and comparable with similar programs offered by universities of national and international repute.
- To develop the logical and analytical thinking, quantitative reasoning and problem solving skills of students, to ensure the effective achievements of students' learning in Mathematics.
- To prepare the students to become eligible for professions having minimum eligibility as graduation.
- To provide adequate facilities for proper teaching and learning of Mathematics.
- To prepare the students to serve the society socially as well as economically.
- To prepare the students to take up Graduate Programs in Mathematics.

Degree Awarded

- Bachelor of Science in Mathematics (B. Sc).
- Master of Science in Mathematics (M.Sc).

CAREER AVENUES

(1) Working as a teaching assistant at any of the Saudi universities, military colleges and higher institutes.

(2) Working with relevant government departments, such as quality laboratories, hospital laboratories etc.

(3) Work in institutions and companies specialized in the chemical industries.

(4) Working as a research assistant or technician in the university laboratories.

(5) Working as a researcher in research laboratories.

(6) Teaching in the three stages of general education.

(7) Working in medical laboratories.

(8) Working in military factories.

The New Academic System (e-Register)

- Registration is the cornerstone of the academic system, the center of the educational process, and the first step to start university life. The new Academic System (e-Register) offers students the following opportunities:

(1) Online Registration including (registration, adding, and dropping) using the link: http://sau.edu.sa/ar/register that helps the student to register, in person, from any location during the period of registration and dropping plus an additional period specified in the academic calendar. Thus, without having to visit the College or the Department after reviewing his academic advisor, the student can perform the following:

- ☒ **Registration**: Registration of courses and deciding the required number of credit hours.
- ☒ **Adding and dropping**: The student may drop and add courses during the first week of teaching provided that the study load does not go above, or below, the allowed course load and required course load.

(2) To view the course schedule of the college and the available/ closed groups.

(3) To view the weekly academic schedule and print it.

(4) To view the academic record (transcript) and print a copy (an unofficial copy).

(5) To view the results of the final exams as soon as they are put online.

(6) To view the study plan, the courses passed by student, and the ones remaining to be studied.

(7) To know about the penalties imposed upon the student.

(8) To view the previous academic movements (deleting a course, apology for a semester).

(9) To view the financial rewards.

(10) To view and modify the personal information.

(11) To exchange electronic messages and change the password.

(12) To mail suggestion and submit complaints.

(13) To write the academic performance evaluation of faculty members.

Rules and Mechanisms for Registration of Courses

- The course is a module that meets the needs of the level specified in the approved Study Plan. The Course has a number, a code, a title, and a description of a course.
- The Course is divided into a set of theoretical lectures and practical lessons (study units) taught on a weekly basis, during the academic level.
- The credit hour is a weekly theoretical lecture that is not less than fifty minutes, or a practical lesson which is not less than one hundred minutes.
- The registration of the courses for all students is done automatically through the website http://sau.edu.sa/ar/register.
- The academic levels vary in the number of the units of study, from 12 units to 20 units, for each level.
- The Courses are registered automatically at the beginning of the following semester for the student's convenience. Then, the student can modify the course schedule by adding or dropping.
- The following table shows the student's study load corresponding to the cumulative average:

GPA	2	2.5	3	3.5	4	4.5	5
Hours allowed for registration	12	15	16	17	18	19	20

- The process of dropping and adding are performed by the student electronically in the first week of the semester through accessing the gate of the academic system of the University Deanship of Admission and Registration http://sau.edu.sa/ar/register. The student has no right to register a course without passing its pre-requisite course.
- Students, who pass all courses without failures, are registered in the courses of in the hierarchy levels according to the approved study plan.
- Students, who fail in some courses, are registered in such courses that ensure their minimum study load in each semester taking into account the following point:

(1) No conflict in the schedule.

(2) Fulfilling the prerequisites of the course or courses to be registered.

Calculating of Average and Cumulative GPA

The Average and cumulate GPA are calculated every semester for the student automatically by the system. To know how to calculate the averages, one should follow the following steps:

Calculating the Semester Average

- The GPA is calculated considering the following points:
  (1) Knowing the number of credits of the courses.
  (2) Knowing the mark obtained in each courses.
  (3) Knowing the corresponding grade of each mark.
  (4) Knowing the value of each grade.
  (5) Knowing the points = number of hours of the course x value of the grade.
  (6) Determining the total points obtained in all courses of the semester.
  (7) Determining the total number of credits registered in the semester.
  (8) The average is calculated every semester according to the following equation:

$$\text{GPA} = \frac{\text{Total points (item 6)}}{\text{Number of hours registered in the semester (item 7)}}$$

- The following table shows the percentage of marks, grade and value obtained by the student in each course, which is used to calculate the points:

Mark	Grade	Letter of Grade	Value of Grade
From 95 - 100	+ Excellent	+A	5.00
From 90 to less than 95	Excellent	A	4.75
From 85 to less than 90	+ Very Good	+ B	4.50
From 80 to less than 85	Very Good	B	4.00
From 75 to less than 80	+ Good	+ C	3.50
From 70 to less than 75	Good	C	3.00
From 65 to less than 70	+ Pass	+ D	2.50
From 60 to less than 65	Pass	D	2.00
Less than 60	Failure	E	1.00
Absence from lectures (25% or more)	Debarred	H	1.00

Calculating the Average cumulative:

- The GPA semester average is calculated as follows:
  (1) The grand total of points (for all semesters that have been completed).
  (2) The grand total of credit hours (for all semesters that have been completed successfully).
- The cumulative average is calculated according to the following equation:

GPA =	Grand total of points
	Grand total of credit hours

- Here is an example of how to calculate the grades above:

"Calculating the grade of the first semester"

Course	Credit Hours	Mark	Grade	Grade Value	Points
MATH 1050	3	67	+ D	2.50	3 X 2.50 = 7.50
ENG 1210	3	73	C	3.00	3X 3.00 = 9.00
ENG 1220	3	77	+ C	3.50	3X 3.50 = 10.50
ENG 1230	3	81	B	4.00	3X 4.00 = 12.00
TECH 1400	3	92	A	4.75	3X 4.75 = 14.25
---	15	---			53.25
GPA = Total points ÷ No. of hours registered in semester = 53.25÷ 15 = 3.55					

"Calculating the grade of the second semester"

Course	Credit Hours	Mark	Grade	Grade Value	Points
SALAM 101	2	67	+ A	5.00	2 X 5.00 = 10.00
ARAB 101	2	73	C	3.00	2X 3.00 = 6.00
PHYS 1010	4	77	+ C	3.50	4X 3.50 = 14
1060 MATH	3	81	B	4.00	3X 4.00 = 12.00
COM 1400	2	63	D	2.50	2X 2.50 = 5.00
ENG 1604	3	88	+ B	4.50	3 X 4.50 = 13.50
---	16	---			60.50

GPA = Total points ÷ No. of hours registered in semester = 60.50 ÷ 16 = 3.78

"Calculating the average cumulative"

GPA = total points ÷ total hours of the semester = 113.75 ÷ 31 = 3.67.

Dropping and adding of a course

- The process of dropping and adding is performed through portal (http://sau.edu.sa/ar/register) during the first week of the semester only; but the number of credit hours registered has to be at least 12 hours.
- The student may drop only one course due to excuse acceptable to the dean of the College. This procedure should occur at least five weeks before the final exams begin. The student has the right to apply for such a procedure at a maximum of four courses during the whole period of study at the College.

Attendance, postponing and dropping out of College

- The student must be regular in attendance attending at least 75% of the lectures and the practical classes.
- If any student has a percentage of absence of 25 %, or more, in any course, he is denied access to the final exam of this course and his result is F.
- A student may apply for postponement of the study before the beginning of the semester for an excuse accepted by the College Board. The postponement should not exceed two consecutive semesters or maximum of three semesters during the allowed duration of Program.
- The University Council may, in case of necessity, exempt the applicant from the previous provision.
- If student drops out of College for one semester without requesting the postponement of his registration, the University has the right to dismiss his registration. The university Council has the right to do this for a lesser period of time.
- The student is not considered as dropping out of College if he is a visiting student at another university.

Visiting student

The Visiting student is student who studies some courses at another university, or at a branch of the university to which he belongs without being transferred. The courses he studied are accredited according to the following regulations:

- The student has a transcript (including a grade point average) for, at least, two semesters at his college before he applies as a visiting student.
- The student must obtain a prior approval from his college permitting him to study as a visiting student while specifying the courses that will be studied. The college has the right to require a specific grade to be achieved by the student to offset the course. The student should obtain an official letter from the Deanship of Admission and Registration directing him to study as a visiting student.
- The student has to report back to his parent University/department after completion of the course(s).
- The courses, undertaken by the student for study outside the university, must be equivalent in their description to the similar courses offered in the parent univeristy, and the total credit units should be less than the units required for graduation.
- The total acquired credit units acquired from outside the University should not exceed a maximum of 20% of the total credit units required for graduation from Prince Sattam Bin Abdulaziz University.
- The courses undertaken by the visiting student are not included in the cumulative average. However, these courses are recorded in his academic record.
- The student must provide the Deanship of Admission and Registration with the results he obtained during the first two weeks of study in the semester following the period of study as a visitor. If not reported within that period, the student is considered as dropping out of College during those semesters.

Dismissal from the University

The student is dismissed from the University in the following cases:

- If he received three consecutive warnings due to a cumulative average below a minimum of 2 out of 5.
- The student may be given a fourth opportunity by the Council of the University based upon the recommendation of the College Council to raise his cumulative GPA by studying the available courses.
- The University Council may give the dismissed students an opportunity that does not exceed two semesters as a maximum.
- If the student does not fulfill his graduation requirements at the college in a period of up to half of the period prescribed for graduation in addition to the duration of the Program, the student is deemed to be dismissed.
- The student is given an exceptional opportunity by the University Council to meet the graduation requirements with the maximum period not exceeding twice the original term specified for graduation.
- The University Council may allow dismissed students, due to the exhaustion of failure times, to attend twice the duration of the Program. This extension should not exceed a maximum of two semesters.

Examination and Grades

- Based on the recommendations of the Department council, the college council specifies a mark for the student's course work, varying from 40% to 60% of the totalmarks of the course.
- The mark of the course's semester work is calculated by one of the following two methods:

  (1) Calculating the degree specified by the College Council for the semester work.

  (2) Announcing how the semester work grades will be distributed to students at the beginning of each semester, according to what is stated in the course description, and the date of the end semester exams.

  (3) Informing students of their performance in the quarterly test after announcing its result and allowing the students to compare it with the standard answer for the test.

(4) Announcing the results of the semester exams within two weeks from the date of taking the exam. Also, he is obligated to announce the detailed results of the other semester work at least one week before the start of the final exams.

- Based on the recommendation of the course teacher, it is permissible for the Council of the Department, that teaches the course, to allow the student to complete the requirements of any course in the following semester and to give the student a grade of (I) (incomplete) in his academic record. Only the grades achieved by the student are included in the GPA or cumulative after the completion of the requirements of that course. If one semester passes without changing the grade incomplete (I), the student is given an (F) which is calculated in the GPA and cumulative.
- The grades obtained by the student in each course are calculated according to the schedule mentioned above.

End Semster Examination Regulations

(1) No student may be tested in more than two courses in one day.

(2) A student is not allowed to enter the exam room after half an hour of its beginning and is not allowed to leave the exam room before half an hour after its beginning.

(3) Based on a recommendation from the relevant Department Council, the College Council specifies the duration of the final written exam to be within a period not less than one hour, and not more than three hours.

(4) Cheating in the exam, initiating it, or violating the instructions and rules of examination procedures are actions punishable in accordance with the Regulation of the students' Discipline issued by the University Council.

(5) In cases of necessity, the college council, incharge of teaching a course, has the right to approve re-marking of the answer sheets in a period of time not later than the beginning of the following semester in accordance with the following rules:

- A student applies for re-marking the answer sheet of only one course per semester.
- The student, who wishes to re-mark his answer sheets, may apply for re-marking to the department that teaches this course, not later than one month after taking the final exam.

- A student, who has already applied for re-marking and proved the invalidity of his application, should never apply for re-marking his answer sheets in any exam in the future.

Transferring

(1) "Transferring from one college to another within the University"

- It is permissible, with the consent of the respective dean of the colleges; accept the transfer request of a student from one college to another in accordance with the conditions approved by the College Council in which the student wishes to transfer.
- The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

(2) "Transferring from one major to another within the college"

- The student may, after the approval of the Dean, transfer to another specialty within the College according to the guidelines established by the College Council.
- The student's college academic record has to show all courses previously studied, including grades, semester and cumulative averages throughout the study at the college from which he is transferred.

Batchlor of Science in Mathematics

The Study System

Teaching at the mathematics department is subject to the following scheme:

(1) The school year consists mainly of two regular semesters and a summer semester, if available.

(2) The stage of academic progress is indicated by the academic level since the number of levels to graduate is at least eight levels in conformity with the approved study plan.

(3) The duration of a level is a full semester (not less than 15 weeks) and this period does not include the periods of registration and final exams.

(4) The duration of the summer semester is not less than eight weeks where the teaching time allocated per week for each course is increased.

(5) Students have to study 138 class units (credit hours) to obtain a Bachelor's Degree as follows:

- The student completes 31 credit hours during the Preparatory Year (two semesters in one academic year).
- University Requirements: The student acquires 8 credit hours during the period of the study at the Department.
- The students acquire 76 credit hours (compulsory + elective) from the mathematics department throughout the six semesters following the preparatory year (beginning with the third semester).
- The students complete 15 credit hours (compulsory + elective) from other department.
- The students complete 6 credit hours (free elective) from other departments.

The students acquire 2 credit hours for the field training.

Graduation

The student graduates after successfully completing graduation requirements according to the study plan, provided that his cumulative average is not less than an average of 2 (pass), and the college council, based on the recommendation of the competent department council, may determine appropriate courses that the student can study to raise his cumulative average in the event of success in the courses.

Study Plan of Bachelor Program

The Curriculum Leading to the Bachelor's degree in Mathematics

- Students must successfully complete total of (138) credit hours to earn a Bachelor Degree in Mathematics.
- The study plan for students of the College of Science and Humanity Studies is designed to contain the basic cognitive aspects in each of:

(1) Preliminary courses in the preparatory year.

(2) Islamic culture.

(3) Core and Elective Courses: These courses are offered starting from the third level to the eighth level, and specialized courses are offered at these levels in various branches of mathematics (pure mathematics, applied mathematics, statistics with other supporting courses), as well as practical courses to train students to conduct mathematical and statistical applications and elicit and analyze results. The study plan for the bachelor's stage in the Department of Mathematics, provided that the total number of credits is the same as in the other departments of the college and distributed among the preparatory year requirements with other requirements. The following distribution shows the details of the study plan for the bachelor degree in mathematics:

Requirements	No. of Courses	Credit Hours
Preparatory Year Requirements	11	31
University Requirements	4	8
Compulsory Courses from the Department	21	61
Elective Courses from the Department	5	15
Compulsory Courses from other departments	4	12
Elective Courses from other departments	1	3
Free elective Courses from other departments	2	6
Field Training	----	2
Total	**48**	**138**

Detailed description of the requirements for a Bachelor degree in Mathematics

(a) Compulsory Courses at the Department (61 Credit Hours):

Course Code	Course Name	Credit Hours	Prerequisite
Math 2240	Algebra and Geometry	3 (3, 1, 0)	Math 1060
Math 2250	Linear Algebra-I	3 (3, 1, 0)	Math 2240
Math 2290	Mechanics	3 (3, 1, 0)	Math 1060
Math 2301	Visual Programming of Mathematical Problems	3 (3, 0, 1)	CT 1400 (Computer Skills)
Math 2311	Infinite Series and Calculus Applications	3 (3, 1, 0)	Math 1060
Math 2321	Actuarial Mathematics –I	3 (3, 1, 0)	Math 1060
Math 2455	Group Theory	3 (3, 1, 0)	Math 2240
Math 3280	Linear Algebra-II	3 (3, 1, 0)	Math 2250
Math 3320	Multivariable Calculus	3 (3, 1, 0)	Math 2311
Math 3330	Ordinary Differential Equations-I	3 (3, 1, 0)	Math 2250 + Math 2311
Math 3340	Ordinary Differential Equations-II	3 (3, 1, 0)	Math 3320 + Math 3330
Math 3350	Vector analysis	3 (3, 1, 0)	Math 3320
Math 3370	Numerical Analysis	3 (3, 1, 0)	Math 2250 + Math 2311
Math 3460	Real Analysis-I	3 (3, 1, 0)	Math 3320 + Math 3330 + Math 2240
Math 3510	Mathematical Packages	3 (3, 1, 0)	Math 3330 + Math 2301
Math 4350	Complex Analysis	3 (3, 1, 0)	Math 3320 + Math 3330
Math 4360	Introduction to Partial Differential Equations	3 (3, 1, 0)	Math 3320 + Math 3330
Math 4430	Introduction to Topology	3 (3, 1, 0)	Math 3460
Math 4455	Rings and Fields	3 (3, 1, 0)	Math 2455
Math 4620	Ethics of Mathematicians	1 (1,0, 0)	Math 3460
Math 4820	Graduation Project	3 (2, 1,0)	After acquiring 115 credit hours

Credit Hours	61 (59, 18, 1)

(b) Compulsory Courses at other Departments (12 credits):

Course Code	Course Name	Credit Hours	Prerequisite
Stat 2010	Principles of Statistics and Probability	3 (3, 1, 0)	Math 1060
Stat 2040	Statistical Methods	3 (3, 1, 0)	Stat 2010
Stat 3280	Statistical Packages	3 (2, 0, 1)	Stat 2040
Phys 2180	General Physics for Mathematics Students (2)	3 (3, 0, 1)	Phys 1010
Credit Hours		**12 (11, 2, 2)**	

(c) Elective Courses from the Department (15 Credit Hours):

Five courses to be chosen from the following two groups of elective courses: (The student chooses two courses from group-1 and three courses from the group-2 or vice versa)

Group (1)

Course Code	Course Name	Credit Hours	Prerequisite
Math 3240	Actuarial Mathematics –II	3 (3, 1,0)	Math 2321
Math 3270	Number Theory	3 (3, 1, 0)	Math 2240
Math 4390	Differential Geometry	3 (3, 1, 0)	Math 2250 + Math 3320 + Math 3330
Math 4420	Introduction to Functional Analysis	3 (3, 1, 0)	Math 3280 + Math 3460
Math 4470	Real Analysis-II	3 (3, 1, 0)	Math 3460 + Math 3280 + Math 3320
Math 4520	Calculus of Variations	3 (3, 1, 0)	Math 3320 + Math 3330
Math 4530	Methods of Optimization	3 (3, 1, 0)	Math 2250 + Math 3260

Group (2):

Course Code	Course Name	Credit Hours	Prerequisite
Math 3260	Mathematical Programming	3 (3, 1, 0)	Math 2250 + Math 2311
Math 4380	Non-Linear Dynamics	3 (3, 1, 0)	Math 2250 + Math 3330
Math 4400	Advanced Fluid Mechanics	3 (3, 1, 0)	Math 2290 + Math 4360

Math 4410	Classical Mechanics	3 (3, 1, 0)	Math 2290 + Math 4360
Math 4480	Principles of Automatic Control	3 (3, 1, 0)	Math 2250 + Math 3320 + Math 3330
Math 4490	Applications of Continuum Mechanics	3 (3, 1, 0)	Math 2250 + Math 4360
Math 4500	Numerical Methods to Solve Partial Differential Equations	3 (3, 1, 0)	Math 3370 + Math 4360
Math 4540	Computational Geometry	3 (3, 1, 0)	Math 2250 + Math 3330 + Math 3370
Math 4550	Wavelet and Signal Processing	3 (3, 1, 0)	Math 4470
Math 4560	Dynamics of the Rigid Body	3 (3, 1, 0)	Math 2290 + Math 3330

(d) Elective Courses from other Departments (3 Credit Hours):

The student selects one course from the following list:

Course Code	Course Name	Credit Hours	Prerequisite
Math 2300	Visual Programming -II	3 (3, 1, 0)	Math 2301
IS 2510	Databases	3 (3, 1, 0)	Math 2301
Phys 2140	Classical Mechanics -I	3 (3, 1, 0)	Phys 1010
Phys 2230	Modern Physics	3 (3, 1, 0)	Phys 1010
Phys 2410	Thermodynamics	3 (3, 1, 0)	Phys 1010 + Math 1060
Stat 2150	Probability -I	3 (3, 1, 0)	Stat 2040

(e) Free Elective Courses (6 Credit Hours):

Students may select up to six credit hours for the development of their professional skills either from the core courses or outside the College of Science and Humanity Studies. The selected courses must meet the prerequisite.

Field Training:

Each student will be required to complete a training period for seven weeks appropriate to their studies in an approved place after completing 95 credit hours.

Course Code	Courses Offered	Contact hours	Prerequisites
Math 4590	Field Training	2 (0, 0, 15)	After completing 95 credit hours

Distribution of Study Plan Courses

Third Level:

Course Code	Course Name	Credit Hours	Prerequisite
IC 102	Islam and Society	2 (2, 0, 0)	----
Math 2240	Algebra and Analytical Geometry	3 (3, 1, 0)	Math 1060
Math 2301	Visual Programming of Mathematical Problem	3 (3, 1, 0)	CT 1400
Math 2311	Infinite Series and Calculus Applications	3 (3, 1, 0)	Math 1060
Phys 2180	General Physics for Students of Mathematics -II	3 (3, 0, 1)	Phys 1010
Stat 2010	Elementary Probability and Statistics	3 (3, 1, 0)	Math 1060
Credit Hours		**17 (17,4,1)**	**---**

Fourth Level:

Course Code	Course Name	Credit Hours	Prerequisite
IC 103	The Economic System in Islam	2 (2, 0, 0)	----
Math 2250	Linear Algebra- I	3 (3, 1, 0)	Math 2240
Math 2290	Mechanics	3 (3, 1, 0)	Math 1060
Math 2321	Actuarial Mathematics-I	3 (3, 0, 0)	Math 1060
Math 2455	Group Theory	3 (3, 1, 0)	Math 2240
Stat 2040	Statistical Methods	3 (3, 1, 0)	Stat 2010
Credit Hours		**17 (17,4,0)**	

Fifth Level:

Course Code	Course Name	Credit Hours	Prerequisite
IC 104	Political System in Islam	2 (2,0,0)	----
Math 3280	Linear Algebra- II	3 (3,1,0)	Math 2250
Math 3320	Multivariable Calculus	3 (3,1,0)	Math 2311
Math 3330	Ordinary Differential Equation- I	3 (3,1,0)	Math 2250 + Math 2311
Math 3370	Numerical Analysis	3 (3,1,0)	Math 2250 + Math 2311
Stat 3280	Statistical Package	3 (3,1,0)	Stat 2040

	Credit Hours	**17 (16,5,0)**	

Sixth Level:

Course Code	Course Name	Credit Hours	Prerequisite
Math 3340	Ordinary Differential Equation II	3 (3,1,0)	Math 3330 + Math 3320
Math 3350	Vector Analysis	3 (3,1,0)	Math 3320
Math 3460	Real Analysis- I	3 (3,1,0)	Math 3330 + Math 2240 + Math 3320
Math 3510	Mathematical Package	3 (3,1,0)	Math 3330 + Math 2301
---	Free Course	3 (3,1,0)	
---	Elective Course from within the Department of Mathematics	3 (3,1,0)	
	Credit Hours	**18 (17,6,0)**	

Field Training:

Course Code	Courses Offered	Contact hours	Prerequisites
Math 4590	Field Training	2 (0, 0, 15)	After completing 95 credit hours

Seventh Level:

Course Code	Course Name	Credit Hours	Prerequisite
Math 4360	Introduction to Partial Differential Equations	3 (3, 1, 0)	Math 3330 + Math 3320
Math 4430	Introduction to Topology	3 (3, 1, 0)	Math 3460
Math 4455	Rings and Fields	3 (3, 1, 0)	Math 2455
---	Elective Course from within the Department of Mathematics	3 (3, 1, 0)	Provided that Prerequisite has completed
---	Elective Course from outside the Department of Mathematics	3 (3, 1, 0)	Provided that Prerequisite has completed
---	Free Course	3 (3, 1, 0)	---
	Credit Hours	**18 (18, 6, 0)**	

Eighth Level:

Course Code	Course Name	Credit Hours	Prerequisite
Math 4350	Complex Analysis	3 (3, 1, 0)	Math 3330 + Math 3320
---	Elective Course from within the Department of Mathematics	3 (3, 1, 0)	Provided that Prerequisite has completed
---	Elective Course from within the Department of Mathematics	3 (3, 1, 0)	Provided that Prerequisite has completed
---	Elective Course from within the Department of Mathematics	3 (3, 1, 0)	Provided that Prerequisite has completed
Math 4620	Ethics	1 (1, 0, 0)	Math 3460
Math 4820	Graduation Project	3 (2, 1, 0)	After acquiring 115 credit hours
Arab 103	Writing Skills	2 (2, 0, 0)	
	Credit Hours	**18 (17, 5, 0)**	

Service Courses:

The courses offered by the department and taught in programs of other departments within the college and beyond.

Course Code	Course Name	Credit Hours
Math 2230	Algebra and Analytic Geometry for students of Physics and Statistics	4 (3, 1, 1)
Math 3320	Multivariable Calculus	2 (2, 0, 0)
Math 3410	Differential Equations for Physics and Chemistry students	2 (2, 0, 0)
Math 142	Mathematics-I for students of Business Administration	2 (2, 0, 1)

Math 143	Mathematics-II for students of Business Administration	2 (2, 0, 0)
Math 1050	Differential Calculus (For Preparatory Year)	2 (2, 0, 0)
Math 1060	Integral Calculus (For Preparatory Year)	2 (2, 0, 0)
Math 1070	Algebra and Analytic Geometry	2 (2, 0, 0)
Math 2030	Differential and Integral Calculus	2 (2, 0, 0)
Math 2040	Differential Equations	2 (2, 0, 0)
Math 2440	Linear Algebra	2 (2, 0, 0)
Math 2540	Numerical Methods	2 (2, 0, 0)
Math 2220	Linear algebra for Computer Students	2 (2, 0, 0)
Math 2350	Calculus for Computer Students	2 (2, 0, 0)
Math 3310	Differential Equations for Computer Students	2 (2, 0, 0)
Stat 106	Principles of Biostatistics for (For Preparatory Year)	2 (2, 0, 0)
Math 109	Mathematics for Pharmacy	2 (2, 0, 0)
Math 2230	Differential Equations	2 (2, 0, 0)
Math 3320	Linear Algebra	2 (2, 0, 0)
Math 3410	Numerical Methods	2 (2, 0, 0)
Math 1420	Linear algebra for Computer Students	2 (2, 0, 0)
Math 1430	Calculus for Computer Students	2 (2, 0, 0)
Math 1050	Differential Equations for Computer Students	2 (2, 0 , 0)
Math 1060	Principles of Biostatistics Program for Students of the Common Program of Medical Colleges	2 (2, 0, 0)
Math 109	Mathematics for Pharmacy	2 (2, 0, 0)

Courses which serve the labor market:

Course Code	Course Name	Credit Hours	Labor Market
Math 2321	Actuarial Mathematics-I	3 (3, 0, 0)	Capital Market
Math 3240	Actuarial Mathematics-II	3 (3, 1, 0)	Capital Market
Math 3260	Mathematical Programming	3 (3, 1, 0)	Support centers and decision-making
Math 3370	Numerical Analysis	3 (3, 1, 0)	Research centers
Math 3510	Mathematical Packages	3 (2, 1, 0)	Research Centers – Computer Companies
Math 4400	Advanced Fluid Mechanics	3 (3, 1, 0)	Research centers for oil, water, and meteorological
Math 4480	Principles of Automatic Control	3 (3,1, 0)	All fields of engineering
Math 4490	Applications of Continuum Mechanics	3 (3,1, 0)	Research centers
Math 4500	Numerical Methods to Solve Partial Differential Equations	3 (3, 1, 0)	Research centers
Math 4530	Methods of optimaization	3 (3, 1, 0)	Research centers, Banks, Airlines
Math 4540	Computational Geometry	3 (3, 1, 0)	Support Centers and decision making industries
Math 4550	Wavelet and signal processing	3 (3, 1, 0)	Communication, Engineering

Description of Bachelor Program Courses

Course Code: Math 2240 **Course Title:** Algebra and Analytic Geometry **Credit Hours:** 3(3,1,0) **Level:** Third **Prerequisites:** Math 1060	**Course Code: Math 2250** **Course Title:** Linear Algebra- I **Credit Hours:** 3(3,1,0) **Level:** Fourth **Prerequisites:** Math 2240
Course Description Analytic Geometry: the straight line – Circle – Conic sections General theory of second order curves – Simplifying the general second order equation by Translation and Rotation – systems of coordinates – Introduction to mathematical logic: Statement – Conjunction – Disconjunction – Conditional and bi-conditional statements – Existential and universal quantifiers – Negation – Converse– Inverse and contrapositive – Truth tables – Methods of proof. Sets theory: Concept De Morgan's laws – power set – Cartesian product – ordered pairs and triples. Relations: domain and range of relation notions of reflexive – symmetric – transitive relation – Equivalence relations – equivalence class – partition– quotient set. Orderings: partial and total orderings – Mapping and Functions – Different types of mapping domain and range of a function – composition of functions – Inverse of mapping – Composition of mapping – Countable set – Equivalent sets – Cardinal Number – Finite and infinite sets.	**Course Description** Matrix Definition– Matrix Operations– Symmetric Matrices – Transpose and Inverse of a Matrix – Hermitian Matrices – Markov Matrices – Factorization – Positive definite Matrix – Row Operations – Row Reduced Echelon Form – Linear system of Equations – Solving $Ax=0$ and $Ax=b$ – Vector Spaces and Subspaces – Basis and Dimension – Orthogonality – Similar Matrices – Singular Value Decomposition – Least Squares Approximations – Determinants – Properties of Determinants – Applications of Determinants – Cramer's Rule – Gauss elimination rule – Gauss Jordan Elimination – Eigen values and Eigenvectors – Diagonalization – Linear Transformation – Matrices with MATLAB.
Course Symbol and Code:2301 Math **Course Title:** Visual Programming of Mathematical Problems **Course hours:** 3 (3, 0,1) **Level:** Third **Pre-requisite:** 1400 TC	**Course Code: Math 2311** **Course Title:** Infinite Series and Calculus Applications **Credit Hours:** 3(3,1,0) **Level: Third** **Prerequisites: Math** 1060

Course Description The course covers the basic programming principles focusing on graphical user interfaces and structured programming techniques. The topics include design interfaces for mathematical applications, using variables and constants to store information, input/output operations, arithmetic operations, arithmetic expressions, sequential, selection, and repetition programming structure, arrays implementation, function implementation and other related topics. Upon completion, students should be able to design, code, test, and debug Visual programs.	**Course Description** Sequences and Series – Sequence of real number – Bounded and monotonic sequences – Geometric sequences – Infinite series – Convergence and Divergence of Infinite Series – Integral Test – Ratio Test – Root Test and Comparison Test. Conditional Convergence and Absolute Convergence – Alternating Series Test – Power Series – Differentiation and integration of power series –Taylor and Maclaurin series – The centroid of a plane region – Moments and center of mass – Work- Power – Energy – Fluid pressure and force – Newton's Method – Linearization and Differentials – Optimization.
Course Code: Math 2321 **Course Title:** Actuarial mathematics-I **Credit Hours: 3**(3,0,0) **Level:** Fourth **Prerequisites: Math** 1060	**Course Code: Math 3260** **Course Title:** Mathematical Programming **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2250, **Math** 2311
Course Description Introduction and definitions – the general law of simple interest –true and commercial interest – present value and discount – the sum of annuities –certain using fixed and variable simple interest rates– some practical applications on simple interest including methods of redemption of short term loans, modification of loans and saving accounts. The general law of compound interest: the sum, present values and discount –the nominal rate of compound interest – the calculation of the sum and present value of annuities – certain with fixed and variable compound rates of interest-some practical applications on compound interest including methods of redemption of long term loans, modification of loans and redeemable	**Course Description** Polyhedra–Extreme Points– Optimality Conditions – The Simplex Method – Separating Hyper planes and Duality – Sensitivity Analysis – Parametric Programming – Interior Point Methods – Affine Scaling–Network Problems and the Simplex Method – Duality in Networks – Shortest Path Problem – Integer Programming Formulations – Integer Programming Duality.

securities – investment using software and spread sheets – insurance-Investment using Excel.	
Course Code: Math 2290 **Course Title:** Mechanics **Credit Hours:** 3(3,1,0) **Level:** Fourth **Prerequisites: Math** 1060	**Course Code: Math 3320** **Course Title:** Multivariable Calculus **Credit Hours:** 3(3,1,0) **Level:** Fifth **Prerequisites: Math** 2311
Course Description Static: Force as a vector – Vector Algebra – Free-body Diagrams – Coplanar Forces – Couples. Dynamics: Kinematics – Rectilinear Motion – Position Vector – Velocity and Acceleration – Graphical Methods – Relative Motion – Curvilinear Motion – Position Vector - Velocity and Acceleration in 2- D and 3- D – Relative Motion – Applications on Curvilinear Motion. Kinetics: Newton's 2nd Law – Principle of Work and Kinetic Energy – Principle of Impulse and Momentum – Central Force – Impact–Vibrations.	**Course Description** Coordinate Systems – Multivariable Functions – Partial derivatives - Critical Points of Multivariable Functions - Maxima and Minima of the Functions of Two Variables –SP - Lagrange Multipliers – Double Integrals in Rectangular Coordinates – Double Integrals in Polar Coordinates –Triple Integrals in Rectangular and Cylindrical Coordinates – Spherical Coordinates – Centre of Mass - Moment of Inertia - Gradient Fields and Path Independence – Divergence and Curl.
Course Code: Math 3270 **Course Title:** Number Theory **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2240	**Course Code: Math 3280** **Course Title:** Linear Algebra-II **Credit Hours:** 3(3,1,0) **Level:** Fifth **Prerequisites: Math** 2250
Course Description Divisibility – Greatest Common Divisor – Division Algorithm – Prime Factorization and Binomial – Binomial Theorem and Congruencies – Congruencies – Residue Systems – Fermat's Little Theorem – Euler's Theorem – Wilson's Theorem – Diophantine Equations – Chinese Remainder Theorem – RSA Cryptography - Hensel's Lemma –	**Course Description** Vector Spaces: Vector space axioms– Subspace and Span – Linear Combination – Linear independence – Generators – Basis and Dimension – Coordinate and Change of Basis – Rank of a Matrix – Linear Transformations–Kernel and range– Isomorphism – Matrix of a Linear transformation – Similarity and change of basis – Trace – Determinants and Permutations – Odd and even permutations – Computation by row and

Solving Equations Modulo Primes – Quadratic Residue Symbol –Quadratic Reciprocity– Continued Fractions – Curves in Projective Space – Statement of Falting's Theorem –(Mordell Conjecture)–Singular Points and Smoothness – Elliptic Curves – Abelian Groups – Torsion Points and Finite Generation of Group of Torsion Points – Mazur's Theorem and Calculating the Torsion Subgroup.	column operations – Cofactor expansion – Eigenvalues and Eigenvectors – Diagonalization – Characteristic Polynomial – Cayley Hamilton theorem – Jordan canonical form I& II – Symmetric Matrices – Inner Product – Norm – orthogonal transformations – Congruence – orthogonal basis – orthogonal Projections – Isometrics – Spectral theorem– Hermitian Products –Cauchy-Schwarz inequality–Angle between vectors – Gram–Schmidt processes – Applications of Linear Algebra: Graph Theory – Cryptography – Finding The Equation of a Curve Passing through a Point – Computer Graphics.
Course Code: Math 3330 **Course Title:** Ordinary Differential Equations-I **Credit Hours:** 3(3,1,0) **Level:**Fifth **Prerequisites: Math** 2250, **Math** 2311	**Course Code: Math 3340** **Course Title:** Ordinary Differential Equations- II **Credit Hours:** 3(3,1,0) **Level:** Sixth **Prerequisites: Math** 3320, **Math** 3330
Course Description First Order Equations: Non-Linear Separable – Homogeneous – Exact Equation – Linear Bernoulli's Equation – Direction Fields. Second Order Linear Equations with Constant Coefficients– Homogeneous case – Non-homogeneous Equations via Method of Undetermined Coefficients – Non-homogeneous Equations via Method of Variation of Parameters – Remarks on Higher Order Equations – Linear Independence and the Wronksian – Applications to Forced Oscillation Problems – Effect of Resonances – Laplace Transform Application to Constant Coefficient Linear Equations – Fourier Series.	**Course Description** First Order Systems – Conversion of Second and Higher Order Equations to First Order Systems – Differentiation of Vector and Matrix Functions – Solution of Linear Constant Coefficient Systems – Two Dimensional Systems and Phase Plane – Classification of Equilibria for Linear Systems – Qualitative behavior of Nonlinear Systems: Classification of Equilibria–Stability – Applications – Examples to the Pendulum and Population Models – Singular Points of Linear Second Order ODEs with Variable Coefficients – Frobenius Method – Bessel Functions – Properties of Bessel Functions–Modified Bessel Functions– Differential Equations Satisfied by Bessel Functions – Introduction to Boundary– Value Problems – Eigenvalues–EigenFunctions– Orthogonality of Eigen Functions–Sturm-Liouville

	Problem– Fourier Series – Fourier Sine and Cosine Series – Complete Fourier Series.
Course Code: Math 3350 **Course Title: Vector Analysis** **Credit Hours:** 3(3,1,0) **Level:** Sixth **Prerequisites: Math** 3320	**Course Code: Math 3370** **Course Title:** Numerical Analysis **Credit Hours:** 3(3,1,0) **Level: Fifth** **Prerequisites: Math** 2250, **Math** 2311
Course Description Vectors – Dot Product – Cross Product –Parametric Curves – Velocity – Acceleration–arc length – Curvature–Torsion–Level Curves–Partial Derivatives – Tangent Plane – Scalar Field and the Gradient – Directional Derivative–Lagrange Multipliers–Double and Iterated Integrals – Double Integrals in Polar Coordinates – Applications – Change of Variables–Triple Integrals in Rectangular and Cylindrical Coordinates–Spherical Coordinates–Gradient Fields and Path Independence – Conservative Fields and Potential Functions–Green's Theorem–two dimensional Curl (Vorticity)–Simply connected Regions– Flux Form of Green's Theorem – Vector Fields in 3-D-space – Surface Integrals and Flux – Divergence Theorem – Line Integrals in Space – Exactness–Potential– Stokes' Theorem-Conservation Laws– Heat/Diffusion Equation-Maxwell's Equations.	**Course Description** Types of Errors – Interpolation – Numerical Differentiation – Numerical Integration – Solving Algebraic Systems of Equations by Iterations – Root Finding – Solving System of Nonlinear Equations – Methods of Solving First Order Initial Value Ordinary Differential Equations – Converting Higher Order Ordinary Differential Equations to First Order Ones – Solving Systems of First Order Initial Value Ordinary Differential Equations – Finite Differences – Solving Two Point Boundary Value Problems by Finite Differences.
Course Code: Math 2455 **Course Title:** Group Theory **Credit Hours:** 3(3,1,0) **Level:** Fourth **Prerequisites: Math** 2240	**Course Code: Math 3460** **Course Title:** Real Analysis- I **Credit Hours:** 3(3,1,0) **Level:** Sixth **Prerequisites: Math** 2240, **Math** 3320, **Math** 3330
Course Description	**Course Description**

Binary Operation – Associative – Commutative – Identity element ν Inverse of an element – Fundamental Properties of Groups – Subgroups – Cyclic Groups – Permutation Groups – Symmetry Groups – Group Homeomorphisms and Cayley Theorem – Cosets and Lagrange's Theorem – Quotient Groups – Finite Groups – Discrete Groups – Finite Rotation Groups – Normal and Factor Groups – BiLinear Forms – Symmetric Forms – Hermitian Forms –The Rotation Group – Abelian Groups – Finitely Generated Abelian Groups – P Group - The Isomorphism - Theorems of Groups – Simple Group – Group Representation –Normal and Subnormal Series – Composition Series – Soluble Groups – Nilpotent Groups.	Sets and Fields – The Real Numbers – Countability – Metric Spaces – Closed Sets – Compact Spaces – Compact Subsets of Euclidean Space – Completeness – Sequences and Series – Continuity – Continuity and Compactness – Differentiability – Mean Value Theorem – Taylor Series – Riemann- Stieltjes Integral – Integrability – Fundamental Theorem of Calculus – Sequences of Functions – Uniform Convergence – Equicontinuity – Power Series – Fundamental Theorem of Algebra.
Course Code: Math 3510 **Course Title:** Mathematical Packages **Credit Hours:** 3(2,1,0) **Level:** Sixth **Prerequisites: Math** 2301, **Math** 3330	**Course Code: Math 4350** **Course Title:** Complex Analysis **Credit Hours:** 3(3,1,0) **Level: Eighth** **Prerequisites**: **Math** 3320, **Math** 3330
Course Description Introduction: Problem Formulation– Algorithm Development. FORTRAN 95: Program Creation – Compilation and Linking Variables and Parameters – Flow Control – Subroutines and Functions –Use of Libraries. C++ for Scientific Uses – Mathematica®: Vectors and Matrices – Numerical Calculations – Symbolic Calculations–Graphics. MATLAB®"Matrix Laboratory": MATLAB® Vectors and Matrices – Numerical Calculation. Applications: Polynomials – Interpolation – Integration – Differentiation – ODE – Graphics – 2- D and 3- D. Graphics: Review of Common Graphics Program –	**Course Description** Complex Algebra and Functions – Algebra of Complex Numbers – Complex Plane – Polar Form – Geometric Series – Functions of Complex Variable – Analyticity–Cauchy-Riemann Conditions– Harmonic Functions – Complex Exponential – Complex Trigonometric and Hyperbolic Functions – Complex Logarithm–Complex Powers–Inverse Trig. Functions – Complex Integration – Contour Integration – Path Independence–Cauchy's Integral Theorem– Cauchy's Integral Formula – Higher Derivatives – Bounds – Liouville's Theorem – Maximum Modulus Principle – Mean value Theorems – Fundamental Theorem of Algebra – Radius of Convergence of Taylor Series – Residue Calculus – Laurent Series – Poles – Essential

Graphics with Spreadsheets – Kaleidagraph – SigmaPlot – TecPlot, etc.	Singularities – Point at Infinity – Residue Theorem – Integrals around Unit Circle – Real Integrals From -∞ to +∞. Contours. Singularity on Path of Integration – Principal Values – Integrals involving Multivalued Functions – Conformal Mapping – Inversion Mappings – BiLinear/Mobius Transformations.
Course Code: Math 4360 **Course Title:** Introduction to Partial Differential Equations **Credit Hours:** 3(3,1,0) **Level:** Seventh **Prerequisites: Math** 3320, **Math** 3330	**Course Code: Math 4380** **Course Title:** Nonlinear Dynamics **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2250, **Math** 3330
Course Description Introduction and Basic Facts about PDE's – Types of PDE's – Derivation of the Heat and Wave Equations from physics – Solution of boundary problems (Dirichlet, Newmann, Robin) by Fourier series – Eigenvalues–EigenFunctions–Orthogonality of Eigen Functions–Sturm–Liouville Problem– Separation of Variables: The Heat Equation in 1D – The Wave Equation in 1D – Laplace's Equation in Rectangles, Circles - Inhomogeneous PDEs and the (Generalized) Fourier series – Fourier Transform – Solutions of PDE's by Fourier Transform – Heat and Wave Equations in Half Space – Solving Simple Equations by Characteristics.	**Course Description** Pendulum – Free Oscillator – Energy in the Plane Pendulum – Stability of Solutions to ODEs – Linear Systems – Nonlinear Systems – Conservation of Volume in Phase Space – Damped Oscillators and Dissipative Systems – Phase Portrait of Damped Pendulum – Forced Oscillators and Limit Cycles – Van der Pol Equation – Parametric Oscillator – Mathieu's Equation – Elements of Floquet Theory – Stability of the Parametric Pendulum – Damping. Fourier Transforms: Continuous Fourier Transform – Discrete Fourier Transform–Inverse DFT– Autocorrelations–Power Spectra – Poincaré Sections – Periodic – Quasiperiodic Flows – Aperiodic Flows – 1– D Flows – Rössler Attractor– Fluid Dynamics and Rayleigh– Bénard Convection – The Concept of a Continuum – Mass Conservation – Momentum Conservation – Substantial Derivative – Forces on Fluid Particle – Nondimensionalization of Navier–Stokes Equations – Bifurcation Diagram – Pattern Formation– Convection in the Earth – Introduction to Strange Attractors – Dissipation and Attraction – Attractors with 2D– Aperiodic Attractors – Rössler Attractor –

	Lorenz Equations – Physical Problem and Parameterization–Equations of Motion– Momentum Equation – Temperature Equation – Dimensionless Equations – Stability – Diverging Trajectories – Lyaponov Exponents.
Course Code: Math 4390 **Course Title:** Differential Geometry **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2250, **Math** 3320, **Math** 3330	**Course Code: Math 4400** **Course Title:** AdvancedFluid Mechanics **Credit Hours:** 3(3,1,0)) **Level:** Elective **Prerequisites: Math** 2290, **Math** 4360
Course Description Geometry of Curves in the Plane – Arc Length – Tangential and Normal Vectors – (signed) Curvature – Reconstruction of a Curve with given Curvature and Arc Length – Evolutes and Involutes – the Isoperimetric Inequality and Hopf's Theorem on the Tangential Degree of an Embedded Closed Curve – Geometry of Curves in the Space – Arc length – Curvature – Torsion – The Frenet– Serret Equations – Reconstruction of a curve with given curvature and torsion – Generalized helices – Evolutes and involutes. Surfaces in Space: The first and second fundamental forms – Area and the Gauss and Codazzi Equations–Gaussian curvature– developable surfaces – principal curvature – Meunier's Theorem – surfaces of constant Gaussian curvature – mean curvature – minimal surfaces – Intrinsic Geometry of Surfaces – Geodesic curvature of curves on surfaces – First variation of arc length – The Gauss– Bonnet Theorem and applications.	**Course Description** Continuum Viewpoint and the Equation of Motion – Static Fluids – Mass Conservation – Inviscid Flow (Differential Approach) – Euler's Equation – Bernoulli's Integral – The Effects of Streamline Curvature – Control Volume Theorems (Integral Approach) – Linear Momentum Theorem – Angular Momentum Theorem – First and Second Laws of Thermodynamics – Navier– Stokes Equation and Viscous Flow – Boundary Layers – Separation and the Effect on Drag and Lift – Vorticity and Circulation – Potential Flow – Lift – Drag and Thrust – Surface Tension and its Effect on Flows.
Course Code: Math 4410 **Course Title:** Classical Mechanics **Credit Hours:** 3(3,1,0) **Level:** Elective	**Course Code: Math 4420** **Course Title:** Introduction to Functional Analysis **Credit Hours:** 3(3,1,0) **Level:** Elective

Prerequisites: Math 2290, **Math** 4360	**Prerequisites: Math** 3280, **Math** 3460
Course Description Principle of Stationary Action – Lagrange Equations – Hamilton's Principle – Coordinate Transformations and Rigid Constraints – Total time Derivatives and the Euler– Lagrange Operator – State and Evolution – Chaos – Conserved Quantities – Rigid Bodies – Kinematics of Rigid Bodies – Moments of Inertia – Generalized Coordinates for Rigid Bodies – Motion of a Free Rigid Body – Axisymmetric Top – Spin– Orbit Coupling – Euler's Equations –Hamilton's Equations – Legendre Transformation – Hamiltonian Action and Poisson Brackets – Phase Space Reduction – Phase Space Evolution – Surfaces of Section – Autonomous Systems: Henon– Heiles – Exponential Divergence – Solar System–Liouville Theorem–Phase Space Structure – Linear Stability – Homoclinic Tangle – Integrable Systems – Poincare – Birkhoff Theorem– Invariant Curves – KAM Theorem – Canonical Transformations – Integral Invariants – Extended Phase Space – Generating Functions – Time Evolution in Canonical Hamilton–Jacobi Equation – Lie Transforms – Perturbation Theory – Perturbation Theory with Lie Series.	**Course Description** Normed Vector Spaces – Completeness – Functionals – Hilbert spaces – Isomorphism – Cardinality – Aleph Null – Invariant Subspace – Basic theory of Banach Spaces – Lebesgue Measure – Measurable Functions – Completeness of L–p spaces – Dual Space " The space of all Continuous Linear Functionals" – Frechet spaces - Frechet Urysohn Space as a type of Sequential Space – Major and Foundational results – The Uniform Boundedness Principle or (Banach–Steinhous Theorem) – Spectral Theorems - Integral Formula for the Normal Operators on a Hilbert Space – Hahn–Banach Theorem – extends Functionals from a subspace to the full space – Open Mapping Theorem – Closed Graph Theorem – Theory of Compact Operators – Hilbert–Schmidt and Trace Class Operators.
Course Code: Math 4430 **Course Title:** Introduction to Topology **Credit Hours:** 3(3,1,0) **Level :** Seventh **Prerequisites: Math** 3460	**Course Code: Math 4455** **Course Title:** Rings and fields **Credit Hours:** 3(3,1,0) **Level:** Seventh **Prerequisites: Math** 2455
Course Description Logic and Foundations – Relations – Cardinality – Axiom of Choice – Topologies – Closed Sets – Continuous Functions – Arbitrary Products – Metric Topologies – Quotient Topology – Connected Spaces – Compact Spaces – Well– Ordered Sets –	**Course Description** Rings: Definitions – Basic Properties of Rings – Subrings– Fields– Division Ring – Integral Domain – Characteristic of the Rings – Right and Left Ideal of the Ring – Quotient Rings – Principal Ideal Domains–Unique Factorization–Gauss' Lemma – Explicit Factorization – Maximal Ideals

Maximum Principle – Countability and Separation Axioms – Urysohn Lemma – Metrization – Tietze Theorem – Tychonoff Theorem – Stone–Cech Compactification – Baire Spaces – Dimension – Imbedding in Euclidean Space.	– Gauss Primes– Quadratic Integers– Ideal Fractions – Ideal Classes–Relations in a Ring– Adjoining Elements– Polynomial Rings – Euclidean Rings–Ring Homomorphism–Ring Endomorphism – Fields: Algebraic Elements – Modules over rings – Submodules – quotient modulas.
Course Code: Math 4470 **Course Title:** Real Analysis–II **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 3320, **Math** 3460, **Math** 3280	**Course Code: Math 4480** **Course Title:** Principles of Automatic Control **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2250, **Math** 3320, **Math** 3330
Course Description: Metric Spaces – Continuity – Limit Points – Compactness – Connectedness – Differentiation in n Dimensions – Conditions for Differentiability – Mean Value Theorem – Chain Rule – Mean Value Theorem in n Dimensions – Inverse Function Theorem – Reimann Integrals of Several Variables – Conditions for Integrability – Measure Zero – Fubini Theorem – Properties of Reimann Integrals – Integration Over More General Regions – Rectifiable Sets – Volume–Improper Integrals – Exhaustions – Compact Support – Partitions of Unity – Dual Spaces–Tensors–Pullback Operators – Alternating Tensors – Redundant Tensors – Wedge Product – Determinant – Orientations of Vector Spaces – Tangent Spaces and k– Forms – The d Operator – Pullback Operator on Exterior Forms – Integration with Differential Forms – Change of Variables Theorem–Sard's Theorem Poincare Theorem – Generalization of Poincare Lemma – Proper Maps and Degree – Regular Values – Degree Formula – Topological Invariance of Degree – Canonical Submersion and Immersion Theorems – Manifolds – Tangent Spaces of Manifolds – Differential Forms on Manifolds – Orientations of Manifolds – Integration on Manifolds – Degree on	**Course Description** Closed– loop control systems – Open– loop control systems – The Laplace Transform – Mathematical Modelling of Dynamic Systems – Transient response Analysis – Basic Control Actions and Response of Control Systems – Root Locus Analysis – Frequency– Response Analysis – Analysis of Control System in State Space – Liapunov Stability Analysis and Quadratic Optimal.

Manifolds – Hopf Theorem – Integration on Smooth Domains – Stokes' Theorem .	
Course Code: Math 4490 **Course Title:** Applications of Continuum Mechanics to Earth, Atmospheric, and Planetary Sciences **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites**: **Math** 2250, **Math** 4360	**Course Code: Math 4500** **Course Title:** Numerical Methods for Partial Differential Equations **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 3370, **Math** 4360
Course Description Tractions – Stress Tensor – Stress Tensor in Different Coordinate Systems – Pore Fluid Pressure – Newton's Second Law – Stress in the Earth – Stress Rotation – Sandbox Tectonics – Displacement Gradients – Measurement of Displacement Gradient Tensor – Finite Strain – Elasticity – Dislocation in Elastic Half space Model of the Earthquake Cycle – Stress and Strain from a Screw Dislocation Plates – Navier Stokes Equation – Growth and Decay of Boundary undulations – Flow in Porous Media.	**Course Description** Finite Differences: Elliptic Problems – Parabolic Problems – 2D Problems – Solution Methods – Iterative Methods – Multigrid Methods – Hyperbolic Problems – Finite Volumes: Linear Problems – Conservation Laws. Nonlinear Problems. Finite Elements: Variational Formulation – General Elliptic Problems – Overview –Parabolic Problems – Eigenvalue Problems. Integral Equations: Collocation and Galerkin Methods – Fast Solvers.
Course Code: Math 4520 **Course Title:** Calculus of Variations **Credit Hours:** 3(3,1,0) **Level:** Selective **Prerequisites: Math** 3320, **Math** 3330	**Course Code: Math 4530** **Course Title:** Optimization **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2250, **Math** 3320
Course Description Review of Vector Spaces – Functional – The Geodesics Problems – Brachistochrone – Linear Functional – Properties of Functional – Local Maximum – Local Minimum – Extremum Value – Extremals with Corners – Euler's Necessary Condition – Constant End Points Problems – Minimal Time Curve Problem – Functional of Several Variables – Canonical Euler – Lagrange	**Course Description** Linear Optimization – Introduction – The Geometry of Linear Optimization – The Simplex Method – Duality Theory I – Duality Theory II – Sensitivity Analysis – Robust Optimization – Large Scale Optimization – Network Flows – Network Optimization – Introduction and Applications – Network Optimization – The Network Simplex Algorithm–Discrete Optimization – Exact

Equations – Hamilton's Principle – Functional of Higher Derivatives – Euler– Poisson Differential Equation – Functional with Multiple integrals – Minimal Surface Plateau's Problem and Applications – Schrödinger's Equations – Inverse Problem – Moving End Points Problems – Transversality Conditions – Hamilton– Jacobi Equation – Extremals With Corners – Reflection of Extremals – Refraction of Extremals – Corners Conditions – Necessary and Sufficient Conditions of Extremals – Legendre Condition – Jacobi Conditions – Weierstrass Condition – Optimal Control – Optimality Principle – Bellman's Equation – Maximum Principle and Its Applications.	Methods for IP – Lagrangian Methods – Heuristic Methods – Dynamic Optimization – Dynamic Programming –Nonlinear Optimization– Applications of Nonlinear Optimization – Optimality Conditions and Gradient Methods for Unconstrained Optimization – Line Searches and Newton's Method – The Conjugate Gradient Algorithm Optimality Conditions for Constrained Optimization – The Affine Scaling Algorithm – Barrier Interior Point Algorithms – Semidefinite Optimization.
Course Code: Math 4550 **Course Title:** Wavelets and Modern Signal Processing **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 4470	**Course Code: Math 4560** **Course Title:** Rigid Body Dynamics **Credit Hours:** 3(3,1,0) **Level:** Elective **Prerequisites: Math** 2290, **Math** 3330
Course Description The Continuous Fourier Transform – The Discrete Fourier Transform – FFT – Time Frequency Analysis –Short time Fourier transform – The Wavelet Transform –The Continuous Wavelet Transform – Discrete Wavelet Transforms – Orthogonal Basis of Wavelets – Statistical Estimation – Denoising by Linear Filtering – Inverse Problems – Approximation Theory: Linear/Nonlinear Approximation and Applications to Data Compression. – Wavelets and Algorithms– Fast Wavelet Transforms – Avelet Packets – Cosine Packets – Basis Pursuit – Data Compression –	**Course Description** CurviLinear Motion – Cartesian Coordinates – Equations of Motion in Cartesian Coordinates – Intrinsic Coordinates – Other Coordinate Systems – Application Examples – Work and Energy – Conservative Forces – Potential Energy– Linear Impulse and Momentum – Angular Impulse and Momentum – Relative Motion – Translating Axes – Relative Motion Rotating/Translating Axes – Newton's Second Law for Non– Inertial Observers – Inertial Forces –Newtonian Relativity – Gravitational Attraction –The Earth as a Non– Inertial – Reference Frame – 2D Rigid Body Kinematics – Conservation Laws for Systems of Particles. 2D Rigid Body Dynamics: Equations of Motion – Work and Energy –Impulse and

Nonlinear Estimation – Topics in Stochastic Processes– Topics in Numerical Analysis – Multigrids and Fast Solvers.	Momentum–Pendulums. 3D Rigid Body Kinematics. 3D Rigid Body Dynamics: Inertia Tensor – Equations of Motion – Gyroscopic Motion – Torque– Free Motion – Spin Stabilization. Variable Mass Systems: The Rocket Equation – Central Force Motion – Keppler's Laws – Orbits – Orbit Transfer.
Course Code: Math 3240 **Course Title: Actuarial mathematics-II** **Credit Hours:** 3(3,1,0) **Level:**Elective **Prerequisites: Math** 2320	**Course Code: Math 4620** **Course Title:** Ethics of Mathematicians **Credit Hours:** 1(1,0,0) **Level:**Eighth **Prerequisites: Math** 3460
Course Description Review of financial models – portfolio selection – taxation – Monte-Carlo simulation and option pricing–measurement and assessment of financial performance – Risk managemen – financial analysis and planning – Finite Difference methods for partial differential equations in finance – Time series analysis and parameter estimation – Applications	**Course Description** Concept of Ethics in Islam – Manners of Mathematicians–Difference between Mathematical Ethics and Manners – Ethics and General Welfare – Ethics in General jobs – Duties in General job – Manners of the Mathematical Employee – Illegal Manners of the Mathematical Employee – Deviation of Authority or job – Bribery – Gifts and Tips – Favoritism – Embezzlement – Forgery – Using the Authority or job.
Course Code: Math 4820 **Course Title:** Graduation Project **Credit Hours:** 3(2,1,0) **Level:** Eighth **Prerequisites: Math** 4430	**Course Code: Math 1050** **Course Title:** Differential Calculus **Credit Hours:** 3(3,1,0) **Level:** First (**Preparatory Year)** **Prerequisites: ---**
Course Description As a partial fulfilment for the award of degree of Bachelor of Science in Mathematics, students are required to complete a graduation project during the course of study. At the beginning of the last semester of the program the student will have to select a topic for the project in consultation with the project	**Course Description** Real numbers, polynomials, Functions, Limits & Continuity: Algebraic Functions– Exponential and Logarithmic Functions – Trigonometric Functions– Limits–Continuity. Derivatives: Techniques of Differentiation–Derivatives of Algebraic Functions– Derivatives of Exponential Functions–Derivatives of Logarithmic Functions –Derivatives of Trigonometric Functions – Equations of the Tangent

supervisor allotted to them from the department. The student will have to do a detailed study of the selected topic under the guidance of the supervisor and submit a report by the end of the semester. The project report will be examined by an examiner appointed by the Head of the Department and proper grade will be awarded for the project.	and Normal – The Chain Rule – Inverse Trigonometric Functions – Hyperbolic Function and Inverse Hyperbolic Functions – Inverse Trigonometric Functions – Derivatives of Inverse Trigonometric Functions – Derivatives of Hyperbolic Functions – Inverse Hyperbolic Functions–Derivatives of Inverse Hyperbolic Functions – Calculation of the nth Derivatives– Differentiation of a composite Functions– Differentiation of Implicit Functions- Applications to Calculus: Function graph– Rolle's Theorem-mean value theorem – L'Hospital Theorem -maxima and minim – Related Rates -horizontal and vertical asymptotes.
Course Code: Math 1060 **Course Title:** Integral Calculus **Credit Hours:** 3(3,1,0) **Level:** Second **(Preparatory Year)** **Prerequisites:**	**Course Code: Math 3310** **Course Title:** Differential Equations for Computer Students **Credit Hours:** 3(3,1,0) **Level:** **Prerequisites:**
Course Description: Integration: Indefinite Integrals–Techniques of Integration: Trigonometric Integrals – Integration by Inverse Substitution–Completing the Square– Partial Fractions–Integration by Parts – Reduction Formulas – Definite Integrals– Arc length– Surface Area- Areas between Curves–Volumes of Revolution– Numerical Integration–Parametric Equations–Polar Coordinates – Area in Polar Coordinates – Indeterminate Forms – Improper Integrals	**Course Description** First order Equations: Nonlinear Separable – Homogeneous–Exact Equation – Linear Bernoulli's Equation – Direction fields – Second Order Linear Equations with Constant Coefficients – Homogeneous Case – Inhomogeneous Equations via Method of Undetermined Coefficients – Inhomogeneous Equations via Method of Variation of Parameters–Remarks on Higher Order Equations–Linear Independence and the Wronskian–Applications to Forced Oscillation Problems–Effect of Resonances– Laplace Transform –Application to Constant Coefficient Linear Equations – Fourier Series.
Course Code: Math 2350	**Course Code: Math 2440**

Course Title: Calculus for Computer Students **Credit Hours:** 3(3,1,0) **Level:** **Prerequisites:**	**Course Title:** Linear Algebra **Credit Hours:** 3(3,1,0) **Level:** Fourth **Prerequisites: Math** 1060, **Math** 1070
Course Description Differentiation: Graphing – Derivatives – Slope – Velocity – Rate of Change – Limits – Continuity– Trigonometric Limits – Derivatives of Products – Quotients–Derivatives of Trigonometric Functions–Chain Rule – Higher Derivatives – Implicit Differentiation – Inverses – Exponential and Logarithmic Differentiation – Hyperbolic Functions. Applications of Differentiation: Linear and Quadratic Approximations – Function Graph – Maxima and Minima – Related Rates – Newton's Method and Other Applications – Mean Value Theorem. Integration: Indefinite Integrals – Techniques of Integration: Trigonometric Integrals – Integration by Inverse Substitution – Completing the Square – Partial Fractions – Integration by Parts – Reduction Formulas–Definite Integrals – Areas between Curves – Volumes by Slicing – Volumes by Disks – Work – Average Value – Numerical Integration – Parametric Equations–Arc length – Surface Area – Polar Coordinates–Area in Polar Coordinates– Indeterminate Forms – L'Hospital's Rule – Improper Integrals – Infinite Series – Convergence Tests – Taylor Series.	**Course Description** Column and Row Vectors – Product of Vectors – Matrices and their combination with vectors – Addition and Multiplication of Matrices. Solution of Linear Equations – Inverse of Square Matrix – Permutation Matrices. Systems of Equations and inequalities – Matrix Algebra – Determinants – Linear Dependence and Linear Independence – Properties of Matrices – Adjoint Matrix – Matrix Inverse – Matrix Functions of Single Variables – Solution of Systems of Linear Equations – Solution of Linear systems by elimination– Rank of Matrices – Eignvalues and Eignvectors – Introduction – Properties of Eignvalues and Eignvectors – Applications – Diagonalizable Matrices – Block Diagonal and Jordan Forms – Review and Miscellaneous Exercises.
Course Code: Math 2220 **Course Title:** Linear Algebra for Computer Students **Credit Hours:** 3(3,1,0) **Level:** **Prerequisites:**	**Course Code: Math 109** **Course Title:** Mathematics for pharmacy Students **Credit Hours:** 3(3,1,0) **Level: First** **Prerequisites:**

Course Description Matrix Definition – Matrix Operations – Symmetric Matrices – Transpose and Inverse of a Matrix – Hermitian Matrices–Markov Matrices– Factorization – Positive Definite Matrix – Row Operations – Row Reduced Echelon Form – Linear system of Equations – Solving Equation of the form $Ax = 0$ and $Ax = b$. Vector Spaces and Subspaces – Basis and Dimension – Orthogonality – Similar Matrices – Singular Value Decomposition – Least Squares Approximations – Determinants – Properties of Determinants – Applications of Determinants – Cramer's Rule – Gauss Elimination Rule – Gauss Jordan Elimination – Eigenvalues and Eigenvectors – Diagonalization – Linear Transformation – Matrices with MATLAB.	**Course Description** Real Numbers – Solutions of Algebraic Equalities – Linear Inequalities – Roots of Quadratic Equations – Trigonometric Functions – Limits – Continuity – Derivatives–Rules of Derivatives – Partial Derivatives–Integration–Techniques of Integration: Integration by Substitution – Integration by Parts – Integration by Partial Fractions – Introduction to Differential Equations.
Course Code: Math 142 **Course Title:** Mathematics-I for Students of Business Administration **Credit Hours:** 3(3,1,0) **Level:** First **Prerequisites:**	**Course Code: Math 143** **Course Title:** Mathematics-II for Students of Business Administration **Credit Hours:** 3(3,1,0) **Level:** Second **Prerequisites:** MATH 1420
Course Description Properties of Real Numbers – Fractions – Solutions to Algebraic Equations and Inequalities – Quadratic Equations – Functions and their Graphs – Trigonometric Functions – Matrices and Systems of Algebraic Equations.	**Course Description** Limits – Continuity – Asymptotic Lines – Derivatives–Implicit Differentiations– Applications to Calculus – Mean Value Theorem – Rolle's Theorem – L'Hospital rule – Maxima and Minima – Points of Inflection – Curvature – Function Graph.
Course Code: Math 1070 **Course Title:** Algebra & Analytic Geometry **Credit Hours:** 3(3,1,0) **Level:** Third	**Course Code: Math 2030** **Course Title:** Differential and Integral Calculus **Credit Hours:** 3(3,1,0) **Level:** Fourth

Prerequisites: Math 1050	**Prerequisites: Math** 1060, **Math** 1070
Course Description Vectors in Two and Three Dimensions – Scalar and Vector Products – Equations of Lines and Planes in Space – Surfaces – Cylindrical and Spherical Coordinates – Vector valued Functions – Limits and Continuity – Derivatives and Integrals. Motion of a particle in space – Tangential and Normal components of Acceleration – Functions in two or three variables – Limits – Continuity – Partial Derivatives – Differentials– Chain Rule – Directional Derivatives – Tangent Planes and Normal Lines to Surfaces – Extrema of Functions of Several Variables – Lagrange Multipliers – Systems of Linear Equations – Matrices – Determinants – Inverse of a Matrix –Cramer's Rule.	**Course Description** Infinite Series – Convergence and Divergence of Infinite Series – Integral Test – Ratio Test, Root Test and Comparison Test. Conditional Convergence and Absolute Convergence – Alternating Series Test – Power Series – Taylor and Maclaurin series – Double Integral and its Applications to Area, Volume, Moments and Center of Mass – Double Integrals in Polar Coordinates – Triple Integral in Rectangular, Cylindrical and Spherical Coordinates and Applications to Volume, Moment and Center of Mass – Vector Fields – Line Integrals – Surface Integrals – Green's Theorem – The Divergence Theorem –Stoke's Theorem.
Course Code: Math 2040 **Course Title:** Differential Equations **Credit Hours:** 3(3,1,0) **Level:** Fifth **Prerequisites: Math** 2030	**Course Code: Math 2540** **Course Title:** Numerical Methods **Credit Hours:** 3(3,1,0) **Level:** Fifth **Prerequisites: Math** 1070
Course Description Introduction to Differential Equations – Equations with separable variables – Homogeneous Equations – Exact Equation – The Linear Equation of First Order–Linear Equation of Second Order – Direct Deduction–Comparison Theorems–Linear Equations with Constant Coefficients– Inhomogeneous case – Methods of undetermined Coefficients and Variations – Variation of Parameters – Systems of Differential Equations – Odd & Even Fourier Series – Fourier Integral.	**Course Description** Linear and Quadratic Equations – Functions of a Single Variable – Solution of Systems of Linear Equations – Solution of Linear Systems by Elimination – Elementary Introduction to Linear Programming – Convex Sets– Maxima and Minima of Linear Functions–Problems of Maximizing or Minimizing a Linear Function to Linear Constraints – Linear Programming Problems–Numerical Solution of Differential Equations – Mathematical Preliminaries – Simple Difference Equations - Euler Method – Runge-Kutta Methods –Systems of Linear Equations –

. .	Introduction – Properties of Matrices – Diagonal and Triangular Matrices – Numerical Solution of Linear systems – The Pivoting Strategy – Introduction, Properties and the Numerical Methods.
Course Symbol and Code: Stat 1050 **Course Title:** Probability and Statistics for Computer Students **Course hours:** 3 (3, 1, 0) **Level:** **Pre-requisite:** CS 1110	**Course Symbol and Code: Stat 2010** **Course Title:** Elementary Probability and Statistics **Course hours:** 3 (3, 1, 0) **Level:** Third **Pre-requisite:** None
Course Description Descriptive statistics, statistical data classification, measures of central tendency, measures of dispersion. Basic probability concepts, conditional probability, Bayes law, random variable and probability distribution. Some discrete distributions, some continuous distributions and its applications. Sampling distribution of the mean, central limit theorem, estimation of the population mean and proportion, testing hypotheses about population mean and proportion. Course must focus on applications in the field of computer engineering and sciences.	**Course Description** Descriptive statistics: Statistical data classification –Measures of central tendency –Measures of dispersion. Basic probability concepts: Conditional probability – Bayes law–Random variable and probability distribution– Binomial distribution – Normal distribution and its applications – sampling distribution of the mean– Central limit theorem, Estimation of the population mean and proportion– Testing hypotheses about population mean and proportion.
Course Symbol and Code: Stat 2040 **Course Title: Statistical Methods** **Course hours: 3 (3, 1,0)** **Level: Fourth** **Pre-requisite: Stat** 2010	**Course Symbol and Code: Stat 3280** **Course Title:** Statistical Packages **Course hours:** 3 (2, 1, 0) **Level: Fifth** **Pre-requisite: Stat** 2040
Course Description Concept of Ethics in Islam–Manners of Mathematicians –Difference between Mathematical Ethics and Manners – Ethics and General Welfare – Ethics in General jobs – Duties in General job - Manners of the Mathematical	**Course Description** Using program code in a statistical software package (Excel, MINITAB, SAS, SPSS, R and Maple or MATLAB), to write a program for data and statistical analysis. Topics include creating and

Employee – Illegal Manners of the Mathematical Employee – Deviation of Authority or job – Bribery – Gifts and Tips –Favoritism – Embezzlement – Forgery – Using the Authority or job.	managing data files, graphical presentation, and Monte Carlo simulations.
Course Symbol and Code: Stat 1060 **Course Title: Biostatistics** **Course hours:** 2(1, 1, 0) **Level:** **Pre-requisite: None**	**Course Symbol and Code**: **Stat 2060** **Course Title:** Statistics for Students of Biology **Course hours:** 2(2, 1, 0) **Level: Third** **Pre-requisite: Math 1060**
Course Description Descriptive Statistics – Measure of location and dispersion – Elementary probability – Random variable and probability distribution – Binomial distribution – Poisson distribution – Normal Distribution and with Applications – Testing and confidence interval for sample mean and proportion.	**Course Description** Descriptive statistics – Measure of location and dispersion – Simple regression – Coefficient of correlation – Elementary probability – Random variable and probability distribution – Binomial distribution – Poisson distribution – Normal Distribution and with Applications – Testing and confidence interval for sample mean and proportion – ANOVA

Master of Science in Mathematics

Mission, Goals, and Program objectives

1. Program Mission:

To produce competent postgraduates who can disseminate their mathematical knowledge and understanding and serve the job market and community by providing a stimulating academic and research environment

2. Program Goals:

1. Providing in-depth knowledge of advanced mathematical theories and its applications

2. Preparing postgraduates who can conduct research or undertake professional projects in the field of mathematics.

3. Producing Postgraduates who can disseminate their mathematical knowledge in various forms.

4. Preparing the students to serve the community by pursuing a career in the field of mathematics and related fields.

3. Program objectives

- Equip students with foundational and advanced knowledge of mathematical concepts, principles, and theories, fostering analytical and logical reasoning.

- Prepare graduates to apply mathematical techniques and tools to solve real-world problems in various fields such as science, engineering, finance, and technology.

- Develop the ability to conduct research, identify relevant mathematical problems, and apply suitable methods to propose solutions.

- Enhance communication skills, enabling students to effectively articulate mathematical ideas and solutions in both written and oral formats.

- Instill ethical values, professionalism, and a commitment to integrity in academic and professional endeavors.

- Promote lifelong learning and encourage students to pursue advanced studies or professional development in mathematics and related disciplines.

- Encourage students to serve the community and contribute to societal development through careers in education, research, and industry.

GRADUATE ATTRIBUTES OF MASTER OF SCIENCE IN MATHEMATICS

Attribute	Code	Graduate Attributes
Breadth of Knowledge	GA1	Ability to integrate mathematical principles with concepts from other disciplines, fostering a broader understanding of applications
Problem solving skills	GA2	Skills to apply mathematical concepts and tools to address real-world problems, demonstrating creativity and innovation in solutions.
Critical and creative thinking	GA3	Proficiency in evaluating problems, synthesizing information, and developing logical arguments to solve complex mathematical issues.
Research skills	GA4	Ability to design, conduct, and analyze research projects, employing advanced mathematical techniques and methodologies.
Technical skills	GA5	Familiarity with mathematical software, programming languages, and / or computational tools relevant to research and data analysis
Communication skills	GA6	Competence in effectively communicating complex mathematical ideas and research findings through written reports, presentations, and discussions.

Self-directed Lifelong learning	GA7	Commitment to continued professional development and engagement with ongoing advances in mathematics and related fields.
Career Skills	GA8	Experience working in collaborative research environments, demonstrating the ability to engage with peers and mentors.
Ethical responsibilities	GA9	Awareness of ethical considerations in research practices, including integrity, responsibility, and respect for intellectual property.
Social Responsibilities	GA10	Ability to adjust to new conditions and contribute with the help of acquired knowledge and skills.

Program Learning Outcomes

Knowledge and Understanding:	
K1	Demonstrate understanding of advanced Mathematical concepts, Principles and theories and their applications
K2	Describe various definitions and theorems and identify the underlying mathematical concepts.
K3	Identifying relevant research problems in the field of mathematics and describe suitable algorithms.
Skills:	
S1	Apply appropriate theories, principles and concepts to solve mathematical problems using various techniques.
S2	Carryout research in the field of mathematics.
S3	Exhibit oral and written scientific or technical communication skills.
Values, Autonomy, and Responsibility:	
V1	Work effectively exhibiting integrity and professional value to the assigned task.
V2	Conducting scholarly or professional activities in an ethical manner

Study Plan for Master of Science in Mathematics
(Thesis Option)

Level	Course Code	Course Title	Required or Elective	Pre-Requisite Courses	Credit Hours	Type of requirements (Institution, College, or Program)
Level 1	Math 620	Differential Equations	Required	--	3(3,0,0)	Program
	Math 632	Linear Algebra	Required	--	3(3,0,0)	
	Math 610	Research Methodology	Required	--	3(3,0,0)	
	Math 629	Complex Analysis	Required	--	3(3,0,0)	
Level 2	Math 633	Numerical Analysis	Required	--	3(3,0,0)	
	Math 639	Selected Topics in Discrete Mathematics	Required	--	3(3,0,0)	
	Math 615	Partial Differential Equations (I)	Required	--	3(3,0,0)	
	Math XXX	Elective	Elective	--	3(3,0,0)	
Level 3	Math 621	Selected Topics in Applied Mathematics	Elective	--	3(3,0,0)	
	Math xxx	Elective Course	Elective	--	3(3,0,0)	
Level 4	Math 699	Thesis	Required		6(6,0,0)	

Admission requirements

- The candidate must be a Saudi national or a non-Saudi who has obtained an official scholarship through one of the cultural exchange programs.
- The candidate must hold a B Sc degree in Mathematics or Mathematics education (or its equivalent) from any university recognized by the MOE either inside or outside the Kingdom of Saudi Arabia.
- The candidate must have a GPA of (3.25) out of (5) at the bachelor's degree level as a minimum to be admitted in the program
- The candidate must have secured atleast a score of 4 in IELTS or equivalent English Test.
- The candidate must not have previously been dismissed from any university for disciplinary or academic reasons.
- The candidate must pass the written test, and a personal interview held by the Department of Mathematics.
- The candidate must have the approval of the employer if he/she works in either the government sector or the private sector

Graduation requirements

- The Minimum period of study is 2 years and the Maximum time allowed is 4 years.
- The Student must complete around 8 core courses and 3 elective courses in the first three semesters and submit a thesis on the research topic under a Supervisor allotted by the Department Council.

- For successful completion of each course, the student must secure atleast 75% marks (3.75 in 5 point scale of GPA).
- Regarding Master Thesis Course, the student must comply with the Thesis regulations given below.

Thesis Regulations

1. Registration of the thesis:

Requirements and Procedures:

1. In order to register for Thesis, the graduate student must have successfully completed the course work of all courses successfully.
2. The graduate student has the option to choose the supervisor of his choice. However, the Head of the Department will allocate the supervisor in consultation with the coordinator of Higher Education Committee of the Department.
3. The student in consultation with the allocated research supervisor selects the topic and makes a formal application to the competent authority for consideration and approval.
4. Once approved, the graduate student registers the title in the National Library to avoid duplicate work.

Responsibilities and Procedures for Scientific Guidance:

1. The Research Supervisor advises the student on the research methodology to be adopted.
2. The Supervisor periodically interacts with the student and provide guidance with regard to collection and review of literature, identifying the research problem and its solution.

2. Scientific Supervision:

(The regulations of the selection of the scientific supervisor and his/her responsibilities, as well as the procedures/ mechanisms of the scientific supervision and follow-up)

Appointment of Supervisor:

1. The Research Supervisor must be a doctorate degree holder holding an academic rank of Assistant Professor and above. However, in case of the supervisor being an Assistant Professor, he must have published atleast 2 publications after acquiring Ph D degree and immediately before the appointment as Assistant Professor.

Responsibilities:

1. The Supervisor is responsible for the quality of the research being undertaken by the graduate student and the output.
2. The Supervisor advises the student from time to time and help the students in case of any hardship in research.
3. The Supervisor must make a record of the progress of research by the graduate student from time to time.
4. The Supervisor must ensure that atleast one paper is published/accepted in a scientific journal before submission of the thesis.
5. The duration allowed is a minimum of three to a maximum of five semesters.
6. On completion of preparation of the thesis by the student, the supervisor reviews for any correction and modification and recommends the names of examinations for the evaluation of thesis and defense.

3.Thesis Defense/Examination:

(The regulations for selection of the defense/examination committee and the requirements to proceed for thesis defense, the procedures for defense and approval of the thesis, and criteria for evaluation of the thesis)

1. The Thesis evaluation committee is formed comprising of three to five examiners – (Supervisor and two to four other examiners).
2. The thesis evaluation committee is approved in the Department Council, College Council and approved by the Higher Studies Committee of the University.
3. On approval, the supervisor forwards the thesis to the examiners for their evaluation and comments and a suitable date for defense is notified.
4. On the date of defense, the graduate student makes a presentation on his/her work before the audience and responds to their queries.
5. After the open defense, the graduate student defends the thesis in private before the Committee.

   Criteria for evaluation:

   The committee considers the following aspects:

   (a) Originality of Research
   (b) Research Methodology
   (c) Past work done in the area
   (d) Reporting of the derived results
   (e) Scope for further research

(f) Presentation by the student and the defense on the questions raised by the committee members.

Notification of the Outcome:

On completion of the defense, the Chairman of the Committee prepares a report signed by all three members and reads in the open house whether or not the Thesis could be considered for award of Master Degree before the audience.

GPA, Graduation requirements etc

The Average and cumulate GPA are calculated every semester for the student automatically by the system. To know how to calculate the averages, one should follow the following steps:

Calculating the Semester Average

- The GPA is calculated considering the following points:

(9) Knowing the number of credits of the courses.

(10) Knowing the mark obtained in each courses.

(11) Knowing the corresponding grade of each mark.

(12) Knowing the value of each grade.

(13) Knowing the points = number of hours of the course x value of the grade.

(14) Determining the total points obtained in all courses of the semester.

(15) Determining the total number of credits registered in the semester.

(16) The average is calculated every semester according to the following equation:

$$\text{GPA} = \frac{\text{Total points (item 6)}}{\text{Number of hours registered in the semester (item 7)}}$$

- The following table shows the percentage of marks, grade and value obtained by the student in each course, which is used to calculate the points:

Mark	Grade	Letter of Grade	Value of Grade
From 95 - 100	+ Excellent	+A	5.00
From 90 to less than 95	Excellent	A	4.75
From 85 to less than 90	+ Very Good	+ B	4.50
From 80 to less than 85	Very Good	B	4.00
From 75 to less than 80	+ Good	+ C	3.50
Less than 75	Failure	D	1.00
Absence from lectures (25% or more)	Debarred	H	1.00

Calculating the Average cumulative:

- The GPA semester average is calculated as follows:

  (3) The grand total of points (for all semesters that have been completed).

  (4) The grand total of credit hours (for all semesters that have been completed successfully).

- The cumulative average is calculated according to the following equation:

GPA =	Grand total of points
	Grand total of credit hours

Course description

توصيف المقررات

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 610	أساليب البحث العلمي	2	

توصيف المقرر

The main objective is to prepare the students gain awareness about review of scientific literature, identify scientific problem and associated research methods and writing scientific reports thus prepare them undertake independent research in their field of interest on completion of the Program

1: الأهداف .

- **إثبات القدرة على اختيار الأساليب المناسبة للبحث الأهداف والغايات**
- **فهم قيود أساليب بحث معينة**
- **تطوير المهارات في تحليل البيانات النوعية والكمية وكيفية العرض**
- **تطوير مهارات التفكير النقدي المتقدمة**
- **إظهار مهارات الكتابة المحسنة.**
- **التعرف على أهمية البحث.**
- **القدرة على تمييز بيان الغرض ، سؤال بحث أو فرضية ، وهدف بحثي.**
- **مناقشة أنواع تصميم الدراسة.**
- **إظهار أساليب أخذ العينات.**
- **التفريق بين السببية وعدم وجود علاقة سببية**
- **حدد العينة المناسبة للبحث.**
- **التمييز بين أساليب وتقنيات جمع البيانات.**
- **إجراء البحوث العلمية على نحو فعال.**
- **استخدام أساليب التفكير النقدي في حل مشاكل البحث العلمي.**
- **استخدام موارد تكنولوجيا المعلومات المتاحة.**

2. المحتوي

مقدمة في أساليب البحث ودور البحث العلمي في مختلف المجالات – أواع البحث العلمي : عملية – نظرية إحصائية – خطوات إجراء البحث العلمي – المسح الأدبي – أهداف وفروض البحث العلمي - تطور الإطار النظري للبحث –عينات من الأساليب السابقة في موضوع البحث العلمي – استراتيجية البحث العلمي – منهجية إجراء البحث العلمي – اعتماد واختيار اسلوب للبحث العلمي - أخلاقيات إجراء البحوث العلمية - كتابة البحث العلمي.

Course Code	Course Title	Credits	Prerequisite
Math 610	**Research Methodology**	**2 hours**	

Course Description

The main objective is to prepare the students gain awareness about review of scientific literature, identify scientific problem and associated research methods and writing scientific reports thus prepare them undertake independent research in their field of interest on completion of the Program

1. Objectives/ILO:

- Demonstrate the ability to choose methods appropriate to research aims and objectives
- Understand the limitations of particular research methods
- Develop skills in qualitative and quantitative data analysis and presentation
- Develop advanced critical thinking skills
- Demonstrate enhanced writing skills.
- Recognize the importance of research.
- Able to distinguish a purpose statement, a research question or hypothesis, and a research objective.
- Discuss types of study design.
- Demonstrate the sampling methods.
- Differentiate between causal and no causal association
- Select the proper sample for the research.
- Discriminate between data collection methods and techniques.
- Conduct scientific research effectively.
- Use critical thinking methods in solving scientific research problems.
- Use available IT resources.

2. Content:

Introduction to research and the role of research in various fields.

Types of Research – Experimental, Theoretical, Statistical (Survey) - The research process - Conducting a critical review of the literature - Development of research questions and objectives - Development of a theoretical framework - Sampling techniques - Decisions in developing a research design and research strategy - (eg. Case study, action research) - Research methodologies (eg. qualitative, quantitative, ethnography) - Research techniques (methods and analysis) - Ethical issues in doing research - Writing a comprehensive research proposal

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
Math 619	Quantum Mechanics I	2	Math 620

توصيف المقرر

The main purpose is to make students gain knowledge about various concepts of Quantum mechanics such as wave functions, representation of operators, perturbations, oscillators etc., and their associated theories and results.

1. **الاهداف:**

- القدرةعلي فهم أساس للتطور التاريخي ، والفلسفات ومفاهيم ميكانيكا الكم
- فهم معنى وظائف الموجات وتقنيات تطبيعها.
- معرفة جميع أنواع تمثيل المؤثرات وطرق تطبيقها في مشاكل مختلفة.
- اكتساب المعرفة والمهارة لحل مشكلة ذرة الهيدروجين باستخدام ميكانيكا الكم.
- اكتساب المعرفة حول التحولات الوحدية ، وظيفة دلتا ديراك ، تمثيل المصفوفة للمؤثرات وتطبيقاتها.
- فهم مفهوم مشغل الزخم الزاوي وتمثيلها في الإحداثيات الكروية وإضافة الزخم الزاوي وما إلى ذلك.
- الحصول على نظرة لحل معادلة موجة شرودنجرثلاثية الابعاد.

2. **المحتوي**

الدالة الموجية والطاقة فى - فروض نظرية الكم – الوصف الاحتمالي لنظرية الكم –مبدأعدمالدقهلهيزنبرج معادلة شرودنجر وتطبيقاتها – المتذبذب التوافقي في ميكانيكا الكم – ذرة الهيدروجين- ذرة الهليوم – الفراغات الاتجاهيه–– العزم الزاوي في ميكانيكا الكم

Course Code	Course Title	Credits	Prerequisite
Math 619	**Quantum Mechanics I**	**2 hours**	**Math 620**

Course Description

1. Objectives: The main purpose is to make students gain knowledge about various concepts of Quantum mechanics such as wave functions, representation of operators, perturbations, oscillators etc., and their associated theories and results.

ILO:

On completion of the course, the students will

- have a basic understanding of the historical development, philosophies and conceptsof quantum mechanics
- understand the meaning of wave functions and the techniques of normalizing them.
- be knowing all types of representations of operators and ways to apply them in different problems.
- Gain knowledge and skill to solve the hydrogen atom problem by using quantum mechanics.
- Learn about time independent degenerate and non degenerate perturbations and to apply them in harmonic oscillator.
- gain knowledge about unitary transformations, dirac delta function, matrix representation of operators and their applications.
- Understand concept on angular momentum operator and their representation in spherical coordinates and addition of angular momentum etc.
- Get an insight to solve Schrodinger wave equation in three dimensions

2. Content:

Foundations of Quantum Mechanics and its mathematical tools. Energy Spectra for some molecules. – Hiesenberg uncertainty principle - Wave Mechanics and Schrödinger equation and its applications – simple harmonic oscillation – hydrogen atom – helium atom - vector spaces- angular momentum in Q. M.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
MAT 622	Quantum Mechanics II	2	

توصيف المقرر

The main objective : To provide students better understanding about some advanced concepts of quantum mechanics such as time-independent perturbation theory and its applications, slater determinant,Born approximation techniques etc.

1. الأهداف:

- فهم مفهوم نظرية الاضطراب الزمني المستقل وتطبيقاته في فهم ظواهر الفيزياء
- اكتساب المعرفة حول نظرية الاضطراب المعتمد على الوقت وتطبيقاتها التي تنطوي على مشاكل انتثار بسيطة
- التعرف علي معاملات أينشتاين.
- معرفةبالتناثرفيإطارينمختلفين ، ويمكنهابسهولةحسابسعةالتناثروالقسمالعرضيللانتشار.
- القدرة على كتابة طاقة كاملة ودالة الموجة كمحدد سليتر.
- اكتساب الوعي حول مفهوم تقريب بورن.
- استخدم تقنية تقريب بورن لحل المشاكل الفيزيائية لنظرية الكم.
- تكامل عدة مكونات للمقرر في سياق الوضع الجديد
- القدرة على تقديم عرض تقديمي في موضوع معين
- القدرة على إجراء البحوث وتطوير نماذج رياضية باستخدام نظرية الكم

2. المحتوي

نظرية التشتت – نظرية الاضطرابات الغير زمنيه – نظرية الاضطرابات الزمنيه– تقريب بورن – ميكانيكا الكم النسبيه

Course Code	Course Title	Credits	Prerequisite
Math 622	**Quantum Mechanics II**	**2 hours**	

Course Description

1- Objectives: To provide students better understanding about some advanced concepts of quantum mechanics such as time-independent perturbation theory and its applications, slater determinant,Born approximation techniques etc.

ILO:

On completion of the course, the students will

- understand the concept of time–independent perturbation theory and its applications in understanding physics phenomena
- acquire knowledge about time-dependent perturbation theory and its applications involving simple scattering problems
- be knowing about the Einstein's coefficients.
- know about scattering in two different frames and can easily calculate scattering amplitude and scattering cross section.
- Be able to write total energy and wave function as Slater determinant for system of identical fermions
- gain awareness about the Born approximation concept
- Use the Born approximation technique to solve physical problems of Quantum theory
- integrate several components of the course in the context of a new situation
- be able to make presentation in a given topic
- be able to perform research and develop mathematical models using quantum theory

2. Content:

Scattering Theory – time independent perturbation theory - time dependent perturbation theory- Born approximation- relativistic Q. M.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 612	نظرية الاضطراب	2	

توصيف المقرر

The main objective : To provide the students adequate knwoledge about asymptotic exapnasions and Light Hill coordinate techqnique in solving problems and to make presentation in selected topics

الأهداف:

• الحصول على معرفة دقيقة حول التوسعات المفلترة

• حل مشاكل الاضطراب العادية باستخدام التوسعات المفلترة

• الحصول على فهم واضح حول تقنية ليتهيلالمتوترة وطريقةالموازين المتعددة.

• تطبيق الأساليب المتعلمة في حل المشكلات الفيزيائية

• العثور على تطبيقات بسيطة لميكانيكا الموائع ، الهيدروديناميكيةالمغناطيسية ، ميكانيكا الكم الخ

• تقديم عرض تقديمي في موضوع معين

• متابعة البحث في المجالات ذات الصلة.

2. المحتوي:

مفكوكاتالمقارب - ومســـائل الاضـــطرابالعادية - الطرق المســـتخدمةوتشـــمل مفكوكات المقاربالمتلاقية– محاورليتهيلالمتوترةوطريقةالموازين المتعددة - تطبيقات فيميكانيكاالموائع -والمغانطيســـيةوميكانيكا الكم -ونظرية التحكم الأمثل

Course Code	Course Title	Credits	Prerequisite
Math612	**Perturbation Theory**	**2 hours**	

Course Description

1. Objectives/: To provide the students adequate knwoledge about asymptotic exapnasions and Light Hill coordinate techqnique in solving problems and to make presentation in selected topics

ILO:

At the end of the course, the students shall be able to

- get a thorough knowledge about asymptotic expansions
- solve regular perturbation problems using asymptotic expansions
- get a clear understanding about Light hill's Strained coordinate technique and the method of multiple scale
- Apply the learnt techniques in solving physical problems
- Find simple applications to fluid mechanics, magneto hydrodynamics, Quantum mechanics etc.
- Make presentation in a given topic
- Pursue research in related areas / fields

2. Content:

Asymptotic expansions, Regular perturbation problems, Methods used include matched asymptotic expansions, Light hill's Strained coordinate technique and the method of multiple scale, Applications to problems in fluid Mechanics, Magneto hydrodynamics and Quantum Mechanics - and optimal control theory

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
611 ريض	ديناميكا الموائع	2	620 ريض

توصيف المقرر

The main objective : To prepare the students get better understading about various concepts and theories of fluid dynamics and find simple analytical solutions of various types fluid flow including Boundary Layer flow

1. الأهداف:

- اكتساب المعرفة حول مختلف المفاهيم الأساسية لتدفق الموائع والنظريات المرتبطة بها .
- فهم مختلف القوانين الفيزيائية للحفظ مثل الكتلة والزخم والطاقة وتطبيقها في حركة السوائل.
- فهم مفهوم تدفق الموائع غير قابل للضغط
- فهم وتطبيق معادلات Navier Stoke• لتدفق غير قابل للضغط
- القدرة على اشتقاق المعادلات لتدفق غير قابل للضغط
- القدرة على إيجاد حلول تحليلية بسيطة لتدفق الموائع
- فهم النظريات ومفهوم تدفق الطبقات الحدية
- القدرة على صياغة مشكلة رياضية على تدفق الطبقات الحدية
- القدرة على تقديم عرضتقديمي حول موضوع معين
- إجراء البحوث وتصميم النماذج باستخدام قيود مختلفة على تدفق الموائع

2. المحتوي:

المفاهيم الأساسية لديناميكا الموائع - المعادلة الأساسية لتدفق الموائع الغير قابلة للانضغاط -معادلات نافيير- ستوكس - الطبقات الجدارية - التدفق حول الاجسام المغمورة.

Course Code	Course Title	Credits	Prerequisite
Math611	Fluid Dynamics	2 hours	Math620

Course Description

1. **Objectives: To prepare the students get better understading about various concepts and theories of fluid dynamics and find simple analytical solutions of various types fluid flow including Boundary Layer flow**

ILO:

On successful completion of the course, the student shall be able to:

- Acquire knowledge on various basic concepts of fluid flow and associated theories there on
- Understand the various physical laws on conservation such as mass, momentum, energy and apply the same in motion of fluids
- Understand the concept of incompressible flow of fluids
- Understand and apply the Navier Stoke equations for incompressible flow
- Able to derive the equations for incompressible flow
- Able to find simple analytical solutions of fluid flow
- Understand the theories and concept of Boundary Layer flow
- Able to formulate mathematical problem on immersed flow and Boundary layer flow
- Able to make presentation on a given topic
- Conduct research and design models using various constraints on fluid flow

2. Content:

Fundamental concepts. Basic equation for incompressible flow. Navier-Stokes equations. Boundary Layer. Flow about an immersed body.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
613 ريض	حساب المتغيرات والتحكم الأمثل	2	

توصيف المقرر

The main obtective : To provide various theories and concpets of Optimal Control and prepare the students solve mathematical problems using variational approach

1. الأهداف:

• اكتساب المعرفة حول الحساب التاريخي للنظرية ، الرموز القياسية والصيغ البسيطة

•calculus of variations. صياغة مشاكل بسيطة في

• اكتساب القدرة على استخدام التقنيات التحليلية لحساب التفاضل والتكامل ، والبرمجة الديناميكية والمبدأ الاعظم وما إلى ذلك.

• تطبيق نظرية وتقنيات حساب التفاضل والتكامل والتحكم الأمثل لحل بعض مشاكل التحكم.

• تجميع المعرفة الرياضية في نمذجة مشاكل التحكم الأمثل الأمثل مثل بلوزا ، مايرولجرانج صياغة الخ

•Pontryagin القدرةعلى تطبيق النهج المتغير للتحكم الأمثل ، مبدأ الحد الأقصى في حل المشاكل الرياضية

• تقديم عرض تقديمي حول موضوع معين

2. المحتوي:

المتغيرات العامة للدوال القصـــوى المقيدة . معادلات أويلر. معادلة هاملتون-جاكوبي وموضـــوعات ذات الصـلة. المتغير الثاني والشـروط الكافية القصـوى. التشـكيل التحكم الأمثل بالمسـائل ، بولزا، ماير، وصـيغة لاغرانج، اقتراب المتغيرات للتحكم الأمثل ، مبدأ الحد الأقصى بونترايجين، البرمجة الديناميكية.

Course Code	Course Title	Credits	Prerequisite
Math613	Calculus of Variations and Optimal control	2 hours	

Course Description

1. **Objectives : To provide various theories and concpets of Optimal Control and prepare the students solve mathematical problems using variational approach**

ILO:

Upon completion of the subject, students will be able to:

- acquire knowledge about historical account for the theory, standard notations and simple formulations
- Formulate simple problems in calculus of variations.
- Gain ability to use Analytical techniques of Calculus of variations, dynamic programming and the maximum principle etc.
- Apply theory and techniques of calculus of variations and optimal control to solve certain control problems.
- Synthesize mathematical knowledge in modeling simple optimal control problems such as Bolza, Mayer and Lagrange Formulation etc.
- Be able to apply Variational Approach to Optimal Control, Pontryagin Maximum Principle in solving mathematical problems
- Make presentation on a given topic

2. Content:

General variations of a functional constrained extrema. Euler equations. Hamilton-Jacobi equation and related topics. The second variation and sufficient conditions for an extremum. Formation of optimal control Problems, Bolza, Mayer and Lagrange Formulation, Variational Approach to Optimal Control, Pontryagin Maximum Principal, Dynamic programming.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 620	المعادلات التفاضلية	2	

توصيف المقرر

The main objective : To make the students aware of Stability Theory, Poincare's Theory etc and solve differential equations including Sturm-Liouville Boundary Problems using various techniques

1. الأهداف:

• فهم المفهوم الأساسي لنظرية الاستقرار.

للنظم ثنائية الأبعاد.Poincare• اكتساب المعرفة حول نظرية

• تعلم كيف يتم استخدام المعادلات التفاضلية لدراسة المشاكل الجسدية المختلفة وصياغتها.

•Poincare. صياغة المشاكل التي تنطوي على المعادلات التفاضلية لتحليل نظرية

• الحصول على حلول لعدة فئات مهمة من المعادلات التفاضلية.

•Sturm-Liouville فهم مشكلة حدود

وتحليل استقرار الخطية وغير الخطية.S- L• البحث عن حل مشكلة حدود

• القدرة على تقديم عروض / ندوة حول موضوع معين.

2. المحتوي:

الوجود والتفرد لحلول النظم الخطيه، نظرية الإســـتقرار، نظرية بونكير للنظم ذات البعد الثاني ، مســـائل شتيرم- ليوفيلالحدوديه

Course Code	Course Title	Credits	Prerequisite
Math620	Differential Equations	2 hours	

Course Description

1. **Objectives: To make the students aware of Stability Theory, Poincare's Theory etc and solve differential equations including Sturm-Liouville Boundary Problems using various techniques**

ILO:

Upon completion of this course, the student will be able to:

- Understand the basic concept of Stability Theory
- Acquire knowledge about the Poincare's theory for two dimensional systems
- Learn how the differential equations are used to study various physical problems and formulate the same.
- Formulate problems involving differential equations to analyse Poincare theory
- Obtain solutions of several important classes of differential equations
- Understand the Sturm-Liouville boundary problem
- Find the solution of S- L boundary problem and analyze stability of linear and non-linearsystems
- Able to make presentations / seminar on a given topic

2. Content:

Existence and uniqueness of solutions of linear systems. Stability theory. Poincare's theory for two dimensional systems. Sturm-Liouville boundary problems.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
626 ريض	الجبر الخطي العددي	2	632 ريض

توصيف المقرر

The main objective : Prepare the students solve various types of Linear Algebraic Problems using matrix factorization, iterative methods, QR methods, Single value decomposition techniques etc.

1. الأهداف .

• القدرة على حل أنظمة كبيرة من المعادلات الخطية باستخدام عامل المصفوفة المباشرة ، والطرق العددية التكرارية ، وبرامج الكمبيوتر مع فهم ومعرفة المفاهيم الرياضية الأساسية.

• تطبيق ، توسيع وتعميم الطرق العددية الرئيسية

• فهم أنواع مختلفة من أساليب التكرار وطرق التوصيف

• فهم الأساس النظري للأساليب المباشرة والمتكررة لحل أنظمة المعادلات الخطية

• معرفة كيفية اختيار الطرق العددية المناسبة لحل مشكلة جبرية خطية معينة

• القدرة على حل المعادلات الخطية باستخدام التحليل و الطرق التكرارية

• القدرة على حل مشاكل القيمة المميزة بشكل مستقل

• فهم مفاهيم وتقنيات التكرار العكسي

و متوالية شتورمQR• القدرة على تطبيق طريقة

• القدرة على تقديم عرض تقديمي / ندوة في موضوع معين

• القدرة على استخدام الأدوات / الحزم الرياضية ذات الصلة مثل الماتلاب لإيجاد حلول عددية

• القدرة على تنفيذ واختبار والتحقق من رموز لحل المشاكل في الجبر الخطي عدديا.

• فهم تحليل القيمة المفردة وكيفية استخدامها لتحليل البيانات

2. المحتوي:

SQRطرائقجاكوبي،جاوسسايدل- (الحلالمباشرللمعادلاتالخطية –طريقة الحذف و التحليل- تحليل الخطأ- التحسينالمتكرر، التحليلالمتعامد - التدريجات المترافقة الشروط المسبقة، طرائق تشيبيشيف شبه التكرارية) مسائلالقيمالمميزةللمصفوفة: طريقة القوى – التكرار العكسي- ، تحليلالقيم الشاذةQRوطرائق جاكوبي، جيفينزوهاوس هولدر،متواليةشتورم وطريقة

Course Code	Course Title	Credits	Prerequisite
Math 626	Numerical Linear Algebra	2 hours	Math 632

Course Description

1. **Objectives: Prepare the students solve various types of Linear Algebraic Problems using matrix factorization, iterative methods, QR methods, Single value decomposition techniques etc.**

ILO:

At the end of the course, the student shall be :

- Able to solve large systems of linear equations using direct matrix factorization, iterative numerical methods, and computer software with the understanding and knowledge of the underlying mathematical concepts.
- Apply, extend and generalize the main numerical methods
- Understand various types of iteration methods and factorization methods
- Understand the theoretical basis for direct and iterative methods for solving linear systems of equations
- Know how to choose appropriate numerical methods to solve a particular linear algebra problem
- Able to solve linear equations using factorization and iterative methods

- Able to solve Matrix Eigen value problems independently
- Understand the concepts of Power Method and inverse iteration techniques
- Able to apply QR Method and singular value decompotiontechniqeus
- Able to make a presentation / seminar in a given topic
- Able to use related mathematical soft wares / packages such as Matlab to find numerical solutions
- Be able to implement, test and validate codes to solve problems in linear algebra numerically.
- Understand the singular value decomposition and how to use it for data analysis

2. Content:

Direct solution of linear equations: Elimination and Factorization method, Ill-conditioning, Iterative refinement, Orthogonal Factorizations: (Jacobi, Gauss-Seidel, SOR, Conjugate Gradients, Pre-conditioning, Chebyshev semi-iteration methods). Matrix Eigenvalue Problems: Power method and inverse iteration, Jacobi, Givens and Householder methods, Sturm Sequence and QR method, Singular value decomposition.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 614	المعادلات التفاضلية الجزئيةالتطبيقية	2	Math615

توصيف المقرر

The main objective : Prepare the sudents formulate mathematical models involving PDEs and solve problems involving Green's function and find applications of Elliptical Differential Operators etc.

1. الأهداف:

• صياغة نماذج رياضية تنطوي على المعادلات التفاضلية الجزئية لمشاكل فيزيائية.

• تحديد المعادلات الخطية من الدرجة الأولى والنظام الثاني

• القدرة على حل مختلف المشاكل الفيزيائيةو التي تنطوي عليمعادلة لابلاس ، المعادلة الموجية ، والمعادلات الحرارية

• فهم مفهوم دالة جرين

• تحليل وحل المشاكل التي تنطوي على دالة جرين

• فهم مفهوم المؤثر الناقص.

• البحث عن التطبيقات باستخدام المؤثر التفاضلي الناقصي في الفضاء هيلبرت

• القيام بعمل سيمينار أو عرض تقديمي في موضوع معين

•إجراء البحوث وتصميم النماذج الرياضية التي تنطوي على المعادلات التفاضلية الجزئية

2. المحتوي:

دراسة المعادلات التفاضلية الجزئية كنماذج للمسائل الفيزيائية ، المعادلات الخطية من الرتبة الثانية وتصنيفها (معادلة لابلاس ، المعادلة الموجية ، معادلة الحرارة) ، طرق الحل ، دالة غرين، التحليل الطيفى للمؤثرات التفاضلية الناقصيةفى فراغات هيلبرت

Course Code	Course Title	Credits	Prerequisite
Math614	Applied Partial Differential Equations	2 hours	Math615

Course Description

1. Objectives: Prepare the sudents formulate mathematical models involving PDEs and solve problems involving Green's function and find applications of Elliptical Differential Operators etc.

ILO:

At the end of the course, the student shall be able to:

- Formulate mathematical models involving PDEs for physical problems
- Identify Linear Equations of first order and Second order
- Able to solve various physical problems involving Laplace Equation, Wave Equation, heat-equations
- Understand the concept of Green's function
- Analyse and solve problems involving Green's function
- Understand the concept of elliptical operators
- Find applications using Elliptical differential operators in Hilbert space
- Make a seminar or presentation in a given topic
- Perform research and design mathematical models involving PDEs

2. Content:

Partial Differential Equations as mathematical models of physical problems. Linear second order equations and their classification (Laplace's equation, wave equation, heat- equation). Methods of solution Green's function. Special analysis of elliptic differential operators in a Hilbert space.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 615	المعادلات التفاضلية الجزئية1	2	Math620

توصيف المقرر

The main objective : To provide the students with various concepts of PDEs such as space distribution, tempered distribution and fourier transforms. Sobolve spaces etc and train the students prepare presentation on selected topics.

1. الأهداف .

- اكتساب المعرفة حول المشتقات الضعيفة
- القدرة على تحديد مساحة التوزيعات والتبولوجيا المرتبطة بها
- فهم مفهوم الضرب الالتفافي لاثنين من التوزيعات
- اكتساب المعرفة وتطبيق نظرية الوجدانية للمعادلات الخطية
- تحديدفضاءالتوزيعات
- فهم خصائص فضاءالتوزيعات
- اكتساب المعرفة حول تحويل فوربيه تعمل على فضاءالتوزيعات
- sobolev اكتساب المعرفة حول مسافات
- القدرة على تقديم عرض حول موضوع معين
- القدرة على صياغة النماذج الرياضية التي تنطوي على المعادلات التفاضلية الجزئية وإيجاد الحلول التحليلية هناك

2. المحتوي:

فضـــاءدوالالاختبار $C_0^\infty(\Omega)$ -فضـــاءالتوزيعاتوالتوبولوجياالخاصـــة بها - ناتج ضـــرباثنينمنالتوزيعات– نظريةالوجودللمعادلات الخطية ذات المعاملاتالثابتة–فضاءالتوزيعاتوتحويلاتفوربيه -فضاءاتسوبوليف.

Course Code	Course Title	Credits	Prerequisite
Math615	Partial Differential Equations I	2 hours	Math620

Course Description

1. **Objectives: To provide the students with various concepts of PDEs such as space distribution, tempered distribution and fourier transforms. Sobolve spaces etc and train the students prepare presentation on selected topics.**

ILO:

At the end of the course, the student shall

- Acquire knowledge about weak derivatives
- Able to define space of distributions and their associated topologies
- Understand the concept of convolution product of two distributions
- Acquire knowledge and apply the existence theorem for linear equations
- Define a Tempered Distribution
- Understand the properties of tempered distribution
- Acquire knowledge about the Fourier transform acting on Tempered distribution
- Acquire knowledge about sobolev spaces
- Able to make presentation on a given topic
- Able to formulate mathematical models involving partial differential equations and find analytical solutions there on

2. Content: The space of test functions $\mathbf{C}_0^\infty(\Omega)$. The space of distributions and its topology. The convolution product of two distributions. Existence theorem for linear equations with constant coefficients. The space of tempered distributions and Fourier transforms. Sobolev spaces.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 616	المعادلات التفاضلية الجزئية II))	2	Math615

توصيف المقرر

The main objective : To make the students understand various types of PDEs and solutions of the same and their applications, thus preparing the students undertake resarch in Applied PDEs

1. الأهداف:

- الحصول على فهم شامل على أنواع مختلفة من المعادلات التفاضلية الجزئية مثل المعادلات المكافئة ، الناقصية والمعادلات الزائدية
- وصف أهمية المعادلات التفاضلية الجزئية والعلاقة بين المعادلات التفاضلية الجزئية والعلوم الأخرى في حل مشكلات المجتمع
- اكتساب المعرفة حول حل المعادلات التفاضلية الجزئية تحت شروط الحدود المختلفة
- إظهار المهارات في حل أنواع مختلفة من المعادلات التفاضلية الجزئية - المعادلات مكافئة ، والقطع الزائدي
- اختتام الحقائق والمفاهيم والمبادئ والنظريات الأساسية المتعلقة بالمعادلات التفاضلية الجزئية من الرتبة الثانية
- تطبيق المفاهيم المكتسبة في مجالات أخرى مثل العلوم الفيزيائية والعلوم والهندسة.
- تقديم عرض حول موضوع معين
- إجراء بحث في موضوع معين من العلوم الفيزيائية وصياغة نماذج رياضية تشمل المعادلات التفاضلية الجزئية

2. المحتوي

تعامل نظريةالمعادلاتالتفاضـليةالجزئيةمع التركيز علىالسـماتالأسـاسـية للمعادلات الناقصـية –وجودوتفردالحلوللأنواع مختلفة منالشروط الحدية–مناقشةنماذجتمثيليةللمعادلاتالناقصية ذات القطعالمكافئوالزائد.

Course Code	Course Title	Credits	Prerequisite
Math616	Partial Differential Equations (II)	2 hours	Math615

Course Description

1. **Objectives: To make the students understand various types of PDEs and solutions of the same and their applications, thus preparing the students undertake resarch in Applied PDEs.**

ILO:

At the end of the course, the student will be able to

- Get a thorough understanding on different types of PDEs such as parabolic, elliptic and hyperbolic equations
- Describe the importance of partial differential equations and the relation between partial differential equations and other sciences in solving Society problems
- Acquire knowledge about the solution of PDEs under different boundary conditions
- Demonstrate skills in solving various types of PDEs – parabolic, elliptic, and hyperbolic equations
- Conclude the essential facts, concepts, principles and theories relating to the linear second order partial differential equations
- Apply the learned concepts in other areas such as physical, sciences and engineering.
- Make presentation on a given topic
- Undertake research in a given topic of physical science and formulate mathematical models involving PDEs

2. Content:

Treatment of the Theory of partial differential equations with emphasis on the fundamental features of elliptic equations. Existence and uniqueness of solutions for various types of boundary conditions. Discussion of representative examples of elliptic, parabolic and hyperbolic equations.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 617	انتقال الحرارة	2	Math611

توصيف المقرر

The main objective : To help the student acquire knowledge about Heat transfer and their associated theories such as Boundary Layer Flow, Laminar Flow, Turbulant Flow, Convective mass transfer, thermal energy systems and process etc.

1. الأهداف:

• اكتساب المعرفة حول آليات نقل الحرارة الأساسية (التوصيل والحمل الحراري والإشعاع).

• فهم النظريات والمفاهيم نقل الحرارة عن طريق التوصيل في المواد الصلبة لحالة ثابتة وعابرة.

• أن تكون على علم بنقل الحرارة عن طريق الحمل الحراري في قنوات مغلقة وعلى الأسطح الخارجية ونقل الحرارة عن طريق الإشعاع الحراري.

• فهم مفهوم نقل كتلة الحمل الحراري.

• اكتساب المعرفة حول تدفق طبقة الحدود ، وتدفق رقائقي مضطرب.

• حساب نقل الحرارة عن طريق التوصيل والحمل الحراري والإشعاع الحراري لحالات عملية..

• تحليل وحساب نقل الحرارة في النظم المعقدة التي تنطوي على العديد من آليات نقل الحرارة مثل الحمل الحراري الطبيعي ، الحمل القسري إلخ.

• حساب نقل الكتلة عن طريق القياس لنقل الحرارة.

• اكتساب الكفاءة الأساسية المتعلقة بدورات أخرى تنطوي على نظم وعمليات الطاقة الحرارية.

• المهارات في تحليل وحساب نقل الحرارة في مشاكل معقدة

• القدرة على تقديم عرض في موضوع معين

• القدرة على إجراء البحوث في المواضيع المتعلقة بمفاهيم نقل الحرارة

2. المحتوي

مقدمة ، حالاتالاستقرارفى التوصيل الحرارى احادىالبعد،حالاتالاستقرارفى التوصيل الحرارى متعددالأبعاد،حالات عدم الثبات فى التوصيل الحرارى، اســـاســـيات الحمل الحرارى، العلاقات التطبيقية والعملية فى انتقال الحرارة بالحمل القســـرى، انظمة انتقال الحرارة بالحمل الطبيعى، انتقال الحرارة بالاشعاع.

Course Code	Course Title	Credits	Prerequisite
Math617	Heat Transfer	2 hours	Math611

Course Description

1. **Objectives: To help the student acquire knowledge about Heat transfer and their associated theories such as Boundary Layer Flow, Laminar Flow, Turbulant Flow, Convective mass transfer, thermal energy systems and process etc.**

ILO:

- Gain knowledge about the basic heat transfer mechanisms (conduction, convection and radiation).
- Understand the theories and concepts Heat transfer by conduction in solids for steady-state and transient conditions.
- Be familiar with heat transfer by convection in closed conduits and on external surfaces and heat transfer by thermal radiation.
- Understand the concept of Convective mass transfer.
- Gain knowledge about Boundary layer flow, laminar and turbulent flows.
- Calculate heat transfer by conduction, convection and thermal radiation for practical situations.
- Analyze and calculate heat transfer in complex systems involving several heat transfer mechanisms such as Natural convection, forced convection etc.
- Calculate mass transfer by analogy to heat transfer.
- Gain basic competence related to other courses involving thermal energy systems and processes.
- Skills in analyzing and calculating heat transfer in complex problems
- Able to make presentation in a given topic
- Able to conduct research in topics involving Heat Transfer concepts

2. Content:

Introduction, Steady-State Conduction-One Dimension, Steady-State conduction-Multiple Dimensions, Unsteady-State Conduction, Principlesof Convection, Empirical and Practical Relations or Forced-Convection Heat Transfer, Natural Convection Systems, Radiation Heat Transfer.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 618	ميكانيكا المواد الصلبة	2	Math615 Math633

توصيف المقرر

The main objective : to make the students gain knowledge about various mathematical formulations of Solid mechanics such as Stress, Strain, various types of structures, Hooke's Law, Euler Bernoulli Law and use the same to solve physical problems.

1. الأهداف:

• فهم المفاهيم الأساسية للإجهاد والتوتر

• فهم العلاقة من خلال معادلات الإجهاد الإجهاد من أجل حل المشاكل للمواد الصلبة المرونة البسيطة الثلاثية الأبعاد

• حساب وتمثيل الرسوم البيانية الإجهاد في القضبان والهياكل البسيطة

• حل المشاكل المتعلقة الانحناء النقي وغير منتظم من الحزم وغيرها من الهياكل البسيطة

• فهم مفهوم التواء وتمكن من حل المشاكل المتعلقة بالأعمدة المعزولة

• فهم وتطبيق قانون هوك

• حل المعادلات الديناميكية والمتوازنة لحدود متينة متناسلة الحدود والظروف الأولية

• فهم قانون أويلر برنولي وتطبيقه على حل المشاكل الفيزيائية

•Alry اشتقاق وظيفة الضغط من

• حل مشاكل المعادلة الموجية

• تقديم عرض حول موضوع معين

• إجراء البحوث في الميكانيكا واستنباط الصيغ الرياضية وإيجاد حل تحليلي لتطبيق النظريات المختلفة المستفادة.

2. المحتوي

خصائص المواد الصلبة التي تتعرض للإجهادات والتشوهات نتيجة الأحمال المختلفة: المشتقات في محاور الاحداثيات المختلفة - تحليل الاجهاد والانفعال –التشوهات الصغيرة - أمثلة علي الانفعال – معادلة الاتصال –القوي السطحية والحجمية –ممتد الاجهاد – معادلة الاتزان

مبدأ الاجهاد – علاقات الاجهاد والانفعال في المســتوي بعض الأمثلة علي الاجهاد - قانون هوك للأوســاط المتجانســة - معادلة نافير– معادلة أويلر-برنولي – اجهاد ايرلي

Course Code	Course Title	Credits	Prerequisite
Math618	Solid Mechanics	2 hours	Math615 Math633

Course Description

1. **Objectives: The main objective is to make the students gain knowledge about various mathematical formulations of Solid mechanics such as Stress, Strain, various types of structures, Hooke's Law, Euler Bernoulli Law and use the same to solve physical problems.**

ILO:

Uponsuccessful completion of this course students shall be able to:

- Understand the fundamental concepts of stress and strain
- Understand the relationship through the strain-stress equations in order to solve problems for simple tridimensional elastic solids
- Calculate and represent the stress diagrams in bars and simple structures
- Solve problems relating to pure and non-uniform bending of beams and other simple structures
- Solve problems relating to tensional deformation of bars and other simple tri-dimensional structures
- Understand the concept of buckling and be able to solve the problems related to isolated bars
- understand and apply Hooke's Law
- solve equilibrium and dynamical equations for an isotropic elastic solid Boundary and initial conditions
- understand the Euler Bernoulli law and apply the same for solving physical problems
- derive Alry's stress function
- solve wave equation problems
- make presentation on a given topic
- perform research in mechanics and derive mathematical formulations and find analytical solution applying various theories learnt

2. Content:

Elasticity Material time derivative. Analysis of stress and strain, Invariants, Infinitesimal deformation, Examples of strain. Equations of continuity, motion, momentum and compatibility. Body and surface forces, stress tensor, Equation of equilibrium, Transformation of coordinates, Principal stresses. Stress-strain relations in plane, Examples of stresses. Hooke's law for Homogeneous and isotropic media. Equilibrium and dynamical equations for an isotropic elastic solid Boundary and initial conditions, Navier's equation, Bending And Torsion: Bending of beams by terminal couples. The Euler Bernoulli law. Equations for plane strain. Alry's stress function. Plane stress, Torsion of circular and elliptical shaft and bars; Elastodynamics: One dimensional wave equation, Reflection and Transmission, Plane harmonic wave, Elastic body waves, Reflection of SV-waves, Reflection and refraction of P & 5 waves at a free surface, at the interface between slightly different media, energy balance for P- and S- waves.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
632 ريض	الجبر الخطى	2	

توصيف المقرر

The main objective : Become fully conversant with all basic concepts of Linear Algebra such as Linear Functionals, Linear Transformation, Vector Spaces and associated theorems and results and able to apply to solve mathematical problems.

1:الأهداف .

• فهم مفهوم الدالة الخطية والمساحات المزدوجة

• القدرة على كتابة اثبات على النظريات المرتبطة بها

• فهم مفهوم التحول الخطي القدرة على تقديمه في شكل مصفوفة .

• القدرة على تمثيل التحول الخطي في شكل مخروطي

• فهم مفهوم ممتد المتجهات للفضائات المتجهة

• القدرة على تقديم المفاهيم الأساسية والنظريات في أجزاء الجبر الخطي كما هو موضح في محتوى المقرر.

• استخدام المفاهيم والنظريات الأساسية في أجزاء الجبر الخطي كما هو موضح في محتوى المقرر من أجل حل المشكلات المطبقة

2. المحتوي

المؤثر(الناقل) الخطى والفراغات المزدوجة الخطية، الأشكال القانونية للمؤثرات و التحويلات الخطية، صيغة جوردان والصيغ الدورية- الصيغ متعددة الخطية والهرميتية - التحويلات الطبيعية وتحويلات الوحدة – ممتد للفراغات الاتجاهية. tensorالاتجهات

Course Code	Course Title	Credits	Prerequisite
Math632	Linear Algebra	2 hours	

Course Description

1. **Objectives : Become fully conversant with all basic concepts of Linear Algebra such as Linear Functionals, Linear Transformation, Vector Spaces and associated theorems and results and able to apply to solve mathematical problems.**

ILO:

After completing the course students shall be able to:

- Understand the concept of Linear Functional and Dual Spaces
- Able to write proof for associated theorems
- Understand the concept of Linear Transformation and able to present in matrix form (Both Real and Complex including Unitary Matrices)
- Able to represent Linear Transformation in canonical form
- Understand the concept of tensor product of vector spaces
- Able to present basic concepts and theorems within the parts of linear algebra as described by the course content.
- Use basic concepts and theorems within the parts of linear algebra as described by the course content in order to solve applied problems
- Communicate with the help of mathematical terminology also in other contexts.

2. Content:

Linear functional and dual spaces, Canonical form of linear transformations, Jordan and rational forms, Multilinear forms, Hermitian, unitary and normal transformations, Tensor product of vector spaces.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض633	التحليل العددي	2	

توصيف المقرر

The main objective : To prepare the students understand various concepts of Numerical Analysis and solve problems using various methods such as iterative techniques, chord method, newton method, Bairsou Technique etc.

1. الأهداف:

- فهم مفاهيم قواعد المتجهات والمصفوفات
- البحث عن حل تكراري للمعادلات غير الخطية باستخدام تقنيات مختلفة
- تطبيق التكرار الثاني وأعلى من أجل المعادلات غير الخطية
- اكتساب مهارة لتطبيق تقنيات مختلفة مثل طريقة وتر ، طريقة نيوتن ، طريقة الموضع الزائف وطريقة دلتا دلتا
- Bairsou فهم مبدأ ونظرية طريقة برنولي وتقنية
- secant أن تكون قادراً على إيجاد حل لنظام المعادلات غير الخطية باستخدام الاستبدال ، طريقة نيوتن –رافسون.

2. المحتوي

حساب الفاصلة المتحركة –خطأ التقريب- معايير المتجهات والمصفوفات- طرائق عددية لحل المعادلات ذات المتغير الواحد (الوضع الزائف-نيوتن-التكرار الدالي- القاطع وايتكن تحليل الخطأ لهذه الطرائق ودراسة معدلات التقارب 0 طرائق خاصة لحل كثيرات الحدود – حساب كثيرات الحدود و مشتقاتها- متوالية شتورم – طريقة برنولى- طريقة برسيو). طرائق عددية لحل مجموعة من المعادلات الغير تحليل الخطأ والتقارب لهذه الطرائق.خطية: نيوتن- نيوتنب الفروق المنتهية، القاطع، القاطعالموجبة بالتحديد، ،والنزولاالانحداري

Course Code	Course Title	Credits	Prerequisite
Math633	Numerical Analysis	2 hours	

Course Description

1. **Objectives : To prepare the students understand various concepts of Numerical Analysis and solve problems using various methods such as iterative techniques, chord method, newton method, Bairsou Technique etc.**

ILO:

After Completion of the course, the student shall:

- Understand the concepts of norms of vectors and matrices
- Find iterative solution of non-linear equations using various techniques
- Apply second and higher order iterations for non linear equations
- Acquire skill to apply various techniques such as the chord method, newton method, false position method and atikin's delta square method
- Understand the principle and theory of Bernoulli method and Bairsou's technique
- Be able to find solution of system of nonlinear equations using substitution, secant method, newton raphson method etc.

2. Content:

Norms, Arithmetic, and well-posed computations (Norms of vectors and matrices, Floating-point arithmetic and rounding errors, Well-posed computations); Iterative solution of non- linear equations(Functional iterations for a single equation: error propagation, second and higher order iteration methods. Some explicit iteration procedures: The Chord method, Newton method, method of false position and Aitkin's delta square method, Special methods for polynomials: evaluation of polynomials and their derivatives, sturm sequence, Bernoulli's method, Bairsou's method); Solution of Systems of Nonlinear equations: Substitution, Secant and Newton Raphson method, Continuation methods.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
628 ريض	الحلول العددية للمعادلات التكاملية	2	Math620 Math633

توصيف المقرر

The main objective : To make the students aware about Integral Equation, their formulations and findin solutions and its application to mathematical physics.

1. الأهداف:

- اكتساب المعرفة حول المفاهيم الأساسية للمعادلات التكاملية
- الحصول على الوعي حول معادلات فريدهولم التكاملية
- حل معادلات فريدهولم التكاملية باستخدام تقنيات مختلفة مثل طريقة نيستروم ، طرق تكامل المنتج ، طرق العرض إلخ
- حل مشاكل القيمة المميزة التي تنطوي على معادلات متكاملة
- الحصول على فهم واضح لمعادلات فولتيرا التكاملية
- حل معادلات فولتيرا التكاملية باستخدام أساليب التربيع ، وسبلينج وتقنيات التجميع
- الحصول على الوعي حول تطبيق معادلة متكاملة لفيزياء الرياضيات
- حل المعادلات التكاملية الحدودية
- تقديم عرض تقديمي في موضوع معين
- متابعة البحث وحل المشكلات التي تنطوي على معادلات متكاملة

2. المحتوي

مراجعة النظرية الأساسية للمعادلات التكاملية . المعادلات التكاملية لفريدهولم: طريقة نيستروم، وطريقة التكامل الضربى، وطرائق الإسقاط، مسائل القيم الذاتية، للمعادلات من نوع الأول ومنتظمة. المعادلات التكاملية لفولترا: التربيع، وطرقالاسبلاين والتجميع. المعادلات التكاملية فى الفيزياء الرياضية. المعادلات التكاملية ذات القيم الحدية

Course Code	Course Title	Credits	Prerequisite
Math628	Numerical Solution of Integral Equations	2 hours	Math620 Math633

Course Description

1. **Objectives: To make the students aware about Integral Equation, their formulations and findin solutions and its application to mathematical physics.**

ILO:

At the end of the course, the students will be able to:

- Gain knowledge about the fundamental concepts of Integral Equations
- Get awareness about Fredholm integral equations
- Solve Fredholm integral equations using various techniques such as Nystrom's method, product integration methods, projection methods etc
- Solve eigen value problems involving integral equations
- Get clear understanding about Volterra Integral Equations
- Solve the Volterra Integral Equations using Quadrature, Spline methods and collocation techniques
- Get awareness about the application of integral equation to mathematics physics
- Solve boundary integral equations
- Make a presentation in a given topic
- Pursue research and solving problems involving integral equations

2. Content:

Review of basic theory of integral equations. Fredholm integral equations: Nystrom's method, product integration methods, projection methods, Eigenvalue problems, First Kind equation and regularization. Volterra Integral Equations: Quadrature, Spline methods and collocation. Integral equations of mathematical physics. Boundary Integral Equations.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
630 ريض	نظرية التقريب	2	

توصيف المقرر

The main objective : To make the students gain skills in the Concept of Approximation theory such as Polynomial Interpolation, Lagranges formula and its application etc., and able to apply the concepts in various types of physical problems.

1: الأهداف .

- اكتساب المعرفة حول استكمال كثيرات الحدود
- فهم مفهوم صيغة استكمال لاغرانج وتطبيقاتها
- القدرة على تطبيق طريقة استكمال نيوتن لحل المشاكل الرياضية
- القدرة على إعادة إنتاج النظريات وتطبيق النتائج المرتبطة بها على مشكلة التقريب ، ووجود أفضل شروط التقريب والتفرد.
- القدرة على إيجاد تقريب في مساحات مختلفة مثل المساحات القياسية والمساحة المعيارية الخ.
- اكتساب المعرفة حول التقارب الموحد للتقريبات كثيرة الحدود
- القدرة على تطبيق تقنيات تقريبية مختلفة مثل تقريب المربعات الصغرى وتقريب تشبيشيف وتقريب المنحنيات الخ.
- القدرة على تقديم عرض في موضوع معين

2. المحتوي

دراسة استكمال كثيرات الحدود ، صيغ لانجرانج ، الخطأ فى استكمال كثيرات الحدود ، طريقة نيوتن للاستكمال ، استكمال هيرميت ، مسائل التقريب ووجود أحسن تقريبات والوحدانية ، التقريب فى الفراغ المترىوالنظيمى ، وجود وحدانية الحل أ أهمية التحدب ، التفارب المنتظم لتقريب كثيرات الحدود ، طريق اقل مربع ، تقريب تشبيشيف ، التقريب الاسبلينى

Course Code	Course Title	Credits	Prerequisite
Math630	Approximation Theory	2 hours	

Course Description

1. **Objectives : To make the students gain skills in the Concept of Approximation theory such as Polynomial Interpolation, Lagranges formula and its application etc., and able to apply the concepts in various types of physical problems.**

ILO:

At the end of the course, the students shall :

- gain knowledge about polynomial interpolation
- understand the concept of Lagrange's Interpolation formula and its applications
- be able to apply newton's interpolation method to solve mathematical problems
- be able to reproduce the theories and apply associated results to approximation problem, and existence of best approximation and uniqueness conditions
- be able to find approximation in various spaces such as metric spaces, normed space etc.
- gain knowledge about uniform convergence of polynomial approximations
- be able to apply various approximation techniques such as Least Squares approximation, Chebyshev approximation, Spline approximation etc.
- be able to make presentation in a given topic

2. Content:

Polynomial Interpolation: Lagrange interpolation formula, error in polynomial interpolation, Newton's interpolation method, Hermite interpolation. The approximation problem, existence of best approximation and uniqueness: approximation in a metric space, approximation in normed space, conditions for uniqueness of the best approximation, the uniform convergence of polynomial approximations, Least Squares approximation, Chebyshev approximation, Spline approximation.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
640 ريض	الحسابات المصفوفيه	2	

توصيف المقرر

The main objective : To make the students become complacent with Linear Systems and able to find various applications of Linear System; also gain awareness about various theorems such as Courant minimax theorem, Gershgorin's theorems etc., and their applications

1: الأهداف .

- الحصول على معرفة وافية عن النظم الخطية والنظريات المرتبطة بها
- أن تكون قادرة على العثور على تطبيقات علاقاتجوردان المخروطية ، العلاقاتالخطية الثنائية والتربيعية للأنظمة الخطية
- القدرة على إجراء تحليل مصفوفة من المعادلات التفاضلية
- الالمام ب مفهوم المبادئ المتغيرة وتطبيقها على حل المشاكل الرياضية
- القدرة على إنتاج نظرية الحد الأدنى من كورانت وتطبيقه لحل المشاكل الرياضية
- الحصول على فهم واضح حول نظرية جيرشغورين وتطبيقاتها
- اكتساب المعرفة حول معيار المتجهات وقواعد المصفوفة و حل الحسابات الرياضية
- القدرة على الحصول على رقم الشرط للمصفوفة
- القدرة على تقديم عرض حول موضوع معين

2. المحتوي

مراجعة لنظرية الانظمة الخطية. القيم الذاتية والمتجهات الذاتية. صيغة جوردان القانونية. الصيغ الشبه خطيه والصيغ من الدرجة الثانية. التحليل باستخدام المصفوفة للمعادلات التفاضلية. مبادئ التغييرية ونظرية الاضطراب. نظرية اصغرقيمة كبيرة ، متباينات ويلى، نظرية الاضطرابات الطيفيه ومعايير المتجه والمصفوفة ذات الصلة، العدد الشرطى للمصفوفة.Gershgorin ،

Course Code	Course Title	Credits	Prerequisite
Math640	Matrix Computation	2 hours	

Course Description

1. **Objectives: To make the students become complacent with Linear Systems and able to find various applications of Linear System; also gain awareness about various theorems such as Courant minimax theorem, Gershgorin's theorems etc., and their applications**

ILO:

At the end of the course, the students shall :

- get thorough knowledge about linear systems and its associated theories
- be able to find applications of Jordan Canonical forms, Bilinear and Quadratic forms of Linear systems
- be able to perform matrix analysis of differential equations
- be thorough with the concept of variational principles and apply the same to solve mathematical problems
- be able to reproduce Courant minimax theorem and apply the same to solve mathematical problems
- get a clear understanding about the Gershgorin's theorem and its applications
- gain knowledge aboutvector norms and related matrix norms and make mathematical computations
- be able to obtain the condition number of a matrix
- be able to make presentation on a given topic

2. Content:

Review of the theory of linear systems. Eigenvalues and eigenvectors. The Jordan canonical form. Bilinear and quadratic forms. Matrix analysis of differential equations. Variational principles and perturbation theory; the Courant minimax theorem, Weyl's inequalities, Gershgorin's theorem, perturbations of the spectrum, vector norms and related matrix norms, the condition number of a matrix.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
634 ريض	عديد الطيات التفاضلي	2	Math629

توصيف المقرر

The main objective : To make students gain knowledge about manifolds and its types, whitney's embedding theorem, Lie Group, differntial forms and its application etc

1: الأهداف .

• تحديد وإعطاء أمثلة من عديد الطيات

• فهم جيد للمفاهيم على عديد الطياتالاملس و الفضاء المماسي

• يمكن أن تعمل مع عديدات الطيات الجزئية وتعرف نظرية التضمين في ويتني.

• معرفة النتائج الأساسية حول حقول المتجهات ، الأقواس المنحنية ، والمنحنيات المتكاملة .

• يمكن القيام بحسابات بأشكال تفاضلية وتوصيف المشتق الخارجي

• فهم مفهوم التكامل على عديد الطيات وتطبيقها

• تقديم أطروحة قصيرة حول موضوع مختار ذو صلة

2. المحتوي

تعريف وأمثلة على عديد الطيات، وعديدات الطيات الجزئية. دراسة:-حزم الظل وظل التمام، الحقول الاتجاهيه، الصيغ -التكامل على عديد الطيات. عديدات الطيات التفاضلية- حقول والعمليات الاتجاهيه tensorsالتفاضلية، ممتد الاتجاه لممتد الاتجاه- الصيغ التفاضلية ونظرية دى رهام- حزم الالياف الرئيسيه ومجموعات هولنومى- صيغة الانحناء وتكوين المعادلات- مؤثر الوحدهلبيانكى- التفاضلات الثابته- الاسطح الجيوديسيه والاحداثيات المتعامده- شرط ريمان- فراغات الانحناء الثابت- نظرية شفارتز.

Course Code	Course Title	Credits	Prerequisite
Math634	Differentiable Manifolds	2 hours	Math629

Course Description

1. **Objectives: To make students gain knowledge about manifolds and its types, whitney's embedding theorem, Lie Group, differntial forms and its application etc**

ILO:

At the end of the course the student shall be able to :

- Define and give examples of Manifolds
- understand well the concepts smooth manifold, smooth map, and tangent space;
- Can work with submanifolds and know Whitney's embedding theorem;
- Know fundamental results about vector fields, Lie brackets, and integral curves, are familiar with the Lie algebra and exponential map of a Lie group;
- Can do calculations with differential forms and characterize the exterior derivative
- Understand the concept of integration on manifolds and apply the same
- Will present, on a scientific level, a short thesis on a chosen topic of relevance

2. Content:

Definition and examples of manifolds, Sub manifolds, tangent and cotangent bundles, Vector fields, Differential forms, Tensors, Integration on manifolds.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
635 ريض	هندسة عديد الطيات	2	Math634

توصيف المقرر

The main objective : To prepare the students gain knowledge about advanced theoreis of differential manifolds such as Differential Forms, De-Rham Theory of cohomology and derive structural equations, Schurz theorem and its applications etc.

1: الأهداف .

•دراية الطالب بجميع النظريات والمفاهيم الأساسية

• القدرة على اكتساب المعرفة حول حقول الممتدات

• القدرة على حساب ضربالممتدات.

• اكتساب مهارة لإيجاد الصيغ التفاضلية

• القدرة على فهم النماذج التفاضلية ودمجها

• القدرة على تطبيق نتائج نظرية دي-رهام

• أن يكون قادرا على استخلاص هوية بيانكي الأولى والثانية باستخدام مشتق خارجي .

• اكتساب المعرفة حول الانحناء.

• اكتساب المعرفة حول الإحداثيات الطبيعية للجيوديسيا (إحداثيات ريمان العادية) ومفاهيمها الأساسية

•Schurz تكون قادرة على إنتاج وتطبيق نظرية

• القدرة على تقديم عرض في موضوع معين

• اكتساب مهارة لأداء البحوث في المواضيع ذات الصلة في مشتقة عديد الطيات

2. المحتوي

عديدات الطيات التفاضـــلية- حقول والعمليات الاتجاهيه لممتد الاتجاه- الصـــيغ التفاضـــلية ونظرية دى رهام- حزم الالياف الرئيســـيه ومجموعات هولنومى- صـــيغة الانحناء وتكوين المعادلات- مؤثر الوحدهلبيانكى- التفاضـــلات الثابته- الاســـطح الجيوديســـيه والاحداثيات المتعامده- شرط ريمان- فراغات الانحناء الثابت- نظرية شفارتز.

Course Code	Course Title	Credits	Prerequisite
Math 635	Geometry of Manifolds	2	Math 629

Course Description

1. **Objectives : To prepare the students gain knowledge about advanced theoreis of differential manifolds such as Differential Forms, De-Rham Theory of cohomology and derive structural equations, Schurz theorem and its applications etc.**

ILO:

At the end of the course, the student shall :

- Be familiar with all basic theories and concepts Differential Manifolds
- Be able to acquire knowledge about Tensor fields
- Be able to compute Tensor Products and Wedge Products
- Be acquiring skill to find exterior derivatives
- Be able to understand Differential forms and Integrate the same
- Be Familiar with De-Rham Theory of Cohomology
- Be able to apply the results of De-Rham Theorem
- Be familiar with curvature forms and derive cartan's structural equations
- Be able to derive the first and second bianchi identity using exterior covariant derivative of torsion
- Gain knowledge about curvature and geodesics
- Be able to define Orthonormal frame
- Acquire knowledge about normal coordinates of geodesics (Reimman Normal Coordinates) and their underlying concepts
- Be able to reproduce and apply Schurz theorem
- Able to make presentation in a given topic
- Acquire skill to perform research in related topics in Differentiable Manifolds

2. Content:

Differentiable manifolds. Tensor fields and operations. Differential forms and de Rham's Theorem. Principal fiber bundles, holonomy groups. Curvature form and structural equations. Bianchi's identity. Covariant differentiation. Geodesics. normal coordinates. Riemannian connection. Spaces of constant curvature. Schurz Theorem.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
629 ريض	التحليل المركب	2	

توصيف المقرر

1. **The main objective : The sutdents gain better understanding about various concepts of contemporary complex analysis and their applications in solving mathematical problems.**

1. الأهداف:

- فهم بعض موضوعات التحليل المركب المعاصر ، ولا سيما في فضاءات خاصة من الدوال التحليلية ، والتطبيقات شبه المطابقة ، الدوال غير المتكافئة إلخ.
- أداء العمل المستقل في هذه المواضيع وخاصة استخدام أساليب التحليل المركب في مجالات الرياضيات الأخرى مثل التحليل التوافقي ، المعادلات التفاضلية ، إلخ.
- اكتساب المهارات لتطبيق تقنيات مختلفة من التحليل المركب المعاصر في حل المشاكل الرياضية
- القدرة على المشاركة في المناقشات العلمية
- إجراء البحوث على المستوى الدولي العالي في التحليل المركب والكلاسيكي المركب وتطبيقاته.

2. المحتوي

الدوال التوافقية ,الصـــيغة العامة لنظرية كوشـــى, عائلة المنحنيات الطبيعية, الراســـم المحافظ, الاتصـــال التحليلي , نظرية الدوال احادية التكافؤ.

Course Code	Course Title	Credits	Prerequisite
Math629	Complex Analysis	2 hours	

Course Description

2. Objectives : The sutdents gain better understanding about various concepts of contemporary complex analysis and their applications in solving mathematical problems.

ILO:

At the end of the course, the student shall be able to :

- Understand some topics of contemporary complex analysis, in particular spaces of analytic functions, quasi-conformal mappings, univalent functions etc.
- Perform independent work in these topics and especially to use the methods of complex analysis in other areas of mathematics such as harmonic analysis, differential equations etc.
- Acquire skills to apply various techniques of contemporary complex analysis in solving mathematical problems
- Able to participate in scientific discussions
- Conduct researches on high international level in contemporary and classical complex analysis and its applications.

2. Content:

Harmonic function, the general form of Cauchy's Theorem, Normal families, Conformal mapping. Analytic continuation, univalent function theory.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
637 ريض	نظرية الجهد	2	

توصيف المقرر

The main objective : To make the students gain thorough knowledge about Potential Theory and associated concpets such as Harmonic and Subharmonic functions, classical Dirichlet problems and its solutions, super harmonic functions and their applications etc.

1: الأهداف .

•فهم مفهوم الدوال التوافقية والتناوبية وتطبيقاتها

• اكتساب المعرفة حول تكامل بوايزونالقدرة على حل مسألة ديريليشية الكلاسيكية

• الالمام بالتعاريف والمسلمات المتعلقة بالدوال التوافقية

• القدرة على تطبيق نتائج نظرية تحليل ريزلتفكيكالاقترانات التوافقية

• الالمام بنظرية التقارب للاقترانات التوافقية وتطبيقاتها

• أن تكون قادرة على حل مسألةديريليشيةالكلاسيكيةالمعممة في فضاء توافقي

• القدرة على تقديم عرض في موضوع معين

2. المحتوي

، تكامل بوايزون، مسألة ديريليشية الكلاسيكية، مسلمات تعرف الاقترانات التوافقية على Rnالاقترانات التوافقية و التوافقية الجزئية على الفضـــاءات المتراصـــة موضـــعيا،الاقترانات التوافقية جدا والجهد، نظرية ريز لتفكيك الاقترانات التوافقية جدا الموجبة، مجموعات بالايجالاستثناءية (مثال: المجموعات القطبية والمجموعات التي سعتها صفر)، نظرية التقارب للاقترانات التوافقية جدا المرشحة المتناقصة، مسألة ديريليشية المعممة في فضاء توافقي، التدفق واستخدامه في نظريات التوسعات التوافقية جدا في فضاء توافقي بدون جهد موجب.

Course Code	Course Title	Credits	Prerequisite
Math637	Potential Theory	2 hours	

Course Description

1. **Objectives : To make the students gain thorough knowledge about Potential Theory and associated concpets such as Harmonic and Subharmonic functions, classical Dirichlet problems and its solutions, super harmonic functions and their applications etc.**

ILO:

At the end of the course, the student shall:

- Understand the concept of Harmonic and subharmonic functions and their applications
- Gain knowledge about poission integral and able to solve Classical Dirichlet problem
- Be thorough with various definitions and axioms relating to harmonic functions
- Be able to apply the results of Reisz-decomposition theorem for positive super-harmonic functions
- Be conversant with convergence theorem for decreasing filtered super-harmonic functions and its applications
- Be able to solve Generalized Dirichlet problem in a harmonic space
- Have an understanding on theory of flux and its use
- Able to make presentation in a given topic

2. Content:

Harmonic and sub harmonic functions in IRn. Poisson integral. Classical Dirichlet problem. Different sets of axioms defining harmonic functions on a locally compact space. Super harmonic functions and potentials. Reisz-decomposition theorem for positive super harmonic functions. Balayage. Exceptional sets (e.g. polar sets، sets of capacity Zero), a convergence theorem for decreasing filtered super harmonic functions. Generalized Dirichlet problem in a harmonic space. Flux and its use in some super harmonic extension theorems in a harmonic space without positive potentials.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
672ريض	الحلول العددية للمعادلات التفاضلية	2	

توصيف المقرر

1. **The main objective : At the end of the course the students will be able to find numerical solution of ODE and error estimation using various techniques.**

1: الأهداف .

- دراية الطالب بطرق مختلفة مثل طرق تايلور ، أويلر و أويلر المعدلة لحل مشاكل المعادلات التفاضلية.
- القدرة على حساب الحدود للخطأ القطعي.
- فهم مفهوم الاستقرار المطلق والنسبي
- المام الطالب بالطرق العددية المختلفة مثل طرائقالتنبؤوالتصحيح ، تقدير ميلن للخطأ. طرائق رونج - كوتا
- القدرة على اشتقاق طرق رونج - كوتا الكلاسيكية من الرتبة الثانية، والتأكد من استقرارها
- القدرة على حل مشاكل القيمة الحدية
- الالمامبطريقة العناصر المحدودة في حل المشاكل الرياضية
- القدرة على تطبيق تقنيات مختلفة مثل طريقةالتصويب، ، وطريقة التجميع وطريقة التغيريةفي إيجاد حلول المعادلات التفاضلية
- القدرة على تقديم عرض تقديمي لموضوع معين
- متابعة البحث في ساحة المعادلات التفاضلية وتطبيقاتها

2. المحتوي

، النظام والاتســـاق ، والتقارب،) الرتبة،التوافق،الاتزانوالتقارب وعدم الاســـتقرار(مقدمةطرائقتيلور،أويلر،أويلرالمعدلة. طرائقالخطواتالمتعددةالخطية: حدودالخطأالمحلي والخطأالكلىالقطع ، للخطأ والاتزان المطلق و النسـبي،طرائقالتنبؤوالتصـحيح ، تقدير ميلن للخطأ. طرائق رونج - كوتا طرق: اشـتقاق كوتا، مسـائل الشـروطالحدية: طريقةالفرق محدود، وطريقةالتصـويب، ، وطريقة - طرائق رونج - كوتا الكلاسـيكية من الرتبة الثانيةاتزانطريقةرونج التجميع وطريقة التغيرية.

Course Code	Course Title	Credits	Prerequisite
Math 6	Numerical Solution of Ordinary Differential Equation	2 hours	

Course Description

2. **Objectives : At the end of the course the students will be able to find numerical solution of ODE and error estimation using various techniques.**

ILO:

At the end of the course, the student shall

- Be aware of various methods such as Taylor, Euler and Modified Euler methods to solve ODE problems
- Be able to compute bounds for local and global truncation error
- Understand the concept of absolute and relative stability
- Be thorough with various numerical methods such as Skob predictor-corrector methods, Milne's error estimate. Range-Kuta Methods
- Be able to Derive classical RK methods of 2nd order, and ascertain their stability
- Be able to solve boundary value problems
- Be conversant with finite element method in solving mathematical problems
- Able to apply various techniques such as shooting methods, collocation method and variational methods in finding solution of ODEs
- Able to make presentation to a given topic
- Pursue research in the arena of ODE and its applications

2. Content:

Introduction: Taylor, Euler, and modified Euler methods. Linear Multistep Methods: Order, consistency, zero-stability, convergence, Bounds for local and global truncation error, Absolute and relative stability, Skob predictor-corrector methods, Milne's error estimate. Range-Kuta Methods: Derivation of classical RK methods of 2nd order, stability of RK methods. Boundary value problems: Finite difference methods, shooting methods, collocation method and variational methods.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
Math 641	الأنظمة الديناميكية غير الخطية	2	620ريض

توصيف المقرر

The main objective : The students will be fully conversant with nonlinear dynamical systems and able to perform various calculations such as periodic orbits and limit cycles, bifurcation diagrams etc.

1: الأهداف .

سوف يغطي الكورس الأفكار الرياضية الأساسية ، ولكنها تركز على التطبيقات من العديد من المجالات العلمية. كما ينبغي أن يكون الطالب قادرا على التالي

- حساب المدارات الدورية ودورات الحد والاستقرارللانظمة الديناميكية.
- حساب مخططات التشعب لعائلات الأنظمة الديناميكية .
- حساب المانيفولداللامتغيرالزائدي، الظواهر الهيموكلينكية والاستقرار الهيكلي.
- تحليل الأنظمة الديناميكية من خلال التشعبات والتطبيق في بعض ديناميكيات السكان.

2. المحتوي

- براهينوجود و تفرد لحلول المعادلات التفاضلية العادية.
- الرواسم أحادية البعد ومعادلات الفروق: المسائل الخطية وغير الخطية ، والحلول البيانية ، والتشعبات ، والفوضى.
- المعادلات تفاضلية من الدرجة الأولى (تدفقات أحادية البعد): معادلات الخطية وغير الخطية ، حلول بيانية ، تشعبات.
- تدفقات ثنائية الأبعاد: مستوى الطور ، و استقرار النقاط الثابتة ، والحلول الدورية ، ودورات الحد. مقدمة لنظرية التشعب ، التشعبات المحلية و الكلية. أدوات لدراسة السلوك العالمي للتدفقات و دوال ليبانوف، نظرية بوانكارية -بندوكسنوالظواهر الهيموكلينكيةوالتدرج للتدفق.
- تدفقات ثلاثية الأبعاد: دلائل ليبانوف و مقاطع بوانكارية و الجاذبات الغريبه و الفوضي.

Course Code	Course Title	Credits	Prerequisite
Math 641	Nonlinear Dynamical Systems	2	Math 620

Course Description

1. Objectives : The students will be fully conversant with nonlinear dynamical systems and able to perform various calculations such as periodic orbits and limit cycles, bifurcation diagrams etc.

ILO:

On completion of the course, will give underlying mathematical ideas, but emphasize applications from many scientific fields. Also the student should be able to

- Calculate periodic orbits and limit cycles and the stability of the dynamical systems;
- Calculate bifurcation diagrams for families of dynamic systems;
- Account for hyperbolicity, invariant, manifolds, homoclinic phenomena and structural stability;
- Analyze dynamic systems via bifurcations and application in some population dynamics.

2. Content:

- Existence and uniqueness proofs for solutions to ordinary differential equations.
- One-dimensional maps and difference equations: linear and nonlinear problems, graphical solutions, bifurcations, chaos.
- First-order differential equations (one-dimensional flows): linear and nonlinear equations, graphical solutions, bifurcations.
- Two-dimensional flows: phase plane, stability of fixed points, periodic solutions, and limit cycles. Introduction to bifurcation theory, local and global bifurcations. Tools for studying global behavior of flows: Lyapunov functions, Poincare-Bendixson Theorem, homoclinic phenomena, gradient of flows.
- Three-dimensional flows: Lyapunov exponents, Poincare sections, strange attractors, chaos.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
642	رياضيات حيوية	2	620ريض

توصيف المقرر

The main objective : To prepare the students develop the skill in mathematical modelling for biological problems such as population models , epidemic models and find analytical solutions under various constraints

1. الأهداف:

يقدم هذا الكورستطوير أساليب النمذجة المختلفة لمختلف الظواهر البيولوجية والفيزيولوجية. في نهاية الكورس ، سيقوم الطالب بتطوير المهارات التالية

- طرق النمذجة المختلفة لفهم والتقاط جوهر مجموعة واسعة من الظواهر البيولوجية.
- تحليل النموذج الأساسي: المحاكاة ، الاتزان ، الاستقرار ، الافتراضات ، تحليل الحساسية ، التحقق من الصحة.
- صياغة وحل النماذج الرياضية للتطور من حيث النماذج السكانية ونماذج الاوبئة.
- بعض الطرق التحليلية والحسابية المستخدمة لدراسة الظواهر البيولوجية.

2. المحتوي

- النمذجة ، ومناقشة بعض النماذج لنمو البكتيريا ، وخاصة المعادلة اللوجيستية ، ونماذج المنافسة ، والكيموستات ، والحالات الاتزان وتحليل الاستقرار.
- نماذج الفريسة من نوع لوتكا-فولتيرا (Lotka-Volterra)، حالات الاتزان وتحليل الاستقرار الخطي.
- نمذجة الاوبئة ، اولا نموذج قابل للعدوى ، مصاب ومتعافى (SIR نموذج ، (SIS نموذج ، SEIR وناقلات الأمراض المتنقلة.
- التذبذبات والإيقاعات في النظم البيولوجية ، التدفق في الخلايا العصبية ، نموذج هودجكين-هكسلي (Hodgkin-Huxley model)، نموذج فيتزهوج-ناجومو (Fitzhugh-Nagumo model) >

Course Code	Course Title	Credits	Prerequisite
Math 642	Mathematical biology	2	Math 620

Course Description

1. Objectives: To prepare the students develop the skill in mathematical modelling for biological problems such as population models , epidemic models and find analytical solutions under various constraints

ILO:

This course introduces different modeling approaches to various biological and physiological phenomena are developed. By the end of the course, the student will develop the following skills

• Different modeling approaches to understand and capture the essence of a wide variety of biological phenomena.

•Basic model analysis: simulation, equilibria, stability, assumptions, sensitivity analysis, validation.

• Formulate and solve mathematical models of evolution in terms of population models and Epidemic models

• Some of the analytical and computational methods used to study biological phenomena.

2. Content:

- Modeling, discuss some models for the growth of bacteria, especially the logistic equation, Competition models and the chemostat, steady states and stability analysis.
- Lotka-Volterra Predator prey models, steady states and linearized stability analysis.
- Epidemic modeling, Susceptible, infected and recovered (SIR) model, SIS model,SEIR model and Vector transmitted disease models.
- Oscillations and rhythms in biological systems, Flow in neurons, Hodgkin-Huxley model, Fitzhugh-Nagumo model.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
643ريض	الرياضيات المالية الحسابية	2	620 ريض ريض 615,

توصيف المقرر

The main objective : : **To make the students understand the concept of SDEs and their applications in financial domain**

1. **الأهداف:**

(1) فهم مفهوم المعادلات التفاضلية العشوائية وتطبيقاتها

(ب) محاكاة تسعير الأصول باستخدام اكسيل

(ج) فهم مفهوم الأسواق المالية والنظريات المرتبطة بها

(د) اكتساب المعرفة حول التحوط

(ه) العثور على حلول رقمية من للمعادلات التفاضلية في المجال المالي

(و) تقديم عرض بسيط حول موضوع معين

2. المحتوي

Itˆosالعشوائية والمعادلات التفاضلية العشوائية - الانجراف ، الانتشار و مبرهنة و تكامل
المنتجات والأسواق المالية: مقدمة للأسواق المالية والمنتجات التي يتم تداولها فيها: الأسهم ، المؤشرات ، العملات الأجنبية والسلع. عقود الخيارات واستراتيجيات المضاربة والتحوط.

التمويل الحسابي: حل المعادلات التفاضلية للتسعير باستخدام نظام **Finite Difference**.

Course Code	Course Title	Credits	Prerequisite
Math 643	**Computational Financial Mathematics**	**2 hours**	MATH 615, Math 620

Course Description

1. **Objectives : To make the students understand the concept of SDEs and their applications in financial domain**

ILO: At the end of the course the students shall be able to:

(a) Understand the concept of SDEs and its applications
(b) Simulate Asset Pricing using Excel
(c) Understand the concept of financial markets and associated theories
(d) Gain knowledge about hedging
(e) Find numerical solutions of PDEs in Financial Domain
(f) Make simple presentation on a given topic

2. Content:

Stochastic Calculus:. Stochastic Differential Equations (SDEs) - drift, diffusion, Itˆos Lemma, Itˆo Integral and Itˆo Isometry. Simulating asset price SDEs in Excel.

Financial Products and Markets: Introduction to the financial markets and the products which are traded in them: Equities, indices, foreign exchange and commodities. Options contracts and strategies for speculation and hedging.

Computational Finance: Solving the pricing PDEs numerically using Explicit Finite Difference Scheme.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
644ريض	التطبيقات المالية للمعادلات التفاضلية الجزئية	2	615 ريض

توصيف المقرر

The main objective : **To prepare the students apply the PDE for desiging models for Pricing Theory, Risk Analysis (Block-Scholes Problem) etc., and finding their solutions**

1. **الأهداف:**

(أ) تطبيق المعادلات التفاضلية الجزئية لمشاكل Black-Scholes

(ب) تطبيق تقنيات المعادلات التفاضلية الجزئية في نظرية التسعير

(ج) اكتساب المعرفة في مونت كارلو تقنيات التسعير

(د) تصميم نماذج CAPM و Fator

(ه) اكتساب المعرفة عن نظرية التسعير التحكيمية

(و) فهم مفهوم نماذج معدل معدل الفائدة العشوائية

(ز) حل معادلات تسعير السندات

2. المحتوي

لتسعير خيارات السلع والعملات. المدفوعات غير المستمرة .إطار بلاك سكولز: معادلة بلاك سكولز التفاضلية الجزئية : ثيتا ، دلتا ، غاما ، فيغا ورهو ودورهم في التحوط. التسعير باستخدام نهج **The Greeks**- الخيارات الثنائية والرقمية. مونتي كارلو و تقريب المعادلات التفاضلية.

) - نماذج عامل النمو: نظرية التسعير الخاصة بنظرية CAPMنظرية التسعير: نموذج تسعير الأصول الرأسمالية ( ) - استراتيجيات التحوط والتسعير من دون تحكيم - النظرية الأساسية لتسعير الأصول.Ross-Huberman (APT

منتجات الدخل الثابت: مقدمة لخصائص وخصائص منتجات الدخل الثابت. العائد والمدة والتحدب. منحنيات العائد والمعدلات الآجلة ؛ سندات كوبون صفر. نماذج معدل الفائدة العشوائية وحلول معادلة تسعير السندات.

Course Code	Course Title	Credits	Prerequisite
Math 644	**Financial Applications of PDE**	**2 hours**	MATH 615

Course Description

1. Objectives: To prepare the students apply the PDE for desiging models for Pricing Theory, Risk Analysis (Block-Scholes Problem) etc., and finding their solutions

ILO: At the end of the course the students will be able to :

(a) Apply PDEs for Black-Scholes Problems
(b) Apply the PDE techniques in pricing theory
(c) Gain knowledge in Monte Carlo Techniques of pricing
(d) Design CAPM and Fator Models
(e) Gain Knowledge about Arbitrage Pricing Theory
(f) Understand the concept of Stochastic Interest rate models
(g) **Solve Bond Pricing Equations**

2. Content:

Black-Scholes framework: Black-Scholes PDE. The PDE for pricing commodity and currency options. Discontinuous payoffs - Binary and Digital options. The Greeks: theta, delta, gamma, vega& rho and their role in hedging. Pricing using Monte Carlo and PDE approach.

Pricing Theory : Capital Asset Pricing Model (CAPM) -Factor models: the Ross-Huberman arbitrage pricing theory (APT) - Hedging strategies and pricing by no-arbitrage - Fundamental Theorem of Asset Pricing.

Fixed-Income Products: Introduction to the properties and features of fixed income products; yield, duration & convexity; yield curves & forward rates; zero coupon bonds. Stochastic interest rate models; bond pricing PDE; popular models for the spot rate (Vasicek, CIR and Hull & White); solutions of the bond pricing equation.

رمز ورقم المقـرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
645ريض	الاقتصاد الرياضي	2	620 ريض

توصيف المقرر

The main objective : **To make the students gain awareness about Economical Applications of Mathematics using various theorems such as Implicit function theorem, Ehtoven Sufficiency theorem, Fixed Point Theorems Game theory etc., and their applications to Economic Problems**

1. **الأهداف:**

• فهم مفاهيم نظرية Enthoven Sufficiencyوتطبيقاتها

• اكتساب المعرفة حول نظرية Envelopوتطبيقاتها

• فهم تأثير تغير السعر في الأرباح وفائدة العملاء

• الحصول على وعي مفاهيم وتطبيقات توازن النقاط الثابتة إلى شروط التوازن

• اكتساب المعرفة حول نظرية الألعاب

• القدرة على تطبيق مختلف مفاهيم نظرية الألعاب للنماذج الاقتصادية لمختلف المواقف التنافسية

• البحث عن تطبيقات لنماذج نظرية اللعبة غير المتعاون وطرق مصفوفة

2. المحتوي

Iتقنيات التحسين مع قيود المساواة
النمذجة الاختيارات المقيدة. المزيد من تطبيقات طريقة الاستبدال ، نظرة عامة على طريقة Lagrangian - Arrow-Enthoven Sufficiency Theorem
. نظرية الدالة الضمنية: نظرية الدالة الضمنية وقواعد التفاضل ، نظرية الأظرف. التطبيقات: كيف تؤثر الأسعار المتغيرة على الشركات التي تعظيم الربحية II
وتعظيم الاستفادة من المستهلكين.
. التوازن العام ، نظرة عامة قصيرةIII
. وجود التوازن العام ، نظرية بروويرزللنقطة ثابتة ، نظرية 'Walras المفاهيم الرياضية: ترتيب الأفضليات الضعيف ، ومراسلات الطلب الزائدة ، وقانون
الكاكوتانيللنقطة ثابتة
. القرارات المترابطةIV
مقدمة لنظرية الألعاب (2) مفاهيم أساسية ورياضيات للألعاب - مصفوفات اللعبة: إستراتيجية ، مكافأة ، ألعاب غير متعاونة ، أفضل وظائف الرد. الألعاب المسماة: لعبة معضلة السجين ، ألعاب الربح الصفري ، ألعاب التنسيق ، إلخ. - الألعاب الاقتصادية مع الإستراتيجية المستمرة: الاحتكار ، المنافسة الاحتكارية ، المنافسة السياسية ، البحث عن الريع. الأفكار والمصطلحات الفنية: توازن ناش ، استراتيجيات نقية ، إستراتيجيات مختلطة ، توازن مثالي ثانوي. وجود تكافؤ ناش (Kakutani revisited) - مُقدِّر كلثوم - مُستخدِم تطبيقات نظرية ومصفوفات الألعاب غير المتعاونة

Course Code	Course Title	Credits	Prerequisite
Math 645	**Mathematical Economics**	**2 hours**	MATH 620

Course Description

1. **Objectives : To make the students gain awareness about Economical Applications of Mathematics using various theorems such as Implicit function theorem, Ehtoven Sufficiency theorem, Fixed Point Theorems Game theory etc., and their applications to Economic Problems**

ILO: At the end of the course the students will be able to :

- Understand the concepts of Ethoven Sufficiency Theorem and its applications
- Gain knowledge about Envelop Theorem and its applications
- Understand the impact of price change in profits and utility of customers
- Get awareness about Equilibiriumconceps and applications of Fixed Point Results to Equilibirium conditions
- Gain knowledge about Game Theory
- Able to apply various concepts of Game Theory for Economic models for various competitive situations
- Find applications of Non-cooperative Game Theory Models and Matrix Methods

2. Content:

I Techniques for Optimization with Equality Constraints

Modeling constrained choices. more applications of the substitution method, an overview of the Lagrangian method - Arrow-Enthoven Sufficiency Theorem

II. The Implicit Function Theorem: The Implicit Function Theorem and differentiation rule, the envelop theorem. Applications: how changing prices affect profit maximizing firms and utility maximizing consumers.

III. General Equilibrium, a Short Overview

Mathematical Concepts: weak preference ordering, excess demand correspondence, Walras' law. Existance of a general equilibrium, Browers fixed point theorem, Kakutani fixed point theorem

IV. Interdependent Decisions:

An Introduction to Game Theory (2) Essential Concepts and Mathematics of Games - Representing interdependent choices with game matrices: strategy, payoff, non-cooperative games, best reply functions. Named games: prisoner's dilemma game, zero sum games, coordination games, etc. - Economic games with strategy continua: duopoly, monopolistic competition, political competition, rent seeking. Technical ideas and terms: Nash equilibrium, pure strategies, mixed strategies, subgame perfect equilibria. Existance of Nash Equilibrium (Kakutani revisited) –OLS Estimator – Applications of Non-cooperative Game Theory and Matrix Methods

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
646ريض	رياضيات متقطعة	2	620 ريض

وصف المقرر

The main objective : **To train the students in designing algorithm, graph theory, structural induction. Lattices, Boolean Algebra and their application to Computer Architecture**

1. **الأهداف**:

- فهم مبادئ كتابة الخوارزميات
- جمع المعرفة وتطبيق مبادئ الاستنتاج الرياضي لصياغة الخوارزميات
- فهم مفهوم الاستنتاج الهيكلي وتطبيقاته
- القدرة على حل المشاكل باستخدام العلاقات المتكررة
- تطبيق المعرفة الرسم البياني لأنواع مختلفة من الحلول المثلى
- اكتساب المعرفة حول طريقة الأشجار وتطبيقاتها
- فهم مفهوم الشبكات
- فهم مفهوم الجبر البوليان وتطبيقه على تصميم الكمبيوتر باستخدام بوبات منطقية

2. المحتوي

-أويلر ومسار هاميلتون -الرسم البياني -علاقات التكرار -الاستنتاج الهيكلي -مبادئ الاستنتاج والترتيب -الخوارزميات ونمو الدوال الجبر البوليان والبوابات المنطقية -الشبكات -الأشجار و انواعها وتطبيقاتها

Course Code	Course Title	Credits	Prerequisite
Math 646	**Discrete Mathematics**	**2 hours**	MATH 620

Course Description

1. Objectives: To train the students in designing algorithm, graph theory, structural induction. Lattices, Boolean Algebra and their application to Computer Architecture

ILO: At the end of the course the students will be able to :

- Understand the Principles of writing Algorithms
- Gather knowledge and apply Mathematical Induction Principles to formulate algorithms
- Understand the concept of structural induction and its applications
- Able to solve problems using recursive relations
- Apply the knowledge of graph for various types of optimal solutions
- Gain knowledge about trees and their applications
- Understand the concept of Lattices
- Gain knowledge of Boolean Algebra and its application to Computer Design using Logic Gates

2. Content:

Algorithms and Growth of Functions – Induction and Ordering Principles – structural induction – recurrence relations – Graph – Euler and Hamiltonean Path – Trees, types and their Applications –Lattices – Boolean Algebra and Logic Gates

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
ريض 647	الحلول العددية للمعادلات التفاضلية الجزئية	2	627 ريض

توصيف المقرر

The main objective : **To prepare the student find numerical solutions of PDEs using various techniques and error estimation suing Finite difference methods and their applciation to physical problems.**

1. **الأهداف:**

- استيعاب و فهم مجموعة مختارة من المعادلات التفاضلية الجزئيةالتنتصف العديد من الظواهر الفيزيائية.
- إدراك كامل للاختلافات الأساسية ، ونقاط القوة والضعف فى الطرق العددية شائعة الاستخدام مع المعادلات التفاضلية الجزئية.
- تطبيق طرق الحل العددية المشهورة لمختلف المعادلات التفاضلية الجزئيةمعالشروط الحدية / الأولية المرتبطة بها.
- القدرة على تقطيع المعادلات التفاضلية الجزئية في المكان والزمان.
- اشتقاق تقديرات الخطأ القياسية لطرق الفروق المحدودة والعناصر المحدودة.
- القدرة على إنشاء برامج تطبق طرق الحل العددية المشهورة لمختلف المعادلات التفاضلية الجزئية.
- تقديم و مناقشة طرق الحل والنتائج المستخلصة منها في تقارير المكتوبة.
- تحديد الطرق العددية المناسبة على أساس خصائص المعادلات التفاضلية الجزئيةالمعطاة.

2. المحتوي

أساليب الفروق المحدودة الصريحة - أساليب الفروق المحدودة الضمنية - مشكلات القيمة الابتدائية / الحدية للمعادلات التفاضلية الجزئية بأنواعها المختلفة - استقرار الحلول العددية - تقديرات الخطأ والتحكم فيه - تقطيع العناصر المحدودةو الحجوم المحدودة فى المكان و الزمان.

Course Code	Course Title	Credits	Prerequisite
Math 647	**Numerical solutions of partial differential equations**	**2 hours**	MATH 627

Course Description

1. Objectives: To prepare the student find numerical solutions of PDEs using various techniques and error estimation suing Finite difference methods and their applciation to physical problems.

ILO: At the end of the course the students will be able to :

- Understanding a selection of PDEs describing physical phenomena
- Give a detailed account for the principal differences, strengths and weaknesses of commonly used numerical methods for PDE
- Apply common numerical solution methods for various PDEs with associated boundary/ initial conditions
- Discretize PDEs in space and time
- Derive standard error estimates for finite element and finite difference methods
- Develop programming codes for common numerical discretization methods for PDEs
- Present and critically discuss solution methods and results in written reports
- Select appropriate numerical methods based on the characteristics of a PDE problems

2. Content:

Explicit Finite difference schemes- Implicit Finite difference schemes- Initial/boundary value problems for parabolic and hyperbolic PDEs-Boundary value problems for elliptic PDEs-Stability of numerical solutions-error estimation and control-Finite element discretization-Finite volume discretization.

رمز ورقم المقرر	عنوان المقـــرر	عدد الوحدات	متطلب سابق
695ريض	مشروع بحث	4	615 ريض

توصيف المقرر

The main objective : To prepare the student take up independent research in Mathematics on completion of the Program by making them undertake a guided research project in any area of mathematics of their interest.

1. الأهداف:

- القدرة على جمع المعلومات فيما يتعلق بموضوع رياضي معين أو مجال مرتبط من الملخصات العلمية
- القدرة على تقديم عرض من المعلومات المجمعة
- القدرة على صياغة مشكلة البحث على أساس المعرفة المكتسبة
- إجراء دراسة موجهة تحت إشراف مشرف
- عقد سيمينار حول تقدم العمل
- إعداد تقرير للدراسة
- تقديم عرض حول النتائج والتقرير والدفاع عنه أمام لجنة المحكمين العلميين

2. المحتوي

لإستيفاء متطلبات منح درجة الماجستير فى الرياضيات التطبيقيةيلزم على الطالب إتمام مشروعالبحث في الفصل الدراسيالأخير منهذا البرنامج حيث يقوم الطالبباختيارموضوعلهذا المشروعبالتشاور معالمشرف على المشروعالمخصصلهمن قبل القسم ومن ثم موافقة مجلس القسم . وعلى الطالب القيام بدراسة مفصلة عنهذا الموضوعالمحددبتوجيهمن المشرف وتقديم تقرير في نهايةالفصل الدراسي.وسيتمالنظر في تقريرالمشروعمن قبل لجنة محكمين تعين من مجلس القسم.

Course Code	Course Title	Credits	Prerequisite
Math 695	**Research Project**	**4 hours**	**MATH 615**

Course Description

1. **Objectives: To prepare the student take up independent research in Mathematics on completion of the Program by making them undertake a guided research project in any area of mathematics of their interest.**

ILO:

At the end of the course the student shall

- Be able to collect information with regard to a given mathematical topic or associated area from scientific literature
- Be able to make presentation from the gathered information
- Be able to formulate a research problem based on the acquired knowledge
- Perform guided study under the supervision of a supervisor
- Make seminar about the progress of work
- Prepare a report of study
- Make a presentation on the findings and the report and defend before a committee of scholars

2. Content:

As a partial fulfillment for the award of degree of master in science in applied mathematics students are required to complete a research project. The student will have to make a detailed study of a topic allotted by the supervisor appointed by the department council and submit a project report. The report will be examined by a panel of examiners appointed by the department council.

Faculty Members

No	Name of Faculty Member	Degree	Major
1	Dr. Fahd bin Misfer Al-Jaidi	Head of the Department	
2	Professor Dr. Rene George	Professor	
3	Professor Dr. Essam Rushdi Al-Zahhar	Professor	
4	Professor Dr. Muhammad Mudathir Muhammad Abdo	Professor	
5	Professor Dr. Hossam Nabawy	Professor	
6	Prof. Dr. / Nisar Kotakaran Subi	Professor	
7	Professor Dr. Mahmoud Mohamed Salim Saleh	Professor	
8	Professor Dr. Abdel Basit Abdel Hamid Mohamed	Professor	
9	Professor Mohamed Abdel Rahman El Shorbagy	Professor	
10	Dr. Abdullah bin Mohammed Ahmed Al-Durahim	Associate Professor	
11	Dr. Khader Hayat Khan	Associate Professor	
12	Dr. Abdel-Aleem Abdo Al-Saadani	Associate Professor	
13	Dr. Mahmoud Al-Morshedy	Associate Professor	
14	Dr. Amr Refaat Turki El-Sunbaty	Associate Professor	
15	Dr. Raja Goplan	Associate Professor	
16	Dr. Abdel Fattah Azzam	Associate Professor	
17	Dr. Imad Rizq Attia	Associate Professor	
18	Dr. Fahd bin Samir Wadi Al-Shammari	Associate Professor	
19	Dr. Imad Al-Qadim	Associate Professor	
20	Dr. Murad Mustafa Shehadeh Ara R	Associate Professor	
21	Dr. Hani Samih Bayoumi	Associate Professor	

22	Dr. Majid Khan	Associate Professor	
23	Dr. Mohamed Metwally Attia Metwally	Associate Professor	
24	Dr. Muhammad Abdullah Al-Shahrani	Assistant Professor	
25	Dr. Mohamed Mohamed Awad Abdel Jalil	Assistant Professor	
26	Dr. Jalal Abdel Qader Al-Ashari	Assistant Professor	
27	Dr. Abdul Karim Muhammad Hamarsha	Assistant Professor	
28	Dr. Muhammad Nasser Al-Shahrani	Assistant Professor	
29	Dr. Md. Taufiq Nasseef	Assistant Professor	Computational Neuroscience & Mathematical Modelling
30	Dr. Muhammad Saud Abdul Aziz Al Daoud	Assistant Professor	
31	Dr. Abdulaziz Al-Otaibi	Assistant Professor	
32	Dr. Tariq Muhammad Abdel Latif	Assistant Professor	
33	Dr. Mahmoud Hosseini Harbi	Assistant Professor	

Faculty Members (Girls Section)

No	Name of Faculty Member	Drgree	Major
1	Afrah Abulqasim Basali	Professor	Mathematical Statistics
2	Mashael Mothebet Albaidani	Associate Professor	Linear Algebra and its applications
3	Laila Fouad Seddek	Associate Professor	Applied Mathematics (Numerical Analysis)
4	Karima Mohamed Oraby	Associate Professor	Pure Mathematics
5	Gehad Mohamed Mahfood	Assistant Professor	Pure Mathematics
6	Ola Abdelnaby Ashour	Assistant Professor	Pure Mathematics

7	Shaimaa Abdou Ahmed Dawood	Assistant Professor	Pure Mathematics
8	Abeer Adel Alnana	Assistant Professor	Applied Mathematics
9	Jihan Ghazi Alahmadi	Assistant Professor	Applied Mathematics
10	Aeshah Abdullah Aldosari	Assistant Professor	Applied Mathematics
11	Sarah Rashed Aldawsari	Assistant Professor	Stochastic Modeling
12	Hala Abdelmageed Mahmoud	Assistant Professor	Pure Mathematics
13	Rabab Omar Alzahrani	Assistant Professor	Applied Mathematics
14	Hend Salah Shahen	Assistant Professor	Mathematical Statistics
15	Enas Hassan Elkordy	Assistant Professor	Pure Mathematics
16	Amna Mohammed Ali	Lecturer	Mathematics
17	Manal Abdullah Alhaqbani	Lecturer	Mathematics
~~9~~	~~Maliha Ased Quadri~~	~~Lecturer~~	~~Mathematics~~
18	Faizah Matar Alharbi	Lecturer	Mathematics
19	Ashwag Khalid Aljeraiwi	Lecturer	Mathematics
20	Shikhah Ibrahim Alothman	Lecturer	Statistics
21	Manasik Mahjob Mustafa	Lecturer	Mathematics
22	Basheer Rashid Aldosari	Lecturer	Mathematics
23	Nouf Katib Alawaji	Lecturer	Statistics
24	Noura Abdulrahman Alquwazani	Lecturer	Mathematics
25	Sarah Saleh Alassaf	Lecturer	Mathematics
26	Sabah Sidig Hasballa Sidig	Lecturer	Mathematics
27	Munirah Abdullah Alrumayli	Lecturer	Mathematics
28	Reem Sulaiman Alrashed	Lecturer	Statistics
29	Sharifah Ali Almaymuni	Lecturer	Mathematics
30	Maryam Mubarak Almadrada	Lecturer	Mathematics

31	Latifa Abdulatif Almulhim	Teaching Assistant	Mathematics
32	Fatimah Muhamad Aldrees	Teaching Assistant	Mathematics
33	Refah Mohammed Alwthiah	Teaching Assistant	Mathematics
34	Somaya Ibrahim ALshber	Teaching Assistant	Mathematics

Committees in the department

No.	Committee Name	Committee Coordinator	Committee Members
1	Tables and Exams	Muhammad Awad Abd aljalil	Muhammad Awad Abd aljalil Mohammed Modather Abdou
2	Quality and academic accreditation	Raja Gopalan	Raja Gopalan Mahmoud Mahmoud Elmorshedy Mohammed Abd Elrahman Elshorbagy Khizar Hayat Khan Hafedh Mohammed Saleh Abdelli
3	Academic Advising	Essam Basiouny Aboshanab	Essam Basiouny Aboshanab Imed Rajab Kedim Ahmed Mansour Aljilani
4	Alumni Affairs	Abdel Fattah Abdallah Azzam	Abdel Fattah Abdallah Azzam Ferid Mahmoud Beldi
5	Community Service	Ahmed Mansour Aljilani	Ahmed Mansour Aljilani Abdul Alim Abdo Elsadany Abdulkareem Hamarsheh
6	Field Training	Fahad Sameer Alshammari	Fahad Sameer Alshammari Raja Gopalan Abdullah Mohammed Alrogaib
7	Study plans	Hossam Abdelmaksoud Nabwey	Hossam Abdelmaksoud Nabwey Reny George Muhammad Awad Abd aljalil Imed Rajab Kedim

8	Scientific Research	Abdul Alim Abdo Elsadany	Abdul Alim Abdo Elsadany Imed Rajab Kedim Amr Refat Torky Elsonbaty
9	Graduate Studies	Hossam Abdelmaksoud Nabwey	Hossam Abdelmaksoud Nabwey Reny George Fahad Sameer Alshammari Abdullah bin Muhammad Aldurhim
10	Laboratories, devices, libraries an classrooms	Mohammed Abd Elrahman Elshorbagy	Mohammed Abd Elrahman Elshorbagy Ahmed Mansour Aljilani Hafedh Mohammed Saleh Abdelli
11	Student issues	Essam Basiouny Aboshanab	Essam Basiouny Aboshanab Essam Roshdy Moustafa El-Zahar Emad Rizk Attia
12	Cultural student activities	Abdulkareem Hamarsheh	Abdulkareem Hamarsheh Mahmoud Mahmoud Elmorshedy Fahad Mesfer Aljuaydi Mohammed Abdulaziz Almutarrid
13	Sport activities	Mahmoud Nawasreh	Mahmoud Nawasreh Firas Abdullah Ismael Alwawi Mohammad Al-Sayed Al-Dawoody
14	Media	Firas Abdullah Ismael Alwawi	Firas Abdullah Ismael Alwawi Fahad Mesfer Aljuaydi Mohammed Abdulaziz Almutarrid
15	Statistics	Mahmoud Mahmoud Elmorshedy	Mahmoud Mahmoud Elmorshedy Mohammad Al-Sayed Al-Dawoody Jalal Abdulqadir Ahmad Alashari
16	Graduation Projects	Emad Rizk Attia	Emad Rizk Attia Ferid Mahmoud Beldi Khizar Hayat Khan
17	Scholarships	Essam Roshdy Moustafa El-Zahar	Essam Roshdy Moustafa El-Zahar Mohammed Modather Abdou

			Abdel Fattah Abdallah Azzam

Contact Information

Contacts:

Department of Mathematics College of Science and Humanities Prince Sattam Bin Abdul Aziz University - P.O Box 173, Al-Kharj 11942

Email:

Mathematicsdepartment@gmail.com

Phone:

Head of department Phone No. +966 (11) 5888145

Female Branch Phone No. +966 (11) 5888950

Website:

https://csh.psau.edu.sa/en/department/Department-of-Mathematics

PHOTO GALLARY


PHYSICS


لِقاءُ الخَميسْ
Thursday Meeting
وارف