# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## DEPARTMENT OF MATHEMATICS

| COURSE PLAN – PART I | | | |
|---|---|---|---|
| **Name of the programme and specialization** | **B.TECH-CIVIL ENGINEERING** | | |
| **Course Title** | **MATRICES AND CALCULUS** | | |
| **Course Code** | **MAIR11** | **No. of Credits** | **3** |
| **Course Code of Pre-requisite subject(s)** | - | | |
| **Session** | **July 2019** | **Section (if, applicable)** | **A & B** |
| **Name of Faculty** | P. Saikrishnan | **Department** | **MATHEMATICS** |
| **Official Email** | psai@nitt.edu | **Telephone No.** | **Int.com: 3661 9787877471** |
| **Name of Course Coordinator(s) (if, applicable)** | | | |
| **Official E-mail** | | **Telephone No.** | |
| **Course Type** (please tick appropriately) | ✓ **Core course** | ☐ **Elective course** | |

## Syllabus (approved in BoS)

### MAIR11 – MATRICES AND CALCULUS

Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. Quadratic form

Sequence and series: Convergence of sequence. Infinite series-Tests for convergence-Integral test, comparison test, Ratio test, Root test, Raabe's test, Logarithmic test, and Leibnitz's test; Power series;

Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series, Maxima, minima and saddle points; Method of Lagrange multipliers; Double and triple integrals, change of variables, multiple integral in cylindrical and spherical coordinates.

Gradient, divergence and curl; Line and surface integrals; Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs).

Reference books:

1. Dennis Zill, Warren S. Wright, Michael R. Cullen, Advanced Engineering Mathematics, Jones & Bartlett Learning, 2011
2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 2019.
3. Jerrold E. Marsden, Anthony Tromba, Vector Calculus, W. H. Freeman, 2003
4. Strauss M.J, G.L. Bradley and K.J. Smith, Multivariable calculus, Prentice Hall, 2002.
5. Ward Cheney, David Kincaid, Linear Algebra: Theory and Applications, Jones & Bartlett Publishers, 2012.

## COURSE OBJECTIVES

Objective of the course is to

1. introduce eigen value and eigen vectors and its properties.
2. determine canonical form of given quadratic form.
3. discuss the convergence of infinite series.
4. analyze and discuss the extrema of the functions of several variables.
5. evaluate the multiple integrals and apply in solving problems.
6. introduce vector differential operator for vector function and important theorems on vector functions to solve engineering problems.

## MAPPING OF COs with POs

| Course Outcomes | Programme Outcomes (PO) (Enter Numbers only) |
|---|---|
| Completion of the course, student will be able to | |
| 1. compute eigenvalues and eigenvectors of the given matrix and transform given quadratic form into canonical form. | |
| 2. discuss the convergence of infinite series by applying various test. | |
| 3. compute partial derivatives of function of several variables and write Taylor's series for functions with two variables. | |
| 4. evaluate multiple integral and its applications in finding area, volume. | |
| 5. Compute the dot product of vectors, lengths of vectors, and angles between vectors. | |
| 6. Perform gradient, div, curl operator on vector functions and give physical interpretations. | |
| 7. Use Green's , Gauss divergence and Stoke's theorems to solve engineering problems. | |

## COURSE PLAN – PART II

### COURSE OVERVIEW

This course will introduce
- ➤ eigenvalues and eigenvectors of a martix and its applications.
- ➤ the theory of convergence of seqences and infinite series of real numbers.
- ➤ the theory of functions of several variables.
- ➤ multiple integrals and its applications in engineering problems.
- ➤ Vector valued function and various operator on it.

## COURSE TEACHING AND LEARNING ACTIVITIES

| S.No. | Week/Contact Hours | Topic | Mode of Delivery |
|---|---|---|---|
| 1 | Week 1,2,3 (9 hours) | Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. Quadratic form | Chalk & Talk |
| 2 | Week 4, 5, 6 (9hours) | Sequence and series: Convergence of sequence. Infinite series-Tests for convergence-Integral test, comparison test, Ratio test, Root test, Raabe's test, Logarithmic test, and Leibnitz's test; Power series; | Chalk & Talk |
| 3 | Week 7,8,9 (9 hours) | Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series, Maxima, minima and saddle points; Method of Lagrange multipliers; Double and triple integrals, change of variables, multiple integral in cylindrical and spherical coordinates. | Chalk & Talk |
| 4 | Week 10,11,12 (9 hours) | Gradient, divergence and curl; Line and surface integrals; Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs). | Chalk & Talk |

## COURSE ASSESSMENT METHODS (shall range from 4 to 6)

| S.No. | Mode of Assessment | Week/Date | Duration | % Weightage |
|---|---|---|---|---|
| 1 | Assessmet 1 | 6th week | 1 hour | 20 |
| 2 | Assessment 2 | 10th week | 1 hour | 20 |
| 3 | Assessment 3 (Assignments) | | | 10 |
| CPA | Compensation Assessment* | 12th week | 1 hour | |

| 4 | Assessment 4 (semester examination) | 14th week | 3 hours | 50 |
|---|---|---|---|---|

## COURSE EXIT SURVEY

1. Students can meet the faculty at any stage in the course duration in case he/she finds difficulty in understanding the concept.
2. Feedback form issued to students to express their comments about the course before assessment - 1 & after completing the syllabus. Students are requested to give genuine feedback about the course.
3. Student knowledge about the topic covered in this course will be judged through marks obtained in examination.

## COURSE POLICY

a) Students who have missed the assessment 1 or assessment 2 or both can register for CPA which shall be conducted soon after the completion of the assessment 2 and before the regular semester examination. Other students were strictly **NOT** allowed to register for CPA.

b) The CPA examination shall be conducted for 20 marks comprising the syllabus of both assessment 1 and assessment 2.

c) Students should submit assignments before last date of submission. In case students fails to submit their assignments, he/she will get zero mark for that particular assignment.

d) If the students fails to appear semester examination due to genuine/medical reason, can register for special end semester examination after approval from course teacher & Head of department of Mathematics/Dean(academic). The special end semester examination will be conducted within the time specified by office of the Dean (academic). Students should register in MIS to appear for special end semester examination (Reassessment) within the time specified by the office of Dean(academic). Grade issued as per the guidelines followed for his/her batch students.

e) There will be one reassessment for the students who have secured "F" in this course and will be conducted within the time specified by office of the Dean(academic). Students should register their names in MIS within the time specified by the office of Dean(academic). If the students satisfy the criteria fixed by the faculty to promote E grade, will be given E grade and others given 'F' grade.

# NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

## ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- At least 75% attendance in each course is mandatory.
- A maximum of 10% shall be allowed under On Duty (OD) category.
- Students with less than 65% of attendance shall be prevented from writing the final assessment and shall be awarded 'V' grade.

## ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.
- The above policy against academic dishonesty shall be applicable for all the programmes.

## ADDITIONAL INFORMATION, IF ANY

Students can reach course faculty by fixing appointment through E-mail (psai@nitt.edu) or phone (9787877471 or intercom: 3661).

## FOR APPROVAL

**Course Faculty**
**Dr. P. Saikrishnan**

**CC- Chairperson**

**HOD**