# Bagalkot University,

**(A State Public University of Govt. of Karanataka)**

# Jamkhandi

## The Draft

**DEPARTMENT OF STUDIES IN MATHEMATICS UNDER THE SCHOOL OF MATHEMATICS & COMPUTING SCIENCES**

## M.Sc. MATHEMATICS

**CHOICE BASED CREDIT SYSTEM**

**REGULATIONS AND COURSE STRUCTURE**

Adapted from RCU Belagavi applicable from the Academic Year 2023-24

## Preamble for PG Syllabus of Bagalkot University

Bagalkot University Jamkhandi has been established by the Government of Karnataka and has started functioning from the academic year 2023-24. All the degree colleges other than engineering and medical colleges in the district of Bagalkote, are affiliated to this university as per the Karnataka State Universities Act 2000, as modified by the 26th Act of 2022. The students taking admission to any of the colleges in the district of Bagalkote, from the academic year 2023-24 will be students of Bagalkot University. The Chancellor of the university, the honorable Governor of Karnataka, has instructed the Vice chancellor and the university to adapt, the rules and regulations of the parent university, Rani Channamma University, Belagavi for the immediate activities (Vide letter from the office of the Governor GS 01 BGU 2023 dated 17/05/2023).

In this connection, Bagalkot University has adapted the postgraduate syllabus from RCU, Belagavi for all the 2 years degree PG programmes such as M.A.(English), M.A.(Political Science), M.S.W.,M.Com, etc. The syllabus follows the Choice Based Credit System introduced by University and provides flexibility to the students to choose their course from a list of electives and soft-skill courses, which makes teaching-learning student-centric. The higher semester syllabi will be published in due course. The syllabus is being published as one electronic file for each degree and is self-contained. Only the subject codes/ question paper codes are changed, whereas the subject syllabi remains the same. The subject code format is described in the following.

## Subject Code Format for M.A. (History) and M.Sc. (Physics)

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ver | Uni. Code | | DEGREE | | | SEM | | DISCIPLINE | | | SUB. TYPE | | | SL. NO. IN DISC. & S. TYPE | | TH/ LAB /B/I NT. |
| 1 | 2 | 6 | M | S | C | 0 | 1 | P | H | Y | C | S | C | 0 | 1 | T |

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 6 | M | A | M | 0 | 1 | H | I | S | C | S | C | 0 | 1 | T |

**[1]The Ver information gives the version of the syllabus. It can take values 1,2..9,a,b,…**

**[2-3] The University UUCMS Code**

**[4-6] The PG degree codes to be provided as**

| Sl. No | Degree Code | Degree |
|---|---|---|
| 1 | MSC | Master of Science |
| 2 | MAM | Master of Arts |
| 3 | MCM | Master of Commerce |
| 4 | MBA | Master of Business Administration |
| 5 | MCA | Master of Computer Applications |
| 6 | MSW | Master of Social Work |
| 7 | MED | Master of Education |
| 8 | MPE | Master of Physical Education |

**[7-8]The Semester Information is provided as**

| Sl. No | Semester |
|---|---|
| 1 | ‘01 |
| 2 | ’02 |
| 3 | 03 |
| …. | |

## [9-11]The Discipline Information to be provided as

| Sl No | Degree | Discipline Code |
|---|---|---|
| 1 | MCM-MCOM | XXX |
| 2 | MCA | XXX |
| 3 | MBA | XXX |
| 4 | MSW | XXX |
| 5 | MAM | 'HIS',POL','KAN', 'ENG' |
| 6 | MSC | 'PHY','CHE', 'MAT', |
| 7 | MED-MEd | XXX |
| 8 | MPE-MPEd | XXX |

## [12-14]The Subject Type to be provided as

| Sl. No. | TYPE | Description |
|---|---|---|
| 1 | HCC | Hard Core Course |
| 2 | CSC | Core Subject Course |
| 3 | SCC/SPC/OPC | Soft Core Course /Specialization Course/ Optional Course |
| 4 | OEC | Open Elective Course |

## [15-16] The Running Serial Number is to be provided for a particular subject type 01 to 99

## [17] This character specifies the category of the subject namely, T=theory, L-Lab, P-Project, I-Internship, B- Bothe theory and Lab

## 1.0 Course Offered: M.A/ M.Sc. Degree in Mathematics

## 2.0 Duration:

The Course shall be of Four Semester and each semester is of 16 weeks duration student shall not be permitted to obtain degree earlier than 4 semesters. The student shall complete the course within **four** years from the date of admission to the first semester of Post graduate Programme. The academic session in each semester provide 90 teaching days.

However, the students, who discontinue the programme after one or more semester due to extraordinary circumstances are allowed to continue and complete the programme with due approval from the Registrar. Candidates shall not register for any other regular course other than Diploma and Certificate Courses during the duration of the PG programme.

## 3.0 Eligibility Criteria for Admission:

3.1 Candidates who possess a Bachelor's degree in Arts/ Science of this University or a equivalent Degree of any other university recognized as equivalent there to with Mathematics as one of the subjects, having at least 45% of marks in aggregate at degree level is eligible to apply. However, relaxation of 5% of marks in respect of SC/ST/Cat-I will be allowed as per prevailing rules of the University and Government Orders issued from time to time.

3.2 The admission shall be made as per the reservation policy and directions issued in this regard from time to time by the Government of Karnataka and also as per rules as prescribed by the University from time to time.

## 4.0 Medium of Instruction:

The medium of Instruction shall be English.

## 5.0 Course Structure:

The Course are of Four types

i. Core Subjects

ii. Soft core/Specialization/ Optional Subjects

iii. Practicals

iv. Open Elective Courses.

In the first semester there shall be 5 (five) core Subject and 1 (one) Soft core/Specialization/ Optional theory papers of 4 credits in each. In the second semester there shall be 3 (three) core theory papers of 4 credits each, 1 (one) core theory paper of 3 credits and 1 (one) Soft core/Specialization/ Optional theory paper of 4 credits. There shall be practicals of one credit and one open Elective course (theory) paper of 4 credits. In the third semester there shall be 3 (three) core papers of 4 credits each, 1 (one) core theory paper of 3 credits and 1 (one) Soft core/Specialization/ Optional theory paper of 4 credits. There shall be practicals of one credit and one Open Elective Course (theory) paper of 4 credits. In the fourth semester there shall be 4 (four) core papers of 4 credits each, one Soft core/Specialization/ Optional theory paper of 4 credits and in addition the student shall carry out a project of 4 credits.

## 6.0 Minimum and Maximum Credits:

6.1 "Credit" means the unit by which the course work is measured. For this Regulation, one Credit means one hour of teaching work or two hours of practical work per week. As regards the marks for the courses, 1 Credit is equal to 25 marks, 2 Credits are equal to 50 marks, 3 Credits are equal to 75 marks and 4 Credits are equal to 100 marks as used in conventional system.

6.2 There are two courses of 3 credits, two practical's are of 1 credit and remaining all other courses are of 4 credits.

6.3 A Student shall register for 24 credits in each semester.

6.4 Total Credits for MA/M.Sc. in Mathematics shall be 96.

6.5 There shall be practicals (Lab) conducted batchwise and each batch shall consists of 25 students.

## 7.0 Attendance:

7.1 Each paper/ course shall be taken as a unit for the purpose of calculating the attendance.

7.2 Each student shall sign the attendance maintained for each course for every hour of teaching of each paper.

7.3 Marks shall be awarded to the students for attendance as specified in the regulations concerning the evaluation as shown below:

| Attendance (in percentage) | 90 and above | Above 80 and up to 90 | Above 75 and up to 80 | 75 and Below |
|---|---|---|---|---|
| Marks | 3 | 2 | 1 | No Marks |

7.4 A student shall be considered to have satisfied the required attendance for each course, if he/she has attended not less than 75% of the number of instructional hours during the semester.

7.5 There is no provision for condoning shortage of attendance.

7.6 The students who do not satisfy the prescribed requirement of attendance shall not be eligible for the ensuing examination. Such candidates may seek admission afresh to the given semester.

7.7 Such of the candidates who have participated in State/ National level Sports, NSS, NCC, Cultural activities and other related activities and as stipulated under the existing regulations shall be considered forgiving attendance for actual number of days utilized in such activities (including travel days) subject to the production of certificates from the relevant authorities within two weeks after the event.

## 8.0 Examination:

8.1 There shall be an examination at the end of each semester.

8.2 Unless otherwise provided, there shall be a semester end examination of 3 hours duration for 80 marks and internal assessment for 20 marks in core/soft core/ specialization/ optional paper. Practical examination is of two hours duration for 40 marks and practical internal assessment is for10 marks.

8.3 Every student shall register for each semester and examination as per the University notification by submitting duly completed application form through the proper channel and shall also pay the prescribed fees.

8.4 The office of the Registrar (Evaluation) shall allot the Register Number to the candidate in the 1st Semester examination. That will be the Register Number of the candidate for all the subsequent appearances and semester examinations.

8.5 The answer scripts shall be in the safe custody of the University for a maximum period of six months from the date of announcement of the results. These shall be disposed off after six months.

8.6 The programme under CBCS is a fully carry-over system. A candidate reappearing either the odd or even semester examinations shall be permitted to take examinations as and when they are conducted (even semester examination in even semester and odd semester examination in odd semester).

8.7 Candidates who have failed, remained absent or opted for improvement in any course/ s shall appear for such course/s in the immediate two successive examinations that are conducted. However, in the case of candidates appearing for improvement of their marks, the marks secured in the previous examination shall be retained if the same is higher.

8.8 Candidates who desire to challenge the marks awarded to them, in the examinations, may do so by submitting an application along with the prescribed fee to the Registrar (Evaluation) within fifteen days from the announcement of the result.

8.9 Whenever the syllabus is revised, the candidate reappearing shall be allowed for PG Degree examinations only according to the new syllabus.

## 9.0 Course Weightage:

Course Weightage would be equal to the number of credits awarded to the particular course. For instance, if the Course has a credit award of 4, then the appropriate weightage for the course would be 4.

## 10.0 Course Evaluation:

10.1 Each course shall have two evaluation components – Internal assessment (IA) and the Semester end examinations for both theory and practicals.

10.2 The IA component in a course shall carry 20 marks ( including 3 marks for attendance as specified above) and the semester end examination shall carry 80 marks. The IA Component in practical shall carry 10 marks and the semester end examination shall carry 40 marks

10.3 The various components of I.A. marks are as follows:

i) Attendance : 3 marks for both theory papers and practicals

ii) Assignment : 3 marks for theory papers and 2 marks for practicals

ii) Test : 14 marks for theory and 10 marks for practicals

Total – 20 marks for theory and 15 marks for practicals.

10.4 Calendar of tests shall be notified in the first week of each semester.

10.5 The IA marks list shall be notified on the Department Notice Board as and when the individual IA components are completed and the consolidated list shall be submitted to the Office of the Registrar (Evaluation) before the commencement of semester end examination, or as directed by the University in this regard from time to time.

10.6 The tests shall be written in a separate sheet supplied by the Department/College which shall be open for inspection by the students after evaluation.

10.7 There is no provision for seeking improvement of Internal Assessment marks.

10.8 If a candidate remains absent for I.A Test, there is no provision for Re-test.

10.9 The Project/ Dissertation / report to be submitted at the end of the IV semester.

10.10 Twenty marks(20) shall be allocated for Internal assessment by the concern Guide, 50 Marks wood be allotted for Evaluation of project/ Dissertation report, next 30 marks is allocated for viva-voce Examination.

## 11.0 Declaration of Results:

11.1 Minimum for a pass in each paper shall be 40% of the total 100 marks including the IA/ Practicals and the semester end examinations marks. However, candidate shall obtain at least 40% of the marks in the Semester end Examination (i.e 32/80). There is no minimum in the IA / Practical marks. However, after adding the IA / Practical and the semester end examinations marks, the candidate shall score a minimum 40% of the maximum marks for the course/paper.

11.2 Candidates shall secure a minimum of 50 % in aggregate in all courses/ papers of a programme in each semester to successfully complete the programme.

11.3 Candidates shall earn the prescribed number of credits (i.e. 96) for the programme to qualify for the PG Degree in mathematics.

11.4 For the purpose of announcing the results, the aggregate of the marks secured by a candidate in all the semester examinations shall be taken into account. However, Ranks shall not be awarded in case the candidate has not successfully completed each of the semesters in first attempt or has not completed the programme in the stipulated time or had applied for improvement of results.

11.5 The candidates, seeking improvement of their results shall submit an application along with prescribed fee to the Registrar (Evaluation) and surrender the degree certificate / provision pass certificate / original marks cards of that semester within 15 days from the date of announcement of the result, or as per the prevailing rules of University from time to time.

## 12.0 Marks, Credit Points, Grade Points, Grades and grade Point Average:

12.1 The grade points and the grade letters to candidates in each course shall be awarded as follows:

| Percentage of marks | Grade Points | Grade Letter |
|---|---|---|
| 75 and above, up to 100.00% | 7.50 to 10.00 | A |
| 60 and above but less than 75% | 6.00 and above but less than 07.5 | B |
| 50 and above but less than 60% | 5.00 and above but less than 6.0 | C |
| 40 and above but less than 50% | 4.00 and above but less than 05.00 | D |
| Less than 40.00% | Less than 4.00 | F |

12.2 Credit Point (CP): The Credit Point for each course/paper shall be calculated by multiplying the grade point obtained by the credit of the course.

12.3 The award of Grade Point average (GPA) for any student is based on the performance in the whole semester. The student is awarded Grade Point Average for each semester based on the Total Credit Points obtained and the total number of credits opted for. The GPA is calculated by dividing the total credit points earned by the student in all the courses by the total number of credits of those courses of the semester.

12.4 The Cumulative Grade Point Average (CGPA) Shall be calculated by dividing the total number of credit points in all the semesters by the total number of credits in all the semesters. The CGPA to data shall be calculated by dividing the total number of credit points in all the semesters to date by the total number of credits in all the semesters to date.

CGPA for the I semester = Sum of the CP of the I sem ÷ Sum of the credits of the I semester

CGPA for the II semester =

(Sum of the CP of the I sem + Sum of the CP of the II sem) ÷ ( sum of the credits of the I sem + sum of the credits of the II sem)

CGPA for the III and IV Semesters shall be computed accordingly.

12.5 The Grade Card at each semester examination shall indicate the courses opted by the student, the credit for the course chosen by the student, the credit points obtained in each course, the grade letter and the grade point average. No class shall be awarded for each semester and the same shall only be awarded at the end of all the semesters based on Cumulative Grade Point average.

12.6 Class shall be awarded to the successful candidates based on the Cumulative Grade Point average (CGPA) as specified below:

| **Cumulative Grade Point Average(CGPA)** | **Class to be awarded** |
|---|---|
| 7.5 to 10.0 | First Class with Distinction |
| 6.0 and above but below 7.5 | First Class |
| 5.0 and above but below 6.0 | Second Class |
| Less than 5.0 | Fails |

## 13.0 Question paper pattern:

13.1 The question paper pattern contains 3 parts namely Part A, Par B and Part C.

13.2 A Student shall answer any 5 questions by choosing at least one question from each Part.

13.3 All question carry equal marks

## 14.0 Miscellaneous:

14.1 The provisions of any order, rules or regulations in force shall be inapplicable to the extent of its inconsistency with these Regulations.

14.2 The University shall issue such orders, instructions, procedures and prescribe such format as it may deem fit to implement the provisions of these Regulations.

14.3 Procedural details may be given by the University from time to time.

14.4 Any unforeseen problems/difficulties may be resolved by the Vice- Chancellor, whose decision in the matter shall be final.

**Illustrative Model:**
**Grade Card**

**Programme:_____**

Name of the candidate:

Semester: I/II

Sear No: Month & Year:

| Papers/Courses | Paper/ Courses Code No. | Credits | Max. Marks | Marks Obtained | Semester Grade Point | Credit Points |
|---|---|---|---|---|---|---|
| **Core Courses** | | | | | | |
| Paper- I | | 04 | 100 | 60 | 6.00 | 24.00 |
| Paper- II | | 04 | 100 | 74 | 7.40 | 29.60 |
| Paper- III | | 04 | 100 | 43 | 4.30 | 17.20 |
| Paper- IV | | 04 | 100 | 52 | 5.20 | 20.80 |
| Paper- V | | 04 | 100 | 54 | 5.40 | 21.60 |
| Soft/Specialization / Optional course Paper-VI | | 04 | 100 | 65 | 6.50 | 26.00 |
| Practicals Open Elective Paper VII | | 04 | 100 | 75 | 7.50 | 30.00 |

GPA for I semester = Total no. of CP ÷ Total no of Credits =

CGPA for I semester =GPA=

$$\text{CGPA for II Sem} = \frac{\text{CP (I Sem) + CP (II Sem)}}{\text{Credits ( I Sem) + Credits (II Sem)}}$$

$$\text{CGPA for III Sem} = \frac{\text{CP (I Sem) + CP (II Sem) + CP (IIISem)}}{\text{Credits ( I Sem) + Credits (II Sem) + Credits (III Sem)}}$$

$$\text{CGPA for the programme} = \frac{\text{CP (I Sem) + CP (II Sem) + CP (IIISem) + CP (IV Sem)}}{\text{Credits ( I Sem) + Credits (II Sem) + Credits (III Sem) + Credits (IV Sem)}}$$

(* CP: Credit Points)

**Choice based credit system (CBCS)**
**Course structure**

| | Sl. No. | Paper & Title | Credit | No of Hrs/week Theory/ Practical | Duration of exam in Hrs Theory/ Practical | IA Marks Theory/ Practical | Marks at the Exams | Total Marks |
|---|---|---|---|---|---|---|---|---|
| | **I Semester** | | | | | | | |
| Core Subject | 126MSC01MATCSC01T | Algebra –I | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC01MATCSC02T | Topology | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC01MATCSC03T | Real Analysis - I | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC01MATCSC04T | Linear Algebra | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC01MATCSC05T | Ordinary Differential Equations | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| (Softcore\ Specilization\ optional) | 126MSC01MATSCC01T | Discrete Mathematical Structures | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | Total Credits/Hours | | 24 | 24 | - | - | - | 600 |
| | **II Semester** | | | | | | | |
| Core Subject | 126MSC02MATCSC06T | Algebra – II | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC02MATCSC07T | Complex Analysis | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC02MATCSC08T | Partial Differential Equations | 3 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC02MATCSC09T | Real Analysis-II | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| (Softcore\ Specilization\ optional) | 126MSC02MATSCC02T | Classical Mechanics | 3 | 4 | 3 Hrs | 20 | 80 | 100 |
| Practicals: | 126MSC02MATCSC01L | Latex and Beamer Lab | 2 | 2 | 2Hrs | 10 | 40 | 50 |
| OEC | 126MSC02MATOEC01T | **Open Elective Course** I. Set Theory (Arts & Commerce stream) | 4 | 4 | 3 Hrs | 20 | 80 | 100 |
| | 126MSC02MATOEC02T | II. Integral Transforms (Science stream) | | | | | | |
| | Total Credits/Hours | | 24 | 26 | | | | 650 |

## SEMESTER – I

**Core Subject Code:** 126MSC01MATCSC01T

| | |
|---|---|
| **Paper Code: 1.1** | **Paper Title: ALGEBRA – I** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory - 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Group axioms with examples including Dihedral Groups, Symmetric Groups, Matrix groups; Homomorphisms and Isomorphisms; Subgroups; Lagrange's Theorem.

**Unit 2:**

Cyclic groups, generators and relation; Quotient groups; Cayley's Theorem.

**Unit 3:**

Normal subgroups; Kernel of a Homomorphisms; Iso-morphism Theorems; Centers of a groups, Centralizer and Normalizers

**Unit 4:**

Group action; Orbits and Stabilizers; Class equation; Cauchy Theorem; Sylow Theorems; Derect products; Semidirect products; free groups; free abelian groups.

**Unit 5:**

Structure Theorem for finite abelian groups; simple groups and solvable groups; nilpotent groups; simplicity of alternating groups; composition series; Jordan-Holder Theorem.

**REFERENCES**


1. J.B.Fraleigh, Abstract Algebra, Narosa Publications
2. Joseph A. Gallian, Contemporary Abstract Algebra, Narosa Publications
3. N.S.Gopalakrishnan, University Algebra,
4. I.N.Herstein,Topics in Algebra, Wiley
5. David S. Dummit & Richard M. Foote, Abstract algebra, John Willy & Sons, Inc., 2004.

## SEMESTER – I

**Core Subject Code:** 126MSC01MATCSC02T

| | |
|---|---|
| **Paper Code: 1.2** | **Paper Title: TOPOLOGY** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Axiom of choice, Zorn's lemma, Topological Spaces; open sets, closed sets, neighbourhoods, bases, sub-bases, limit points, closures. Interiors; Exampels of topological spaces; sub-space topology, product topology, metric topology, order topology.

**Unit 2:**

Continuous functions; homeomorphisms; Connected Spaces; Connected subspaces of the Real Line with usual topology; Intermediate value theorem; Local Connectedness.

**Unit 3:**

Compact Spaces; Compact subspaces of the Real Line, with usual Topology, Limit Point Compactness, Local Compactness. The Countability Axioms,

**Unit 4:**

The Separation Axioms,Para-compactness. Hausdorff spaces, Normal Spaces, the Urysohn Lemma, Regular Lindelof spaces.

**Unit 5:**

The Urysohn Metrization Theorem, The Tietze Extention Theorem, The Tychonoff Theorem

**REFERENCES:**


1. J.R.Munkers : Topology, Pearson, 2000
2. M.A.Armstrong, Basic Topology, Springer, 1983.
3. J.L.Kelley : General Topology,Van Nostrand (1995).
4. O. Ya. Viro et. Al., Elementary, Topology problem textbook, American Mathematical Society,2008.

## SEMESTER – I

**Core Subject Code: 126MSC01MATCSC03T**

| | |
|---|---|
| **Paper Code:1.3.** | **Paper Title: REAL ANALYSIS - I** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Intergers, Rational Numbers; Real and Complex Number Systems; The field axioms, order axioms, Cauchy- Schwarz inequality, The least upper bound, greatest lower bound, properties of L.U.B and G.L.B, Archimedean Property, countable and uncountable sets, The completeness property of R; ..

**Unit 2:**

Euclidean space $R^n$, open balls and open Sets in $R^n$. Closed Sets, Limit point, Adherent Points, Bolzano- Weierstrass Theorem, The Cantor intersection theorem, Lindelof covering theorem, Heine- Borel covering theorem, compactness in $R^n$.

**Unit 3:**

Metric spaces. Point Set in Metric spaces, compact Subsets of a metric space, Sequences, Subsequences, Convergent and Cauchy Sequences in a metric space, Complete metric space.

**Unit 4:**

Limit, Continuity, Continuity of composite functions, continuity and inverse image of open and closed sets. Functions continuous on compact sets. Connectedness, Uniform continuity, Fixed point theorem for contractions.

**Unit 5:**

Differentiation, Algebra of derivatives, chain rule, One Sided derivatives and infinite derivatives, Rolle's theorem, Mean- value Theorem for derivatives. Intermediate- value theorem, Taylor's formula with remainder. Functions of bounded variation, Total variation, Continuous functions of bounded variations, Rectifiable paths and arc length, Additive and continuity properties of arc length, Equivalence of path.

**REFERENCES:**

1.Apostol T.M- Introduction to Mathematical Analysis, Narosa Publishing House,2002.
2.Terence Tao, Analysis- I and Analysis- II, TRIM series, HBA.
3. Richard,Goldberg, Real Analysis, Oxford and IBH.
4.S.R.Ghorpade and B.V.Limaye, A Course in Calculus and Real Analysis,UTM,Springer
5 W.Rudin, Introduction to Mathematical Analysis, Wiley.

**SEMESTER – I**

**Core Subject Code: 126MSC01MATCSC04T**

| | |
|---|---|
| **Paper Code:1.4.** | **Paper Title: LINEAR ALGEBRA** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Vector space over a field, subspaces, Linear span , Linear dependence, independence and their basic properties. Basis and Dimension. Quotient space and its dimension, Subspace, Sum and direct sum of subspaces.

**Unit 2:**

Linear transformations; the algebra of linear transformation; representation of linear transformation by matrices. Rank-Nullity theorem; duality and transpose; Linear Functionals; dual and bidual space, natural isomorphism.

**Unit 3:**

Eigen values and eigenvectors of a linear transformation, Diagonalization. Minimal Polynimial; Caley Hamilton Theorem; Annihilator of a subspace; Direct-Sum Decompositions; Invariant Direct Sums; The Primary Decomposition Theorem.

**Unit 4:**

Nilpotent transformations; Index of nilpotency; Cyclic Subspaces and Annihilators; Cyclic Decompositions and the Rational Forms; The Jordan Forms.

**Unit 5:**

Inner product spaces; Gram-Schmidt orthonormalization; Linear operators and adjoint; normal and self-adjoint operators; Unitary and Normal operators; orthogonal projections and spectral Theorem.

**REFERENCES:**


1. Hoffeman and Kunze, Linear Algebra, Prentice-Hall, Inc.,,1971.
2. N.Herstein,Topics in Algebra,Wiley Eastern Ltd,New York (1975)
3. S.Lang,Introduction to Linear Algebra 2nd Edition Springer-Verlag (1986)
4. Kumaresan, Linear algebra: A geometric approach, Prentice Hll of India, 2000.

## SEMESTER – I

**Core Subject Code: 126MSC01MATCSC05T**

| | |
|---|---|
| **Paper Code:1.5.** | **Paper Title: ORDINARY DIFFERENTIAL EQUATIONS** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Linear-differential equation of $n^{th}$ order, fundamental sets of solution, Wronskian – Abel's Identity, theorem on linear dependence of solutions, Adjoint, self-adjoint linear operator, Green's formula.

**Unit 2:**

Adjoint equations, the $n^{th}$ order non-homogenous linear equations. Variation of parameters,- zeros of solutions, comparison and separation theorem, Fundamental existence and uniqueness theorem, dependence of solution on initial conditions, existence and uniqueness for higher order system of differential equations.

**Unit 3:**

Eigen value problems, Strum-Liouville's problem, Eigen functions, Orthogonality of Eigen functions, expansion in a series of orthogonal functions, Green's function method.

**Unit 4:**

Power series solution of linear differential equations- ordinary and singular points of differential equations, Classification into regular and irregular singular points, Series solution about an ordinary point and a regular singular point – Frobenius method-Hermite, Laguerre, differential equations, Recurrence relations, Rodrigue's formula and Orthagonality properties.

**Unit 5:**

Chebyshev and Gauss Hypergeometric equations and their general solutions. Generating function, Recurrence relations, Rodrigue's formula-Orthagonality properties. Behavior of solution at irregular singular points and the point at infinity Linear system of homogeneous and non-homogeneous equations (matrix method) Linear and Non-linear autonomous system of equations - Phase plane - Critical points - stability - Liapunov direct method - Limit cycle and periodic solutions-Bifurcation of plane autonomous systems.

**REFERENCE BOOKS:**

1.G.F. Simmons: Differential Equations, TMH Edition, New Delhi, 1974.
2. M.S.P. Eastham: Theory of ordinary differential equations, Van Nostrand, London, 1970.
3. S.L. Ross: Differential equations (3rd edition), John Wiley & Sons, New York, 1984.
4. Boyce and Diprima, Elementary Differential Equations and Boundary Value Problems, J.Wiley.
5. E.Coddington, Introduction to Ordinary Differential Equations.

## SEMESTER – I

**Soft Core Code: 126MSC01MATSCC01T**

| | |
|---|---|
| **Paper Code:1.6.** | **Paper Title: DISCRETE MATHEMATICAL STRUCTURES** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Boolean algebra and lattices, partially ordered sets lattices, complete, distributive, complimented lattices, Boolean functions and expressions, Propositional calculus, logical connectives , truth values and tables, Boolean algebra to digital networks and switching circuits.

**Unit 2:**

Coding Theory: Coding of binary information and error detection, Group codes, decoding and error correction.

**Unit 3:**

Recurrence Relations and Recursive Algorithms - Introduction: Recurrence relations, linear recurrence relations with constant coefficients, Homogeneous solutions, particular solutions, total solutions, solution by a method of generating functions.

**Unit 4:**

Graph theory - Basic Concepts: Different types of graphs, sub-graphs, walks and connectedness. Degree sequences, directed graphs, distances in graphs, isomorphism and self complimentary graphs. Operations on graphs, Extremal graphs.
Trees and Fundamental circuits: Characterization of trees pendant vertices centers, centroids, spanning trees Fundamental circuits, cut sets properties of cut set fundamental circuits and cut sets connectivity and separability.

**Unit 5:**

Matrix Representation of graphs; Adjacency matrix, Incidence matrix, sub matrices of circuit matrix, fundamental circuit matrix and it's Rank. An application to switching network. Cut set matrix, relationship between the matrices, path matrix.

**REFERENCES:**


1. C. L. Liu, Elements of Discrete Mathematics, McGraw Hill.
2. B. K. Kolman, R.C.Busby and S.Ross, Discrete mathematical structures, PHI
3. K. D. Joshi, Foundations of Discrete Mathematics, Wiley eastern.
4. N. L. Biggs, Discrete Mathematics, Oxford University Press.
5. Ralpha P. Grimaldi and B. V. Ramana, Discrete abd Combinatorial Mathematics, Pearson Education, 5th Edition
6. Narsingh Deo, Graph Theory with applications to Engineering and Computer Science.

# SEMESTER – II

## SEMESTER – II

**Core Subject Code: 126MSC02MATCSC06T**

| | |
|---|---|
| **Paper Code:2.1.** | **Paper Title: ALGEBRA-II** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**2.1 Unit 1:**

Rings, subrings, ideals, factor ring (all definitions and examples). Homomorphism of Rings, Isomorphism theorems. Integral domain, field and embedding of an integral domain in a field. Prime ideal, maximal ideal of a ring. Polynomial ring R[X] over a Ring in an indeterminate X.

**Unit 2:**

Principal Ideal Domain (PID). Euclidean domain. The ring of Gaussian integers as an Euclidean domain. Fermat's theorem. Unique factorization domain. Primitive polynomial. Gauss lemma.

**Unit 3:**

F[X] is a unique factorization domain for a field. Eisenstein's criterion of irreducibility for polynomials over a unique factorization domain.

**Unit 4:**

Field, subfield, Prime fields-definition and examples, finite fileds Characteristic of a field. Field extensions, Algebraic extension. Transitivity theorem. Simple Extensions

**Unit 5:**

Roots of Polynomials. Splitting field of a polynomial. Existence and uniqueness theorems. Existence of a field with prime power elements.

**REFERENCES:**


1. N.S.Gopalakrishna University Algebra, New Age International Publishers
2. Joseph A. Gallian, Contemporary Abstract Algebra, Narosa Publications
3. I.N.Herstein, Topics in Algebra 2nd Edition, John –wiley and sons,New York
4. Surjit Singhand Quazi Zameeruddin,Modern Algebra, Vikas Pulishers(1990)
5. S.K.Jain, P.B.BhattaCharya and S.R.Nagpaul,Basic Abstract Algebra, Cambridge University Press.

**SEMESTER – II**

**Core Subject Code: 126MSC02MATCSC07**

| | |
|---|---|
| **Paper Code:2.2.** | **Paper Title: COMPLEX ANALYSIS** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Complex plane, its algebra and topology, Holomorphic maps, Analytical function, power series as an analytical functions, inverse function, Zero's of Analytic function.

**Unit 2:**

Review of Complex integration, Basic properties of complex integral, Winding number, Cauchy-Gourasat theorem, Cauchy's theorem in a disk, triangle rectangle, Homotopy version of Cauchy's theorem, Morera's theorem, Cauchy integral formula. Laurent series.

**Unit 3:**

Maximum modulus Principle, Open mapping theorem , Hadamard three circle theorem and their consequences, Schwartz Lemma, Liouville's theorem

**Unit 4:**

Classification of singularities, Poles, Casorati- weierstrass theorem, Singularities at infinity, Residue at a finite point, Residue at the point at infinity. Residue theorem, Rouche's theorem,

**Unit 5:**

Intergral of types $\int_{\alpha}^{2\pi+\alpha} R(cos\theta, sin\theta)d\theta$ , $\int_{-\infty}^{\infty} f(x)dx$, $\int_{-\infty}^{\infty} g(x)cosmxdx$, Mittag leffler's theorem, Normal families, Montel's theorem and Riemann mapping theorem.

**REFERENCES:**


1. S. Ponnusamy, Foundations of Complex Analysis
2. J.B.Conway, Functions of One complex variable, Springer.
3. Greene, Robert.F,S.Krantz, Functions of One Complex variable, Universities Press.
4 L.Ahlfors, Complex Analysis, McGraw Hill.

## SEMESTER – II

**Core Subject Code: 126MSC02MATCSC08T**

| | |
|---|---|
| **Paper Code:2.3.** | **Paper Title: PARTIAL DIFFERENTIAL EQUATIONS** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 03** |

**Unit 1:**

First order Partial Differential Equations, the classification of solutions-Pfaffian differential equations-quasi linear equations, Lagrange's method-compatible systems,Charpit's method, Jacobi's method, integral surfaces passing through a given curve.

**Unit 2:**

Method of Characteristics for quasi-linear and non-linear equations, Monge's method , Monge cone, characteristic strip.

**Unit 3:**

Origin of second order partial differential equations, their classification, and wave equation-D'Alemberts solution, vibrations of a string of finite length, existence and uniqueness of solution-Riemann's Method.

**Unit 4:**

Laplace equation boundary value problems, Maximum and minimum principles,Uniqueness and continuity theorems, Dirichilet problem for a circle, Dirichilet problem for a circular annulus, Neumann problem for a circle, Theory of Green's function for Laplace equation.

**Unit 5:**

Heat equation, Heat conduction problem for an infinite rod, Heat conduction in a finite rod existence and uniqueness of the solution Classification in higher dimensions, Kelvins inversion theorem, Equi-potential surfaces.

**REFERENCES**


1. I.J.Sneddon, Partial Differential equations, McGraw Hill.
2. F.John, PartialDifferentialEquations, Springer.
3. P.Prasad,R.Ravindran, Introduction to Partial Differential Equations, New AgeInternational
4. T.Amarnath, An Elementary Course on Partial differential Equations, Narosa Publishers.

5. K Shankara Rao, Introduction to Partial Differential Equations. PHI
6. Debnath and Tyn Myint-U Birkhauser Linear Partial Differntial Equations for Scientist and Engineers.

## SEMESTER – II

**Core Subject Code: 126MSC02MATCSC09T**

| | |
|---|---|
| **Paper Code:2.4.** | **Paper Title: Real Analysis - II** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Rieman-Stieltjes integral, Linear properties, Intergration by parts, Change of Variables, step functions, Reduction of a Rieman-Stieltjes integral to a finite sum, sufficient and Necessary conditions for existence of Riemann- Stieltjes's integrals, Mean value theorems, Second fundamental theorem of integral calculus, Second mean value theorem.

**Unit 2:**

Sequences and series of functions, Uniform convergence, uniform convergence and continuity, Uniform convergence and differentiation, Uniform convergence and integration. The stone- Weierstnass theorem.

**Unit 3:**

Functions of Several Variables, Directional derivative and continuity total derivative total derivative expressed in terms of partial derivatives.

**Unit 4:**

Matrix of a Linear Function, Jacobian matrix, Chain rule, Matrix form of the chain rule, Mean value Theorems.

**Unit 5:**

Sufficient condition for differentiability and equality of mixed partial derivatives Taylor's Theorem, Inverse function Theorem, Implicit function Theorem.

**REFERENCES**


1. Apostol T.M- Mathematical Analysis(Ch.6,7,10 and 11)
2. Apostol T.M,Calculus-2-Part 2(Non-Linear Analysis)
3. Vector Analysis (Schaum Series)
4. Tarence Tau. Real Analysis. I and II Hindustan Book Agency
5. Goldberg, Real Analysis.
6. Michael Spvak CRC pass Calculus on Manif

## SEMESTER – II

**Soft Core Code: 126MSC02MATSCC02T**

| | |
|---|---|
| **Paper Code:2.5.** | **Paper Title: CLASSICAL MECHANICS** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3Hrs** | **Credits: 04** |

**Unit 1:**

Coordinate transformations, Cartesian tensors, Basic Properties, Transpose, Symmetric and Skew tensors, Isotropic tensors, Deviatoric Tensors, Gradient, Divergence and Curl in Tensor Calculus, Integral Theorems.

**Unit 2:**

Continuum Hypothesis, Configuration of a continuum, Mass and density, Description of motion, Material and spatial coordinates, Translation, Rotation, Deformation of a surface element, Deformation of a volume element, Isochoric deformation, Stretch and Rotation, Decomposition of a deformation, Deformation gradient, Strain tensors, Infinitesimal strain, Compatibility relations , Principal strains.

**Unit 3:**

Material and Local time derivatives Strain, rate tensor, Transport formulas, Stream lines, Path lines, Vorticity and Circulation, Stress components and Stress tensors, Normal and shear stresses, Principal stresses.

**Unit 4:**

Fundamental basic physical laws, Law of conservation of mass, Principles of linear and angular momentum, Equations of linear elasticity, Generalized Hooke's law in different forms, Physical meanings of elastic moduli, Navier's equation.

**Unit 5:**

Equations of fluid mechanics, Viscous and non-viscous fluids, Stress tensor for a non-viscous fluid, Euler's equations of motion, Equation of motion of an elastic fluid, Bernoulli's equations, Stress tensor for a viscous fluid, Navier-Stokes equation.

**REFERENCE BOOKS**


1. D.S. Chandrasekharaiah and L. Debnath: Continuum Mechanics, Academic Press, 1994.
2. A.J.M. Spencer: Continuum Mechanics, Longman, 1980.
3. Goldstein, Classical Mechanics, Addison – Wesley, 3rd Edition, 2001.
4. P. Chadwick : Continuum Mechanics, Allen and Unwin, 1976.
5. Y.C. Fung, A First course in Continuum Mechanics, Prentice Hall (2nd edition), 1977
6. A.S. Ramsey, Dynamics part II, the English Language Book Society and Cambridge University Press,(1972)

7. F. Gantmacher, Lectures in Analytical Mechanics, MIR Publisher, Mascow,1975.
8. Narayan Chandra Rana and Sharad Chandra Joag, Classical Mechanics, Tata McGraw Hill, 1991.
9. F. Chorlton, Text Book of Dynamics, (ELBS Edition), G. Van Nostrand and co.(1969.

## SEMESTER – II

**Core Subject Code: 126MSC02MATCSC01L**

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|---|---|
| **Paper Code:2.6.** | **Paper Title: Latex and Beamer** |
| **Lab Teaching Hours: 2 Hrs / Week** | **Marks: Lab – 35 + IA - 15** |
| **Teaching Hours: 2Hrs** | **Credits: 01** |

**Latex practicals:**

1. Creating Article/document
2. Write and Display Mathematical Equations
3. Create a table in different forms
4. Import figures and graphs into latex document
5. Draw different figures using latex commands

**Using Beamer**

6. Create frames in different formats
7. Create frames containing mathematical expressions
8. Create frames containing tables and figures
9. Create Bibliography in frames

## SEMESTER – II

**Open Elective Code: 126MSC02MATOEC01T**

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|---|---|
| **Paper Code:2.7. I Open Elective Course** | **Paper Title: SET THEORY (Arts & Commerce Stream)** |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3 Hrs** | **Credits: 04** |

**Unit 1:**

Logic, Proposition, Truth Values, Connectives, Truth table.

**Unit 2:**

Set, Subset, Cross-Product, Complement, Difference, intersection, union function, onto function, One-One function, Bijective functions, Relations, Equivalence Relations.

**Unit 3:**

Combinations, Properties, Binomial Theorem, Expansion using Binomial Theorem.

**Unit 4:**

Matrix, Determinant, Cramer's rule, Inverse, Cayley- Hamilton Theorem (Statement only) Eigen values. (Discussion & problems of 3X3 matrix only)

**Unit 5:**

Vectors' Representation of vectors, Properties , Scalar of Dot Product vectors, or Cross product, Scalar Triple Product, vector Triple product.

**REFERENCES:**


1. Courant.R, Robbins ,What is Mathematics. Oxford University Press.
2. Kalyan Sinha, Rajeeva Karandikar, C.Musili and others, Understanding Mathematics,University Press.
3. Proof and fundamental, Ethan , d Bloch, UTM springar.
4. How to think like a Mathematics, Kevinhouston Cambridge University.

## SEMESTER – II

**Open Elective Code: 126MSC02MATOEC02T**

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|---|---|
| **Paper Code:2.7. II Open Elective Course** | **Paper Title:** Integral Transforms (Science Stream) |
| **Teaching Hours: 4 Hrs / Week** | **Marks: Theory – 80 + IA - 20** |
| **Teaching Hours: 3 Hrs** | **Credits: 04** |

**Unit 1:**

Integral Transforms, Fourier Integral Theorem, Fourier sine and cosine integrals Fourier complex integral.

**Unit 2:**

Fourier Transforms, Fourier sine and cosine transforms, Properties, convolution theorem, Parseval's Identity, Parseval's identity cosine transform, Parseval's identity sine transform Fourier transforms of Derivative of a function.

**Unit 3:**

Solution of Boundary value problems by using integral transform, Fourier transforms of partial derivative of a function, Finite Fourier transforms.

**Unit 4:**

Z- Transforms, Properties, Z- Transform Theorem, Change of Scale, Shifting property.

**Unit 5:**

Inverse Z- Transform, Solution of Difference equations.

**REFERENCES :**


1. B.S Grewal, Higher Engineering Mathematics 43rd Edition, Khanna Publication.
2. Lokenath Debnath, Dambaru Bhatta, Integral Transforms and Their Applications, CRC Press.
3. Gerald B. Foland, Fourier Analysis and its applications, AMS.
4. E.M. Stein and R. Shakarchi, Fourier Analysis: An instruction, Princenton University Press,Princenton – 2003.