PREAMBLE

The courses for the Bachelor's Programme in Mathematics are framed by the Board of Studies using time tested and internationally popular text books so that the courses are at par with the courses offered by any other reputed university around the world.

Only those concepts that can be introduced at the under graduate level are selected and instead of cramming the course with too many ideas, the stress is given in doing the selected concepts rigorously. The course is framed in such a way that a graduate in Mathematics will have developed the required analytical skills and logical reasoning requiredto identify problems, construct proofs and find solutions.

GRADUATE ATTRIBUTES

The Department of Mathematics is committed to provide a culturally enriched educational experience that will transform the lives of its students.Our aspiration is for graduates who have developed the knowledge, skills and attributes to equip them for life in a complex and rapidly changing world.

On completion of the B.ScProgramme in Mathematics, our students should be able to demonstrate the graduate attributes listed below

- *Professionalism, employability and enterprise*
  - Proficiency in problem solving, creativity, numeracy and self-management.
  - Confidence in accepting professional challenges, act with integrity, set themselves high standards.
  - Ability to workindependently and along a team withprofessional integrity.
- *Learning and research skills*
  - Acquire skills of logical and analytical reasoning.
  - Develop a critical attitude towards knowledge and inculcate scientific temper.
  - Equipped to seek knowledge and to continue learning throughout their lives.
  - Develop intellectual curiosity, effective learning and research abilities.
- *Intellectual depth, breadth and adaptability*
  - Proficiency in curricular, co-curricular and extracurricular activities that deepen and broaden knowledge.
  - Develop skills of analysis, application, synthesis, evaluation and criticality.
- *Respect for others*
  - Develop self-awareness, empathy, cultural awareness and mutual respect.
  - Ability to work in a wide range of cultural settings and inculcate respect for themselves and others and will be courteous.
- *Social responsibility*
  - Knowledge in ethical behaviour, sustainability and personal contribution.
  - Awareness in the environmental, social and cultural value system.

AIMS AND OBJECTIVES

Aims:

The Board of Studies in Mathematics aims to provide an academic environment to inculcate mathematical skills and familiarize students to the modern trends in Mathematics. The programme also aims to develop the following abilities:

1.Develop logical thinking and reasoning 2. Impart skills required to gather information from resources and use them. 3. Develop analytical and problem solving skills. 4. Provide an intellectually stimulating environment to develop scientific temper and mould the students to utilize their potential to maximum. 5. Use of Information Communication Technology to acquire knowledge.

Objectives:

The syllabi are framed in such a way that it bridges the gap between the plus two and post graduate levels of Mathematics by providing a more complete and logic frame work in almost all areas of basic Mathematics.

By the end of the second semester, the students should have

1) Attained a secure foundation in Mathematics and other relevant subjects to complement the core for their future courses.

By the end of the fourth semester,the students should have been

1) Introduced to powerful tools for tackling a wide range of topics in Calculus, Theory of Equations and Numerical methods.
2) Familiarized with additional relevant mathematical techniques and other relevant subjects to complement the core.

By the end of sixth semester, the students should have

1) Understood a range of topics in almost all areas of Mathematics including Analysis, Graph Theory, Calculus,Fuzzy Mathematics, Operations Research and Algebra.
2) Experienced independent works such as project, seminar etc.

COURSE CODING FORMAT

The programme is coded according to the following criteria.

1. The first letter plus second letter/any letter from the programme ie., **MT**
2. One digit to indicate the semester. i.e., **MT1 (Mathematics, 1st semester)**
3. One letter from the type of courses such as, **A** for common course, **B** for core course, **C** for Complementary course, **D** for Open course,ie.,**MT1B (Mathematics, 1st semester Core course)**and **P** for project.
4. Two digits to indicate the course number of that semester. i.e.,**MT1B01 (Mathematics, 1st semester, Core course, course number is 01)**
5. The letter **B** to indicate Bachelors Programme.
6. **MT1B01B** (**Mathematics**, 1st semester, Core course, courses number 01, and **B** for bachelors Programme)
7. **18 to indicate the year.**i.e., **MT1B01B18**

MATHEMATICS COURSE CODES

MT	**Mathematics**
MTB	Mathematics Core Courses MT1B01B18, MT2B02B18, MT3B03B18, MT4B04B18, MT5B05B18, MT5B06B18, MT5B07B18, MT5B08B18, MT6B09B18, MT6B10B18, MT6B11B18, MT6B12B18 Mathematics Core, Choice Based (MT6B13aB18/MT6B13bB18/MT6B13cB18)
MTD	Mathematics Open Course (MT5D01aB18/MT5D01bB18/MT5D01cB18)
MTC	Mathematics Complementary to Physics/Chemistry (MT1C01B18/MT2C01B18/MT3C01B18/MT4C01B18) Mathematics Complementary to Economics (MT1C02B18/MT2C02B18) Mathematics Complementary to B.Voc Software Development (MT2C03B18) Mathematics Complementary to Cloud Computing and Information Security Systems (MT2C04B18)
MTPR	Mathematics Project MT6BPRB18

STRUCTURE OF BACHELOR'S PROGRAMME IN MATHEMATICS

The Programme in Mathematics must include (1) Common courses, (2) Core courses, (3) Choice Based Courses (4)Open Courses(5)Project (6) Complementary Courses.

During the First four Semesters the student must complete 10 common courses of which Six English courses are compulsory and common for all streams. The students can choose one language course from among French, Hindi and Malayalam. There will be 13 core courses. The student shall select any choice based course from the two courses offered by the Department.Open course may be offered in any subject and the student shall have the option to do courses offered by other departments in the fifth semester. Every student has to do a project during the 6^{th} semester. The topics for the project can be selected as early as the beginning of the 5^{th} semester. Physics and Statistics are the Complementary Courses during the first four semesters.

PROGRAMME DESIGN:

Programme consists of 33 courses. The number of courses for the programme contains 12 compulsory core courses, one choice based course, one open course offered by other departments, one project and 8 complementary courses. There are 10 common courses which includes the first and second language of study.

Total credits will be 120 of which 38 credits for common courses, 46 for core courses, 1 credit for the project, 3 for choice based courses, 28 for Complementary Courses and 4 credits for open courses.

Open Courses and Choice Based Courses

The Department offers four open courses to the students of other streams. One course will be selected by the Department and offered to the students of other streams. The list of open courses is given below.

a)Applicable Mathematics b)Mathematical Modelling c)Financial Mathematics

d) Mathematical Economics.

The Department offers two choice based courses during the sixth semester. The students can choose one course according to their choice. The list of choice based course is given below:

a) Operations Research
b) Integral Transforms

STRUCTURE OF COURSES WITH CREDITS.

Courses	Number of courses	Credits
Core courses	12	46
Open Course	1	3
Choice Based Course	1	3
Project	1	2
TOTAL	**15**	**54**
Complementary Course I (Statistics)	4	14
Complementary Course II (Physics)	4 Theory + 2 Practical	14
TOTAL	**10**	**28**
Common Courses I	6	22
Common Course II	4	16
GRAND TOTAL	**35**	**120**

SCHEME OF DISTRIBUTION OF INSTRUCTIONAL HOURS FOR CORE COURSES

Semester	Theory(no. of hours)
First	4
Second	4
Third	5
Fourth	5
Fifth	25
Sixth	25

DURATION OF COURSE

• The duration of U.G. programmes shall be 6 semesters.

• A student may be permitted to complete the programme, on valid reasons, within a period of 12 continuous semesters from the date of commencement of the first semester of the programme.

• Attendance: Students having a minimum of 75% average attendance for all the courses only, can register for the examination.

CONSOLIDATED SCHEME FOR I TO VI SEMESTERS

PROGRAMME STRUCTURE

B.SC MATHEMATICS PROGRAMME

Sem	Course Type	Course Code	Course Title	Hrs/wk	Credits	Total Marks	
						ISA	ESA
I	Common courseI	EN1A01B18	FINE-TUNE YOUR ENGLISH	5	4	20	80
		EN1A02B18	PEARLS FROM THE DEEP	4	3	20	80
	Common course II	MA1A01B18	KATHASAHITHYAM	4	4	20	80
		HN1A01B18	KAHAANI AUR UPANYAS				
		FR1A01B18	FRENCH LANGUAGE AND COMMUNICATIVE SKILLS –I				
	Complementary course I	ST1C01B18	DESCRIPTIVE STATISTICS	4	3	20	80
	Complementary course II	PH1C01B18	PROPERTIES OF MATTER & ERROR ANALYSIS	2	2	15	60
	Complementary II Practical	PH2CP01B18	PRACTICAL	2	-	-	-
	Core course-1	MT1B01B18	DISCRETE MATHEMATICS AND TRIGONOMETRY	4	3	20	80
			Total Credits		**19**		
II	Common courseI	EN2A03B18	ISSUES THAT MATTER	5	4	20	80
		EN2A04B18	SAVOURING THE CLASSICS	4	3	20	80
	Common course II	MA2A03B18	KAVITHA	4	4	20	80
		HN2A03B18	KAVITA VYAKARAN AUR ANUVAD			20	80
		FR2A03B18	FRENCH LANGUAGE AND COMMUNICATIVE SKILLS-II			20	80
	Complementary course I	ST2C01B18	PROBABILITY AND RANDOM VARIABLES	4	3	20	80
	Complementary course II	PH2C01B18	MECHANICS AND ASTROPHYSICS	2	2	15	60
	Complementary II Practical	PH2CP01B18	PRACTICAL	2	2	10	40

	Core course-2	MT2B02B18	NUMBER THEORY, CRYPTOGRAPHY, LAPLACE TRANSFORMS & CONIC SECTIONS	4	3	20	80
			Total Credits		**21**		
III	Common course I	EN3A05B18	LITERATURE AND/AS IDENTITY	5	4	20	80
	Common course II	MA3A05B18	DRISYAKALASAHITHYAM	5	4	20	80
		HN3A05B18	NAATAK AUR LAMBI KAVITA			20	80
		FR3A05B18	AN ADVANCED COURSE IN FRENCH -I			20	80
	Complementary course I	ST3C01B18	PROBABILITY DISTRIBUTIONS	5	4	20	80
	Complementary course II	PH3C01B18	MODERN PHYSICS, BASIC ELECTRONICS AND DIGITAL ELECTRONICS	3	3	15	60
	Complementary II Practical	PH4CP01B18	PRACTICAL	2	-	-	-
	Core course-3	MT3B03B18	CALCULUS	5	4	20	80
			Total Credits		**19**		
IV	Common course I	EN4A06B18	ILLUMINATIONS	5	4	20	80
	Common course II	MA4A06B18	MALAYALA GADHYARACHANAKAL	5	4	20	80
		HN4A06B18	GADYA AUR EKANKI			20	80
		FR4A06B18	AN ADVANCED COURSE IN FRENCH -II			20	80
	Complementary course I	ST4C01B18	STATISTICAL INFERENCE	5	4	20	80
	Complementary course II	PH4C01B18	PHYSICAL OPTICS, LASER PHYSICS AND DIELECTRICS	3	3	15	60
	Complementary II Practical	PH4CP01B18	PRACTICAL	2	2	10	40
	Core course-4	MT4B04B18	VECTOR CALCULUS, THEORY OF EQUATIONS & MATRICES VECTOR CALCULUS, THEORY OF EQUATIONS & MATRICES	5	4	20	80
			Total Credits		**21**		

V	Core Course-5	MT5B05B18	HUMAN RIGHTS AND MATHEMATICS FOR ENVIRONMENTAL STUDIES.	4	4	20	80
	Core Course-6	MT5B06B18	REAL ANALYSIS-I	6	4	20	80
	Core Course-7	MT5B07B18	DIFFERENTIAL EQUATIONS	6	4	20	80
	Core Course-8	MT5B08B18	ABSTRACT ALGEBRA	5	4	20	80
	Open Course		OFFERED BY OTHER DEPARTMENTS	4	3	20	80
			Total Credits		**19**		
VI	Core Course-9	MT6B09B18	REAL ANALYSIS –II	6	4	20	80
	Core Course-10	MT6B10B18	COMPLEX ANALYSIS	5	4	20	80
	Core Course-11	MT6B11B18	GRAPH THEORY & FUZZY MATHEMATICS	5	4	20	80
	Core Course-12	MT6B12B18	LINEAR ALGEBRA	5	4	20	80
	Core Course-13		CHOICE BASED COURSE	4	3	20	80
	Core	MT6BPRB18	PROJECT	0	2	20	80
			Total Credits		**21**		

Total credits = 120

SCHEME FOR B.SC MATHEMATICS PROGRAMME

Sem	Course Code	Title of the Course	Hrs/wk	Credits	Total hours/ semester
1	MT1B01B18	Discrete Mathematics and Trigonometry	4	3	72
2	MT2B02B18	Number Theory, Cryptography, Laplace Transforms & Conic Sections	4	3	72
3	MT3B03B18	Calculus	5	4	90
4	MT4B04B18	Vector Calculus, Theory of Equations & Matrices	5	4	90
5	MT5B05B18	Human Rights and Mathematics for Environmental studies	4	4	72
	MT5B06B18	Real Analysis-I	6	4	108
	MT5B07B18	Differential Equations	6	4	108
	MT5B08B18	Abstract Algebra	5	4	90
		Open Course	4	3	72
6	MT6B09B18	Real Analysis –II	6	4	108
	MT6B10B18	Complex Analysis	5	4	90
	MT6B11B18	Graph Theory & Fuzzy Mathematics	5	4	90
	MT6B12B18	Linear Algebra	5	4	90
		Choice Based Course	4	3	72
	MT6BPRB18	Project	0	2	0
		Total Credits		**54**	

SCHEME OF CHOICE BASED COURSES IN THE SIXTH SEMESTER:

Semester	Course Code	Title of the paper	Number of hours per week	Total Credits
6th	MT6B13aB18	Operations Research	4	3
6th	MT6B13bB18	Integral Transforms	4	3

SCHEME OF OPEN COURSE FOR STUDENTS OF OTHER DEPARTMENTS DURING THE FIFTH SEMESTER

Semester	Course Code	Title of the paper	Number of hours per week	Total Credits
5th	MT5D01aB18	Applicable Mathematics	4	3
5th	MT5D01bB18	Mathematical Modelling	4	3
5th	MT5D01cB18	Financial Mathematics	4	3
5th	MT5D01dB18	Mathematical Economics	4	3

SCHEME OF COMPLEMENTARY COURSESOFFERED BY THE DEPARTMENT

1. Mathematics for B.Sc Physics and Chemistry

Semester	Course Code	Title of the paper	Number of hours per week	Credits
I	MT1C01B18	DIFFERENTIAL AND INTEGRAL CALCULUS	4	3
II	MT2C01B18	PARTIAL DERIVATIVES, MULTIPLE INTEGRALS TRIGONOMETRY AND MATRICES	4	3
III	MT3C01B18	VECTOR CALCULUS , DIFFERENTIAL EQUATIONS AND ANALYTIC GEOMETRY	5	4
IV	MT4C01B18	FOURIER SERIES , PARTIAL DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA	5	4

2.Mathematics for B.A Economics

Semester	Course Code	Title of the paper	Number of hours per week	Credits
I	MT1C02B18	GRAPHING FUNCTIONS, EQUATIONS AND FUNDAMENTAL CALCULUS	6	4
II	MT2C02B18	EXPONENTIAL, LOGARITHMIC FUNCTIONS, LINEAR ALGEBRA AND ADVANCED CALCULUS	6	4

3.Mathematics for B.Voc Software Development

Semester	Course Code	Title of the paper	Number of hours per week	Credits
II	MT2C03B18	BASIC MATHEMATICS	4	4

4. Mathematics for BCA Cloud computing and Information Security Management

Semester	Course Code	Title of the paper	Number of hours per week	Credits
II	MT2C04B18	FUNDAMENTALS OF MATHEMATICS	4	4

EXAMINATIONS

The external theory examination of all semesters shall be conducted by the College at the end of each semester. Internal evaluation is to be done by continuous assessment.

Examinations have two parts: Internal or In-Semester Assessment (ISA) & External or End–Semester Assessment (ESA). The ratio between ISA and ESA shall be 1:4. Both internal and external marks are to be rounded to the next integer.

MARKS DISTRIBUTION FOR END SEMESTER ASSESSMENT AND IN-SEMESTERS ASSESSMENT

Marks distribution for external and internal assessments and the components for internal evaluation with their marks are shown below:

Components of the internal evaluation and their marks are as below.

For all courses without practical

a) End Semester Assessment (ESA): 80 marks

b) In Semester Assessment (ISA): 20 marks

Internal assessment components - Theory	**Marks**
Attendance	5
Assignment/Seminar/Viva	5
Test papers (2 x 5)	10
Total	20

Attendence:

% of Attendance	**Marks**
>90%	5
Between 85 and 90	4
Between 80 and 85	3
Between 75 and 80	2
75 %	1
< 75	0

FOR PROJECTSAND COMPREHENSIVE VIVA-VOCE*:

(a) Marks of End Semester Assessment : 80
(b) Marks of In Semester Assessment : 20

Components of Project I.V. and Viva – End Semester Assessment	
Dissertation (End semester)	50
Comprehensive Viva-voce(End semester)	30
Total	80

Bonafide reports of the project work conducted shall be submitted at the time of examination.

Components of Project/ - In semester assessment	Marks
Punctuality	5
Content	5
Knowledge	5
Report	5
Total	20

ASSIGNMENTS

Assignments are to be done from 1st to 4th Semesters. At least one assignment should be done in each semester for all papers.

SEMINAR / VIVA

A student shall present a seminar in the 5th semester and appear for Viva- voce in the 6th semester for all papers.

IN SEMESTER ASSESSMENT TEST PAPERS

Two internal test- papers are to be attended in each semester for each paper. The evaluations of all components are to be published and are to be acknowledged by thecandidates. All documents of internal assessments are to be kept in the college for two years.

Documents shall be made available for verification by the University. The responsibility of evaluating the internal assessment is vested on the teacher(s) who teach the paper.

END SEMESTER ASSESSMENT

The End-Semester examination of all courses shall be conducted by the College on the close of each semester. For reappearance/ improvement, students can appear along with the next batch.

Pattern of Question Paper

A question paper shall be a judicious mix of short answer type, short essay type/ problem solving type and long essay type questions. For each course the Final Assessment is of 3 hours duration. The question paper has 3 parts. Part A contains 12 objective type questions of which 10 are to be answered.Part B contains 9 short essay questions of which 6 are to be answered. Part C has 4 long essay questions of which 2 are to be answered.

Part	No. of Questions	No. of Questions to be answered	Marks
A(Short Answer type)	12	10	$10\times 2=20$
B(Short Essay)	9	6	$6\times 5=30$
C(Long Essay)	4	2	$2\times 15=30$

GRADES

A 7-point scale based on the total percentage of marks (ISA + ESA) for all courses(theory, practical, project)

% of marks	Grade	Grade point
>95	S - Outstanding	10
85 – 95	A^+ - Excellent	9
75 – 85	A - Very good	8
65 – 75	B^+ - Good	7
55 – 65	B - Above average	6
45 – 55	C - Satisfactory	5
35 – 45	D - Pass	4
<35	F - Failure	0
	Ab - Absent	0

PASS CRITERIA:

- A separate minimum of 30% marks each for internal and external (for both theory and practical) and aggregate minimum of 35% for a pass in a course.
- For a pass in a programme, a separate minimum of Grade D is required for all the individual courses.
- If a candidate secures F Grade for any one of the courses in a semester/programme, only F grade will be awarded for that semester/programme until he/she improves this to D Grade or above within the permitted period.
- Students who complete the programme with D grade will have one betterment chance within 12 months, immediately after the publication of the result of the whole programme.

CREDIT POINT AND CREDIT POINT AVERAGE

Credit Point (CP) of a course is calculated:

$$CP = C \times GP$$

C = Credit; GP = Grade point

Semester Grade Point Average (SGPA) of a semester:

$$SGPA = TCP/TC$$

TCP = Total Credit Point of that semester

TC = Total Credit of that semester

Cumulative Grade Point Average (CGPA) is calculated:

$$CGPA = TCP/TC$$

TCP = Total Credit Point of that programme

TC = Total Credit of that programme

GRADE POINT AVERAGE (GPA)

GPA of different category of courses viz. Common courses, Complementary courses, Core courses etc. are calculated:

$$GPA = TCP/TC$$

TCP = Total Credit Point of a category of course

TC = Total Credit of that category of course

Grades for the different courses, semesters and overall programme are given based on the corresponding GPA:

GPA	Grade
>9.5	S - Outstanding
8.5 – 9.5	A^+ - Excellent
7.5 – 8.5	A - Very good
6.5 – 7.5	B^+ - Good
5.5 – 6.5	B - Above average
4.5 – 5.5	C - Satisfactory
3.5 – 4.5	D - Pass
<3.5	F – Failure

- For reappearance/improvement for other semesters, appear along with the next batch.
- There shall be supplementary exams only (no improvement) for V semester.
- Notionally registered candidates can also apply for the said supplementary examinations.
- A student who registers his name for the external exam for a semester will be eligible for promotion to the next semester.

- A student who has completed the entire curriculum requirement, but could not register for the Semester examination can register notionally, for getting eligibility for promotion to the next semester.
- A candidate who has not secured minimum marks/credits in internal examinations can re-do the same registering along with the University examination for the same semester, subsequently.
- There shall be no improvement for internal evaluation.

SYLLABI
OF
CORE COURSES

MATHEMATICS (CORE COURSE1)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

FIRST SEMESTER

MT1B01B18-DISCRETE MATHEMATICS&TRIGONOMETRY

Credits: 3 Credits

Total Lecture Hours: 72 (4 hours /week)

Aims:

The course aims to introduce Discrete Mathematics&Advanced Trigonometry. One of the strong points of Discrete Mathematics is its powerful applications to fields like Computer Science, engineering and operations research. This course also discusses some advanced topics in trigonometry which has a wide range of applications in the Engineering and construction field.

Course Overview and Context :

This course starts by introducing the alphabets of modern mathematics the mathematical logic and the sets and functions. A brief introduction of theory of Ordered sets & Lattices is also included. The concepts of Circular and hyperbolic functions of a complex variable are then introduced.

SYLLABUS CONTENT

Module 1 **(20 Hrs)**

Mathematical Logic:
Propositional logic, Propositional equivalences, Predicates and quantifiers, Rules of inference,Introduction to proofs.

(Chapter 1 excluding sections 1.4 & 1.7 of text 1)

Module 2(12Hrs)

Set theory:
Sets, set operations, functions

(Chapter 2 excluding section 2.4 of text 1)

Module 3 **(20 Hrs)**

Ordered sets & Lattices:

Poset, Product set & order, Hasse diagrams of partially ordered sets,Minimal& Maximal, and First & Last point, Lattices, Lattices as partially ordered sets.

(Chapter 4 (4.1 to 4.6) of text 2)

Module 4

Trigonometry:**(20 Hrs)**

Circular and hyperbolic functions of a complex variable Separation into real and imaginary parts. Factorisation of x^n-1, x^n+1, $x^{2n} - 2x^n a^n \cos n\theta + a^{2n}$. Summation of infinite series by C+iS method.

(Relevant sections of Text 3, Chapters – 5, 7, 9 of Text 3)

Learning Resources:

Text Books:

1. K.H. Rosen: Discrete Mathematics and its Applications (Sixth edition), Tata McGraw HillPublishing Company, New Delhi.
2. B.S.Vatsa&SuchiVatsa : Discrete Mathematics (Fourth revised edition), New Age International Publishers, New Delhi.
3. S.L. Loney – Plane Trigonometry Part – II, S. Chand and Company Ltd

References:

- J. P Tremblay and R. Manohar- Discrete Mathematical Structures with applications to computer science, Tata McGraw-Hill Education, 2001
- Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi. (Reprint)
- P.R. Halmos : Naive Set Theory, Springer.
- Ian Chiswell&Wifrid Hodges: Mathematical Logic, Oxford university press
- Richard Johnsonbaugh – Discrete Mathematics (Pearsons).
- Ralph P. Grimaldi, B.V.Ramana; Discrete And Combinatorial Mathematics ; PearsonEducation; Dorling Kindersley India Pvt. Ltd
- Winfried Karl Grassman, Jean-Paul Tremblay; Logic And Discrete

Mathematics AComputer Science Perspective ; Pearson Education; Dorling Kindersley India Pvt. Ltd

- Lipschutz:Set Theory And Related Topics (2ndEdition), SchaumOutlineSeries, Tata
- McGraw-Hill Publishing Company, New Delhi.
- H.S.Hall, S.R. Knight: Higher Algebra, Surjit Publications, Delhi.

Competencies of the course:

- Explain the Propositional Calculus in Mathematical Logic.
- Describe Set theory , Relations & Functions
- Explain Ordered sets & Lattices
- Define Circular and hyperbolic functions of a complex variable
- Illustrate the Separation of these functions into real and imaginary parts
- Examine the Factorisation of x^n-1, x^n+1, $x^{2n} - 2x^n a^n \cos n\theta + a^{2n}$
- Define Summation of infinite series by C +iS method

QUESTION PAPER PATTERN

MT1B01B18-DISCRETE MATHEMATICS&TRIGONOMETRY

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	3	2	1	31
II	**12**	3	2	1	31
III	**20**	3	2	1	31
IV	**20**	3	3	1	36
Total		**12**	**9**	**4**	

MODEL QUESTION PAPER

MATHEMATICS (CORE COURSE 1)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

FIRST SEMESTER
MT1B01B18-DISCRETE MATHEMATICS & TRIGONOMETRY

Time: 3 hrs Max.Marks:80

Part A

(Answer any **ten** questions. Each question carries **2** marks)

1. Show that $(p \wedge q) \rightarrow (p \vee q)$.
2. State the converse and contra positive of the conditional statement

   "I go to the beach whenever it is a sunny summer day"
3. Find the negation of the proposition "At least 10 inches of rain fell today in Miami ".
4. Let A = {a, b, c, d} and B = $\emptyset$ then find A X B.
5. Let A, B and C be sets. Show that $\overline{A \cup (B \cap C)} = (\overline{C} \cup \overline{B}) \cap \overline{A}$
6. What is the composite of the relations R and S, where R is the relation from {1, 2, 3} to {1, 2, 3,4} with R= {(1, 1), (1, 4), (2, 3), (3, 1), (3, 4)} and S is the relation from {1, 2, 3, 4} to {1, 2, 3, 4} with S= {(1, 0), (2, 0), (3, 1), (3, 2), (4, 1)}.
7. Give an example for a relation which is not symmetric but transitive.
8. Is the poset(Z^+, |) a lattice?
9. If $x$is real show that $\sinh^{-1} x = \log(x + \sqrt{x^2 + 1})$
10. If $\cos(x + iy) = \cos\theta + i \sin\theta$. Show that $\cos 2x + \cosh 2y = 2$
11. What is the imaginary part of $\sinh(2 + 3i)$?.
12. If $\tan\frac{\theta}{2} = \tanh\frac{u}{2}$, Show that $\sinh u = \tan\theta$.

Part B

(Answer any **six**questions. Each question carries **5** marks)

13. Show that the inclusion relation $\subseteq$ is a partial ordering on the power set of a set S.
14. Prove that the relation R on a set A is transitive if and only if $R^n \subseteq R$ for n = 1, 2, 3….

15. Draw the Hasse diagram for the partial ordering $\{(A,B)|A \subseteq B\}$ on the power set P(S), where S={a,b,c}

16. (a) Define an equivalence relation

(b) Let R be the relation on the set of real numbers such that xRy if and only if x and y are real numbers that differ by less than 1, that is $|x - y| < 1$. Show that R is not an equivalence relation

17. (a) When does a function have an inverse?

(b) Does the function f(n) = 10 – n from the set of integers to the set of integers have an inverse?

If so what is it?

18. Let f be a function from A to B. Let S and T be subsets of B. Show that

(a) $f(SUT) = f(S)\ U\ f(T)$

(b) $f^{-1}(S \cap T) = f^{-1}(S) \cap f^{-1}(T)$.

19. Determine the truth value of the following statements if the domain consists of all real numbers

(a) $\exists x\ (x^3 = -1)$ (b) $\exists x\ (x^4 < x^2)$ (c) $\forall x\ ((-x)^2 = x^2)$ (d) $\forall x\ (2x > x)$

20. Prove that $x^7 + 1 = (x = 1)\sum_{r=0}^{2}(x^2 - 2x\cos\frac{(2r+1)\pi}{7} + 1)$. Deduce that $\sin\frac{\pi}{14}\sin\frac{3\pi}{14}\sin\frac{5\pi}{14} = \frac{1}{8}$.

21. Find the real and imaginary part of $\tan^{-1}(x + iy)$

Part C

(Answer any **two** questions. Each question carries **15** marks)

22. Sum to infinity the series

$$\cos x \sin x + \frac{\cos^2 x}{2!}\sin 2x + \frac{\cos^3 x}{3!}\sin 3x + \ \ldots\ldots\ldots\ldots$$

23. (a) If a and r are real numbers and $r \neq 0$, then show that

$$\sum_{j=0}^{n} a.r^j = \begin{cases} \frac{a.r^{n+1} - a}{r - 1} & \text{if } r \neq 1 \\ a(n+1) & \text{if } r = 1 \end{cases}$$

(b) Show that the set of rational numbers is countable

(c) Find the sum

$\sum_{k=50}^{100} k^2$ and $\sum_{k=99}^{200} k^3$

24. (a) Determine whether $(\neg p \wedge (p \rightarrow q)) \rightarrow \neg q$ is a tautology.

(b) Show that $p \leftrightarrow q$ and $(p \wedge q) \vee (\neg p \wedge \neg q)$ are logically equivalent

25. Find the sum of the infinite series

$$\cos\theta + \frac{1}{2}\cos 2\theta + \frac{1.3}{2.4}\cos 3\theta + \frac{1.3.5}{2.4.6}\cos 4\theta + \ \ldots\ldots\ldots$$

MATHEMATICS (CORE COURSE 2)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

SECOND SEMESTER

MT2B02B18-NUMBER THEORY, CRYPTOGRAPHY, LAPLACE TRANFORMS&CONIC SECTIONS

Credits: 3 Credits

Total Lecture Hours: 72 (4 hours /week)

Aims:

Classical number theory is introduced in this course. The theory of numbers always occupied a unique position in the world of Mathematics.Another topic in this course is cryptography which is the only known practical means for protecting informationtransmitted through public communication networks.Then it gives geometric definitions of conic sections which models the path of planets and satellites.

Course Overview and Context :

This course aims to give a simple account of classical number theory and to impart some of the historical background in which the subject evolved. The topics discussed under cryptography are Private key cryptosystem, Private key cryptosystem and knapsack cryptosystem Also it describes conic sections and their properties. .

SYLLABUS CONTENT

Module 1

Number Theory: (20 Hrs)

Basic properties of congruence , Linear congruences and Chinese remainder theorem (statement and problems only), Fermat's little theorem and pseudo primes, Wilson's theorem, The sum and number of divisors, Euler's phi-function,

(Chapter 4- sections 4.2,4.4 Chapter 5- sections 5.2,5.3 and Chapter 6- section 6.1,chapter7-section 7.2 of text 1)

Module 2

Introduction to Cryptography: (15 Hrs)

From Caesar Cipher to Public key Cryptography, the Knapsack Cryptosystem

(Sections 10.1, 10.2 only of text 1)

Module 3

Laplace transforms:(20 Hrs)

Laplace transform, Linearity of Laplace transform, First shifting theorem, Existence of Laplacetransform, Transforms of derivatives, Solution of ordinary differential equation & initial value problem, Laplace transform of the integral of a function, Convolution and Integral equations.

(Sections 6.1, 6.2 and 6.5 of text 2)

Module 4

Conic Sections: (17 Hrs)

Conic Sections & quadratic equations, Classifying Conic Sections by eccentricity, quadratic equations & rotations, Conics & parametric equations;Cycloid, Polar coordinates, Graphing in Polar coordinates, Areas & lengths in Polar coordinates, Conic Sections in Polar coordinates

(Chapter 10 of text 2)

Learning Resources:

Text Books:

1. David M. Burton : Elementary Number Theory, Sixth Edn, TMH.
2. Erwin Kreyszig : Advanced Engineering Mathematics, Ninth Edition, Wiley, India.
3. George B. Thomas Jr. (Eleventh Edition) – Thomas' Calculus, Pearson,

References

- ManicavachagomPillay, Natarajan – Analytic Geometry (Part I, Two Dimensions)
- S.K . Stein – Calculus and analytic Geometry, (McGraw Hill)

- A. N. Das – Analytic Geometry of Two and Three Dimension (New Central Books)
- Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)
- C.Y Hsiung Elementary Theory of Numbers, Allied Publishers
- Thomas Koshy - Elementary Number Theory with Applications, Academic Press
- Fernando Rodriguez Villegas: Experimental Number Theory, Oxford University Press
- Graham Everest, Thomas Ward: An Introduction to Number Theory, Springer
- George E. Andrews: Number Theory, HPC.

Competencies of the course:

- Describe Basic properties of congruence
- Compute Binary and decimal representation of integers
- Introduce Chinese remainder theorem and Fermat's little theorem
- Describe pseudoprimes
- ExplainWilson's theorem
- Introduce Euler's phi-function, Euler's Theorem, Properties of the phi-function.
- Define Conic Sections and Classify Conic Sections by eccentricity
- Interpret parametric equations & Polar coordinates of Conic Sections
- Explain Graphing in Polar coordinates
- Introduce Private key cryptosystem
- Analyse Public key cryptosystem
- Describe knapsack cryptosystem.
- Compute Laplace transforms of functions.
- Solve differential equations using Laplace Transforms.
- Compute Laplace transform of the integral of a function.

QUESTION PAPER PATTERN

MT2B02B18-NUMBER THEORY, CRYPTOGRAPHY, LAPLACE TRANSFORM&CONIC SECTIONS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	3	2	1	31
II	**15**	3	2	1	31
III	**20**	3	3	1	36
IV	**17**	3	2	1	31
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 3)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

THIRD SEMESTER

MT3B03B18-CALCULUS

Credits: 4 Credits

Total Lecture Hours: 90 (5 hours /week)

Aims:

Calculus is the mathematical study of change. The studies of probability, statistics , fluid dynamics electricity to mention a few lead in natural ways to functions of more than one variables. In studying quantities that depend on two or more variables we extend the basic idea of calculus to functions of several variables. We use multiple integrals to calculate quantities that vary over two or more dimensions such as total mass or angular momentum of an object of varying density and the volumes of solids with general curved boundaries.

Course Overview and Context:

This course introduces higher order derivatives, Leibnitz theorem, for higher derivatives of the product of two functions. Series expansions of functions using Maclaurin's theorem and Taylor's theorem are discussed. Some applications of derivatives in finding maxima, minima, point of inflection etc are introduced. The concept of partial derivatives and its properties are also introduced.

In integral calculus, certain reduction formulae are discussed. Application of integrals in finding plane area, surface area, arc length, and volume of solids of Revolution are introduced and double and triple integrals and some applications are also introduced.

SYLLABUS CONTENT

Module 1

Differential Calculus: (30Hrs)

Successive Differentiation. Expansion of functions using Maclaurin's theorem and Taylor's theorem.Concavity and points of inflexion.

(Chapter - 5, Chapter – 6, Chapter 13 of text 2)

Module 2

Partial Differentiation: (20 Hrs)

Partial derivatives, The chain rule., Extreme values and saddle points, Lagrange multipliers, Partial derivatives with constrained variables.

(Section 14.3, 14.4, 14.7, 14.8, 14.9 of text 1)

Module 3

Integral Calculus: (20 Hrs)

Substitution and area between curves, volumes by slicing and rotation about an axis. Volumes by cylindrical shells, Lengths of Plane Curves, Areas of surfaces of Revolution and the theorems of Pappus.

(Section 5.6, 6.1, 6.2, 6.3, 6.5 of text 1)

Module 4

Multiple Integrals: (20 Hrs)

Double integrals, Areas, Double integrals in polar form, Triple integrals in rectangular coordinates, Triple integrals in cylindrical and spherical coordinates,substitutions in multiple integrals.

(Section 15.1, 15.2 (area only) 15.3, 15.4, 15.6, 15.7 of text 1)

Learning Resources:

Text Books:

1. George B. Thomas Jr. (EleventhEdition) – Thomas' Calculus, Pearson, 2008.
2. Shanti Narayan and P. K. Mittal– Differential Calculus(S. Chand & Co.) 2008.

References:

- T. M. Apostol – Calculus Volume I & II (Wiley India)
- Widder – Advanced Calculus ,2nd edition

- K. C. Maity& R. K. Ghosh – Differential Calculus (New Central Books Agency)
- K. C. Maity& R. K. Ghosh – Integral Calculus (New Central Books Agency)
- Shanti Narayan, P.K. Mittal - Integral Calculus – (S. Chand & Co.)
- Anton: Calculus, Wiley.

Competencies of the course:

- Find the higher order derivative of the product of two functions.
- Expand a function using Taylor's and Maclaurin's series.
- Find points of extreme values attained by a function on a given interval.
- Conceive the concept of Convexity and Concavity of functions.
- Learn about partial derivatives and its applications.
- Find the area under a given curve, length of an arc of a curve when the equations are given in parametric and polar form.
- Find the area and volume by applying the techniques of double and triple integrals .

QUESTION PAPER PATTERN

MT3B03B18-CALCULUS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**30**	3	3	1	36
II	**20**	3	2	1	31
III	**20**	3	2	1	31
IV	**20**	3	2	1	31
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 4)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

FOURTH SEMESTER

MT4B04B18-VECTOR CALCULUS, THEORY OFEQUATIONS &MATRICES

Credits: 4 credits
Total Lecture Hours: 90 (5 hours/week)
Aims:

We need a mathematical description of three dimensional spaces to apply calculus in many real world situations. Vectors are used to study the analytic geometry of space, where they give simple ideas to describe lines, planes surfaces and curves in space. Numerical methods are gainfully employed by scientists and engineers to solve problems arising in research and industry.

Course Overview and Context:

This course discusses equations of lines and planes in space, introduces elementary methods to find roots of an equation, gives an overview on relation between roots and the coefficients of an equation.

SYLLABUS CONTENT

Module 1

(A quick review) **(20 Hrs)**

Lines and planes in space., Vector functions Arc length and Unit tangent vector, Curvatureand Unit normal vector, torsion and Unit Binormal vector, Directional derivatives and gradient vectors , tangent planes and normal lines (ONLY).

(Sections 12.5, 13.1, 13.3, 13.4, 13.5, 14.5, 14.6(tangent planes and normal lines only)of Text 1)

Module 2

Integration in Vector Fields: (30 Hrs)

Line integrals, Vector fields and line integrals: Work, Circulation and Flux, Path Independence, Conservative Fields and Potential Functions (Proofs of theoremsexcluded), Green's theorem in the plane (Statement and problems only),

Surfaces and Area: Parameterisations of surfaces, Implicit surfaces, Surface integrals, Stokes' theorem (Statement and simple Problems only), Divergence theorem only (Statement and Problems only) Gauss' law onwards are excluded.

(Sections 16.1 to 16.6 and relevant portions from 16.7 & 16.8 of Text 1)

Module 3

Theory of Equations: (20Hrs)

Statement of fundamental Theorem of algebra. Deduction that every polynomial of degree n has n and only n roots. Relation between roots and coefficients. Transformation of equations. Reciprocal equations.

(Chapter 6 - sections 1 to 10,and chapter 12 of text 2)

Module 4

Matrices: (20Hrs)

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non-homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications

(Chapters – 5, 10, 19, 23 of text 3)

Learning Resources:

Text Books:

1. George B. Thomas Jr. (EleventhEdition) – Thomas' Calculus, Pearson, 2008.
2. Bernard and Child - Higher Algebra, AITBS Publishers, India
3. Frank Ayres Jr : Matrices, Schaum's Outline Series, TMH Edition.

References:

- Erwin Kreyszig : Advanced Engineering Mathematics, 8th ed., Wiley.
- H.F. Davis and A.D. Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.

- Shanti Narayan, P.K Mittal – Vector Calculus (S. Chand)
- Merle C. Potter, J. L. Goldberg, E. F. Aboufadel – Advanced Engineering Mathematics(Oxford)
- Ghosh, Maity – Vector Analysis (New Central books)
- QuaziShoebAhamad - Numerical and Statistical Techniques (Ane Books).

Competencies of the course:

- Interpret equations of lines and planes in space
- Explain integration in vector fields.
- Verify Stoke's Theorem, Gauss Divergence Theorem and Green's Theorem.
- Analyse the fundamental theorem of algebra
- Solve equations of nth degree
- Find the equations whose nature of roots is given.
- Interpret the relation between roots and coefficients.
- Apply Descarte's rule of signs to find the number of real and imaginary roots of a given equation.
- Solve system of linear equations using matrices
- Find the characteristic equation of matrices.

QUESTION PAPER PATTERN

MT4B04B18-VECTOR CALCULUS, THEORY OF EQUATIONS AND MATRICES

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	3	2	1	31
II	**30**	3	3	1	36
III	**20**	3	2	1	31
IV	**20**	3	2	1	31
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 5)

FIFTH SEMESTER

MT5B05B18 - HUMAN RIGHTS AND MATHEMATICS FOR ENVIORNMENTAL STUDIES

Credits: 4 Credits

Total Lecture Hours: 72(4 hours /week)

Aims:

Environmental Education aims to students to understand how their decisions and actions affect the environment, builds knowledge and skills necessary to address complex environmental issues, as well as ways we can take action to keep our environment healthy and sustainable for the future, encourage character building, and develop positive attitudes and values. To develop the sense of awareness among the students about the environment and its various problems and to help the students in realizing the inter-relationship between man and environment for protecting the nature and natural resources. To help the students in acquiring the basic knowledge about environment and to inform the students about the social norms that provide unity with environmental characteristics and create positive attitude about the environment.

Course overview and context:

The importance of environmental science and environmental studies cannot be disputed. The need for sustainable development is a key to the future of mankind. Continuing problems of pollution, solid waste disposal, degradation of environment, issues like economic productivity and national security, Global warming, the depletion of ozone layer and loss of biodiversity have made everyone aware of environmental issues. The United Nations Conference on Environment and Development held in Rio de Janero in 1992 and world Summit on Sustainable Development at Johannesburg in 2002 have drawn the attention of people around the globe to the deteriorating condition of our environment. It is clear that no citizen of the earth can afford to be ignorant of environment issues. India is rich in biodiversity which provides various resources for people. Only about 1.7 million living organisms have been described and named globally. Still many more remain to be identified and described. Attempts are made to conserve them in ex-situ and in-situ situations. Intellectual property rights (IPRs) have become important in a biodiversity-rich country like India to protect microbes, plants

and animals that have useful genetic properties. Destruction of habitats, over-use of energy resource and environmental pollution have been found to be responsible for the loss of a large number of life-forms. It is feared that a large proportion of life on earth may get wiped out in the near future. In spite of the deteriorating status of the environment, study of environment have so far not received adequate attention in our academic programme. Recognizing this, the Hon'ble Supreme Court directed the UGC to introduce a basic course on environment at every level in college education. Accordingly, the matter was considered by UGC and it was decided that a six months compulsory core module course in environmental studies may be prepared and compulsorily implemented in all the University/Colleges of India. The syllabus of environmental studies includes four modules including human rights. The first two modules are purely environmental studies according to the UGC directions. The third modules are strictly related with the core subject and fourth module is for human rights.

SYLLABUS CONTENT

Module 1(20Hrs)

Unit 1: Multidisciplinary nature of environmental studies

Definition, scope and importance, Need for public awareness.

Unit 2: Natural Resources

Renewable and non-renewable resources: Natural resources and associated problems.

a) **Forest resources:** Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forest and tribal people.

b) **Water resources:** Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

c) **Mineral resources:** Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) **Food resources:** World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) **Energy resources**: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.

f) **Land resources**: Land as a resource, land degradation, man induced landslides, soil erosion and desertification

- Role of individual in conservation of natural resources.
- Equitable use of resources for sustainable lifestyles.

Unit 3: Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposers
- Energy flow in the ecosystem
- Ecological succession
- Food chains, food webs and ecological pyramids.
- Introduction, types, characteristic features, structure and function of the given ecosystem:- Forest ecosystem

(Relevant sections of text 2 & 3)

Module 2

Unit 1: Biodiversity and its conservation (25Hrs)

- Introduction
- Bio-geograhical classification of India
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- India as a mega-diversity nation
- Hot-sports of biodiversity
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts
- Endangered and endemic species of India

Unit 2: Environmental Pollution

Definition,Causes, effects and control measures of: -

a) Air pollution
b) Water pollution
c) Soil pollution
d) Marine pollution
e) Noise pollution
f) Thermal pollution
g) Nuclear hazards

- Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
- Role of an individual in prevention of pollution
- Pollution case studies
- Disaster management: floods, earthquake, cyclone and landslides.

Unit 3: Social Issues and the Environment

Urban problems related to energy

- Water conservation, rain water harvesting, watershed management
- Resettlement and rehabilitation of people: its problems and concerns, Case studies
- Environmental ethics: Issues and possible solutions
- Climate change, global warming, acid rain, ozone layer depletion , nuclear accidents andholocaust, Case studies
- Consumerism and waste products
- Environment Protection Act
- Air (Prevention and Control of Pollution) Act
- Water (Prevention and control of Pollution) Act
- Wildlife Protection Act
- Forest Conservation Act
- Issues involved in enforcement of environmental legislation
- Public awareness

(Relevant sections of text 2 & 3)

Module 3

Fibonacci Numbers in nature: (10Hrs)

The rabbit problem, Fibonacci numbers, recursive definition, Lucas numbers, Different types of Fibonacci and Lucas numbers. Fibonacci numbers in nature: Fibonacci and the earth, Fibonacci and flowers, Fibonacci and sunflower, Fibonacci, pinecones, artichokes and pineapples, Fibonacci and bees, Fibonacci and subsets, Fibonacci and sewage treatment, Fibonacci and atoms, Fibonacci and reflections, Fibonacci, paraffins and cycloparaffins, Fibonacci and music, Fibonacci and compositions with 1's and 2's (excluding Fibonacci and poetry, Fibonacci and electrical networks)

(Chapters 2 & 3 of text 1) (Excluding Fibonacci and poetry, Fibonacci and electrical networks)

Golden Ratio

The golden ratio, mean proportional, a geometric interpretation, ruler and compass construction, Euler construction, generation by Newton's method. The golden ratio revisited, the golden ratioand human body, golden ratio by origami, Differential equations, Gattei's discovery of golden ratio, centroids of circles.

(Chapters 20, 21 of text 1)

Module 4:

Human rights: (12Hrs)

Unit 1: Human Rights: An Introduction to Human Rights, Meaning, concept and Development, Three Generations of Human Rights (Civil and Political Rights; Economic, Social and Cultural Rights).

Unit 2: Human Rights and United Nations

Contributions, main human rights related organs - UNESCO,UNICEF, WHO, ILO, Declarations for women and children, Universal Declaration of Human Rights.

Human Rights in India

Fundamental rights and Indian Constitution, Rights for children and women, Scheduled Castes, Scheduled Tribes, Other Backward Castes and Minorities

Unit 3: Environment and Human Rights

Right to Clean Environment and Public Safety: Issues of Industrial Pollution, Prevention, Rehabilitation and Safety Aspect of New Technologies such as Chemical and Nuclear Technologies, Issues of Waste Disposal, Protection of Environment

Conservation of natural resources and human rights

Reports, Case studies and policy formulation. Conservation issues of western ghats-mention Gadgil committee report, Kasthurirengan report. Over exploitation of ground water resources, marine fisheries, sand mining etc.

Internal: Field study

- Visit to a local area to document environmental grassland/ hill /mountain
- Visit a local polluted site – Urban/Rural/Industrial/Agricultural Study of common plants, insects, birds etc.
- Study of simple ecosystem-pond, river, hill slopes, etc.

(Field work Equal to 5 lecture hours)

Competencies of the course:

- To understand the importance of environmental science and environmental studies.
- To develop the sense of awareness among the students about the environment and its various problems
- To analyze the inter-relationship between man and environment for protecting the nature and natural resources.
- To create positive attitude about the environment.
- To understand the value of biodiversity.
- To differentiate renewable and non-renewable sources of energy.
- To understand the beauty of Mathematics in nature.
- To analyse Fibonacci numbers and its role in golden spiral.
- To be aware of the rights to clean environment and public safety.

Learning Resources

Text Books:

1. Thomas Koshy: Fibonacci and Lucas numbers with applications, John Wiley & Sons, Inc (2001).
2. BharuchaErach, Text Book of Environmental Studies for undergraduate Courses. University Press, II Edition 2013
3. Miller T.G. Jr., Environmental Science, Wadsworth Publishing Co.

References:

- Clark.R.S., Marine Pollution, Clanderson Press Oxford (Ref)
- Cunningham, W.P.Cooper, T.H.Gorhani, E & Hepworth, M.T.2001Environmental Encyclopedia, Jaico Publ. House. Mumbai. 1196p .(Ref)
- Dc A.K.Enviornmental Chemistry, Wiley Eastern Ltd.(Ref)
- Down to Earth, Centre for Science and Environment (Ref)
- Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge University Press 1140pb (Ref)
- Jadhav.H&Bhosale.V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p (Ref)
- Mekinney, M.L &Schock.R.M. 1996 Environmental Science Systems & Solutions. Web enhanced edition 639p (Ref)
- Odum.E.P 1971. Fundamentals of Ecology. W.B. Saunders Co. USA 574p (Ref)
- Rao.M.N&Datta.A.K. 1987 Waste Water treatment Oxford & IBII Publication Co.Pvt.Ltd.345p (Ref)
- Rajagopalan. R, Environmental Studies from crisis and cure, Oxford University Press, Published: 2016 (TB)
- Sharma B.K., 2001. Environmental Chemistry. Geol Publ. House, Meerut (Ref)
- Townsend C., Harper J, and Michael Begon, Essentials of Ecology, Blackwell Science (Ref)
- Trivedi R.K., Handbook of Environmental Laws, Rules Guidelines, Compliances and Standards, Vol I and II, Enviro Media (Ref)

- Trivedi R. K. and P.K. Goel, Introduction to air pollution, Techno-Science Publication (Ref)
- Wanger K.D., 1998 Environmental Management. W.B. Saunders Co. Philadelphia, USA 499p (Ref)

(M) Magazine (R) Reference (TB) Textbook

Human Rights

- AmartyaSen, The Idea Justice, New Delhi: Penguin Books, 2009.
- Chatrath, K. J.S., (ed.), Education for Human Rights and Democracy (Shimla:Indian Institute of Advanced Studies, 1998)
- Law Relating to Human Rights, Asia Law House,2001.
- Shireesh Pal Singh, Human Rights Education in 21st Century, DiscoveryPublishing House Pvt.Ltd, New Delhi.
- S.K.Khanna, Children and the Human Rights, Common Wealth Publishers,1998-2011.
- SudhirKapoor, Human Rights in 21st Century,Mangal DeepPublications,Jaipur,2001.
- United Nations Development Programme, Human Development Report 2004.
- Cultural Liberty in Today's Diverse World, New Delhi: Oxford University Press,2004.

QUESTON PAPER PATTERN

MT5B05B18 - HUMAN RIGHTS AND MATHEMATICS FOR ENVIORNMENTAL STUDIES

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	4	2	1	33
II	**25**	4	3	1	38
III	**10**	1	2	1	27
IV	**12**	3	2	1	31
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 6)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

FIFTH SEMESTER

MT5B06B18 -REAL ANALYSIS I

Credits: 4 Credits

Total Lecture Hours: 108 (6 hours /week)

Aims:

Real analysis is a branch of mathematical analysis dealing with real numbers and real-valued functions of real variables. In particular, it deals with the analytic properties of real functions and sequences, including convergence and limits of sequences of real numbers, the calculus of the real numbers, and continuity, smoothness and related properties of real valued functions.

Course Overview and Context:

This course provides a systematic approach to the development of the subject Real Analysis. It introduces several fundamental concepts of Real Analysis including the well-orderingprinciple,the completeness axiom, the Archimedean property and the real sequences.Also to the end more abstract notion of a metric space is introduced.

SYLLABUS CONTENT

Module 1 **(18Hrs)**

Intervals, Bounded and unbounded sets, supremum, infimum. Order completeness in R. Archimedian property of real numbers. Dedekinds form of completeness property.

(Sections 2.6, 3, 4.1 ,4.2, 4.3, 4.4 of chapter 1 of text 1)

Module 2 **(30Hrs)**

Neighbourhood of a point. Interior point of a set. Open set. Limit point of a set. Bolzano Weierstrass theorem for sets. Closed sets, closure of a set. Dense sets. Countable and uncountable sets.

(Sections: 1.1,1.2,1.3,2,2.1,2.2,3.1,3.2,3.3,3.4,3.5,4 of chapter 2 of text 1)

Module 3 **(35Hrs)**

Real sequences. The range, bounds of a sequence. Convergence of sequences. Some theorems, limit points of a sequence. Bolzano Weierstrass theorem for sequences. Limit interior and superior. Convergent sequences. Cauchy's general principle of convergence. Cauchy's sequences. Statements of theorem without proof in algebra of sequences. Some important theorems and examples related to them. Monotonic sequences, subsequences.

(Sections : 1.1,to 1.5, 2 to 2.3, 3, 4,6,6.1,7,8, 9, 9.1 of chapter 3 of text 1)

Module 4(25Hrs)

Metric Spaces:

Definitions & examples, Open & Closed Sets, Convergence & Completeness, Continuity & Uniform Continuity

(Section 1 to 4 of chapter 19 of text 1)

Competencies of the course:

- Explain Real number system and some of its basic properties.
- Define the basic concepts needed for real analysis.
- Explain Bolzano Weierstrass theorem for sets.
- Describe Real sequences, its Convergence Some theorems.
- Explain limit points of a sequence.
- Interpret BolzanoWeierstrass theorem for sequences.
- Examine Limit interior and superior.
- Interpret Cauchy's general principle of convergence & Cauchy's sequences.
- Define Monotonic sequences &subsequences.
- DefineMetric Spacesand some of its concepts.

Learning Resources

Text Book:

1. S.C.Malik, SavithaArora - Mathematical analysis. RevisedSecond edition.

References

- Robert G Bartle and Donald R Sherbert –Introduction to real analysis 3rd edition.Wiley

- Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)
- Shanti Narayan – A Course of mathematical analysis , S Chand and Co Ltd(2004)
- Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi(2006)
- J. M .Howie – Real Analysis, Springer 2007
- K.A Ross - Elementary Real Analysis, Springer, Indian Reprint

QUESTION PAPER PATTERN

MT5B06B18 - REAL ANALYSIS I

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**18**	2	2	1	29
II	**30**	4	2	1	33
III	**35**	4	3	1	38
IV	**25**	2	2	1	29
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 7)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

FIFTH SEMESTER

MT5B07B18- DIFFERENTIAL EQUATIONS

Credits: 4 credits

Total Lecture Hours: 108 (6 hours/week)

Aims:

Since the time of Isaac Newton differential equation have been of fundamental importance in the application of Mathematics to the Physical Science. Lately differential equations gained increasing importance in the Biological and Social Science. The integrals of ordinary differential equation are plane curves. Also we should study the differential equation involving one dependent and more than one independent variables that are partial differential equation. Such integrals are space curves and surfaces. Partial differential equation can arise in a variety of ways in Geometry, Physics, ….. etc.

Course Overview and Context:

In this course we are studying the ordinary differential equation involving one independent and one or more dependent variables. The integrals of ordinary differential equation are plane curves. Also we study the differential equation involving one dependent and more than one independent variable that are partial differential equation.

SYLLABUS CONTENT

Module 1

Ordinarydifferential equations: (25Hrs)

Exact differential equations and integrating factors (proof of theorem 2.1 excluded), separable equations and equations reducible to this form, linear equations and Bernoulli equations, special integrating factors and transformations. Orthogonal and oblique trajectories.

(Sections 2.1, 2.2, 2.3, 2.4, 3.1 of Text 1)

Module 2 (30Hrs)

Basic theory of linear differential equations. The homogeneous linear equation with constant coefficients. The method of undetermined coefficients, Variation of parameters, The Cauchy – Euler equation.

(Section 4.1, 4.2, 4.3, 4.4, 4.5 of text 1)

Module 3 (33 Hrs)

Power series solution about an ordinary point, solutions about singular points, the method of Frobenius, Bessel's equation and Bessel Functions, Differential operators and an operator method.

(Sections 6.1, 6.2, 6.3, 7.1 of text 1)

Module 4

Partial Differential equations: (20 Hrs)

Surfaces and Curves in three dimensions, solution of equation of the form $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations, Linear equations of the first order, Lagrange's method

(Chapter 1, section 1 and 3 &Chapter 2, Section 1, 2 and 4 of text 2)

Competencies of the course:

- Recognize exact differential equations.
- Obtain an integrating factor which may reduce a given differential equation into an exact one and eventually provide its solution.
- Obtain the solution of separable equations and equations reducible to this form.
- Identify linear equation, Bernoulli equations and solve them.
- Obtain orthogonal trajectories and Oblique trajectories of families of curve son a given surface.
- Find the complementary function and particular integrals of linear differential equation.

- Derive solution of homogeneous equations with constant coefficient.
- Understand method of variation of parameters.
- Solve Bessel's equations.
- Obtain power series expansion about an ordinary point.
- Method of solution of the differential equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
- Describe the origin of partial differential equation and distinguish the integrals of first order linear partial differential equation into complete, general and singular integrals.
- Use Lagrange's method for solving the first order linear partial differential equation.

Learning Resources:

Text Books:

1. Shepley L. Ross - Differential Equations, 3rd ed., (Wiley India)
2. Ian Sneddon – Elements of Partial Differential Equation (Tata McGraw Hill)

References

- A.H.Siddiqi& P. Manchanda – A First Course in Differential Equation with Applications (Macmillian)
- George. F. Simmons – Differential equation with applications and historical notes (Tata McGraw Hill)
- W.E. Boyce & R.C. Diprima - Elementary Differential Equations and boundary value Problems, (Wiley India)
- S. BalachandraRao& H. Ranuradha – Differential Equation with Applications and Programs (Universities Press)
- R. K. Ghosh& K. C. Maity - An Introduction to Differential Equations (New Central Books Agency)
- B. K. Dutta – Introduction to Partial Differential Equations (New Central Books) Murrary –.Differential Equations. Macmillian
- E.A. Coddington - An Introduction to Ordinary Differential Equation, PHI.
- SankaraRao- Introduction to Partial Differential Equation,2nd edition, PHI.
- ZafarAhsan - Differential Equations and their Applications , 2nd edition, PHI

QUESTON PAPER PATTERN

MT5B07B18 - DIFFERENTIAL EQUATIONS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	25	3	2	1	31
II	30	4	2	1	33
III	33	3	3	1	36
IV	20	2	2	1	29
Total		12	9	4	

MATHEMATICS (CORE COURSE 8)

FIFTH SEMESTER

MT5B08B18- ABSTRACT ALGEBRA

Credits: 4 credits

Total Lecture Hours: 90(5 hours/week)

Aims:

Abstract Algebra is an important branch of Mathematics that has wide applications in almost all branches of Science. Algebra studies the structure of sets with operations on them.This course aims to provide the students with the basic topics ofabstract algebra so as to understand its role in modern mathematics and its applications to otherfields.

Course Overview and Context:

A study of the basic concepts of groups, rings and fields is done. This course also discusses about homomorphism and isomorphism of groups. An introduction to ideals is also included.

SYLLABUS CONTENT

Module 1 **(20Hrs)**

Binary Operations; Isomorphic Binary Structures; Groups; Subgroups

(Sections 2, 3, 4 & 5)

Module 2 **(30Hrs)**

Cyclic Groups; Groups of Permutations; Orbits, Cycles and the Alternating Groups

(Sections 6, 8 & 9)

Module 3 **(25Hrs)**

Cosets and the Theorem of Lagrange; Homomorphisms; Factor Groups; Simple Groups

(Sections 10, 13, 14 15.14 to 15.21)

Module 4 **(15Hrs)**

Rings and Fields; Integral Domains. Ideals and factor rings

(Sections 18, 19, 26)

Learning Resources:

Text Book:

John B.Fraleigh - A first course in Abstract Algebra (7th Edition), Pearson.

References:

- I.N Herstein - Topics in Algebra
- Joseph A Gullian - A Contemporary Abstract Algebra,NarosaPub.House .
- Artin – Algebra , PHI
- P.B Bhattacharya, S. K Jain and S. R . Nagpaul – Basic Abstract Algebra , 2nd edition, Cambridge University Press
- Durbin – Modern Algebra , An introduction , 5th edition , Wiley
- Chatterjee - Abstract Algebra , 2nd edition, PHI
- M. K. Sen, S. Ghosh - Topics in Abstract Algebra (University Press)

Competencies of the Course:

- Define groups, rings and fields.
- Explain different properties of groups.
- Identify examples of groups, rings and fields.
- Explain homomorphism and isomorphism of groups.
- Describe cosets and factor groups.
- Differentiate between the different algebraic structures.
- Solve problems related to groups and rings

QUESTON PAPER PATTERN

MT5B08B18- ABSTRACT ALGEBRA

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	20	2	2	1	29
II	30	4	3	2	53
III	25	4	2	1	33
IV	15	2	2	0	14
Total		12	9	4	

SYLLABUS

OPEN COURSES

MATHEMATICS - OPEN COURSE (a)

FIFTH SEMESTER

MT5D01aB18- APPLICABLE MATHEMATICS

Credits: 3 credits

Total Lecture Hours: 72 (4 hours/week)

Aims:

This course aims to prepare students of all streams, particularly those with arts and commerce back ground to approach competitive examinations and to prepare them for their higher studies. Short cut methods for solving problems are introduced to students, so that they can acquire better understanding of concepts and develop their problem solving skills.

Course Overview and Context:

Open Course is intended to equip students of other streams with the skills of problem solving and logical reasoning. This course introduces the concepts of quadratic equations,Logarithms, Trigonometry, Heights and distances, Probability, Differential Calculus, Area and perimeter of polygons and Elementary Algebra. Knowledge in these areas of Mathematics are necessary for any graduate student to crack any competitive exam.

SYLLABUS CONTENT

Module 1 **(18 Hrs)**

Types of numbers, Quadratic equations (Solution of quadratic equations with real roots only), Logarithms – All rules without proof, Multiplication and division of numbers, Evaluating expressions of the form $x^{p/q}$, x any real number, p & q are integers, Permutations and combinations – simple applications, Trigonometry introduction, Values of trigonometric ratios of 0^0, 30^0, 45^0, 60^0& 90^0, Heights and distances – Simple cases - (application of sinx, cosx, tanx, and their reciprocals only). Two dimensional geometry- Introduction, plotting points and drawing graph of the lines of the form ax + by + c = 0.

Module 2 **(18 Hrs)**

Probability – Introduction – Sample spaces and events, Simple examples like tossing coin, tossing die etc.., Differential Calculus - Differentiation – Standard results (derivatives) without proof, Product rule, Quotient rule and function of function rule, Integral calculus (Integration simple cases, with and without limits)

Module 3 **(18 Hrs)**

HCF and LCM of numbers, Fractions, Squares and square roots, cube and cube roots, simplifications, Ratio and Proportion, Percentage, Profit and loss, Simple average (No Weighed average)

(Sections – 2, 3, 5, 6, 7, 9, 10, 11, 13)

Module 4 **(18 Hrs)**

Simple interest, Compound interest, Time and work, Work and wages, Time and distance, Elementary mensuration – Area and perimeter of polygons

(Sections - 14, 15, 17, 18, 21)

Competencies of the Course:

- Illustrate the types of numbers.
- Describe quadratic equations and its solutions.
- Differentiate between permutations and combinations.
- Tabulate the trigonometric ratios of different angles.
- Compute the heights and distances using trigonometric functions.
- Describe sample spaces and random events.
- Predict the probability of random events.
- Use the rules of differentiation to find the derivatives of functions.
- Evaluate the indefinite and definite integrals of functions.
- Evaluate LCM and HCF of numbers.
- Compute the squares, cubes, square roots and cube roots of numbers.
- Use ratio and proportion to solve problems.
- Evaluate profit and loss of buying and selling problems.
- Calculate the simple average of numbers from a given data.
- Estimate the Simple interest and compound interest on a principal amount.
- Solve problems involving concepts of time and work.

- Evaluate the problems related to work and wages.
- Find the area and perimeter of triangles, quadrilaterals and circles.

Learning Resources:

Text Book:

1. M. Tyra, & K. Kundan- Concepts of Arithmetic, Bsc Publishing Company Pvt.Ltd.

Reference:

- Aggarwal R.S - Quantitative Aptitude, S. Chand & Company Ltd,1989

QUESTION PAPER PATTERN

MT5D01aB18 - APPLICABLE MATHEMATICS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	18	3	2	1	31
II	18	3	2	1	31
III	18	3	2	1	31
IV	18	3	3	1	36
Total		12	9	4	

MODEL QUESTION PAPER

MATHEMATICS OPEN COURSE

MT5D01aB18-APPLICABLE MATHEMATICS

Time:3hrs **Total Marks:80**

PART A

(Answer any **10** questions. Each Question Carries **2** marks.)

1. Find two consecutive even natural numbers such that sum of their squares is 52.
2. Integrate the function $x\sqrt{x+2}$.
3. Draw the graph of $3x+4y=1$.
4. A pair of dice is thrown. What is the probability of getting a sum of 2?
5. The LCM of two numbers is 39780 and their ratio is 13 : 15. Then find the numbers.
6. Evaluate $55\%\text{ of }160 + 24\%\text{ of }50 - 36\%\text{ of }150$.
7. Given $\cot x = \frac{3}{4}$ and x lies in the third quadrant, find the values of $\tan x$ and $\cos x$
8. If 15 men can complete a piece of work in 30 days, in how many days will 18 men complete it?
9. Find the derivative of $\frac{\cos x}{1+\sin x}$.
10. A man walks 22.5 Km in 5hrs. How much he will walk in 4 hours?
11. Find the third proportional to 2 and 32.
12. Raju can do a work in 5 days and Rama can do it in 7 days. How long will they take if both work together?

(2*10=20)

PART B

(Answer any **6** questions. Each question carries **5** marks)

13. Integrate $\frac{2\cos x - 3\sin x}{6\cos x + 4\sin x}$.
14. Ram bought 240 toffees. He gave 4 times of these to his sister and $\frac{5}{12}$ of the remaining to his younger brother. Find how many toffees are still with him.
15. Find the perimeter of a rectangular field whose length is four times its width and which has an area equal to 30976 cm^2.

16. In a school, 20% of the students are below 5 years of age and the number of girls above 5 is $2/3^{rd.}$ of the number of boys above 5 and equal to 64. How many students are there in the school?
17. The area of the square ABCD is 16 cm^2 . Find the area of the square joining the midpoints of the sides.
18. On dividing a certain number by 342, we get 47 as remainder. If the same number is divided by 18, what will be the remainder?
19. Simplify $\dfrac{(893+786)^2-(893-786)^2}{(893\times 786)}$.
20. Four persons are chosen at random from a group of 3 men, 2 women and 4 children. Find the probability that exactly two of them are children.
21. Find the value of x which satisfies the relation $\log_{10} 3+\log_{10}(4x+1)=\log_{10}(x+1)+1$

(5*6=30)

PART C

(Answer any **two** questions. Each question carries **15** marks.)

22. Without using log tables , find the values of

    (a) $\dfrac{1}{2}\log 25-2\log 3+\log 18$.

    (b) $2\log_{10} 5+\log_{10} 8-\dfrac{1}{2}\log_{10} 4$.

23. Differentiate (i) $y=(ax+b)^n(cx+d)^m$ (ii) $y=\dfrac{a+b\sin x}{c+d\cos x}$.

24. (a) A man divided a piece of land among his three sons thus: he gave $35\dfrac{1}{4}$ Square Km to the first, $\dfrac{5}{12}$ of the whole to the second and to the third as much as to the first two together. Find the shares of each.

    (b) If y is the mean proportional between x and z , prove that $xy+yz$ is the mean proportional between x^2+y^2 and y^2+z^2 .

25. Reena borrowed from Kamal certain sum for two years at simple interest. Reena lent this sum to Hamid at the same rate for two years compound interest.at the end of two years she received Rs.110 as compound interest .Find the sum and rate of interest.

(15*1=15)

MATHEMATICS - OPEN COURSE (b)

FIFTH SEMESTER

MT5D01bB18-MATHEMATICAL MODELLING

Credits: 4 credits

Total Lecture Hours : 72 (4 hours/week)

Aims:

This course aims to give knowledge of the basic principles of mathematical modelling by analytical methods as well as by simulation using computers. On completion of this course the students will be able to form mathematical models from various areas of life which include: - Industry, Medicine, Physics, Chemistry, Biology, Astronomy etc.

Content And Course Over view:

Different types of models like Linear growth and decay models, Non-linear growth and decay models, Compartment models are discussed.

Characteristics of mathematical models, Mathematical modelling through geometry, algebra, trigonometry & calculus, Limitations of mathematical modelling are also included.

SYLLABUS CONTENT

Module1

Introduction: (18 Hrs)

Mathematical modelling-what and why? Classification of mathematical models, Characteristics of mathematical models, Mathematical modelling through geometry, algebra, trigonometry & calculus, Limitations of mathematical modelling.

(Chapter-1: Sections 1.1 to 1.9,Page Nos. 1-29 of text 1)

Module 2

Modelling Through First Order: (18 Hrs)

Linear growth and decay models, Non-linear growth and decay models, Compartment models, Modelling in dynamics and Modelling of geometrical problems.

(Chapter-2: Sections 2.1 to2.6, Page Nos.30 -52 of text 1)

MODULE 3

System Simulation: (18 Hrs)

Introduction, Examples, Nature of simulation, Simulation of a chemical reactor, Euler and Runge-Kutta integration formulae, Simulation of a water reservoir system,

Simulation of a servo system. (Write and execute all the computer programs throughout this course using C)

(Chapter-1: Sections 1.1 to 1.7 & Chapter-2: Sections 2.1 to 2.6 and 2.9 Page Nos. 1-39 of text 2)

Module 4

Discrete System Simulation: (18Hrs)

Fixed time-step vs. event-to-event model, on simulating randomness, Monte-Carlo computation vs. stochastic simulation, Rudiments of queuing theory, Simulation of a single-server queue.

(Chapter 3: Sections 3.1 to 3.7 and Chapter4: Sections 4.1 & 4.2 Page Nos. 40 to 76 of text 2)

Learning Resources:

Text Books:

1. Mathematical modelling- J.N.Kapoor, New Age International, 2001 Reprint.
2. System simulation with digital computer- NarsingDeo, Prentice Hall of India, Sixth printing, 1996.

References:

- System simulation – Geoffrey Gordon, Prentice Hall of India, Second edition.
- Mathematical modeling for industry and engineering- Thomas Svobodny, Prentice Hall.
- Mathematical modeling- F.R.Giordano, M.D.Weir&WilliamP.Fox, Third edition.
- A practical course in differential and mathematical modeling- Ibragimov N.H, Alga Publications.

QUESTION PAPER PATTERN

MT5D01bB18-MATHEMATICAL MODELLING

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**18**	3	2	1	31
II	**18**	3	2	1	31
III	**18**	3	2	1	31
IV	**18**	3	3	1	36
Total		**12**	**9**	**4**	

MATHEMATICS OPEN COURSE (c)

FIFTH SEMESTER

MT5D01cB18-FINANCIAL MATHEMATICS

Credits: 4 credits

Total Lecture Hours: 72 (4 hours/week)

Aims:

This course is a combination of mathematical and financial concepts courses aimed at an understanding of the principles of mathematical models of financial markets.

Course overview and context:

Financial Mathematicsis a field of applied mathematics, concerned with mathematical modeling of financial markets. Generally, mathematical finance will derive and extend the mathematical or numerical models without necessarily establishing a link to financial theory. Mathematical consistency is required, not compatibility with economic theory. The yield on a fund and measurement of investment performance,Valuation of securities,Capital Gains Tax are some of the topics dealt with in this course.

SYLLABUS CONTENT

Module 1 **(18Hrs)**

Theory of interest rates : Rate of interest – Accumulation factors – Force of interest and Stoodley's formula for the force of interest. Basic Compound interest relations: Relationships between s, i, v, and d – The equation of value and yield on a transaction.Annuity certain: Present values and accumulations – Loan schedule for a level annuity – Continuously payable annuities and varying (increasing and decreasing) annuities. Nominal rates of interest: Annuities payable p –thly- present values and accumulations- Loan schedule for p-thly annuities.

Module 2 **(18Hrs)**

Discounted cash flow: Net percent values and yields – The comparison two investment projects – The effects of inflation – The yield on a fund and measurement of investment performance. Capital Redemption Policies: Premium calculations- Policy values, Surrnder values, paid-up policy values and policy alterations, Stood ley's logistic model for the force of interest, reinvestment rates.

Module 3 **(18Hrs)**

Valuation of securities: Fixed interest securities – Ordinary shares, prices and yields, perpetuities – Mak ham's formula, optional redemption dates – Effect of the term to redemption on the yield – Real returns and index linked stocks. Capital Gains Tax: Valuing a loan with allowance for capital gains tax - capital tax when the redemption price of the rate of tax is not constant - Finding the yield when there is capital gains tax - optional redemption dates – Offsetting capital losses against capital gains.

Module 4 **(18Hrs)**

Cumulative Sinking Funds (Restricted coverage): The relationships between successive capital repayments – the term of the loan when the redemption price is constant.

Competencies of the course:

- To understand Valuation of securities.
- To calculate Capital Gains Tax.
- To analyze Capital Redemption Policies.
- To compare the relationships between successive capital repayments.

Learning Resources:

Text Book:

1. Mc Cutch eon and Scot Heinemann, *An introduction to the Mathematics of Finance*, Professional publishing.

References:

- Sheldon M.Ross- An *Introduction to Mathematical Finance*, Cambridge University Press.
- John C. Hull - *Options, Futures, and other Derivatives*, Prentice Hall of India Pvt Ltd.
- Salih N. Neftci - *An Introduction to the Mathematics of Financial Derivatives*, Academic press.
- Robert J Elliot and P Ekkehard Kopp - Mathematics *of Financial Market*, Springer- Verlag, New York Inc.
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QUESTION PAPER PATTERN

MT5D01cB18-FINANCIAL MATHEMATICS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	18	3	2	1	31
II	18	3	2	1	31
III	18	3	2	1	31
IV	18	3	3	1	36
Total		12	9	4	

MATHEMATICS- OPEN COURSE (d)

FIFTH SEMESTER

MT5D01dB18-MATHEMATICAL ECONOMICS

Credits: 4 credits

Total Lecture Hours : 72 (4 hours/week)

Aims:

Mathematical economics is the application of mathematical methods to represent theoriesand analyze problems to investigate economic quandaries.

Course overview and context:

The use of mathematics in economics involves differentialcalculus, geometry, and matrix algebra among others.This course helps the students to make assumptionsregardingsupply and demand, analyze economic problems and provide solutions to those problems.

SYLLABUS CONTENT

Module 1

Demand and Supply Analysis: (18Hrs)

Utility and demand – the meaning of demand and quantity demanded – the law of demand – demand curve – market demand curve – reasons for the law of demand – slope of a demand curve – shifts in demand – demand function and demand curve – the meaning of supply – supply function – law of supply – slope of a supply curve – shifts in supply – market equilibrium – price elasticity of demand – measurement of price elasticity – arc elasticity of demand – cross elasticity of demand.

(Relevant sections chapters 5 and 7 of Text 1)

Module 2

Cost and Revenue Functions: (18Hrs)

Cost function: Average and marginal costs, Short run and long run costs, Shapes of average cost curves in the short run and long run and its explanation, Revenue function, Marginal revenue (MR) and Average Revenue (AR) functions, Relation between MR, AR and Elasticity of demand.

(Relevant sections of chapter 19 & 21 of Text 1)

Module 3

Theory of Consumer Behaviour: (18Hrs)

Cardinal utility analysis – the Law of diminishing marginal utility – the Law of equi-marginal utility – Indifference curves – Ordinal utility – Indifference map – Marginal rate of substitution – Properties of indifference curves.

(Relevant sections of chapters 9 and 11 of Text 1)

Module 4

Economic Applications of Derivatives: (18Hrs)

Economic Applications of Derivatives. Marginal, average and total concepts optimizing economic functions - Functions of several variables and partial derivatives, Rules of partial differentiation, Second order partial derivatives, Optimization of multivariable functions, Constrained optimization with Lagrange multipliers, Significance of the Lagrange multiplier, Total and partial derivatives – total derivatives.

Marginal productivity, Income determination, multipliers and comparative statics, Income and cross elasticity of demand, Optimization of multivariable function in Economics constrained optimization of multivariable functions in Economics.

(Chapter 4 – Sections 4.7 and 4.8; chapter 5 and chapter 6 sections 6. 1 to 6.5 of text 2).

Competencies of the course:

- To Analyse and interpret the demand curve.
- To understand the relation between MR, AR and Elasticity of demand.
- To familiarize with the Law of diminishing marginal utility and the Law of equi-marginal utility.
- To use partial derivatives to find optimal solutions to economic and business problems.

Learning Resources:

Text Books:

1. H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand

2. Edward T. Dowling: Introduction to Mathematical Economics, Schaum's Outline Series, Third edition, TMH.

References:

- Singh, Parashar, Singh --*Econometrics & Mathematical Economics*, S. Chand & Co. 1997.
- R.G.D. Allen - Mathematical Analysis for Economists, Macmillan, ELBS.
- Edward T. Dowling - Introduction to Mathematical Economics, Third edition, Schaum'sOutline Series, TMH.
- Henderson &Quandt - Microeconomic Theory: A Mathematical Approach, 3rd Edition, TMH.
- Taro Yamane - Mathematics for Economists: An elementary survey. Second Edition, PHI.
- SrinathBaruah - Basic Mathematics and its Application in Economics, Macmillan.

QUESTION PAPER PATTERN

MT5D01cB18-FINANCIAL MATHEMATICS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**18**	3	2	1	31
II	**18**	3	2	1	31
III	**18**	3	2	1	31
IV	**18**	3	3	1	36
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 9)

COMMON FOR B.SC MATHEMATICS AND B.SC COMPUTER APPLICATIONS

SIXTH SEMESTER

MT6B09B18- REAL ANALYSIS II

Credits: 4 Credits

Total Lecture Hours: 108(6 hours/week)

Aims:

This course aims to define Infinite Series, its convergence and some tests to identify the nature of convergence, Continuous functions and some theorems on continuity. It also introduces Riemann Integration, Uniform Convergence of sequence of functions and some tests for it.

Course Overview and Context :

This course covers the fundamentals of mathematical analysis: convergence of sequences and series, continuity, differentiability, Riemann integral, sequences and series of functions, uniformity, and the interchange of limit operations. It shows the utility of abstract concepts and teaches an understanding and construction of proofs.

SYLLABUS CONTENT

Module 1
Infinite Series:(30 Hrs)

A necessary condition for convergence. Cauchy`s general principle of convergence for a series. Positive term series. A necessary condition for convergence of positive term series. Geometric series. The comparison series $\sum\frac{1}{hP}$ comparison test for positive term series without proof. Cauchy`s root test D'ALEMBERTÈS RATIO test. Raabe's test. Gauss`s test. Series with arbitrary terms. Alternating series. Absolute convergence

(Section 1.1 to 1.4,2 ,2.1 to 2.3,3,4,5,6,9,10,10.1,10.2 of chapter 4 of Text 1)

Module 2

Continuous functions: (25 Hrs)

Continuous function (a quick review). Continuity at a point, continuity in an interval.

Discontinuous functions. Theorems on continuity. Functions continuous on closed intervals. Uniform continuity.

(Section 2.1 to 2.4 ,3,4 of chapter 5 of Text 1)

Module 3

Riemann Integration: (35Hrs)

Definitions and existence of the integral. Inequalities of integrals. Refinement of partitions of integrability. Integrability of the sum of integrable functions. The integrals as the limit of a sum. Some applications. Some integrable functions. Integration and differentiation. The fundamental theorem of calculus.

(Section 1 to 9 of chapter 9 of Text 1)

Module 4:

Uniform Convergence: (18Hrs)

Point wise convergence. Uniform convergence on an interval. Cauchy`s criterion for uniform convergence. A test for uniform convergence of sequences. Test for uniform convergence of series. Weierstrass`s M-test, Abel`s test. Statement of Dirichelet`s test without proof.

(Section 1 to 3.2 of Text 1)

Competencies of the course:

- Define infinite series of real numbers and its convergence.
- Explain some tests to identify nature of convergence of infinite series.
- Describe Continuous functions and some theorems on continuity.
- Introduce Riemann Integration.
- Explain the fundamental theorem of calculus.
- Describe Uniform Convergence of sequence of functions.
- Explain tests for uniform convergence of sequences and series.

Learning Resources:

Text Book:

1. S.C.Malik, SavithaArora _ Mathematical analysis. Revised Second edition.

References:

- 1.Robert G Bartle and Donald R Sherbert –Introduction to real analysis 3rd edition.Wiley

- Richard R Goldberg – Methods of real analysis 3rd edition , Oxford and IBM Publishing Co (1964)
- Shanti Narayan – A Course of mathematical analysis, S Chand and Co Ltd(2004)

4.Elias Zako – Mathematical analysis Vol1, Overseas Press, New Delhi(2006)

- 5.J. M .Howie – Real Analysis, Springer 2007
- 6.K.A Ross - Elementary Real Analysis, Springer, Indian Reprint

QUESTION PAPER PATTERN

MT6B09B18 - REAL ANALYSIS II

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	30	3	2	1	31
II	25	3	2	1	31
III	35	4	3	1	38
IV	18	2	2	1	29
Total		12	9	4	

MATHEMATICS (CORE COURSE 10)

SIXTH SEMESTER

MT6B10B18 - COMPLEX ANALYSIS

Credits: 4 credits
Total Lecture Hours: 90 (5 hours/week)

Aims:

Toexplain the fundamental ideas of Analytic functions, introduce elementary complex functions, discuss basic methods of complex integration, discuss power series expansion of analytic functions.

Course Overview and Context:

This course introduces the concepts analytic function, elementary complex functions, and their properties, basic methods of complex integration and its applications in contour integration

SYLLABUS CONTENT

Module 1 **(30 Hrs)**

Regions in the complex plane.

Analytic functions:

Functions of a complex variable – limits-theorems on limits-continuity – derivatives-differentiation formulas-Cauchy-Riemann equations-sufficient condition for differentiability-analytic functions examples-harmonic functions.

Elementary functions:

Exponential function –logarithmic function –complex exponents –trigonometric functions- hyperbolic functions- inverse trigonometric and hyperbolic functions.

(Chapter1- section 11,Chapter2-sections12, 15,16, 18 to 22, 24, 25, 26

Chapter 3 - sections 29, 30, 33 to 36)

Module 2 **(25 Hrs)**

Integrals:

Derivatives of functions –definite integrals of functions –contours –contour integrals – some examples –upper bounds for moduli of contour integrals –ant derivates –Cauchy-Goursat theorem (without proof)- simply and multiply connected domains- Cauchy's

integral formula- an extension of Cauchy's integral formula- Liouville's theorem and fundamental theorem of algebra- maximum modulus principle.

(Chapter 4-sections 37to 41, 43, 44, 46, 48 to 54)

Module 3 **(15 Hrs)**

Series:

Convergence of sequences and series -Taylor's series -proof of Taylor's theorem-examples- Laurent's series (without proof)-examples.

(Chapter 5-sections 55 to 60 & 62)

Module 4 **(20 Hrs)**

Residues and poles:

Isolated singular points –residues –Cauchy's residue theorem –three types of isolated singular points-residues at poles-examples –evaluation of improper integrals – example –improper integrals from Fourier analysis –Jordan's lemma (statement only) –definite integrals involving sines and cosines.

(Chapter 6 - sections 68 to74 (except71),Chapter 7 - sections 78 to 81 & 85)

Competencies of the course:

- Distinguish complex variables and complex functions.
- Describe complex functions and identify them as transformations.
- Interpret the limit of complex functions.
- Interpret continuity at a point and continuity in a region of complex functions.
- Understand differentiability of complex functions.
- Recognize differentiability implies continuity but continuity need not imply differentiability.
- Describe Cauchy-Riemann equations, and use them to distinguish between differentiable and non-differentiable functions.
- Understand analytic functions and entire functions.
- Describe harmonic functions and utilize the property to verify differentiability.
- Know elementary functions and their properties.
- Understand the theory and techniques of complex integration.
- Recognize that contour integrals of complex functions are path dependent except in certain cases.

- Interpret Cauchy-Goursat Theorem, Cauchy's Integral formula, Cauchy's inequality Theorem, Liouvilles theorem, Maximum-Modulus principle and apply these properties for integration.
- Understand the theory and application of the power series expansion of analytic functions.
- Derive power series expansion of analytic function using Taylor's theorem or Laurent's Theorem.
- Distinguish between singular points, non-singular points isolated singularities and non-isolated singularities.
- Characterise singularities.
- Evaluate residue of functions at isolated singular points.
- Calculate integrals of the form $\int_0^{2\pi} f(\sin\theta, \cos\theta)d\theta$, $\int_{-\infty}^{\infty} f(x)dx$, $\int_{-\infty}^{\infty} f(x)\cos x\, dx$ and $\int_{-\infty}^{\infty} f(x)\sin x\, dx$.

Learning Resources:

Text Book:

1.James Ward Brown &RuelV. Churchill- Complex variables and applications (8^{th} edition)

References

- Lars V. Ahlfors - Complex Analysis – An Introduction to the Theory of Analytic Functions of one Complex Variables (4^{th} edition), (McGRAW-HILL).
- Shanti Narayan - Theory of functions of a complex variable.
- Kasana - Complex Variables: Theory and Applications, 2^{nd} edition.
- B. Choudhary- The Elements of Complex Variables.
- A. David Wunsch – Complex Analysis with Applications (Pearson).
- RohitKhurana – ITL ESL -- Complex Analysis (Pearson).

QUESTION PAPER PATTERN

MT6B10B18 - COMPLEX ANALYSIS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**30**	5	3	1	40
II	**25**	3	3	1	36
III	**15**	2	1	1	14
IV	**20**	2	2	1	29
Total		**12**	**9**	**4**	

MATHEMATICS (CORE COURSE 11)

SIXTH SEMESTER

MT6B11B18- GRAPH THEORY AND FUZZY MATHEMATICS

Credits: 4 credits

Total Lecture Hours : 90 (5hours/week)

Aims:

Graph theory is acknowledged as an important subject in the under graduate mathematics curriculum. Graph theory has a surprising number of applications, not just to computer science but to many other sciences (physical, biological and social),engineering and commerce.

Course Overview and Context:

This course introduces the basic concepts of graph theory. A detailed explanation of different types of graphs and their properties is included.

SYLLABUS CONTENT

Module 1 **(25 Hrs)**

An introduction to graph. Definition of a Graph, Graphs as models, More definitions, Vertex Degrees, Sub graphs, Paths and cycles, The matrix representation of graphs (definition & example only)

(Section 1.1 to 1.7 of text 1)

Module 2 **(20 Hrs)**

Trees and connectivity. Definitions and Simple properties, Bridges, Spanning trees, Cut vertices and connectivity. Euler Tours and Hamiltonian Cycles .Euler's Tours, The Chinese postman problem.

(Section 2.1, 2.2, 2.3, 2.6, 3.1(algorithm deleted) 3.2(algorithm deleted)of text 1)

Module 3 **(20 Hrs)**

Introduction, Crisp Sets: An Overview, Fuzzy Sets: Basic Types, Fuzzy Sets: Basic concepts. Additional properties of αcuts, Representation of fuzzy sets

(Chapter 1 – 1.1, 1.2, 1.3 and 1.4 and Chapter 2– 2.1, 2.2 , 2.3 of Text 2)

Module 4

Operations on Fuzzy Sets: (25hrs)

Types of Operations, Fuzzy complements, Fuzzy intersections: t – norms, Fuzzy Unions: t – conorms, Combinations of operations.(Theorems 3.7, 3.8 Statement only, excluding lemma 3.1, 3.2, theorems 3.11,3.13, 3.16,3.18)

(Chapter 3 – 3.1, 3.2, 3.3, 3.4, 3.5 of Text 2)

Competencies of the course.

- Describe the basic concepts of graph theory
- Construct different types of graphs
- Identify trees, paths and cycles in graphs.
- Solve various real life problems graphically.
- Understand the basic concepts of Fuzzy mathematics
- Differentiate between crisp sets and fuzzy sets
- Manipulate fuzzy operations on fuzzy sets

Learning Resources:

Text books:

1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers
2. George J. Klir and BoYuan, - *Fuzzy Sets and Fuzzy Logic Theory and Applications'*, Prentice Hall of India Private Limited New Delhi, 2000.

Reference:

- Douglas B West ,Peter Grossman - Introduction to Graph Theory
- W.D.Wallis - A Beginner's Guide to Discrete Mathematics, Springer
- R. Balakrishnan, K. Ranganathan - A textbook of Graph Theory, Springer International Edition
- S.Arumugham, S. Ramachandran- Invitation to Graph Theory, Scitech. Peter Grossman,
- S. A. Choudam –A First Course in Graph Theory (Macmillian)

- P.P.G Dyke -An Introduction to Laplace Transforms and Fourier Series,Springer (India) Pvt Ltd
- D.V.Widder-The Laplace Transform, Dover Publications Inc.

QUESTON PAPER PATTERN

MT6B11B18- GRAPH THEORY AND FUZZY MATHEMATICS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	25	3	2	1	31
II	20	4	3	1	38
III	20	3	2	1	31
IV	25	2	2	1	29
Total		12	9	4	

MATHEMATICS (CORE COURSE 12)

SIXTH SEMESTER

MT6B12B18-LINEAR ALGEBRA

Credits: 4 credits

Total Lecture Hours: 90 (5 hours/week)

Aims: In the latter half of the twentieth century no area of mathematics has been more successful than that of Linear Algebra. Linear Algebra has wide applications in mathematical modelling in economics, operations research, stochastic process and probability theory. Many of the concepts of Linear Algebra are abstract. This course aims to introduce the students to formal deductive analysis, formulation of proofs and sharpen the logical reasoning skills.

Course Overview and Context:

The Matrix the most concrete structure in Linear Algebra. This course revises the concepts of Matrix Algebra. Vector spaces and concepts of basis and dimension which lay the foundations of Linear algebra are introduced. Properties of linear transformations, eigen values, eigen vectors and Euclidean inner product are covered in detail.

SYLLABUS CONTENT

Module 1 **(30Hrs)**

Vector spaces: Vectors, Subspace, Linear Independence, Basis and Dimension, Row Space of a Matrix, Rank of a matrix (Theorem statements and problems only of 2.6) .

(Chapter 2 - Sections 2.1, 2.2, 2.3, 2.4, 2.5, 2.6 (Statements and problems only of 2.6)of text 1)

Module 2 **(35Hrs)**

Linear Transformations: Functions, Linear Transformations, Matrix Representations, Change of Basis, Properties of Linear Transformations.

(Chapter 3 - Sections 3.1, 3.2, 3.3, 3.4, 3.5 of text 1)

Module 3 **(20 Hrs)**

Eigen vectors and eigen values, properties of eigen values and vectors, Diagonalization of Matrix

(Chapter 4 - Sections 4.1,4.2,4.3)

Module 4 **(5 Hrs)**

Euclidean Inner product – orthogonality.

(Chapter 5 - Sections 5.1)

Competencies of the course

- Define vector spaces and sub spaces.
- Differentiate between linearly independent and linearly dependent set of vectors.
- Define span of a set.
- Illustrate the concept basis and dimension of vector spaces.
- Define Linear transformations.
- Determine matrix representations of linear transformations.
- Illustrate the properties of linear transformations.

Learning Resources:

Text Book :

1. Richard Bronson, Gabriel B. Costa- Linear Algebra An Introduction (Second Edition), Academic Press 2009, an imprint of Elsevier.

References:

- I. N. Herstein – Topics in Algebra, Wiley India.
- Harvey E. Rose - Linear Algebra, A Pure Mathematical Approach, Springer.
- Devi Prasad, - Elementary Linear Algebra,Narosa Publishing House.
- K. P. Gupta – Linear Algebra, PragathiPrakashan.
- Promode Kumar Saikia – Linear Algebra, Pearson.
- Derek J. S. Robinson – A Course in Linear Algebra with Applications, Allied.
- Singaravalu - Differential Equations, Fourier Series and Laplace Tranforms.
- Hanna, J.R and J.H Rowland, Fourier Series, Transforms and Boundary Value Problems, 2nd Ed. New York, Wiley,1990.

QUESTON PAPER PATTERN

MT6B12B18-LINEAR ALGEBRA

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**30**	2	3	1	34
II	**35**	3	3	2	51
III	**20**	4	2	1	33
IV	**5**	3	1	0	11
Total		**12**	**9**	**4**	

SYLLABI FOR

CHOICE BASED COURSES

MATHEMATICS (CHOICE BASED COURSE 13 a)

SIXTH SEMESTER

MT6B13aB18 - OPERATIONS RESEARCH

Credits: 4 credits

Total Lecture Hours: 72 (4 hours/week)

Aims:

Operations Research (OR) is a science which deals with problem, formulation, solutions and finally appropriate decision making. The programming which involves functions and constraints that are linear is popularly known as Linear Programming. It is one of the most widely used Operation Research (OR) tool. The main aim of this course is to present the different methods of solving Linear Programming problems. These methods are extensively used in different areas of Management, Business, Industry and in various other real life situations.

Course Overview and Context:

The present course examines the basic ideas about LPP and the different methods for solving them. An introduction to Queuing theory is also included.

SYLLABUS CONTENT

Module 1

Linear Programming - Model formulation and solution by the Graphical Method and the Simplex method: (20Hrs)

General Mathematical Model of LPP, Guidelines on linear Programming model formulation andexamples of LP Model formulation.Introduction to graphical method, definitions, Graphicalsolution methods of LP Problems, Special cases in linear Programming, Introduction to simplexmethod, Standard form of an LPP, Simplex algorithm(Maximization case),Simplex algorithm(Minimization case),The Big M Method, Some complications and their resolution, Types oflinear Programming solutions.

(Chapter 2: Sections 2.6 to 2.8,Chapter 3: Sections 3.1 to 3.4,Chapter 4: Sections 4.1 to 4.6)

Module 2

Duality in Linear Programming: (12 Hrs)

Introduction, Formulation of Dual LPP, standard results on duality, Advantages of Duality,Theorems of duality with proof **(theorems 5.1, 5.2, 5.3 only)**

(Chapter 5: Sections: 5.1 to 5.3, 5.5)

Module 3

Transportation and Assignment Problems: (22 Hrs)

Introduction, Mathematical model of Transportation Problem, The Transportation Algorithm,Methods for finding Initial solution, Test for optimality, Variations in Transportation Problem,Maximization Transportation problem,Introduction and mathematical models of Assignmentproblem, Solution methods of Assignment problem, variations of the assignment problem.

(Chapter9: Sections 9.1 to 9.7, Chapter 10: sections 10.1 to 10.4)

Module 4

Theory of Games: (18 Hrs)

Introduction, Two-person zero sum games, pure strategic (Minimax and Maximin principles),Games with saddle point, mixed strategies, Games without saddle point, The rules ofdominance, solution methods: Games without saddle point (Arithmetic method, Matrix method,Graphical method and Linear programming method)

(Chapter 12: Section 12.1 to 12.6)

Competencies of the Course:

On completion of this course, successful students will be able to:

- Define a Euclidean space, a vector space and its basis.
- Express a given LPP in standard form and in a canonical form
- Identify a feasible solution, a basic feasible solution, and an optimal solution using simplex method.

- Identify the Transportation Problem and formulate it as an LPP and hence solve the problem
- Determine that an Assignment problem is a special case of LPP
- Analyze the theory of games

Learning resources:

Text Book:

1. J.K Sharma-Operations Research- Theory And Applications, Macmillan Publishers, India Ltd.

References:

- KantiSwarup, P.K Gupta and Man Mohan-Operations Research (Sultan Chand and sons)
- Frederick S Hillier and Gerald J. Lieberman -Introduction to operations research(Seventh edition), McGraw Hill edition.
- Hamdy A Taha-Operations Research-An introduction (seventh edition), PrenticeHall of India Pvt.Ltd.

QUESTON PAPER PATTERN

MT6B13aB18- OPERATIONS RESEARCH

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	5	4	1	45
II	**12**	1	2	-	12
III	**22**	4	2	2	48
IV	**18**	2	1	1	24
Total		**12**	**9**	**4**	

ST.TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

SIXTH SEMESTER B.Sc.MATHEMATICS

MODEL QUESTION PAPER

MT5B13aB18- OPERATIONS RESEARCH

Time: 3 hours **Max Marks:80**

Part A

(Answer any **TEN** questions, each one carries **2** Marks)

1. Differentiate between slack and surplus variable.
2. What is a Primal Problem in a linear programming problem?
3. Mention the two phases in two-phase simplex method.
4. Define basic feasible solution in a linear programming problem.
5. Define General Linear Programming Problem.
6. Define duality in a linear programming problem.
7. An Assignment problem is a special case of a Transportation problem. True or False.
8. Define loop in transportation array.
9. What do you mean by degeneracy in Transportation problem?
10. What is Balanced Transportation problem?
11. What is game theory?
12. Distinguish between pure and mixed strategies.

(10×2=20)

Part B

(Answer any **SIX** questions, each one carries **5** Marks)

13. Write the following linear programming problem in standard form.
    $Max\ f(x) = 2x_1 + x_2 - x_3$ subject to $2x_1 - 5x_2 + 3x_3 \leq 4, 3x_1 + 6x_2 - x_3 \geq 2$
    $x_1 \geq 0, x_3 \geq 0, x_2$is unrestricted in sign.
14. Define a LPP. Briefly explain how a linear programming problem can be solved graphically.
15. Show that the following system of linear equations has degenerate solution $2x_1 + x_2 - x_3 = 2, 3x_1 + 2x_2 + x_3 = 3$
16. Solve the following LPP using graphical method.
    Minimize $z = 4x_1 + 2x_2$ subject to $x_1 + 2x_2 \geq 2, 3x_1 + x_2 \geq 3, 4x_1 + 3x_2 \geq 6,$
    $$x_1, x_2 \geq 0.$$
17. Solve using Dual Simplex Method:$Min\ z = x_1 + 3x_2 + 2x_3$ subject to$4x_1 - 5x_2 + 7x_3 \leq 8, 2x_1 - 4x_2 + 2x_3 \geq 2$

$x_1 - 3x_2 + 2x_3 \leq 2$, $x_1 \geq 0, x_2 \geq 0$.

18. Show that the dual of the dual is the primal.
19. Solve the following transportation problem:

	D1	D2	D3	D4	Supply
	11	13	17	14	250
	16	18	14	10	300
	21	24	13	10	400
Demand	200	225	275	250	

20. Solve the following Assignment problem:

	M_1	M_2	M_3
J_1	7	4	3
J_2	10	6	8
J_3	9	5	4

21. What are steps involved in the solution of $2 \times n$ and $m \times 2$ games?

(6×5=30)

Part C

(Answer any **Two** questions, each one carries **15** marks)

22. i) Explain the steps involved in principle of dominance.

ii) Solve the following game:

	B_1	B_2	B_3
A_1	15	2	3
A_2	6	5	7
A_3	-7	4	0

23. Solve the transportation problem for minimum cost

	S_1	S_1	S_1	
S_1	2	2	3	10
S_2	4	1	2	15
S_3	1	3	1	40
	20	15	30	

24. Find the minimum cost solution for the following assignment problem:

	1	2	3	4	5
1	-2	-4	-8	-6	-1
2	0	-9	-5	-5	-4
3	-3	-8	-9	-2	-6
4	-4	-3	-1	0	-3
5	-9	-5	-8	-9	-5

25. Solve by graphically and using simplex method.
$max: z = 10x_1 + 6x_2$, subject to$4x_1 + 5x_2 \leq 10, 10x_1 + 3x_2 \leq 15,$
$3x_1 + 8x_2 \leq 12,\ x_1, x_2 \geq 0.$

(2×15=30)

MATHEMATICS (CHOICE BASED (13 b))

SIXTH SEMESTER

MT6B13bB18 - INTEGRAL TRANSFORMS

Credits: 4 credits

Total Lecture Hours: 72 (4hours/week)

Aims:

Laplace Transforms constitute an important tool in solving problems that involve differential equations. Applications of the theory of transforms and integrals are used in fields of Physics, Engineering and Applied Mathematics. The course aims to describe the fundamental ideas of graph theory, identify different types of graphs, explain Laplace Transforms and illustrate the uses of Laplace Transform in differential equations.

Fourier series constitute an important tool in solving problems that involve ordinary and partial differential equations. Applications of the theory of Fourier series, transforms and integrals are used in fields of Physics, Engineering and Applied Mathematics

Course Overview and Context:

An introduction to Laplace Transform and its applications in differential equations is discussed. Fourier series representations of periodic functions in terms of sine and cosine functions are introduced. Fourier transforms and integrals extend the ideas and techniques of Fourier series to non-periodic functions. .

SYLLABUS CONTENT

Module 1 **(20 Hrs)**

Laplace Transform, Inverse Transform, Linearity, Shifting, Transforms of Derivatives and Integrals, Differential Equations, Differentiation and Integration of Transforms, Convolution, Integral Equations, Partial Fractions, Systems of Differential Equations (Section 5.1, 5.2, 5.4, 5.5, 5.6, 5.7)

Module 2 **(18 Hrs)**Fourier Series- Fourier Coefficients, Even and odd functions, half range Expansions

(Chapter10: Sections 10.1, 10.2, 10.3, 10.4)

Module 3 **(14Hrs)**

Fourier Integrals and Transforms- Fourier integrals, Fourier cosine and sine transforms

(Chapter 10: Sections 10.8, 10.9)

Module 4 **(20 Hrs)**

Modelling: vibrating string, wave equations, Separation of variables, use of Fourier series, D' Alembert's Solution of the wave equation, heat equation: solution by Fourier integrals and transforms.

(Chapter 11: Sections 11.1, 11.2, 11.3, 11.4, 11.5, 11.6)

Competencies of the course:

- Compute Laplace transforms of different functions.
- Determine the solutions of differential equations by Laplace transform.
- Compute Fourier series of periodic functions.
- Evaluate Fourier integrals of functions.
- Evaluate Fourier transforms of functions.
- Understand the mathematical modeling of wave equations.
- Understand the mathematical modeling of heat equations.
- Find the solutions of partial differential equations using separation of variables.
- Find the solutions using D' Alembert's method.
- Find the solutions of heat equations using Fourier series.
- Find the solutions of heat equations using Fourier integrals and transforms.

Learning Resources:

Text Book:

1. Erwin Kreyzig – Advanced Engineering Mathematics- 8th Edition

References:

- P.P.G Dyke -An Introduction to Laplace Transforms and Fourier Series,Springer (India) Pvt Ltd.
- D.V.Widder-The Laplace Transform, Dover Publications Inc.
- Singaravalu - Differential Equations, Fourier Series and Laplace Tranforms.
- Hanna, J.R and J.H Rowland, Fourier Series, Transforms and Boundary Value Problems, 2nd Ed. New York, Wiley,1990.

QUESTION PAPER PATTERN

MT6B13bB18 – INTEGRAL TRANSFORMS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	**20**	3	4	1	41
II	**18**	3	1	1	26
III	**14**	2	1	1	24
IV	**20**	4	3	1	38
Total		**12**	**9**	**4**	

SYLLABI OF MATHEMATICS

FOR

COMPLEMENTARY COURSES

TO

PHYSICS AND CHEMISTRY

(Effective from 2018 admission onwards)

MATHEMATICS

(COMPLEMENTARY COURSE TO PHYSICS AND CHEMISTRY)

FIRST SEMESTER

MT1C01B18– DIFFERENTIAL AND INTEGRALCALCULUS

Credits: 3 credits
Total Lecture Hours: 72 (4 hours/week)

Aims:

Calculus has wide applications in the field of science, engineering and this course aims to examine the fundamental concepts of limits, differentiation and integration that has wide applications science, engineering and economics.

Course Overview and Context:

This course introduces the concepts of differentiation and integration. Various applications of differentiation and integration are also discussed.

SYLLABUS CONTENT

Module 1
Differential Calculus: (22 Hrs)

Rates of change and limits, calculating limits using the limit laws, the precise definition of a limit, one sided limits and limits at infinity**,** derivative of a function, differentiation rules, the derivative as a rate of change, derivatives of trigonometric functions, the chain rule and parametric equations, implicit differentiation.

(Sections 2.1 – 2.4, 3.1 to 3.6 of Text 1)

Module 2

Applications of Derivatives: (15 Hrs)

Extreme values of functions, The Mean Value Theorem, Monotonic functions and the first derivative test.

(Sections 4.1 - 4.3 of Text 1)

Module 3

Integral Calculus: (15 Hrs)

A quick review of indefinite integral as anti-derivative,The Definite integral, The fundamental theorem of Calculus.(Section 5.3 and 5.4 of Text -1)

Module 4

Application of Integrals:

(20Hrs) Substitution and area between curves, Volumes by slicing and rotation about an axis (disc method only), Lengths of plane curves, Areas of surfaces of revolution and the theorem of Pappus (excluding theorem of Pappus).
(Section 5.6, 6.1, 6.3, 6.5 of Text1)

Competencies of the Course:

On completion of this course, successful students will be able to:

- To compute the limit of functions.
- To compute the value of the derivative at a point algebraically using the (limit) definition.
- To determine the expression for the derivative of elementary functions from the limit definition.
- To identify the extreme values of a function and classify them as maxima, minima and saddle points using the first derivative test.
- To describe the consequences of Rolle's Theorem and Mean Value theorem for differentiable functions.
- To calculate integrals of functions.
- To interpret the definite integral as the limit of a Riemann sum.
- To determine area between curves, length of plane curves using integration.
- To calculate volumes by slicing and rotation.
- To compute areas of surfaces of revolution.

Learning Resources:

Text Book:

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

Reference Books:

1. Shanti Narayan : Differential Calculus (S Chand)
2. George B. Thomas Jr. and Ross L. Finney : Calculus, LPE, Ninth edition, Pearson Education.
3. Shanti Narayan , P .K . Mittal :Integral Calculus (S. Chand & Company)
4. Muray R Spiegel, Advanced Calculus, Schaum's Outline series.

QUESTION PAPER PATTERN

MT1C01B18-DIFFERENTIAL AND INTEGRAL CALCULUS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	22	3	2	1	31
II	15	3	2	1	31
III	15	3	2	1	31
IV	20	3	3	1	36
Total	Total	12	9	4	

MODEL QUESTION PAPER

FIRST SEMESTER

MT1C01B18-CALCULUS

(MATHEMATICS - COMPLEMENTARY COURSE TO PHYSICS AND CHEMISTRY)

Time: 3 hrs. Max. Marks: 80

Part A

(Answer any **ten** questions. Each question carries 2 mark)

1. Find $\lim_{x\to 1}\frac{x^3-1}{x^2-1}$.
2. Differentiate $e^x\cos(5x+3)$ w.r.t x
3. State Rolle's Theorem.
4. Let $\int_0^2 f(z)\,dz = 3$ and $\int_2^4 f(z)\,dz = 7$. Find $\int_0^4 f(z)\,dz$.
5. Find $\int_0^3 \sqrt{y+1}\,dy$
6. If $(3-x^3) \le g(x) \le 3\cos x$ for all x, then $\lim_{x\to 0} g(x) =$ _____.
7. If $f(x) = \frac{1}{x}$, $x_0 = 4, \in = 0.05$ and $L = \frac{1}{4}$ find $\delta > 0$ such that

   $0 \le |x - x_0| < \delta \Rightarrow |f(x) - L| < \in$.
8. Differentiate $\log(x^2e^{mx})$ w.r.t x.
9. Find the value of c as in the Mean Value Theorem for the function in $f(x) = x^2+2x-1$ in [0, 1].
10. Find the critical points and determine the local extreme values of $y = x^{2/3}(x+2)$.
11. Show that the value of $\int_0^{\frac{\pi}{2}} \sqrt{\sin x}\,dx$ is less than $\frac{\pi}{2}$.
12. Find the area of the region between the curve $y = 3x$ and the $X-$ axis over the interval $[0, b]$.

(6x1=6)

Part B

(Answer any six questions. Each question carries 5 marks)

13. Find the volume of the solid generated by revolving the region between the $Y-$ axis and the curve $x = 2\sqrt{y}$, $0 \le y \le 4$ about $Y-$ axis.
14. Find the length of the circle of radius r defined parametrically by $x = r\cos t$, $y = r\sin t$, $0 \le t \le 2\pi$.
15. Show that f(x) = $\begin{cases} x^2 \sin\frac{1}{x} & x \neq 0 \\ 0 & x = 0 \end{cases}$ is differentiable at x = 0 and find f '(0)
16. Using the definition of the limit of a function show that $\lim_{x\to 1} \frac{3x}{2} - 1 = \frac{1}{2}$.
17. Find the intervals on which the functiong(t) = $-3t^2+9t+5$ is increasing and decreasing.
18. Identify the function's local extreme values and where they are assumed.
    f(x) = $2x- x^2$, $(-\infty < x \le 2)$
19. Find the average value of $f(x) = \sqrt{4-x^2}$ on $[-2, 2]$
20. State Mean Value Theorem for definite integrals. Show that if f is continuous on $[a, b]$; $a \neq b$ and if $\int_a^b f(x)\,dx = 0$, then $f(x) = 0$ at least once in $[a, b]$.
21. Find the length of $y = x^{\frac{3}{2}}$ from $x = 0$ to $x = 4$.

(6x5=30)

PartC

(Answer any two questions. Each question carries 15 marks)

22. Let f(x) = $\begin{cases} 3 - x & x < 2 \\ \frac{x}{2} + 1 & x > 2 \end{cases}$
    a) Find $\lim_{x\to 2^+} f(x)$ and $\lim_{x\to 2^-} f(x)$.
    b) Does $\lim_{x\to 2} f(x)$ exist? Justify.
    c) Find $\lim_{x\to 4^+} f(x)$ and $\lim_{x\to 4^-} f(x)$.
    d) Does $\lim_{x\to 4} f(x)$ exist? Justify.
23. (a) State and prove Rolle's Theorem.
    (b) Verify Rolle's theorem for the function f(x) = $4 - x^2$ and x $\in$ [-2, 2]

(c) Examine whether Rolle's Theorem can be applied to a function f(x) = sin x for the interval $[0, \pi]$

24. Find the volume of the solid generated by revolving the region bounded by $y = x^2 and y = 1,$ about a) the line $y = 1$ b) the line $y = 2$ c) the line $y = -1$

25. a)Find the area of the region between the $X-$ axis and the graph of $f(x) = x^3 - x^2 - 2x,\ -1 \leq x \leq 2$

b) Find the area between the graph of $f(x) = \sin x$ and the X axis over $[0, 2\pi]$

(2x15=30)

MATHEMATICS

(COMPLEMENTARY COURSE TO PHYSICS AND CHEMISTRY)

SECOND SEMESTER

MT2C01B18 -PARTIAL DERIVATIVES,

MULTIPLEINTEGRALS,TRIGONOMETRY AND MATRICES

Credits: 3 credits

Total Lecture Hours : 72 (4 hours/week)

Aims:

This course aims to provide the mathematical language needed for applying the concepts of calculus to numerous applications in science and engineering. Theory of matrices is extensively used in Economics, Linear Algebra and Stochastic Process. This course provides an introduction to matrix theory.

Course Overview and Context:

This course introduces the methods to calculate double integrals and triple integrals and use them to calculate volume of region in space. A detailed study about the matrix theory is done. Partial derivatives of functions and Trigonometric expansions are the other topics discussed in this course.

SYLLABUS CONTENT

Module 1

Multiple Integrals: (17 Hrs)

Double Integrals, area of bounded region in plane only, Double Integrals in Polar form, Triple integrals in rectangular co-ordinates, Volume of a region in space (As in Sections 15.1, 15.2, 15.3, 15.4 of Text 1)

Module 2

Trigonometry: (20Hrs)

Expansions of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$, $\sin^n \theta$, $\cos^n \theta$, $\sin^n \theta \cos^m \theta$ Circular and hyperbolic functions, inverse circular and hyperbolic function. Separation into real and imaginary parts. Summation of infinite series based on C+iS method. (Geometric, Binomial, Exponential, Logarithmic and Trigonometric series)

(Relevant Sections in Chapter 3 to 5 and Chapter 8of Text 3)

Module 3

Partial Derivatives: (15 Hrs)

Functions of several variables (Definition only), Partial derivatives, The Chain Rule (Sections 14.3 - 14.4 of Text 1)

Module 4

Matrices: (20Hrs)

Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of an elementary Transformations, Equivalent matrices, Row Canonical form, Normal form, Elementary matrices only.

Systems of Linear equations: System of non-homogeneous, solution using matrices, Cramer's rule, system of homogeneous equations, Characteristic equation of a matrix; Characteristic roots and characteristic vectors. Cayley-Hamilton theorem (statement only) and simple applications

(Chapters – 5, 10, 19, 23 of text 2).

Competencies of the Course:

On completion of this course, successful students will be able to:

- To interpret double integrals as the limit of a Riemann sum.
- To calculate double integrals using polar coordinates.
- To compute triple integral of a function.
- To calculate partial derivatives of functions of several variables.
- To calculate the rank of a matrix.
- To compute summation of infinite series.
- To solve system of equations using Matrix method.
- Todetermine the characteristic roots and characteristic vectors of a Matrix.

Learning Resources:

Text Books:

1. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.
2. Frank Ayres Jr : Matrices, Schaum's Outline Series, TMH Edition.
3. S.L.Loney– Plane Trigonometry Part – II, AITBS Publishers India, 2009

Reference Books :

- Shanti Narayan, P .K. Mittal :Integral Calculus (S. Chand & Company)
- Shanthi Narayanan & P.K. Mittal, A Text Book of Matrices, S. Chand.
- David W. Lewis - Matrix Theory (Allied)

QUESTION PAPER PATTERN

MT2C01B18-PARTIAL DERIVATIVES, MULTIPLEINTEGRALS, TRIGONOMETRY AND MATRICES

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	17	3	2	1	31
II	20	3	2	1	31
III	15	3	2	1	31
IV	20	3	3	1	36
Total		12	9	4	

MATHEMATICS

(COMPLEMENTARY COURSE TO PHYSICS AND CHEMISTRY)

THIRD SEMESTER

MT3C01B18-VECTOR CALCULUS, DIFFERENTIALEQUATIONS AND ANALYTIC GEOMETRY

Credits: 4 credits

Total Lecture Hours : 90 (5 hours/week)

Aims:

This course aims to provide the mathematical language needed for applying the concepts of Vector calculus to numerous applications in science and engineering. We need a mathematical description of three dimensional spaces to apply calculus in many real world situations. Vectors are used to study the analytic geometry of space, where they give simple ideas to describe lines, planes surfaces and curves in space.

Course Overview and Context:

This course introduces the methods of vector calculus to find the arc length and to find directional derivatives of curves. Various methods to solve differential equations included. A brief study on conic sections is also included.

SYLLABUS CONTENT

Module 1

Vector valued Functions: (15 Hrs)

Vector Functions, Arc length and unit Tangent vector **T**, Curvature and unit Normal Vector **N**, Torsion and unit Binormal vector **B,** Directional Derivatives and Gradient Vectors**.**

(Sections 13.1, 13.3, 13.4, 13.5 and 14.5 of text 2)

Module 2

Integration in Vector Fields: (25 Hrs)

Line Integrals, Vector fields and Work, Circulation and Flux, Path independence, Potential Function and Conservation Fields, Green's theorem in Plane (Statement and problems only), Surface area and Surface integral, Parameterised Surface,

Stoke'stheorem(Statement and Problems only), the Divergence theorem and a Unified theory (Statement and simple problems only).

(Sections 16.1 to 16.8 of text 2)

Module 3

Ordinary differential equations: (25Hrs)

Exact Differential Equation, Linear Equations , Solutions by Substitutions, Equations of first order and not of first degree , First order equations of higher Degree solvable for p , Equations solvable for y , Equationssolvable for x, Equations of first degree in x and y , Lagrange's and Clairaut's Equation

(sections 2.1 , 2.2 , 2.3 , 2.4 , 3.1 , 3.2 , 3.3 , 3.4 , 3.5 of text 1)

Module 4

Analytic Geometry: (25Hrs)

Conic sections and Quadratic equations, Classifying Conic Sections by Eccentricity, Conics and Parametric equations, The Cycloid, polar co-ordinates, Conic Sections in Polar coordinates.

(Sections 10.1, 10.2, 10.4, 10.5, 10.8 of Text 2)

(exclude the pedal Method and Newtonian Method)

Learning Resources:

Text Book:

1. A. H Siddiqi , P Manchanada : A first Course in Differential Equations with Applications(Macmillan India Ltd 2006)
2. George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

Reference Books:

- Shanti Narayan , P .K . Mittal :Vector Calculus (S. Chand & Company)
- P.P.G Dyke : An introduction to Laplace Transforms and Fourier Series
  - (Springer 2005)
- Harry F. Davis & Arthur David Snider: Introduction to Vector Analysis, 6th ed., Universal Book Stall, New Delhi.
- Murray R. Spiegel: Vector Analysis, Schaum's Outline Series, Asian Student edition.
- Merle C. Potter – Advanced Engineering Mathematics , OxfordUniversity Press.

Competencies of the Course

- Define vector valued functions
- Evaluate arc length of curves
- Evaluate the tangent and normal of a curve at a given point.
- Identify different types of differential equations.
- Solving 1st order differential equations.
- Framing equations different conic sections.
- Finding focus , directrix and eccentricity of conic sections.

QUESTION PAPER PATTERN

MT3C03B18 -VECTOR CALCULUS,DIFFERENTIAL EQUATIONS AND ANALYTIC GEOMETRY

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	15	3	2	1	31
II	25	3	2	1	31
III	25	3	2	1	31
IV	25	3	3	1	36
Total		12	9	4	

MATHEMATICS

(COMPLEMENTARY COURSE TO PHYSICS AND CHEMISTRY

FOURTH SEMESTER

MT4C01B18-FOURIER SERIES, PARTIALDIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA

Credits: 4 credits

Total Lecture Hours : 90 (5 hours/week)

Aims: Since the time of Isaac Newton differential equation have been of fundamental importance in the application of Mathematics to the Physical Science. Abstract Algebra is an important branch of Mathematics that has wide applications in almost all branches of Science.Algebra studies the structure of sets with operations on them. Numerical methods are gainfully employed by scientists and engineers to solve problems arising in research and industry. Fourier series constitute an important tool in solving problems that involve ordinary and partial differential equations. Applications of the theory of Fourier series , transforms and integrals are used in fields of Physics, Engineering and Applied Mathematics.

This course aims to provide the students with the basic topics of Fourier Series, Differential Equations, Numerical Analysis and Abstract Algebraso as to understand their role in modern mathematics and its applications to otherfields.

Course Overview and Context:

This course deals with the basic concepts of abstract algebra and differential equations. Groups, rings, fields and vector spaces are the main topics covered under abstract algebra. Fourier series representations of periodic functions in terms of sine and cosine functions are introduced.In this course we are studying the ordinary differential equation involving one independent and one or more dependent variables. The integrals of ordinary differential equation are plane curves. Also we study the differential equation involving one dependent and more than one independent variable that are partial differential equation. This course also deals with different numerical methods for solving algebraic and transcendental equations.

SYLLABUS CONTENT

Module 1

Special Functions: (25Hrs)

Fourier Series : Periodic Functions, Trigonometric Series, Functions of any period p = 2L Fourier Series, Even and Odd functions, Half-range Expansions.*Legendre Polynomials* –A brief introduction to power series and power series method solving Differential equations. Legendre equation and Legendre Polynomials ,Rodrigues' Formula, Bessel's Equation .Bessel's Functions

(Sections 10.1, 10.2, 10.3, 10.4, 4.1, 4.3 , 4.5 of Text 1 – Excluding Proofs).

Module 2

Partial Differential Equations: (15 Hrs)

Surfaces and Curves in three dimensions, solution of equation of the form

$\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$. Origin of first order and second order partial differential equations,

Linear equations of the first order, Lagrange's method

(Chapter 1: section 1 and 3 & Chapter 2 Section 1, 2 and 4 of text 2)

Module 3

Numerical Analysis: (25 Hrs)

(Use of Non Programmable Scientific Calculator is Permitted)

Bisection Method, Methods of false position, Iteration Method, Acceleration of convergence: Aitken's Δ^2 Process, Newton Raphson Method, the quotient – Difference method.

(sections 2.1 , 2.2 , 2.3 , 2.4, 2.5 and 2.11 of Text 3)

Module 4

Abstract algebra: (25 Hrs)

Groups,Subgroups, Cyclic groups, Groups of Permutations and Homomorphisms, Rings and Fields , Vector Spaces. (Theorems Statement only. Omit Proofs)

(Section 1.4, 1.5, 1.6, 2.8, 3.13, 4.18, 6.30 of text 4)

Learning Resources:

Text Books:

1. Erwin Kreyszig : Advanced Engineering Mathematics, Eighth Edition, Wiley, India.

2. Ian Sneddon – Elements of Partial Differential Equation (Tata McGraw Hill)
3. S.S. Sastry : Introductory methods of Numerical Analysis ,4th edition (Prentice Hall)
4. John B Fraleigh- A first course in Abstract Algebra(7th Edition)Pearson Education

References:

- Stephen Andrilli, David Hecker - Elementary Linear Algebra ,Academic Press.
- Surjeet Singh, QaziZameeruddin - Modern Algebra Eighth EsitionVikas Pub. House.
- R. K. Ghosh, K. C. Maity – An Introduction to Differential Equations, New Central Books.
- Shepley L. Ross – Differential Equation, Wiley India.
- Srimanta Pal – Numerical Methods, OxfordUniversity Press.
- QaziShoebAhamad, Zubir Khan – Numerical and Statistical Techniques, Ane Books.

Competencies of the Course:

- Analyse various numerical methods
- Find roots of equations by numerical methods
- Compute Fourier series of periodic functions
- Obtain orthogonal trajectories of families of curve son a given surface.
- Find power series expansion about an ordinary point.
- Describe the origin of partial differential equation
- Solve Bessel's equations..
- Solve the differential equation $\frac{dx}{P} = \frac{dy}{Q} = \frac{dz}{R}$
- Define groups, rings and fields.
- Explain different properties of groups.
- Identify examples of groups, rings and fields.
- Explain homomorphism and isomorphism of groups.

- Describe cosets and factor groups.
- Differentiate between the different algebraic structures.

QUESTION PAPER PATTERN

MT4C01B18- FOURIER SERIES, PARTIAL DIFFERENTIAL EQUATIONS, NUMERICAL ANALYSIS AND ABSTRACT ALGEBRA

Module	Hours	Part A	Part B	Part C	Total Marks
I	25	3	4	1	41
II	15	2	1	1	24
III	25	3	1	1	26
IV	25	4	3	1	38
Total		12	9	4	

SYLLABI OF MATHEMATICS

FOR

COMPLEMENTARY COURSES TO ECONOMICS

(Effective from 2018 admission onwards)

MATHEMATICS

(COMPLEMENTARY COURSETOECONOMICS)

FIRST SEMESTER

MT1C02B18-GRAPHING FUNCTIONS, EQUATIONS ANDFUNDAMENTAL CALCULUS

Credits: 4 credits

Total Lecture Hours : 108 (6 hours/week)

Aims:

The concepts of Mathematics are widely used in modern Economics. Mathematics is used as a tool to interpret and analyze data. Theories of Economics are formulated on the basis of Mathematical Principles. This course aims to familiarize students undergoing a course in Economics, the concepts of Mathematics and will lay a strong foundation to pursue their higher studies and research work.

Course Overview and Context:

This course introduces the concepts of polynomials, functions and equations. A detailed study of differentiation and integration of functions is also included. These topics are foundations of most areas of modern mathematics, and are applied frequently in Business and Economics .

SYLLABUS CONTENT

MODULE 1

Review: **(20 Hrs)**

Exponents, polynomials, factoring, fractions, radicals, order of mathematical operations.

(Chapter 1 – 1.1,1.2,1.3,1.4,1.5,1.6)

Equations and Graphs:

Equations, Cartesian Co-ordinate system, Linear Equations and Graphs, Slopes, Intercepts, The Slope- Intercept Form, Determining the equation of a straight line, Applications of Linear Equations in Business and Economics.

(Chapter 2: 2.1,2.2, 2.3,2.4,2.5,2.6,2.7,2.8)

MODULE 2

Functions: (28Hrs)

Concepts and definitions, Graphing functions, the Algebra of Functions, Applications of linear functions for business and economics, Solving Quadratic Equations, Facilitating Non-linear Graphing, Application of non-linear functions in Business and Economics.

(Chapter 3: 3.1,3.2, 3.3,3.4,3.5,3.6,3.7)

System of equations

Introduction, Graphical solutions, Supply-demand analysis, Break-even analysis, Elimination and substitution methods, IS-LM analysis, Economic and Mathematical modeling, Implicit functions and inverse functions.

(Chapter 4 – 4.1,4.2, 4.3,4.4,4.5,4.6,4.7,4.8,4.9)

Module 3

Concepts of Limits: (30Hrs)

Differential calculus (Fundamentals):

The derivative and the rules of differentiation: limits, continuity, The slope of curvilinear function. The derivative, differentiability and continuity, Derivative notation, Rules of differentiation, Higher order derivatives, Implicit functions, Differential calculus, Uses of derivatives. Increasing decreasing functions.Concavity and convexity.Relativeextrema.Inflection points. Curve sketching. Optimisation of functions.The successive derivative test.Marginal concepts in economics.Optimising economic functions of business.Relation among total, marginal and average functions. Convex functions Quasi-Convex, Quasi – Concave functions

(Chapter 9 and 10)

Module 4

Integral calculus (Fundamentals): (30Hrs)

Integration rules for indefinite integrals. Area under a curve.The definite integral.The fundamental theorems of calculus. Properties of definite integrals. Area between curves.Integration by substitution. Integration by parts. Present value of cash flow consumers and producers surplus.

(Chapter 12)

Competencies of the Course

On completion of this course, successful students will be able to:

- Explain the fundamental ideas of polynomials, functions and equations;
- Analyze linear and nonlinear functions inbusiness and economics;
- Explain the fundamental ideas of limit and continuity.
- Introduce differentiation;
- Calculate first and higher order derivatives :
- Introduce integration of functions;
- Evaluate the indefinite integrals of functions
- Evaluate the definite integrals of functions using the fundamental theorem of calculus.
- Calculate the area under a curve using integration.

apply these mathematical concepts in Business and Economics.

Learning Resources

Text Book:

1. Edward T Dowling : Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series ,McGraw Hill (1993)

Reference Books:

- Mary George, P G Thomaskutty-Textbook Of Mathematical Economics, Published by Discovery Publishing House .
- Singh, Parashar, Singh --*Econometrics & Mathematical Economics*, S. Chand & Co. 1997.
- R.G.D. Allen - Mathematical Analysis for Economists, Macmillan, ELBS.
- Edward T. Dowling - Introduction to Mathematical Economics, Third edition, Schaum's Outline Series, TMH.
- Henderson &Quandt - Microeconomic Theory: A Mathematical Approach, 3rd Edition, TMH.

- Taro Yamane - Mathematics for Economists: An elementary survey. Second Edition, PHI.
- SrinathBaruah - Basic Mathematics and its Application in Economics, Macmillan.
- H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand.
- G.S. Monga, Mathematics and Statistics for Economics, Vikas Publications, Second revised edition.
- Simon and Blume, Mathematics for Economists: W W Norton and Company.

QUESTION PAPER PATTERN

MT1C02B18-GRAPHING FUNCTIONS, EQUATIONS AND FUNDAMENTALCALCULUS

Module	Hours	Part A	Part B	Part C	Total Marks
I	20	3	2	1	31
II	28	3	2	1	31
III	30	3	2	1	31
IV	30	3	3	1	36
Total		12	9	4	

MODEL QUESTION PAPER

FIRST SEMESTER

MT1C02B18–GRAPHING FUNCTIONS, EQUATIONS ANDFUNDAMENTAL CALCULUS

(COMPLEMENTARY COURSE (MATHEMATICS)FOR B.A ECONOMICS)

Time: 3 Hours **Maximum: 80 Marks**

Part A

(Answer any **ten** questions. Each question carries **2** marks.)

1. Find $x^{-3/5}x^5$
2. What is the slope of the linear equation $x - y = 10$
3. If $f(x) = x^2 + 4x + 2$ and $g(x) = x^2 + 4$. Find $f(5) - g(1)$
4. Does the equation $y^2 = x$ represent a function?
5. Find $\lim_{x\to 2} \frac{x-2}{x^2-4}$
6. Evaluate $\int_a^b f(x)dx$ if $\int_b^a f(x)dx = k$.
7. A firm has a fixed cost of Rs.7000/- for equipment and a variable cost of Rs.600/- for each unit produced. What is the total cost of producing 15 units of output?
8. Find the equation of the straight line passing through (5,3) and (1,-2).
9. Find the inverse function of $f(x) = 5x - 4$
10. Define the LM Schedule.
11. Find $\frac{d^2y}{dx^2}$ where $y = 10x^3 + 4x^2 - 20$
12. Check whether the function $f(x) = 5x^2 - 4x - 89$ is increasing or decreasing at $x = 2$.

(10x2=20marks)

Part B

(Answer any **six** questions. Each question carries **5** marks)

13. Find the anti-derivative of f(x) = $16(e^{2t} + 15e^{-3t})$ given the boundary condition $F(0) = 9$.

14. Solve a) $\frac{240}{x-2}=\frac{576}{x+5}$ b) $\frac{x}{5}-4=\frac{x}{9}+8$

15. Solve the simultaneous equations by elimination method

$5x+y=2$

$x-2y=4$

16. Graph the function $f(x)=x^2-3$

17. Find the reduced form equation and hence find the equilibrium level of income given $Y=C+I+G, C=C_0+bY, I=I_0, G=G_0$ where

$C=125+0.8Y, I=45, G=90$

18. Find the successive derivatives of $y=3x^4-15x^3+8x^2-6x+5$

19. Find $\frac{dy}{dx}$ where $y=\frac{6x^2+2x}{3x-4}$

20. Evaluate $\int \frac{x^2}{\sqrt{x^3-3}}dx$

21. Find the consumer's Surplus CS for the demand curves P =148 - Q^2 , Q_0 =10, P_0 = 75.

(5x6= 30 marks)

Part D

(Answer any **two** questions. Each question carries **15** marks).

22. Use $MR=MC$ method to maximize profit π where $TR=800Q-7Q^2$

$$TC=2Q^3-Q^2+80Q+150$$

23. Optimize the function $y=-2x^3+69x^2+1260x-9$

24. Draw the graph and evaluate the area between the curves over the stated interval $y_1=8-x^2$, $y_2=-x+6$ from x=-1 to x=2

25. Evaluate a) $\int \frac{-18x}{(x-7)^3}dx$

b) $\int 7xe^{x-3}dx$ c) $\int 20x(x+9)^4dx$

MATHEMATICS

(COMPLEMENTARY COURSE TO ECONOMICS)

SECOND SEMESTER

MT2C02B18 -EXPONENTIAL, LOGARITHMIC FUNCTIONS, LINEAR ALGEBRA AND ADVANCED CALCULUS

Credits: 4 credits
Total Lecture Hours : 108 (6 hours/week)

Aims:

The concepts of Mathematics are widely used in modern Economics. Mathematics is used as a tool to interpret and analyze data. Theories of Economics are formulated on the basis of Mathematical Principles. This course aims to familiarize students undergoing a course in Economics, the concepts of Mathematics and will lay a strong foundation to pursue their higher studies and research work.

Course Overview and Context:

This course introduces the concepts of exponential and logarithmic functions. An introduction to matrices and linear programming is also included. Another topic for study is the calculus of multi variable functions. These topics are foundations of most areas of modern mathematics, and are applied frequently in Business and Economics .

SYLLABUS CONTENT

Module 1

Exponential and logarithmic functions: (20 Hrs)

Exponential functions. Logarithmic functions properties of exponents and logarithms. Natural exponential and logarithmic functions. Solving natural exponential and logarithmic functions. Logarithmic transformation of nonlinear functions. Derivatives of natural exponential and logarithmic functions. Interest compounding. Estimating growth rates from data points.

(Chapter 11)

MODULE 2 Linear (or Matrix) Algebra: (36 Hrs)

Introduction, Definition and terms,Addition and subtraction of matrices, Scalar multiplication. Vector multiplication, Multiplication of Matrices, Matrix expression of

a system of Linear equations, Augmented matrix, Row operations, Gaussian method of solving linear equations.

(Chapter 5 – 5.1,5.2, 5.3,5.4,5.5,5.6,5.7,5.8,5.9,5.10)

Solving Equations WithMatrix Algebra:

Determinants and linear independence, Third order determinants, Cramer's rule for solving linear equations, Inverse matrices, Gaussian method of finding an inverse matrix, Solving linear equations with an inverse matrix, Business and Economic applications, Special Determinants.

(Chapter 6 – 6.1,6.2, 6.3,6.4,6.5,6.6,6.7,6.8)

MODULE 3

Linear programming using graphs: (20 Hrs)

Use of graphs, Maximisation using graphs, The extreme point theorem, Minimisation using graphs.

(Chapter 7 – 7.1,7.2, 7.3,7.4)

Module 4

Calculus of Multivariable functions: (32 Hrs)

Functions of several independent variables.Partial derivatives. Rules of partial differentiation. Second – order partial derivatives. Optimization of multivariable functions.Constrained optimization with Lagrange Multipliers.Income determination Multipliers. Optimization of multivariable functions in business and economics constrained optimization of multivariable economic functions. Constrained optimization of Cobb Douglas production functions. Homogeneous functions, homothetic functions and Eulers theorem

(Chapter 13 sections 1-10)

Learning Resources:

Text Book:

1.Edward T Dowling: Theory and Problems of Mathematical Methods for Business and Economics, Schaum's Outline Series,McGraw Hill (1993).

References:

- Mary George, PgThomaskutty-Textbook Of Mathematical Economics, Published by Discovery Publishing House .

- Singh, Parashar, Singh --*Econometrics & Mathematical Economics*, S. Chand & Co. 1997.
- R.G.D. Allen - Mathematical Analysis for Economists, Macmillan, ELBS.
- Edward T. Dowling - Introduction to Mathematical Economics, Third edition, Schaum'sOutline Series, TMH.
- Henderson &Quandt - Microeconomic Theory: A Mathematical Approach, 3rd Edition, TMH.
- Taro Yamane - Mathematics for Economists: An elementary survey. Second Edition, PHI.
- SrinathBaruah - Basic Mathematics and its Application in Economics, Macmillan.
- H.L. Ahuja : Principles of Micro Economics, 15th Revised Edition, S. Chand
- Simon and Blume, *Mathematics for Economists*: W W Norton and Company.
- G.S. Monga, Mathematics and Statistics for Economics, Vikas Publications, Second revised edition.

Competencies of the Course

On completion of this course, successful students will be able to:

- Explain exponential and logarithmic functions;
- Solve exponential and logarithmic functions.
- Estimate growth rates from data points.
- Determine partial derivatives of functions of several variables .
- Compute the optimal solutions of economic and business problems using partial derivatives and Lagrange's multiplier method..
- Introduce the concept of matrices;
- Compute addition, multiplication and inverses of matrices.
- Solve system of linear equations using matrices;
- Introduce linear programming
- Formulate linear programming problems using equations and inequalities.

- Construct graphs and finding solutions to linear programming problems.

- Apply these mathematical concepts in Business and Economics.

QUESTION PAPER PATTERN

MT2C02B18-EXPONENTIAL, LOGARITHMIC FUNCTIONS, LINEAR ALGEBRA AND ADVANCED CALCULUS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	20	3	2	1	31
II	36	3	2	1	31
III	20	3	2	1	31
IV	32	3	3	1	36
Total		12	9	4	

SYLLABI OF MATHEMATICS

FOR

COMPLEMENTARY COURSE TO B.VOC SOFTWARE DEVELOPMENT

(Effective from 2018 admission onwards)

MATHEMATICS

(COMPLEMENTARY COURSE TO B.VOC SOFTWARE DEVELOPMENT)

SECOND SEMESTER

MT2C03B18 –BASIC MATHEMATICS

Credits: 4 credits
Total Lecture Hours : 72(4 hours/week)
Aims:.

In this course fundamental ideas of Mathematical Logic, sets and functions and some concepts of matrices like its rank are explained in a detailed manner. The basic concepts of graph theory are also introduced.

Course overview and context:

This course is framed so that the student familiarizes with mathematical logic. Knowledge of matrix algebra is fundamental in analyzing and interpreting data. Graph theory has wide applications in network theory and management problems. The basics of Graph theory is also included.

SYLLABUS CONTENT

Module 1

Mathematical Logic:(20Hrs)

Logical statement or proposition, Types of propositions, The Propositional Calculus, The negation of proposition, Disjunction, Conjunction, Tautologies & Contradictions,Logical Equivalence, The Algebra of propositions, Conditional propositions, Converse,Inverse & Contrapositive propositions, The negation of a Conditional propositions, Biconditional propositions, Arguments

(2 Chapter 1 of text 2)

Module 2 (18 Hrs)

Matrix

Elementary transformation – echelon form – rank using elementary transformation by reducing in to echelon form – solution of linear homogeneous and non – homogeneous equations using elementary transformation

(Relevant sections of Text 3)

Module 3 **(14Hrs)**

Sets, Union, Intersection, Complementation, Symmetric Difference, Power set, Cartesian Products, Generalized set theory, Relation, equivalence relations

(Chapter 2 & Chapter 3: 3.1 & 3.2 of text 2)

Module 4

GraphTheory **(20Hrs)**

An introduction to graph. Definition of a Graph, More definitions, Vertex Degrees, Sub graphs, Paths and cycles The matrix representation of graphs (definition & example only) Trees and connectivity. Definitions and Simple properties, Bridges, Spanning trees, Cut vertices and connectivity(definition & example only)

(Relevant sections of Text 1)

Text Books

.1. John Clark Derek Allen Holton - A first look at graph theory, Allied Publishers

2. B.S.Vatsa&SuchiVatsa : Discrete Mathematics (Fourth revised edition), New Age International Publishers, New Delhi

3. Frank Ayres Jr - Matrices , Schaum's Outline Series, TMH Edition

Competencies of the course:

- Familiarize with the concepts of mathematical logic.
- Understand the rank of matrices.
- Solve a system of linear equations
- Understand the concepts of set theory.
- Understand the definition of graph
- Identify paths and cycles in a graph
- Represent graphs in terms of matrices.
- Apply the concepts of connectivity of graphs in real life problems.

References:

- Shanti Narayan - Matrices (S. Chand & Company)
- Lipschutz: Set Theory and related topics (Second Edition), Schaum Outline Series, Tata McGraw-Hill Publishing Company, New Delhi. (Reprint)
- P.R. Halmos : Naive Set Theory, Springer.
- Ian Chiswell&Wifrid Hodges: Mathematical Logic, Oxford university press

QUESTION PAPER PATTERN

MT2C03B18 –BASIC MATHEMATICS

Module	**Hours**	**Part A** (short answer) 2 marks each 10/12	**Part B** **(short essay)** **5 marks each** **6/9**	**Part C** **(essay)** **15 marks each** **2/4**	**Total Marks**
I	**20**	3	2	1	31
II	**18**	3	2	2	46
III	**14**	2	3	1	34
IV	**20**	4	2	0	18
Total	**Total**	**12**	**9**	**4**	

SYLLABI

FOR

COMPLEMENTARY COURSE TO BCA CLOUD TECHNOLOGY & INFORMATION SECURITY MANAGEMENT

(Effective from 2018 admission onwards)

MATHEMATICS

(COMPLEMENTARY COURSE TO BCA CLOUD TECHNOLOGY & INFORMATION SECURITY MANAGEMENT)

SECOND SEMESTER

MT2C04B18- FUNDAMENTALS OF MATHEMATICS

Credits: 4
Total Lecture Hours:72 (4 hours/week)
Aims:

The aim of this course is to provide an in-depth understanding of operations on matrices, limits, differential equations and associated concepts.

Course Overview and Context :

This course promotes the methods and benefits of mathematical thoughts and logical understandings. So as to use the concepts in computer applications

This course mainly focuses on study of first order differential equation , partial differential equation, Laplace transforms , limit of functions, matrices etc. The learners will obtain problem solving skills and logical perspectives through this course.

Syllabus Content

Module 1

Matrices: (17 Hrs)

A quick review of the fundamental concepts, Rank of a Matrix, Non-Singular and Singular matrices, Elementary Transformations, Inverse of a Non-Singular Matrix, Canonical form, Normal form. Systems of Linear equations: Homogeneous and Non Homogeneous Equations, Characteristic equation of a matrix. (Proof of all the theorems are to be excluded.)

(Chapter 4, section 4.1-4.10, chapter 6, section 6.1,6.2,6.6, chapter 11 Section 11.1 of text 1)

Module 2

Differential Calculus: (20Hrs)

A quick review of limits of function, rules for finding limits, extensions of limit concepts, derivative of a function, differentiation rules, chain rule, rate of change and

simple applications of the rules. Extreme values of a function Rolle's Theorem, Mean Value Theorem. (Excluding proofs of theorems)

(Sections 2.1 – 2.4, 3.1 – 3.6, 4.1 - 4.3 of text 2)

Module 3

Partial Differential Equations: **(15 Hrs)**

Introduction, formulation of Partial Differential Equation by elimination of arbitrary constants and by elimination of arbitrary function. Solution of first order equations using Lagrange's method.

(Chapter 1, section 1 and 3 &Chapter 2 Section 1, 2 and 4 of text 3)

Module 4

Laplace Transforms: **(20 Hrs)**

Definitions- transforms of elementary functions, properties of Laplace transforms, inverse transforms- convolution theorem (no proof).

Text 2 (Sections 6.1, 6.2 and 6.5)

Learning Resources:

Text book:

1.Shanti Narayan , Dr P.K Mittal , A text book of Matrices, S Chand

2.George B. Thomas, Jr: Thomas' Calculus Eleventh Edition, Pearson, 2008.

3. Ian Sneddon – Elements of Partial Differential Equation (Tata McGraw Hill)

4.Erwin Kreyszig: Advanced Engineering Mathematics, Ninth Edition, Wiley, India.

Competencies of the course:

- Familiarize with different operations on matrices.
- Understand the limits of functions.
- Understand differential equation and partial differential equation,
- Familiarize with Laplace transforms.

Learning Resources :

- S.K . Stein – Calculus and analytic Geometry , (McGraw Hill)
- Zubair Khan, Shadab Ahmad Khan - Mathematics – 1 and Mathematics – II (Ane Books)
- Shanti Narayan - Matrices (S. Chand & Company)
- N.P.Bali, Dr.N.Ch.NarayanaIyengar-Engineering mathematics
- Matrices, Frank Ayres JR Schaum's Outline Series, TMH Edition
- Thomas and Finney - Calculus and analytical geometry (Addison-Wesley)
- Dr. B. S. Grewal – Higher Engineering Mathematics

QUESTION PAPER PATTERN

MT2C04B18 – FUNDAMENTALS OF MATHEMATICS

Module	Hours	Part A (short answer) 2 marks each 10/12	Part B (short essay) 5 marks each 6/9	Part C (essay) 15 marks each 2/4	Total Marks
I	17	4	2	1	33
II	20	4	3	1	38
III	15	2	3	1	34
IV	20	2	1	1	24
Total		12	9	4	