



**Dr. V. S. Krishna Govt. Degree College(A)
Visakhapatnam**



DEPARTMENT OF MATHEMATICS

**PROPOSED SYLLABUS FOR
B.Sc MATHEMATICS (Honors) PROGRAMME
UNDER AUTONOMY
(With effect from 2023-24)**

Dr. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

DEPARTMENT OF MATHEMATICS

9th BOARD OF STUDIES - MINUTES OF THE MEETING

2023 – 2024

The Department of MATHEMATICS conducted Pre-Board of Studies meeting on 02.09.2023 at 11.00AM under the Chairmanship of Dr. K.Ravibabu, Head of the department, Dept. of Mathematics and resolved the following:

- 1) To adopt Single major System as per the Staff Councils proceedings commencing from the academic year 2023 – 2024 for Semester I, II, III, IV, V, VI, VII and VIII of B.Sc.(Hons) in Mathematics students.
- 2) To approve and introduce the newly framed syllabus for Semester I, II, III, IV, V, VI, VII and VIII course in B.Sc.(Hons) in Mathematics. The newly framed syllabus is oriented in such a fashion that it caters to the needs of the students and to meet the present-day job employability and to develop professionalism in the field of Mathematics.
- 3) To approve and introduce the semester mode pattern of examinations for Semester I, II, III, IV, V, VI, VII and VIII of B.Sc.(Hons) in Mathematics students. Further it is approved syllabus, blue print and the model question papers submitted by the concerned faculty members for Semester I, II, III, IV, V, VI, VII and VIII.
- 4) To approve new employable and skill-based programs from 2022-23. To adopt NAAC norms by introducing quality circles among student community.
- 5) To approve skill courses, inter disciplinary courses and computer science as minor course for the B.Sc.(Hons) in Mathematics students.
- 6) To adopt multiple entry and multiple exit system for the benefit of the students as per the NEP-2020 recommendations.
- 7) To approve to issue Course certificate on the completion of first year, Diploma certificate on the completion second year, Under Graduation certificate on the completion of third year and Honors certificate on the completion of fourth year programme with regards to multiple entry and multiple exit system.
- 8) To approve for 40 internal marks as a part of Continuous Internal Assessment for core courses and allocation of marks as per Table-I.
- 9) To approve question paper blue print as per BLOOMS TAXONOMY, model question papers for 60 external marks and allocation of marks and the pattern of the paper as per Table-II
- 10) To approve minimum pass percentage of semester end theory examinations as 40% of 40 internal + 60 external=100.
- 11) To approve practical examinations for each core courses for semester I, II, III, IV, V, VI, VII and VIII.
and allocation of marks Table-IIA
- 12) To approve Internship-I as community services project for 1st year students at the end of sem-II w.e.f. 2023-24 as per NEP-2020 and allocation of marks as per Table-III.

13) To approve Internship-II, two months training program for 2nd year students at the end of IV-semester w.e.f. 2023-24 as per NEP-2020 and allocation of marks as per Table-IV.

14) To approve Internship-III, six months On Job Training program for 3rd year students (after IV-semester) as VI-semester w.e.f. 2023-24 as per NEP-2020 and allocation of marks as per Table-V.

15) To approve value-added certificate course INTRODUCTION TO STATISTICS for the academic year 2023-24 and allocation of marks and the pattern of the paper as per Table-VI.

16) To approve blue print and the model question papers for 50 external marks for life skill and multi-disciplinary courses and allocation of marks and the pattern of the paper as per Table-VII.

17) To approve and ratify list of examiners as per Table-VIII.

18) To implement pedagogical strategies to enrich teaching and learning process and to implement Blended learning teaching process.

19) To approve suggestions for students' seminars, workshops and student-centered activities.

20) To approve suggestions for research and extension activities or start-up.

21) To encourage students to take up independent research projects at their level by providing facilities.

22) To adopt NAAC norms by introducing quality circles among student communities.

23) To develop infrastructure facilities in the department and implement guidelines of the academic council.

24) To take up ICT mode of teaching and evolve techniques that are easily understanding by the students and conduct remedial coaching to the below average students.

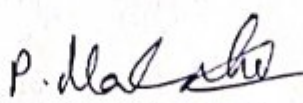
25) To collect feedback on the curriculum of 2023-24 academic year from the four stakeholders at least.

26) To encourage students to join JKC to equip with communication skills and improve their personality development.

27) To encourage students to participate in the community development activities such as Haritha Krishna Eco Club, NCC and NSS.

Signed and approved by


Prof. N. Ramakrishna,
Subject Expert
(University Nominee)


Sri. P. Mahalakshmi Naidu,
Subject Experts
(from outside the parent
university)

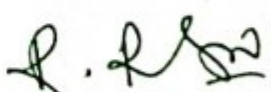

Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)

Table-I: Allocation of Internal Marks as a part of Continuous Internal Assessment methods:

w.e.f. 2023-24			
Assessment	Marks for each Mid examination	Time	Pass Mark
Assignments(at least one assignment from each unit) *The weightage of marks, for the assignments should be awarded after completion of all the assignments which are finished before the mid examinations are commenced.	10	50min	The marks obtained by a student for 100 marks in both mid examination is to be scale down to 40 marks. Minimum Pass marks 15*
Projects/Seminars/PPT/Quizzes/Field trips ..etc	10	NA	
External Activities like clean & green, NCC,NSS and attendance Attendance should be also be taken into account for awarding the total of 5 marks. The award of marks should be completed before conduct of the mid examination commenced.	10	NA	
Internal examination pattern for both Mid1 and Mid2 : Section-A Answer any two out of five $2 \times 5 = 10$ Section-B Answer any five out of seven $5 \times 2 = 10$ ** One mid examination may be conducted through online mode**	20	1 hour	
Total	50		

Table-II: Allocation of External Marks for semester end theory examinations:

Duration of the exam	3 hrs
Maximum marks	60 marks
Minimum pass marks	24*
Paper pattern	Section A for 20 marks: In Section A , answer any 5 questions out of 10, each carry 4 marks. (5X4=20) Section B for 40 marks: In section B, answer all 5 questions(there will be an internal choice), each question carry 8 marks

Table-IIA: Allocation of Practical marks:

Category	Marks
Record	20
Problem solving	60
Viva-voce	20
Maximum marks	100
Minimum pass marks	50*

Table-III: Allocation of Internship-I (Community Service Project) Marks:

Category	Marks
Project log book	20
Implementation	30
Project Report	25
Project Presentation	25
Total marks	100
Minimum pass marks	50*

Table-IV: Allocation of Internship-II Marks:

Category	Marks
Implementation	50
Project Report	25
Project Presentation	25
Total marks	100
Minimum pass marks	50*

Table-V: Allocation of Internship-III Marks:

Category	Marks
Implementation	50
Project Report	25
Project Presentation	25
Internal Viva Voce at industry oblique company	50
External Viva Voce at college	50
Total marks	200
Minimum pass marks	100*

Table-VI: Allocation of Add-On course Marks:

Duration	One and half hrs
Maximum marks	50
Minimum pass marks	25*
Examination pattern	Answer any five questions out of eight questions, each question carry 10 marks 5X10=50 marks

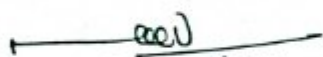
Table-VII: Allocation of external marks for skill and multi-disciplinary courses:

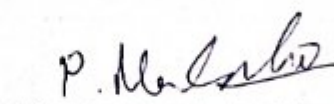
Duration	One and half hrs
Maximum marks	50 marks
Minimum marks	25*
Examination pattern	Answer any five questions out of eight questions, each question carry 10 marks 5X10=50 marks

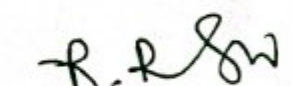
Table-VIII : List of examiners

Sl.No	Name of the examiner	Designation	Place of working
01	ArunaKumari Sadasivuni	Lecturer in Mathematics	GDC(M),Srikakulam
02	Ronanki Ravisankar	Lecturer in Mathematics	GDC(M),Srikakulam
03	Mrs. Y Prasanthi	Lecturer in Mathematics	GDC(W)(A),Srikakulam
04	Duryodhana Dalai	Lecturer in Mathematics	GDC,Ichapuram
05	Chappa .Raghavendra Naidu	Lecturer in Mathematics	GDC,Palakonda
06	L VenkataRamana	Lecturer in Mathematics	GDC,Rajam
07	Dr.SanapalaLakshmanarao	Lecturer in Mathematics	GDC,Tekkali
08	Chappa Naidu	Lecturer in Mathematics	GDC,Veeraghattam
09	P.Mangamma	Lecturer in Mathematics	GDC (W),Marripalem
10	K.V.S.Nagalakshmi	Lecturer in Mathematics	GDC (W),Visakhapatnam
11	Dr.K. VenkataVidyasagar	Lecturer in Mathematics	GDC,Bheemunipatnam
12	AlakaKrishnaRao	Lecturer in Mathematics	GDC,Chodavaram
13	MVRamakrishna	Lecturer in Mathematics	GDC,Sabbavaram
14	ChVijayaKumar	Lecturer in Mathematics	GDC,Yellamanchili

Signed and approved by


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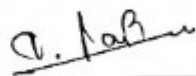
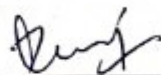
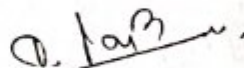

Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
university)

Dr.V.S.Krishna Govt. Degree College (Autonomous), Visakhapatnam
9th Board of Studies----- September-2023
Pre-Approval form

Subject: Mathematics

Department: Mathematics

In pursuance of conferment of Autonomous status to Dr.V.S.Krishna Govt. Degree College(A), Visakhapatnam by the UGC vide letter No.F22-1/2011(AC) dated 20.07.2011 from Dr. Manju Singh, Joint Secretary, UGC, New Delhi and Proceedings No. C-II (CDC) /Dr.VSK.Govt.College/BOS/2020 dt.03.08.2022 of The Vice-Chancellor, Andhra University, Visakhapatnam, the **9th Board of Studies in Mathematics** Subject is conducted on 14.09.2023 at 11.00 AM with the following members. The Changes will be implemented from 2022-23 academic year onwards.

MEMBER	NAME& DESIGNATION	SIGNATURE
Head of the Department (Chairman)	Dr. K. Ravibabu	
Faculty Members	Dr. K. Ravibabu Dr. Appala Naidu Kotana Ms. G.S.B.V. Prajwalini	K. Appala naidu
Subject Expert (University Nominee)	Prof. N. Ramakrishna, Dept of Mathematics, Andhra University.	
Subject Experts (from outside the parent university)	Sri. P. Mahalakshmi Naidu, Lecturer in Mathematics, G.D.C, Perumallapuram,E.G., AdikaviNannaya University	P. Mahalakshmi
	Sri. R. Ravi Shankar, Lecturer in Mathematics, G.D.C (M), Srikakulam Dr. B. R. Ambedkar University	R. Ravi Shankar
Representative Member From Industry / Corporate / Allied Area relating to placement	MR. PANDIT MANU TECH. MAHENDRA	
Member from Alumni	Dr CVS Ravindranath	
Coordinator, IQAC	Dr K Ravibabu	
Academic Coordinator and member secretary, Academic Council	Dr. D Sravankumar	
Principal and Chairperson, Academic Council	Dr.I. Vijayababu	J. Vait 14/9/2023

Dr.V.S.Krishna Govt. Degree College (Autonomous), Visakhapatnam
9th Board of Studies----- September-2023

Department: Mathematics
Courses Structure

Courses	Sem-I	Sem-II	Sem-III	Sem-IV	Sem-V	Sem- VI	Sem- VII	Sem- VIII	Credits @each course	Total Credits
Major	C-1 (05)	C-3 (05)	C-5 (05)	C-9 (05)	C-12 (05)	*****	C-16 (05)	C-19 (05)	4 Cr	3yrs UG
	C-2 (05)	C-4 (05)	C-6 (05)	C-10 (05)	C-13 (05)	*****	C-17 (05)	C-20 (05)		60 Cr
	*****	*****	C-7 (05)	C-11 (05)	C-14(05)	*****	C-18 (05)	C-21 (05)		4yrs Hons
	*****	*****	C-8 (05)	*****	C-15 (05)	*****				84 Cr
Minor	*****	C-1 (05)	C-2 (05)	C-3 (05)	C-5 (05)	*****			4 Cr	24 Cr
	*****	*****	*****	C-4 (05)	C-6 (05)	*****				
Ability Enhancement Compulsory Courses (AECC)	C-1 (04)	C-3 (04)	*****	*****	*****	*****			3 Cr	12 Cr
	C-2 (04)	C-4 (04)	*****	*****	*****	*****				
Multidisciplinary	C-1 (02)	*****	C-2 (02)	C-3 (02)	*****	*****			2 Cr	6 Cr
Skill Enhancement	C-1 (03)	C-3 (03)	C-5 (02)	C-6 (02)	*****	*****	C-7 (3+2)	C-9 (3+2)	3yrs UG 2 Cr	3yrs UG 12 Cr
	C-2 (03)	C-4 (03)	*****	*****	*****	*****	C-8 (3+2)	C-10 (3+2)	4 th yr 4 Cr	4yrs Hons 28 Cr
Environmental Education	*****	*****	*****	*****	1 (02)	*****			2 Cr	2 Cr
Community Service Project	*****	CSP	*****	*****	*****	*****			4 Cr	4 Cr
Internship I	*****	*****	*****	Training Programm	*****	*****			4 Cr	4 Cr
Internship II	*****	*****	*****	*****	*****	On Job Training			12 Cr	12 Cr
OOTC (Open Online Transdisciplinary)							1(2)	1(2)	2 Cr	4yrs Hons 4 Cr
IKS (Indian Knowledge System)							1(2)	1(2)		
Total Courses	7	CSP + 7	7	Short-ntern +7	7	OJT	7	7		160 Cr + 20Cr =180Cr

* Figures in parenthesis are hours per week.

Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

B.A./B.Sc. Hons. AMTHEMATICS

SYLLABUS FOR CORE COURSES

CBCS/ SEMESTER SYSTEM

(w.e.f. 2023-24)

CORE COURSES STRUCTURE

(Sem-I to Sem-VIII)

Year	Semester	Course Code	Title of the Course	No. of Hrs /Week	No. of Credits	IA	ES	Total
I	I	23MATM11	Essentials and Application Of Mathematical, Physical and Chemical Sciences	5	4	40	60	100
		23MATM12	Advances in Mathematical, Physical and Chemical Sciences	5	4	40	60	100
	II	23MATM21 / 23MAT21P	Differential Equations & Differential Equations Problem Solving Sessions Practical Course .	5	4	40	60	100
		23MATM22/ 23MAT22P	Analytical Solid Geometry & Analytical Solid Geometry Problem Solving Sessions Practical Course.	5	4	40	60	100
II	III	23MATM31/ 23MATM31P	Group Theory & Group Theory Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM32/ 23MATM32P	Numerical Methods & Numerical Methods Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM33/ 23MATM33P	Laplace Transforms & Laplace Transforms Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM34/ 23MATM34P	Special Functions & Special Functions Problem Solving Sessions Practical Course	5	4	40	60	100
	IV	23MATM41/ 23MATM41P	Ring Theory & Ring Theory Problem Solving Sessions	5	4	40	60	100
		23MATM42/ 23MATM42P	Introduction to Real Analysis & Introduction to Real Analysis Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM43/ 23MATM43P	Integral Transforms & Integral Transforms Problem Solving Sessions Practical Course	5	4	40	60	100
III	V	23MATM51/ 23MATM51P	Linear Algebra & Linear Algebra Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM52/ 23MATM52P	Vector Calculus & Vector Calculus Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM53A/ 23MATM53AP	Functions of a complex variables & Functions of a complex variables Problem Solving Sessions Practical Course	5	4	40	60	100

		(OR)						
		23MATM53B/23MATM53BP	Advanced Numerical Methods & Advanced Numerical Methods Problem Solving Sessions Practical Course					
		23MATM54A/23MATM54AP	Number Theory & Number Theory Problem Solving Sessions Practical Course	5	4	40	60	100
		23MATM54B/23MATM54BP	(OR) Mathematical Statistics & Mathematical Statistics Problem Solving Sessions Practical Course					
VI	Semester Internship/Apprenticeship with 12 Credits							

IV	VII	23MATM71A/23MATM71AP	Algebra & Algebra Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
		23MATM71B/23MATM71BP	Classical Mechanics & Classical Mechanics Problem Solving Sessions Practical Course					
		23MATM72A/23MATM72AP	Real Analysis & Real Analysis Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
		23MATM72B/23MATM72BP	Discrete Mathematics & Discrete Mathematics Problem Solving Sessions Practical Course					
		23MATM73A/23MATM73AP	Basic Topology & Basic Topology Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
		23MATM73B/23MATM73BP	Cryptography & Cryptography Problem Solving Sessions Practical Course					
	Skill Enhancement Course							
		23MATS71A/23MATS71AP	Lattice Theory & Boolean Algebra & Lattice Theory Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
		23MATS71B/23MATS71BP	Finite Element Analysis & Finite Element Analysis Problem Solving Sessions Practical Course					
		23MATS72A/23MATS72AP	Graph Theory & Graph Theory Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
		23MATS72B/23MATS72BP	Mathematical Finance &					

		Mathematical Finance Problem Solving Sessions Practical Course					
VIII	23MATM81A/ 23MATM81AP	Advanced Algebra & Advanced Algebra Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
	23MATM81B/ 23MATM81BP	Elements of Elasticity & Fluid Dynamics& Elements of Elasticity & Fluid Dynamics Problem Solving Sessions Practical Course					
	23MATM82A/ 23MATM82AP	Advanced Analysis & Advanced Analysis Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
	23MATM82B/ 23MATM82BP	Advanced Linear Algebra& Advanced Linear Algebra Problem Solving Sessions Practical Course					
	23MATM83A/ 23MATM83AP	Advanced Topology& Advanced Topology Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
	23MATM83B/ 23MATM83BP	Differential Geometry& Differential Geometry Problem Solving Sessions Practical Course					
Skill Enhancement Course							
	23MATS81A/ 23MATS81AP	Ordinary Differential Equations & Ordinary Differential Equations Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
	23MATS81B/ 23MATS81BP	Applications of Algebra& Applications of Algebra Problem Solving Sessions Practical Course					
	23MATS82A/ 23MATS82AP	Operation Research & Operation Research Problem Solving Sessions Practical Course (OR)	5	4	40	60	100
	23MATS82B/ 23MATS82BP	Mathematical Modelling & Mathematical Modelling Problem Solving Sessions Practical Course					

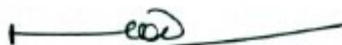
SKILL COURSE

Semester	No. of Courses	Choices	Preferred Teaching Dept.
I	01	Analytical Skills	Mathematics/Statistics

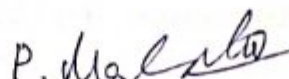
ADD-ON COURSE

No. of Courses	Title	Preferred Teaching Dept.
01	Introduction to Statistics	Mathematics/Statistics

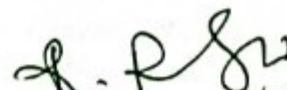
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Sri. R. Ravi Shankar
Subject Experts
(from outside the parent
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Department of Mathematics

Programme Name: BSc. Honors Mathematics

Programme outcomes

PO 1	Critical Thinking: Ability to take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
PO 2	Effective Communication: Ability to speak, read, write, and listen clearly in person and through electronic media in English and in one Indian language, and make meaning of the world by connecting people, ideas, books, media, and technology.
PO 3	Social Interaction: Ability to elicit views of others, mediate disagreements and help reach conclusions in group settings.
PO 4	Effective Citizenship: Ability to demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
PO 5	Ethics: Ability to recognize different value systems including your own, understand the moral dimensions of your decisions, and accept responsibility for them.
PO 6	Environment and Sustainability: Ability to understand the issues of environmental contexts and sustainable development
PO 7	Employability skills: Equipping graduates with the essential abilities and knowledge to excel in their chosen careers
PO 8	Entrepreneurship skills: Seeks to empower students with the competencies needed to be successful entrepreneurs, enabling them to launch, operate, and innovate in their own businesses or entrepreneurial ventures.
PO 9	Self-directed and Life-long Learning: Acquire the ability to engage in independent and life-long learning in the broadest context socio-technological changes

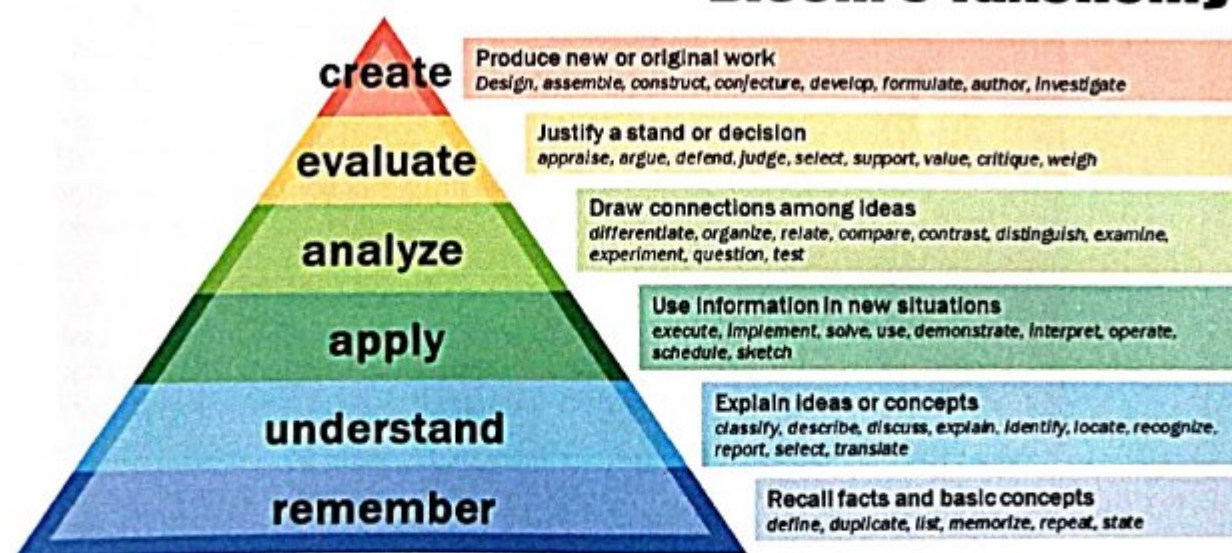
Programme specific outcomes:

PSO1	A student should be able to recall basic facts about mathematics and should be able to display knowledge of conventions such as notations, terminology.
PSO2	A student should get adequate exposure to global and local concerns that explore them many aspects of mathematical sciences.
PSO3	Student is equipped with mathematical modeling ability, problem solving skills, creative talent and power of communication necessary for various kinds of employment.
PSO4	Student should be able to apply their skills and knowledge that is translate information presented verbally into mathematical form, select and use appropriate mathematical formulae or techniques in order to process the information and draw the relevant conclusion.
PSO5	Enabling students to develop a positive attitude towards mathematics as an interesting and valuable subject of study.

Levels of Bloom's Taxonomy

Level-1	Knowledge/Remember
Level-2	Understand
Level-3	Application
Level-4	Analyze
Level-5	Evaluation
Level-6	Create

Bloom's Taxonomy



Vanderbilt University Center for Teaching

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Dr.V.S.KRISHNA GOVT.DEGREE COLLEGE (A), VISAKHAPATNAM.

CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

**COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND
CHEMICAL SCIENCES**

(w.e.f. 2023-24)

Course Code: 23MATM11

Course Objective:

The objective of this course is to provide students with a comprehensive understanding of the essential concepts and applications of mathematical, physical, and chemical sciences. The course aims to develop students' critical thinking, problem-solving, and analytical skills in these areas, enabling them to apply scientific principles to real-world situations.

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. Apply critical thinking skills to solve complex problems involving complex numbers, trigonometric ratios, vectors, and statistical measures.	Level-3 , Level-6
CO2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations	Level-1 , Level-2
CO3. To Explain the basic principles and concepts underlying a broad range of fundamental areas of chemistry and to Connect their knowledge of chemistry to daily life	Level-1 , Level-2
CO4. Understand the interplay and connections between mathematics, physics, and chemistry in various applications. Recognize how mathematical models and physical and chemical principles can be used to explain and predict phenomena in different contexts.	Level-1 , Level-2
CO5. To explore the history and evolution of the Internet and to gain an understanding of network security concepts, including threats, vulnerabilities, and countermeasures.	Level-4, Level-5

CO-PO Mapping	
1-	Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	-	1	-	-	-	3	1	3
CO 2	2	-	2	2	-	2	3	1	3
CO 3	2	-	2	2	-	2	3	1	3
CO 4	2	1	2	2	-	2	3	1	3
CO 5	1	1	3	2	3	2	3	2	3

CO-PSO Mapping	
1-	Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	2	2	3	2
CO 2	3	2	3	3	2
CO 3	3	2	3	3	2
CO 4	3	2	3	3	2
CO 5	1	2	3	3	2

Course Content:

Unit-1: ESSENTIALS OF MATHEMATICS:

Complex Numbers: Introduction of the new symbol i – General form of a complex number – Modulus-Amplitude form and conversions

Trigonometric Ratios: Trigonometric Ratios and their relations – Problems on calculation of angles

Vectors: Definition of vector addition – Cartesian form – Scalar and vector product and problems

Statistical Measures: Mean, Median, Mode of a data and problems

Unit-2: ESSENTIALS OF PHYSICS:

Definition and Scope of Physics- Measurements and Units - Motion of objects: Newtonian Mechanics and relativistic mechanics perspective - Laws of Thermodynamics and Significance- Acoustic waves and electromagnetic waves- Electric and Magnetic fields and their interactions- Behaviour of atomic and nuclear particles- Wave-particle duality, the uncertainty principle- Theories and understanding of universe

Unit-3: ESSENTIALS OF CHEMISTRY:

Definition and Scope of Chemistry- Importance of Chemistry in daily life -Branches of chemistry and significance- Periodic Table- Electronic Configuration, chemical changes, classification of matter, Biomolecules- carbohydrates, proteins, fats and vitamins.



Unit-4: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY:

Applications of Mathematics in Physics & Chemistry: Calculus , Differential Equations &Complex Analysis

Application of Physics in Industry and Technology: Electronics and Semiconductor Industry, Robotics and Automation, Automotive and Aerospace Industries, Quality Control and Instrumentation, Environmental Monitoring and Sustainable Technologies.

Application of Chemistry in Industry and Technology: Chemical Manufacturing, Pharmaceuticals and Drug Discovery, Materials Science, Food and Beverage Industry.

Unit-5: ESSENTIALS OF COMPUTER SCIENCE:

Milestones of computer evolution - Internet, history, Internet Service Providers, Types of Networks, IP, Domain Name Services, applications.

Ethical and social implications: Network and security concepts- Information Assurance Fundamentals, Cryptography-Symmetric and Asymmetric, Malware, Firewalls, Fraud Techniques- Privacy and Data Protection

Recommended books:

1. Functions of one complex variable by John.B.Conway, Springer- Verlag.
2. Elementary Trigonometry by H.S.Hall and S.R.Knight
3. Vector Algebra by A.R.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. Basic Statistics by B.L.Agarwal, New age international Publishers
5. University Physics with Modern Physics by Hugh D. Young and Roger A. Freedman
6. Fundamentals of Physics by David Halliday, Robert Resnick, and Jearl Walker
7. Physics for Scientists and Engineers with Modern Physics" by Raymond A. Serway and John W. Jewett Jr.
8. Physics for Technology and Engineering" by John Bird
9. Chemistry in daily life by Kirpal Singh
10. Chemistry of bio molecules by S. P. Bhutan
11. Fundamentals of Computers by V. Raja Raman
12. Cyber Security Essentials by James Graham, Richard Howard, Ryan Olson

STUDENT ACTIVITIES

Unit-1: ESSENTIALS OF MATHEMATICS:

1: Complex Number Exploration

Provide students with a set of complex numbers in both rectangular and polar forms. They will plot the complex numbers on the complex plane and identify their properties.

2: Trigonometric Ratios Problem Solving

Give students a set of problems that require the calculation of trigonometric ratios and their relations.

Students will solve the problems using the appropriate trigonometric functions (sine, cosine, tangent, etc.) and trigonometric identities.

3: Vector Operations and Applications

Provide students with a set of vectors in Cartesian form.

Students will perform vector addition and subtraction operations to find the resultant vectors. They will also calculate the scalar and vector products of given vectors.

4: Statistical Measures and Data Analysis

Give students a data set containing numerical values.

Students will calculate the mean, median, and mode of the data, as well as other statistical measures if appropriate (e.g., range, standard deviation).

They will interpret the results and analyze the central tendencies and distribution of the data.

Unit-2: ESSENTIALS OF PHYSICS:

1. Concept Mapping

Divide students into groups and assign each group one of the topics.

Students will create a concept map illustrating the key concepts, relationships, and applications related to their assigned topic.

Encourage students to use visual elements, arrows, and labels to represent connections and interdependencies between concepts.

2. Laboratory Experiment

Select a laboratory experiment related to one of the topics, such as motion of objects or electric and magnetic fields.

Provide the necessary materials, instructions, and safety guidelines for conducting the experiment.

Students will work in small groups to carry out the experiment, collect data, and analyze the results. After the experiment, students will write a lab report summarizing their findings, observations, and conclusions.

Unit-3: ESSENTIALS OF CHEMISTRY

1: Chemistry in Daily Life Presentation

Divide students into groups and assign each group a specific aspect of daily life where chemistry plays a significant role, such as food and nutrition, household products, medicine, or environmental issues.

Students will research and create a presentation (e.g., PowerPoint, poster, or video) that showcases the importance of chemistry in their assigned aspect.

2: Periodic Table Exploration

Provide students with a copy of the periodic table.

Students will explore the periodic table and its significance in organizing elements based on their properties.

They will identify and analyze trends in atomic structure, such as electronic configuration, atomic size, and ionization energy.

3: Chemical Changes and Classification of Matter

Provide students with various substances and chemical reactions, such as mixing acids and bases or observing a combustion reaction.

Students will observe and describe the chemical changes that occur, including changes in color, temperature, or the formation of new substances.

4: Biomolecules Investigation

Assign each student or group a specific biomolecule category, such as carbohydrates, proteins, fats, or vitamins.

Students will research and gather information about their assigned biomolecule category, including its structure, functions, sources, and importance in the human body.

They can create informative posters or presentations to present their findings to the class.

Unit-4: APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Interdisciplinary Case Studies

Divide students into small groups and provide them with interdisciplinary case studies that involve the interdisciplinary application of mathematics, physics, and chemistry.

Each case study should present a real-world problem or scenario that requires the integration of concepts from all three disciplines.

2: Design and Innovation Project

Challenge students to design and develop a practical solution or innovation that integrates mathematics, physics, and chemistry principles.

Students can choose a specific problem or area of interest, such as renewable energy, environmental conservation, or materials science.

3: Laboratory Experiments

Assign students laboratory experiments that demonstrate the practical applications of mathematics, physics, and chemistry.

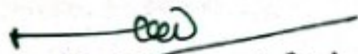
Examples include investigating the relationship between concentration and reaction rate, analyzing the behavior of electrical circuits, or measuring the properties of materials.

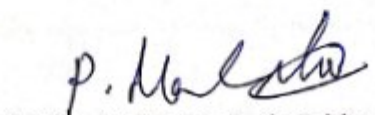
.4: Mathematical Modeling Present students with real-world problems that require mathematical modeling and analysis.

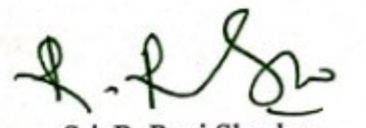
Unit-5: ESSENTIALS OF COMPUTER SCIENCE:

1. Identifying the attributes of network (Topology, service provider, IP address and bandwidth of
2. your college network) and prepare a report covering network architecture.
3. Identify the types of malwares and required firewalls to provide security.
4. Latest Fraud techniques used by hackers.

Signed and approved by


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Recommended Question Paper Patterns and Models :

BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	
Application/	20%	12	1	1(one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		1(one out of two)
Total	100	60		5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	Unit-I	Essentials of Mathematics	2(one out of two)	2
2	Unit -II	Essentials of Physics	2(one out of two)	2
3	Unit -III	Essentials of Chemistry	2(one out of two)	2
4	Unit -IV	Applications of Mathematics, Physics and Chemistry	2(one out of two)	2
5	Unit -V	Essentials of Computer Science	2(one out of two)	2

SEMESTER END EXAMINATIONS
MODEL PAPER
SEMESTER- I

B.Sc Hons Mathematics

**COURSE 1: ESSENTIALS AND APPLICATIONS OF MATHEMATICAL, PHYSICAL AND
CHEMICAL SCIENCES**
(w.e.f. 2023-24)

Course Code : 23MATM11

Time: 3 hours

Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. $5 \times 4 = 20$ Marks

1. Find the square root of $-5 + 12i$ [Synthesis/ Evaluate]
2. Find the Mean, Mode and Median of the following data
1, 5, 10, -8, 6, 11, 10 [Synthesis/ Evaluate]
3. What is F.P.S system and explain about it [Analysis]
4. Write a short note on Electric field [Knowledge/Remember]
5. What are sources of Carbohydrates [Knowledge/Remember]
6. What is the role of fat in the human body [Analysis]
7. Write the differential equation that describe the motion of the Pendulum [Application]
8. What is that formula that describe the radioactive decay [Application]
9. Write a short note on URL [Analysis]
10. What is anti-virus. Give some examples it. [Analysis]

PART- B

Answer **all the following** questions. Each carries **Eight** marks

$5 \times 8 = 40$ Marks

11. (a) Prove that (1) $\sin 18^\circ = \frac{\sqrt{5}-1}{4}$ (2) $\cos 36^\circ = \frac{\sqrt{5}+1}{4}$ [Knowledge/Remember]

(Or)

(b) Find the locus of P satisfying the equation $|z + 4i| + |z - 4i| = 10$ [Knowledge/Remember]

12. (a) What are applications of acoustic waves [**Understanding/ Comprehension**]
]

(Or)

(b) What is the first law of thermodynamics. Explain its significance [**Understanding/ Comprehension**]

13. (a). What are proteins and explain their role in the human body [**Knowledge/Remember**]

(Or)

(b) Write a note on Vitamins [**Knowledge/Remember**]

14. (a). Write a note on applications of calculus in Physics [**Application**]

(Or)

(b) Write a note on applications of differential equations in Chemistry [**Application**]

15. (a) Discuss about the evolution of computers [**Understanding/ Comprehension**]

(Or)

(b) What are various types of networks and explain about them [**Understanding/ Comprehension**]

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

(w.e.f. 2023-24)

Course Code: 23MATM12

Course Objective:

The objective of this course is to provide students with an in-depth understanding of the recent advances and cutting-edge research in mathematical, physical, and chemical sciences. The course aims to broaden students' knowledge beyond the foundational concepts and expose them to the latest developments in these disciplines, fostering critical thinking, research skills, and the ability to contribute to scientific advancements.

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. Explore the applications of mathematics in various fields of physics and chemistry, to understand how mathematical concepts are used to model and solve real-world problems.	Level-3 , Level-6
CO2. To Explain the basic principles and concepts underlying a broad range of fundamental areas of physics and to Connect their knowledge of physics to everyday situations.	Level-1 , Level-2
CO3. Understand the different sources of renewable energy and their generation processes and advances in nanomaterials and their properties, with a focus on quantum dots. To study the emerging field of quantum communication and its potential applications. To gain an understanding of the principles of biophysics in studying biological systems. Explore the properties and applications of shape memory materials.	Level-1 , Level-2
CO4. Understand the principles and techniques used in computer-aided drug design and drug delivery systems, to understand the fabrication techniques and working principles of nanosensors. Explore the effects of chemical pollutants on ecosystems and human health.	Level-1 , Level-2
CO5. Understand the interplay and connections between mathematics, physics, and chemistry in various advanced applications. Recognize how mathematical models and physical and chemical principles can be used	Level-4, Level-5

to explain and predict phenomena in different contexts.	
CO6. Understand and convert between different number systems, such as binary, octal, decimal, and hexadecimal. Differentiate between analog and digital signals and understand their characteristics. Gain knowledge of different types of transmission media, such as wired (e.g., copper cables, fiber optics) and wireless (e.g., radio waves, microwave, satellite)..	Level-4, Level-5

CO-PO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	-	1	-	-	-	3	1	3
CO 2	2	-	2	2	-	2	3	1	3
CO 3	2	-	2	2	-	2	3	1	3
CO 4	2	1	2	2	-	2	3	1	3
CO 5	1	1	3	2	3	2	3	2	3
CO 6	2	-	1	-	-	-	3	1	3

CO-PSO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	1	2	2	3	2
CO 2	3	2	3	3	2
CO 3	3	2	3	3	2
CO 4	3	2	3	3	2
CO 5	1	2	3	3	2
CO 6	1	2	2	3	2

Course Content :

Unit-1: ADVANCES IN BASICS MATHEMATICS

Straight Lines: Different forms – Reduction of general equation into various forms –Point of intersection of two straight lines

Limits and Differentiation: Standard limits – Derivative of a function –Problems on product rule and quotient rule

Integration: Integration as a reverse process of differentiation – Basic methods of integration

Matrices: Types of matrices – Scalar multiple of a matrix – Multiplication of matrices – Transpose of a matrix and determinants

Unit-2: ADVANCES IN PHYSICS:

Renewable energy: Generation, energy storage, and energy-efficient materials and devices.

Recent advances in the field of nanotechnology: Quantum dots, Quantum Communication- recent advances in biophysics- recent advances in medical physics- Shape Memory Materials.

Unit-3: ADVANCES IN CHEMISTRY:

Computer aided drug design and delivery, nano sensors, Chemical Biology, impact of chemical pollutants on ecosystems and human health, Dye removal - Catalysis method

Unit-4: Advanced applications of mathematics, physics & chemistry

Mathematical Modelling applications in physics and chemistry Application of Renewable energy: Grid Integration and Smart Grids, Application of nanotechnology: Nanomedicine, Application of biophysics: Biophysical Imaging, Biomechanics, Neurophysics, Application of medical physics: Radiation Therapy, Nuclear medicine Solid waste management, Environmental remediation- Green Technology, Water treatment.

Unit-5: Advanced Applications of computer Science

Number System-Binary, Octal, decimal, and Hexadecimal, Signals-Analog, Digital, Modem, Codec, Multiplexing, Transmission media, error detection and correction- Parity check and CRC, Networking devices- Repeater, hub, bridge, switch, router, gateway.

Recommended books:

1. Coordinate Geometry by S.L.Lony, Arihant Publications
2. Calculus by Thomas and Finny, Pearson Publications
3. Matrices by A.R.Vasishtha and A.K.Vasishtha, Krishna Prakashan Media(P)Ltd.
4. "Renewable Energy: Power for a Sustainable Future" by Godfrey Boyle
5. "Energy Storage: A Nontechnical Guide" by Richard Baxter
6. "Nanotechnology: Principles and Applications" by Sulabha K. Kulkarni and Raghvendra A. Bohara
7. "Biophysics: An Introduction" by Rodney Cotterill
8. "Medical Physics: Imaging" by James G. Webster
9. "Shape Memory Alloys: Properties and Applications" by Dimitris C. Lagoudas
10. Nano materials and applications by M.N.Borah
11. Environmental Chemistry by Anil.K.D.E.
12. Digital Logic Design by Morris Mano
13. Data Communication & Networking by Bahrouz Forouzan.

STUDENT ACTIVITIES

Unit-1: ADVANCES IN BASIC MATHEMATICS

1: Straight Lines Exploration

Provide students with a set of equations representing straight lines in different forms, such as slope-intercept form, point-slope form, or general form.

Students will explore the properties and characteristics of straight lines, including their slopes, intercepts, and point of intersection.

2: Limits and Differentiation Problem Solving

Students will apply the concept of limits to solve various problems using standard limits.

Encourage students to interpret the results and make connections to real-world applications such as analyzing rates of change or optimizing functions.

3: Integration Exploration

Students will explore the concept of integration as a reverse process of differentiation and apply basic methods of integration, such as the product rule, substitution method, or integration by parts.

Students can discuss the significance of integration in various fields, such as physics and chemistry

4: Matrices Manipulation

Students will perform operations on matrices, including scalar multiplication, matrix multiplication, and matrix transpose.

Students can apply their knowledge of matrices to real-world applications, such as solving systems of equations or representing transformations in geometry.

Unit-2: ADVANCES IN PHYSICS:

1: Case Studies

Provide students with real-world case studies related to renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

Students will analyze the case studies, identify the challenges or problems presented, and propose innovative solutions based on the recent advances in the respective field.

They will consider factors such as energy generation, energy storage, efficiency, sustainability, materials design, biomedical applications, or technological advancements.

Experimental Design

Assign students to design and conduct experiments related to one of the topics: renewable energy, nanotechnology, biophysics, medical physics, or shape memory materials.

They will identify a specific research question or problem to investigate and design an experiment accordingly.

Students will collect and analyze data, interpret the results, and draw conclusions based on their findings.

They will discuss the implications of their experimental results in the context of recent advances in the field.

3: Group Discussion and Debate

Organize a group discussion or debate session where students will discuss the ethical, social, and

environmental implications of the recent advances in renewable energy, nanotechnology, biophysics, medical physics, and shape memory materials.

Assign students specific roles, such as proponent, opponent, or moderator, and provide them with key points and arguments to support their positions.

Unit-3: ADVANCES IN CHEMISTRY:

1. Experimental Design and Simulation

In small groups, students will design experiments or simulations related to the assigned topic.

For example, in the context of computer-aided drug design, students could design a virtual screening experiment to identify potential drug candidates for a specific disease target.

For nano sensors, students could design an experiment to demonstrate the sensitivity and selectivity of nano sensors in detecting specific analytes.

Chemical biology-related activities could involve designing experiments to study enzyme-substrate interactions or molecular interactions in biological systems.

Students will perform their experiments or simulations, collect data, analyze the results, and draw conclusions based on their findings.

2. Case Studies and Discussion

Provide students with real-world case studies related to the impact of chemical pollutants on ecosystems and human health.

Students will analyze the case studies, identify the sources and effects of chemical pollutants, and propose mitigation strategies to minimize their impact.

Encourage discussions on the ethical and environmental considerations when dealing with chemical pollutants.

For the dye removal using the catalysis method, students can explore case studies where catalytic processes are used to degrade or remove dyes from wastewater.

Students will discuss the principles of catalysis, the advantages and limitations of the catalysis method, and its applications in environmental remediation.

3: Group Project

Assign students to work in groups to develop a project related to one of the topics.

The project could involve designing a computer-aided drug delivery system, developing a nano sensor for a specific application, or proposing strategies to mitigate the impact of chemical pollutants on ecosystems.

Students will develop a detailed project plan, conduct experiments or simulations, analyze data, and present their findings and recommendations.

Encourage creativity, critical thinking, and collaboration throughout the project.

Unit-4: ADVANCED APPLICATIONS OF MATHEMATICS, PHYSICS & CHEMISTRY

1: Mathematical Modelling Experiment

Provide students with a mathematical modelling experiment related to one of the topics. For example, in the context of renewable energy, students can develop a mathematical model to optimize the placement and configuration of solar panels in a solar farm.

Students will work in teams to design and conduct the experiment, collect data, and analyze the results using mathematical models and statistical techniques.

They will discuss the accuracy and limitations of their model, propose improvements, and interpret the implications of their findings in the context of renewable energy or the specific application area.

2: Case Studies and Group Discussions

Assign students to analyze case studies related to the applications of mathematical modelling in nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

Students will discuss the mathematical models and computational methods used in the case studies, analyze the outcomes, and evaluate the effectiveness of the modelling approach.

Encourage group discussions on the challenges, ethical considerations, and potential advancements in the field.

Students will present their findings and engage in critical discussions on the advantages and limitations of mathematical modelling in solving complex problems in these areas.

3. Group Project

Assign students to work in groups to develop a group project that integrates mathematical modelling with one of the application areas: renewable energy, nanotechnology, biophysics, medical physics, solid waste management, environmental remediation, or water treatment.

The project could involve developing a mathematical model to optimize the delivery of radiation therapy in medical physics or designing a mathematical model to optimize waste management practices.

Students will plan and execute their project, apply mathematical modelling techniques, analyze the results, and present their findings and recommendations.

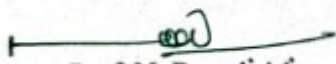
Encourage creativity, critical thinking, and collaboration throughout the project.

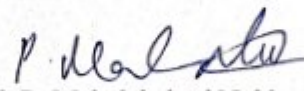
Unit-5: Advanced Applications of computer Science

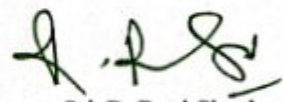
Students must be able to convert numbers from other number system to binary number systems

1. Identify the networking media used for your college network Identify all the networking devices used in your college premises.

Signed and approved by


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BLUE PRINT FOR SEMESTER END EXAMINATIONS PAPER SETTING

Learning level wise Weightage				
Bloom's Taxonomy level	Weightage	marks	Essay type	Short answer type
Knowledge/ Remember	33%	20	2	1(one out of two)
Understanding/ Comprehension	27%	16	2	
Application/	20%	12	1	1(one out of two)
Analysis	13%	8		2(two out of four)
Synthesis/ Evaluate	7%	4		1(one out of two)
Total	100	60		5 out of 10 questions

Chapter wise Weightage				
Sl. No.	Module/ Chapter	Name of the chapter	8 Marks	4 Marks
1	Unit-I	Advances in Basic Mathematics	2(one out of two)	2
2	Unit -II	Advances in Physics	2(one out of two)	2
3	Unit -III	Advances in Chemistry	2(one out of two)	2
4	Unit -IV	Advanced applications of Mathematics, Physics and Chemistry	2(one out of two)	2
5	Unit -V	Advanced applications of Computer Science	2(one out of two)	2

SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- I

B.Sc Hons Mathematics

COURSE 2: ADVANCES IN MATHEMATICAL, PHYSICAL AND CHEMICAL SCIENCES

(w.e.f. 2023-24)

Course code : 23MATM12

Time: 3 hours

Maximum Marks: 60

PART- A

Answer any **five** of the following questions. Each question carries **Four** marks. $5 \times 4 = 20$ Marks

1. Convert $2x+5y = 5$ into intercept form. Find the points of intersection of this line with coordinate axes

2. Calculate the value of $\lim_{x \rightarrow \infty} \frac{\sin x}{x}$
3. What are the technologies that are used to obtain energy from tides
4. What are the advantages of renewable energy
5. What are applications of nano-sensors
6. What is computer aided drug design
7. What are sources of solid wastes
8. What is biomechanics
9. Explain Hexadecimal system with examples
10. Convert binary number 11101 into decimal system

PART- B

Answer **all the following** questions. Each carries **Eight** marks

$5 \times 8 = 40$ Marks

11. (a) Find $\int e^{ax} \sin bx dx$ [Knowledge/Remember]

(Or)

(b) If A, B are invertible matrices then show that $(AB)^{-1} = B^{-1} A^{-1}$

[Knowledge/Remember]

12. (a) Explain different modes of energy storage [Knowledge/Remember]

(Or)

(b) What are quantum dots and give applications [Knowledge/Remember]

13. (a). Explain dye removal using catalysis methods [Understanding/ Comprehension]

(Or)

(b) Explain impact of chemical pollutants on ecosystem [Understanding/

Comprehension]

14. (a). What is green technology? How does it work and give types, adoption and examples of green technology [Understanding/ Comprehension]

(Or)

(b) Write a note on nuclear medicine [Understanding/ Comprehension]

15. (a) What is the difference between analogue and digital signal. Describe differences between them [Application]

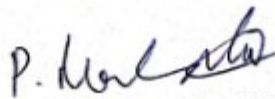
(Or)

(b) Convert the following decimal numbers into binary form

(1) 243, (2) 45, (3) 77, (4) 89 [Application]

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS
COURSE 3: DIFFERENTIAL EQUATIONS

(w.e.f. 2023-24)

Course Code: 23MATM21

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. solve first order first degree linear differential equations.	Level-1, Level-2
CO2. convert a non-exact homogeneous equation to exact differential equation by using an integrating factor.	Level-1, Level-2, Level-3
CO3. know the methods of finding solution of a differential equation of first order but not of first degree.	Level-2, Level-3, Level-5
CO4. solve higher-order linear differential equations for both homogeneous and non-homogeneous, with constant coefficients.	Level-3, Level-4, Level-5
CO5. understand and apply the appropriate methods for solving higher order differential equations.	Level-3, Level-4, Level-5

CO-PO Mapping									
1-Low, 2- Moderate, 3- High, '-' No Correlation									

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	-	1	-	-	-	2	-	3
CO 2	2	-	1	-	-	-	2	-	3
CO 3	3	-	1	-	-	-	2	-	3
CO 4	3	-	1	-	-	-	2	-	3
CO 5	3	1	1	-	-	-	3	-	3

CO-PSO Mapping					
1-Low, 2- Moderate, 3- High, '-' No Correlation					

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	1	2	2	1
CO 2	3	1	2	2	1
CO 3	2	2	2	3	2
CO 4	2	2	2	3	2
CO 5	2	2	3	3	2

Course Content

Unit – 1

Differential Equations of first order and first degree

Linear Differential Equations – Bernoulli's Equations - Exact Differential Equations – Integrating factors - Equations reducible to Exact Equations by Integrating Factors -

Unit – 2

Differential Equations of first order but not of first degree

Equations solvable for p , Equations solvable for y , Equations solvable for x – Clairaut's equation - Orthogonal Trajectories: Cartesian and Polar forms.

Unit – 3

Higher order linear differential equations

Solutions of homogeneous linear differential equations of order n with constant coefficients - Solutions of non-homogeneous linear differential equations with constant coefficients by means of polynomial operators

(i) $Q(x) = e^{ax}$ (ii) $Q(x) = \sin ax$ (or) $\cos ax$

Unit – 4

Higher order linear differential equations (continued.)

Solution to a non-homogeneous linear differential equation with constant coefficients

P.I. of $f(D)y = Q$ when $Q = bx^k$

P.I. of $f(D)y = Q$ when $Q = e^{ax}V$, where V is a function of x

P.I. of $f(D)y = Q$ when $Q = xV$, where V is a function of x

Unit-5

Higher order linear differential equations with non-constant coefficients

Linear differential Equations with non-constant coefficients; Cauchy-Euler Equation; Legendre Equation; Method of variation of parameters

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving Sessions.

Text Book

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

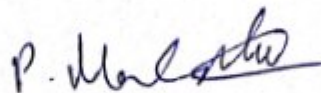
Reference Books

1. Ordinary and Partial Differential Equations by Dr. M.D. Raisinghania, published by S. Chand & Company, New Delhi.
2. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha-Universities Press.
3. Differential Equations -Srinivas Vangala & Madhu Rajesh, published by Spectrum University Press.

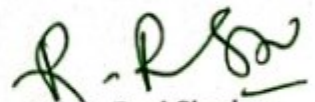
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SEMESTER END EXAMINATIONS MODEL PAPER
SEMESTER- II
B.Sc Hons Mathematics

COURSE 3: DIFFERENTIAL EQUATIONS
(w.e.f. 2023-24)

Course Code: 23MATM21

Time: 3 hours

Maximum Marks: 60

SECTION -A

Answer any FIVE questions

Each question carries 5 marks

5x4=20M

1. Solve $y(1+xy)dx + x(1-xy)dy = 0$.
2. Solve $(1+y^2)dx = (\tan^{-1}y - x)dy$.
3. Solve $p^2 - 5p + 6 = 0$.
4. Solve $(D^4 - 4D^3 + 6D^2 - 4D + 1)y = 0$.
5. Solve $(D^2 - 3D + 2)y = \cosh x$.
6. Solve $(D^2 + 2D + 1)y = x \cos x$.
7. Solve $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 13y = 8e^{3x} \sin 2x$.
8. Solve $(D^2 + 1)y = \operatorname{cosec} x$ by the method of variation of parameters
9. Write formula to solution of $\frac{dy}{dx} + P(x)y = Q(x)$
10. Explain the Clairauts method for the problem $y = px + \sin p$

SECTION-B

Answer any FIVE questions.

Each question carries 10 marks.

5x8=40M

11 a) Solve $x \frac{dy}{dx} + y = y^2 \log x$.

(or)

b) Solve $y^2 dx = (x^2 - xy - y^2)dy$.

12 a). Solve $y = 2xp + x^2 p^4$.

(or)

b). Solve $p^2 + 2py \cot x = y^2$.

13 a). Solve $(D^2 - 4D + 3)y = \sin 3x \cos 2x$.

(or)

b). Solve $(D^2 + 9)y = \cos^3 x$

14. a). Solve $(D^4 + 2D^2 + 1)y = x^2 \cos x$

(or)

b). Solve $\frac{d^2 y}{dx^2} + 3 \frac{dy}{dx} + 2y = x e^x \sin x$

15 a). Solve $(x^3 D^3 + 2x^2 D^2 + 2)y = 10(x + \frac{1}{x})$

(or)

b). Solve $(D^2 + a^2)y = \cot ax$ by the method of variation of parameters.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 4: ANALYTICAL SOLID GEOMETRY

(w.e.f. 2023-24)

Course Code: 23MATM22

Course outcomes – Mapping with Blooms Taxonomy levels	
CO1. understand planes and system of planes	Level-1, Level-2, Level-3
CO2. know the detailed idea of lines	Level-2, Level-3, Level-4, Level-6
CO3. understand spheres and their properties	Level-2, Level-3, Level-4, Level-5
CO4. know system of spheres and coaxial system of spheres	Level-4, Level-5, Level-6
CO5. understand various types of cones	Level-2, Level-3, Level-4

CO-PO Mapping
1-Low, 2- Moderate, 3- High, '-' No Correlation

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9
CO 1	2	1	-	-	-	1	3	-	3
CO 2	2	1	-	-	-	1	3	-	3
CO 3	3	1	-	-	-	1	3	-	3
CO 4	3	1	-	-	-	1	3	-	3
CO 5	2	1	-	-	-	1	3	-	3

CO-PSO Mapping
2- Low, 2- Moderate, 3- High, '-' No Correlation

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	2	3	2
CO 2	3	2	2	3	2
CO 3	3	2	2	3	2
CO 4	3	2	2	3	2
CO 5	3	2	2	3	2

Course Content

Unit – 1 The Plane

Three dimensional coordinates, direction cosines and direction ratios of a line, Equation of plane in terms of its intercepts on the axis - Equations of the plane through the given points - Length of the perpendicular from a given point to a given plane - Bisectors of angles between two planes - Combined equation of two planes - Orthogonal projection on a plane.

Unit – 2

The Line

Equation of a line - Angle between a line and a plane - The condition that a given line may lie in a given plane - The condition that two given lines are coplanar - Number of arbitrary constants in the equations of straight line - Sets of conditions which determine a line - The shortest distance between two lines - The length and equations of the line of shortest distance between two straight lines - Length of the perpendicular from a given point to a given line.

Unit – 3

The Sphere

Definition and equation of the sphere - Equation of the sphere through four given points - Plane sections of a sphere - Intersection of two spheres - Equation of a circle - Sphere through a given circle - Intersection of a sphere and a line - Power of a point - Tangent plane - Plane of contact; Polar plane - Pole of a Plane - Conjugate points - Conjugate planes.

Unit – 4

Spheres (continued)

Angle of intersection of two spheres - Conditions for two spheres to be orthogonal - Radical plane; Coaxial system of spheres - Simplified form of the equation of two spheres. Definitions of a cone – vertex, guiding curve and generators - Equation of the cone with a given vertex and guiding curve - Equations of cones with vertex at origin are homogenous - Condition that the general equation of the second degree should represent a cone.

Unit – 5

Cones

- Enveloping cone of a sphere - Right circular cone - Equation of the right circular cone with a given vertex, axis and semi vertical angle. Introduction to cylinder, Right circular cylinder.

Activities

Seminar/ Quiz/ Assignments/ Three dimensional analytical Solid geometry and its applications/ Problem Solving Sessions.

Text Book

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

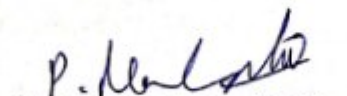
Reference Books

1. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
2. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by TataMcGraw -Hill Publishers.
3. Solid Geometry by B. Rama Bhupal Reddy, published by Spectrum University Press.

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SEMESTER END EXAMINATIONS MODEL PAPER

SEMESTER- II B.Sc Hons Mathematics COURSE 4: ANALYTICAL SOLID GEOMETRY (w.e.f. 2023-24)

Course Code: 23MATM22
Time: 3 hours

Maximum Marks: 60

SECTION – A

Answer any Five questions . Each question carries 04 Marks.

5 x 4M = 20M

1. A variable plane is at a constant distance 'P' from the origin meets the axis in A,B,C. Show that the locus of the tetrahedron OABC is $x^2+y^2+z^2 = 16p^2$
2. Find the equation of the plane that passes through the point (3,-3,1) and is normal to the line joining the points (3,4,-1) and (2,-1,5).
3. Find the image of (2,- Find the an1,3) in the plane $3x-2y-z-9 = 0$.
4. Find the Angle between the lines $x-2y+z = 0$, $x+y-z = 0$ and $x+2y+z = 5$, $8x+12y+5z = 0$.
5. Find the equation of a sphere passing through the circle $x^2+y^2+z^2 = 4$, $z=0$ and is intersected by the plane $x+2y+2z=0$ in a circle of radius 3.
6. Find the pole of the plane $x-y-z+9 = 0$ w.r.t the sphere $x^2+y^2+z^2-2x+4y-6z+5 = 0$.
7. Find the length of the tangent line from the point (3, 1, -1) to the sphere $x^2+y^2+z^2-3x+5y+7 = 0$.
8. Find the equation to the right circular cone whose vertex is (3,2,1), axis line $\frac{x-3}{4} = \frac{y-2}{1} = \frac{z-1}{3}$ and semi vertical angle 30° .
9. Find the vertex of the cone $7x^2+2y^2+2z^2-10zx+10xy+26x-2y+2z-17 = 0$.
10. Find the Enveloping cone of the sphere $x^2+y^2+z^2+2x-2y-2 = 0$ with vertex (1,1,1).

SECTION – B

Answer all questions , Each question carries 08 marks.

5 x 8M = 40M

11. (a). A Variable plane makes intercepts on the axes , the sum of whose squares is K^2 (a constant). Show that the locus of the foot of the perpendicular from the origin is $(x^2+y^2+z^2)(x^2+y^2+z^2)^2 = k^2$
OR
(b) Find the equations of the planes bisecting the angle between the planes $x+2y+2z-3 = 0$, $3x+4y+12z+1 = 0$ and specify the one which bisects the acute angle.

12. (a). Prove that the lines $\frac{x-1}{2} = \frac{y-2}{3} = \frac{z-3}{4}$; $\frac{x-2}{3} = \frac{y-3}{4} = \frac{z-4}{5}$ are coplanar. Also find their point of the intersection and the plane containing the lines.

OR

(b) Find the length and equations to the line of shortest distance between the lines $\frac{x}{4} = \frac{y+1}{3} = \frac{z-2}{2}$; $5x-2y-3z+6=0 = x-3y+2z-3$.

13. (a). Show that the two circles $x^2+y^2+z^2-y+2z=0$, $x-y+z=2$ and $x^2+y^2+z^2+x-3y+z-5=0$, $2x-y+4z-1=0$ lie on the same sphere and find its equation.

OR

(b) Show that the spheres $x^2+y^2+z^2=25$, $x^2+y^2+z^2-24x-40y-18z+225=0$ touch externally. Find the point of contact.

14. (a). Find the limiting points of the coaxial system of spheres determined by the spheres

$$x^2+y^2+z^2+3x-3y+6=0, x^2+y^2+z^2-6y-6z+6=0.$$

OR

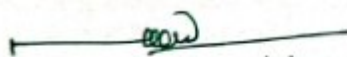
(b) If the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{1}$ represents one of the three mutually perpendicular generators of the cone $11yz+6zx-14xy=0$. Find the equations of the other two.

15. (a). Find the equation of the tangent plane at the point $(-3,0,-1)$ of the cone $7x^2+2y^2+2z^2-10zx+10xy+26x-2y+2z-17=0$.

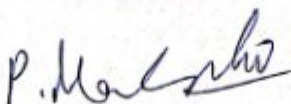
OR

(b) Find the equation to the right circular cone whose vertex is $P(2,-3,5)$, axis PQ which makes equal angles with coordinate axes and which passes through $A(1,-2,3)$.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 5: GROUP THEORY

(w.e.f. 2023-24)

Course Code: 23MATM31

Course Outcomes

After successful completion of this course, the student will be able to

CO1. acquire the basic knowledge and structure of groups

CO2. get the significance of the notation of a subgroup and cosets.

CO3. understand the concept of normal subgroups and properties of normal subgroup

CO4. study the homomorphisms and isomorphisms with applications.

CO5. understand the properties of permutation and cyclic groups

Course Content

Unit – 1 Groups

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

Unit – 2: Sub Groups

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition-examples-criterion for a complex to be a subgroups; Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups. Coset Definition – properties of Cosets – Index of a subgroups of a finite groups – Lagrange's Theorem.

Unit – 3: Normal Subgroups

Normal Subgroups: Definition of normal subgroup – proper and improper normal subgroup–Hamilton group- Criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups Sub group of index 2 is a normal sub group

Unit – 4: Homomorphisms

Quotient groups, Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

Unit – 5: Permutations and Cyclic Groups

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups - Definition of cyclic group – elementary properties – classification of cyclic groups.

Activities

Seminar/ Quiz/ Assignments/ Applications of Group Theory to Real life Problem /Problem Solving Sessions.

Text Book

Modern Algebra by A.R.Vasishtha and A.K.Vasishtha, KrishnaPrakashanMedia Pvt. Ltd., Meerut.

Reference Books

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna, Jai Prakash and Co. Printing Press, Meerut
3. Rings and Linear Algebra by Pundir&Pundir, published by PragathiPrakashan

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 6: NUMERICAL METHODS

(w.e.f. 2023-24)

Course Code: 23MATM32

Course Outcomes

After successful completion of this course, the student will be able to

CO1. difference between the operators Δ, ∇, E and the relation between them

CO2. know about the Newton – Gregory Forward and backward interpolation

CO3. know the Central Difference operators $\delta, \delta^2, \delta^3$ and relation between them

CO4. solve Algebraic and Transcendental equations

CO5. understand the concept of Curve fitting

Course Content

Unit-1 : The calculus of finite differences

The operators Δ, ∇, E - Fundamental theorem of difference calculus- properties of Δ, ∇, E and problems on them to express any value of the function in terms of the leading terms and the leading differences - relations between E and D - relation between D and Δ - problems on one or more missing terms- Factorial notation- problems on separation of symbols- problems on Factorial notation.

Unit – 2: Interpolation with equal and unequal intervals

Derivations of Newton – Gregory Forward and backward interpolation and problems on them. Divided differences - Newton divided difference formula - Lagrange's and problems on them.

Unit – 3 : Central Difference Interpolation formulae

Central Difference operators $\delta, \delta^2, \delta^3$ and relation between them - Gauss forward formula for equal intervals - Gauss Backward formula - Stirlings formula - Bessel's formula and problems on the above formulae.

Unit – 4: Solution of Algebraic and Transcendental equation

Method for finding initial approximate value of the root - Bisection method - to find the solution of given equations by using (i) Regula Falsi method (ii) Iteration method (iii) Newton – Raphson's method and problems on them.

Unit – 5: Curve Fitting

Least-squares curve fitting procedures - fitting a straight line-nonlinear curve fitting-curve fitting by a sum of exponentials

Activities

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson,(2003) 7thEdition
2. Introductory Methods of Numerical Analysis by S.S. Sastry, (6th Edition) PHI New Delhi 2012
3. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers (2012), 6th edition.

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COURSE 7: LAPLACE TRANSFORMS

(w.e.f. 2023-24)

Course Code: 23MATM33

Course Outcomes

After successful completion of this course, the student will be able to

CO1. understand the definition and properties of Laplace transformations

CO2. get an idea about first and second shifting theorems and change of scale property

CO3. understand Laplace transforms of standard functions like Bessel, Error function etc

CO4. know the reverse transformation of Laplace and properties

CO5. get the knowledge of application of convolution theorem

Course Content

Unit – 1: LAPLACE TRANSFORMS – I

Definition of Laplace Transform - Linearity Property - Piecewise Continuous Function - Existence of Laplace Transform - Functions of Exponential order and of Class A.

Unit – 2: LAPLACE TRANSFORMS – II

First Shifting Theorem, Second Shifting Theorem, Change of Scale Property, Laplace transform of the derivative of $f(t)$, Initial value theorem and Final value theorem.

Unit – 3: LAPLACE TRANSFORMS – III

Laplace Transform of Integrals - Multiplication by t , Multiplication by t^n - division by t - Laplace transform of Bessel Function - Laplace Transform of Error Function – Laplace transform of Sine and Cosine integrals.

Unit – 4: INVERSE LAPLACE TRANSFORMS – I

Definition of Inverse Laplace Transform - Linearity Property - First Shifting Theorem - Second Shifting Theorem - Change of Scale property - use of partial fractions - Examples.

Unit – 5: INVERSE LAPLACE TRANSFORMS – II

Inverse Laplace transforms of Derivatives - Inverse Laplace Transforms of Integrals - Multiplication by Powers of ' p ' - Division by powers of ' p ' - Convolution Definition - Convolution Theorem - proof and Applications - Heaviside's Expansion theorem and its Applications.

Activities

Seminar/ Quiz/ Assignments/ Applications of Laplace Transforms to Real life Problem /Problem Solving Sessions.

Text Book

Laplace Transforms by A.R. Vasishtha, Dr. R.K. Gupta, Krishna Prakashan Media Pvt. Ltd., Meerut.

Reference Books

1. Introduction to Applied Mathematics by Gilbert Strang, Cambridge Press
2. Laplace and Fourier's transforms by Dr. J.K. Goyal and K.P. Gupta, Pragathi Prakashan, Meerut.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 8: SPECIAL FUNCTIONS

(w.e.f. 2023-24)

Course Code: 23MATM34

Course Outcomes

After successful completion of the course will be able to

CO1. Understand the Beta and Gamma functions, their properties and relation between these two functions, understand the orthogonal properties of Chebyshev polynomials and recurrence relations.

CO2. Find power series solutions of ordinary differential equations.

CO3. Solve Hermite equation and write the Hermite Polynomial of order (degree) n , also Find the generating function for Hermite Polynomials, study the orthogonal properties of Hermite Polynomials and recurrence relations.

CO4. Solve Legendre equation and write the Legendre equation of first kind, also find the generating function for Legendre Polynomials, understand the orthogonal properties of Legendre Polynomials.

CO5. Solve Bessel equation and write the Bessel equation of first kind of order n , also find the generating function for Bessel function understand the orthogonal properties of Bessel function.

Unit-1: Beta and Gamma functions, Chebyshev polynomials

Euler's Integrals-Beta and Gamma Functions, Elementary properties of Gamma Functions, Transformation of Gamma Functions. Another form of Beta Function, Relation between Beta and Gamma Functions. Chebyshev polynomials, orthogonal properties of Chebyshev polynomials, recurrence relations, generating functions for Chebyshev polynomials.

Unit-2: Power series and Power series solutions of ordinary differential equations

Introduction, summary of useful results, power series, radius of convergence, theorems on Power series Introduction of power series solutions of ordinary differential equation Ordinary and singular points, regular and irregular singular points, power series solution.

Unit-3: Hermite polynomials

Hermite Differential Equations, Solution of Hermite Equation, Hermite polynomials, generating function for Hermite polynomials. Other forms for Hermite Polynomials, Rodrigues formula for Hermite Polynomials, to find first few Hermite Polynomials. Orthogonal properties of Hermite Polynomials, Recurrence formulae for Hermite Polynomials.

Unit-4: Legendre polynomials

Definition, Solution of Legendre's equation, Legendre polynomial of degree n , generating function of Legendre polynomials. Definition of $P_n(x)$ and $Q_n(x)$, General solution of Legendre's Equation (derivations not required) to show that $P_n(x)$ is the coefficient of h^n in the expansion of $(1-2xh+h^2)^{-1/2}$ Orthogonal properties of Legendre's polynomials, Recurrence formulas for Legendre's Polynomials.

Unit-5: Bessel's equation

Definition, Solution of Bessel's equation, Bessel's function of the first kind of order n , Bessel's function of the second kind of order n .

Integration of Bessel's equation in series form, Definition of $J_n(x)$, recurrence formulae for $J_n(x)$

Generating function for $J_n(x)$, orthogonality of Bessel functions.

Activities

Seminar/ Quiz/ Assignments/ Applications of Special functions to Real life Problem /Problem Solving Sessions.

Text Book

Special Functions by J.N.Sharma and Dr.R.K.Gupta, Krishna Prakashan,

Reference Books

1. Dr.M.D.Raisinghania, Ordinary and Partial Differential Equations, S. Chand & Company Pvt.Ltd., Ram Nagar, New Delhi-110055.
2. Shanti Narayan and Dr.P.K.Mittal, Integral Calculus, S. Chand & Company Pvt. Ltd., Ram Nagar, New Delhi-110055.
3. George F. Simmons, Differential Equations with Applications and Historical Notes, Tata McGRAW-Hill Edition, 1994.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 9: RING THEORY

(w.e.f. 2023-24)

Course Code: 23MATM41

Course Outcomes

After successful completion of this course, the student will be able to
CO1. acquire the basic knowledge of rings, fields and integral domains
CO2. get the knowledge of subrings and ideals
CO3. construct composition tables for finite quotient rings
CO4. study the homomorphisms and isomorphisms with applications.
CO5. get the idea of division algorithm of polynomials over a field.

Course Content

Unit – 1: Rings and Fields

Definition of a ring and Examples – Basic properties – Boolean rings - Fields – Divisors of 0 and Cancellation Laws – Integral Domains – Division ring - The Characteristic of a Ring, Integral domain and Field – NonCommutative Rings - Matrices over a field – The Quaternion ring.

Unit – 2: Subrings and Ideals

Definition and examples of Subrings – Necessary and sufficient conditions for a subset to be a subring – Algebra of Subrings – Centre of a ring – left, right and two sided ideals – Algebra of ideals – Equivalence of a field and a commutative ring without proper ideals

Unit III: Principal ideals and Quotient rings

Definition of a Principal ideal ring(Domain) – Every field is a PID – The ring of integers is a PID – Example of a ring which is not a PIR – Cosets – Algebra of cosets – Quotient rings – Construction of composition tables for finite quotient rings of the ring $\mathbb{Z}$ of integers and the ring $\mathbb{Z}_n$ of integers modulo n .

Unit – 4: Homomorphism of Rings

Homomorphism of Rings – Definition and Elementary properties – Kernel of a homomorphism – Isomorphism – Fundamental theorems of homomorphism of rings – Maximal and prime Ideals – Prime Fields

Unit – 5: Rings of Polynomials

Polynomials in an indeterminate – The Evaluation morphism -- The Division Algorithm in $F[x]$ – Irreducible Polynomials – Ideal Structure in $F[x]$ – Uniqueness of Factorization $F[x]$.

Activities

Seminar/ Quiz/ Assignments/ Applications of ring theory concepts to Real life Problem /Problem Solving Sessions.

Text book

Modern Algebra by A.R.Vasishta and A.K.Vasishta, Krishna Prakashan Media Pvt. Ltd.

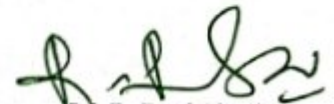
Reference books

1. A First Course in Abstract Algebra by John. B. Farleigh, Narosa Publishing House.
2. Linear Algebra by Stephen. H. Friedberg and Others, Pearson Education India

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 10: INTRODUCTION TO REAL ANALYSIS

(w.e.f. 2023-24)

Course Code: 23MATM42

Course Outcomes

After successful completion of this course, the student will be able to

CO1. get clear idea about the real numbers and real valued functions.

CO2. Obtain the skills of analysing the concepts and applying appropriate methods for testing convergence of a sequence/ series.

CO3. Test the continuity and differentiability and Riemann integration of a function.

CO4. Know the geometrical interpretation of mean value theorems.

CO5. know about the fundamental theorem of integral calculus

Course Contents

Unit – 1: REAL NUMBERS, REAL SEQUENCES

The algebraic and order properties of $\mathbb{R}$ - Absolute value and Real line - Completeness property of $\mathbb{R}$ - Applications of supremum property - intervals. (No question is to be set from this portion) Sequences and their limits - Range and Boundedness of Sequences - Limit of a sequence and Convergent sequence - The Cauchy's criterion - properly divergent sequences - Monotone sequences - Necessary and Sufficient condition for Convergence of Monotone Sequence - Limit Point of Sequence - Subsequences and the Bolzano-Weierstrass theorem - Cauchy Sequences - Cauchy's general principle of convergence.

Unit – 2: INFINITE SERIES

Introduction to series - convergence of series - Cauchy's general principle of convergence for series tests for convergence of series - Series of non-negative terms - P-test - Cauchy's n^{th} root test - D'Alembert's Test - Alternating Series - Leibnitz Test.

Unit – 3: LIMIT & CONTINUITY

Real valued Functions - Boundedness of a function - Limits of functions - Some extensions of the limit concept - Infinite Limits - Limits at infinity (No question is to be set from this portion). Continuous functions - Combinations of continuous functions - Continuous Functions on intervals - uniform continuity.

Unit – 4: DIFFERENTIATION AND MEAN VALUE THEOREMS

The derivability of a function at a point and on an interval - Derivability and continuity of a function - Mean Value Theorems - Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean Value Theorem

Unit – 5: RIEMANN INTEGRATION

Riemann Integral - Riemann integral functions - Darboux theorem - Necessary and sufficient condition for $\mathbb{R}$ integrability - Properties of integrable functions - Fundamental theorem of integral calculus - integral as the limit of a sum - Mean Value Theorems.

Activities

Seminar/ Quiz/ Assignments/ Applications of Real Analysis to Real life Problem /Problem Solving Sessions.

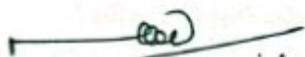
Text Book

An Introduction to Real Analysis by Robert G. Bartle and Donald R. Sherbert, John Wiley and sons Pvt. Ltd

Reference Books

1. Elements of Real Analysis by Shanthi Narayan and Dr. M. D. Raisinghania, S. Chand & Company Pvt. Ltd., New Delhi.
2. Principles of Mathematical Analysis by Walter Rudin, McGraw-Hill Ltd.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 11: INTEGRAL TRANSFORMS WITH APPLICATIONS

(w.e.f. 2023-24)

Course Code: 23MATM43

Course Outcomes

Students after successful completion of the course will be able to

CO1. understand the application of Laplace transforms to solve ODEs

CO2. understand the application of Laplace transforms to solve Simultaneous DEs

CO3. understand the application of Laplace transforms to Integral equations

CO4. basic knowledge of Fourier-Transformations

CO5. Comprehend the properties of Fourier transforms and solve problems related to finite Fourier transforms.

Course Content

Unit – 1: Application of Laplace Transform to solutions of Differential Equations

Solutions of ordinary Differential Equations - Solutions of Differential Equations with constants coefficients - Solutions of Differential Equations with Variable coefficients.

Unit – 2: Application of Laplace Transform to solutions of Differential Equations

Solutions of Simultaneous Ordinary Differential equations - Solutions of Partial Differential Equations.

Unit – 3: Application of Laplace Transforms to Integral Equations

Definitions of Integral Equations - Abel's Integral Equation - Integral Equation of Convolution Type - Integral Differential Equations - Application of L.T. to Integral Equations.

Unit – 4: Fourier Transforms - I

Definition of Fourier Transform - Fourier sine Transform - Fourier cosine Transform - Linear Property of Fourier Transform - Change of Scale Property for Fourier Transform - sine Transform and cosine transform shifting property - Modulation theorem.

Unit – 5: Fourier Transforms – II

Definition of Convolution - Convolution theorem for Fourier transform - Parseval's Identity - Relationship between Fourier and Laplace transforms - problems related to Integral Equations - Finite Fourier Transforms - Finite Fourier Sine Transform - Finite Fourier Cosine Transform - Inversion formula for sine and cosine transforms only - statement and related problems.

Activities

Seminar/ Quiz/ Assignments/Applications of Integral Transforms in real life problems
/Problem Solving Sessions.

Text Book

B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2017.

Reference Book

Fourier Series and Integral Transformations by Dr.S. Sreenadh and others, published by S.Chand and Co, New Delhi

1. E.M. Stein and R. Shakarchi, Fourier analysis: An introduction, (Princeton University Press, 2003).
2. R.S. Strichartz, A guide to Distribution theory and Fourier transforms, (World scientific, 2003).

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 12: LINEAR ALGEBRA

(w.e.f. 2023-24)

Course Code: 23MATM51

Course Outcomes

After successful completion of this course, the student will be able to

CO1. understand the concepts of vector spaces, sub spaces

CO2. understand the concepts of basis, dimension and their properties

CO3. understand the concept of linear transformation and its properties

CO4. apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods

CO5. learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Content

UNIT – I: Vector Spaces-I

Vector Spaces - General properties of vector spaces - n-dimensional Vectors - addition and scalar multiplication of Vectors - internal and external composition - Null space - Vector subspaces -Algebra of subspaces - Linear Sum of two subspaces - linear combination of Vectors- Linear span Linear independence and Linear dependence of Vectors.

UNIT –II: Vector Spaces-II

Basis of Vector space - Finite dimensional Vector spaces - basis extension - co-ordinates- Dimension of a Vector space - Dimension of a subspace - Quotient space and Dimension of Quotient space.

UNIT –III: Linear Transformations

Linear transformations - linear operators- Properties of L.T- sum and product of L.Ts - Algebra of Linear Operators - Range and null space of linear transformation - Rank and Nullity of linear transformations - Rank- Nullity Theorem.

UNIT –IV: Matrices

Characteristic equation - Characteristic Values - Characteristic vectors of a square matrix - Cayley Hamilton Theorem – problems on Cayley Hamilton Theorem.

UNIT –V: Inner product space

Inner product spaces- Euclidean and unitary spaces- Norm or length of a Vector- Schwartz inequality- Triangle Inequality- Parallelogram law- Orthogonality- Orthonormal set- Problems on Gram– Schmidt orthogonalisation process - Bessel's inequality.

Activities :

Seminar/ Quiz/ Assignments/Applications of Linear Algebra in real life problems\ Problem Solving.

Text Books

1. Linear Algebra by J.N. Sharma and A.R. Vasishtha, published by Krishna PrakashanMedia (P) Ltd.
2. Matrices by A.R.Vasishtha and A.K.Vasishtha published by Krishna PrakashanMedia (P) Ltd.

Reference Books

1. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt.Ltd. 4th Edition, 2007
 2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson education lowpriced edition), New Delhi.
 3. Matrices by Shanti Narayana, published by S.Chand Publications
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B.A./B.Sc. Hons. MATHEMATICS

Proposed syllabus

COURSE 13: VECTOR CALCULUS

(w.e.f. 2023-24)

Course Code: 23MATM52

Course Outcomes

Students after successful completion of the course will be able to

CO1. Learn multiple integrals as a natural extension of definite integral to a function of two variables in the case of double integral/three variables in the case of triple integral.

CO2. Learn applications in terms of finding surface area by double integral and volume by triple integral.

CO3. Determine the gradient, divergence and curl of a vector and vector identities.

CO4. Evaluate line, surface and volume integrals.

CO5. understand relation between surface and volume integrals (Gauss divergence theorem), relation between line integral and volume integral (Green's theorem), relation between line and surface integral (Stokes theorem)

Course Content

Unit-1: Multiple Integrals-I

Introduction -Double integrals -Evaluation of double integrals -Properties of double integrals - Region of integration -double integration in Polar Co-ordinates- Change of variables in double integrals -change of order of integration.

Unit-2: Multiple integrals-II

Triple integral-region of integration-change of variables-Plane areas by double integrals-surface area by double integral -Volume as a double integral, volume as a triple integral.

Unit-3: Vector differentiation

Vector differentiation -ordinary - derivatives of vectors - Differentiability -Gradient -Divergence -Curl operators - Formulae involving the separators.

Unit-4: Vector integration

Line Integrals with examples - Surface Integral with examples - Volume integral with examples.

Unit-5: Vector integration applications

Gauss theorem and applications of Gauss theorem-Green's theorem in plane and applications of Green's theorem - Stokes's theorem and applications of Stokes theorem.



Activities

Seminar/ Quiz/ Assignments/ Applications of Vector calculus to Real life Problems /Problem Solving Sessions.

Text Book

A text Book of Higher Engineering Mathematics by B.S.Grawal, Khanna Publishers, 43rd Edition

Reference Books

1. Vector Calculus by P.C.Matthews, Springer Verlag publications.
2. Vector Analysis by Murray Spiegel, Schaum Publishing Company, New York

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COURSE 14 A: FUNCTIONS OF A COMPLEX VARIABLE

(w.e.f. 2023-24)

Course Code: 23MATM53A

Course Outcomes

After successful completion of this course, the student will be able to

CO1. determine a Bilinear transformation under given condition

CO2. know about continuity, compactness and connectedness of sets in complex plane

CO3. know the necessary condition and sufficient condition for $f(z)$ to be analytic

CO4. know about the inverse of an analytic function

CO5. know about the convergence of sequences and the necessary & sufficient condition for a sequence to be convergent

CO6. know the power series expansion of elementary functions

Course Content

Unnit-1: Bilinear Transformations

Extended Complex Plane – Resultant and Inverse of a bilinear transformation – The linear group – Geometrical significance of the transformation. Angle preserving property of Bilinear Transformation– Determination of Bilinear transformations under given condition, some special bilinear transformations.

Unit – 2: Topological Considerations

Neighbourhood of a point – Interior, exterior and frontier points of a set, open and closed sets. Connected sets, Domains and continua - a theorem on Nests of closed Rectangular domains- Bolzano Weierstrass theorem- Hein-Borel theorem. Limits - algebraic operations with limits – continuity and uniform continuity – compactness – connectedness - Jordan curve theorem - connectedness of line segments and polygonal lines. Branch line and Branch point - Characterisation of open connected sets by polygonal lines.

Unit – 3: Analytic functions

Differentiable functions of a complex variable - Geometrical representation of a variable - Analytic function- Elementary rules and chain rule - Derivatives of polynomials and rational functions - The necessary condition and sufficient condition for $f(z)$ to be analytic - Analytic functions in a Domain – Derivative of w in polar form - Construction of $f(z)$.

Unit – 4: Inverse of an analytic function and infinite series

The inverse of an analytic function – neighbourhood preserving mappings - Domain preserving and angle preserving property of analytic mappings.

Convergent sequences, necessary and sufficient condition for a sequence to be convergent, Cauchy sequence, Convergence of infinite series. Cauchy general principle of convergence for a series. Absolute convergence of a series. Abel's and Dirichlet's tests. Rearrangement of series, product of series.

Unit-5: Power-Series

Power series - exponential, trigonometric and hyperbolic functions - zeros of $\sin z$, $\cos z$ - periods of $\sin z$, $\cos z$, $E(z)$ - A law of logarithms - Analytic character of $\log z$ - generalized a^b - Analytic character of z^n - $\cos^{-1} z$, $\sin^{-1} z$ and derivatives of $\cos^{-1} z$, $\sin^{-1} z$.

Activities

Seminar/ Quiz/ Assignments/ Applications of Functions of complex variables to Real life Problem /Problem Solving Sessions.

Text Book

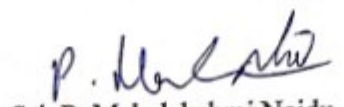
Theory of Functions of a Complex variable by Shanti Narayan & Dr. P. K. Mittal, S. Chand & Company Ltd.

Reference Books

1. Theory of Functions of a Complex Variable by A. I. Markushevich, Second Edition, AMS Chelsea Publishing
2. Theory And Applications by M. S. Kasara, Complex Variables, 2nd Edition, Prentice Hall India Learning Private Limited

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 14 B: ADVANCED NUMERICAL METHODS

(w.e.f. 2023-24)

Course Code: 23MATM53B

Course Outcomes

After successful completion of this course, the student will be able to

CO1. find derivatives using various difference formulae

CO2. understand the process of Numerical Integration

CO3. solve Simultaneous Linear systems of Equations

CO4. understand Iterative methods

CO5. find Numerical Solution of Ordinary Differential Equations

Course Content

UNIT – I: Numerical Differentiation

Derivatives using Newton's forward difference formula - Newton's backward difference formula - Derivatives using central difference formula - Stirling's interpolation formula - Newton's divided difference formula.

UNIT – II: Numerical Integration

General quadrature formula on errors - Trapezoidal rule - Simpson's 1/3 rule - Simpson's 3/8 rule - Weddle's rule - Euler-Maclaurin formula of summation and quadrature - The Euler transformation.

UNIT – III: Solution of Simultaneous Linear systems of Equations – I

Solution of linear systems - Direct Methods - Matrix inversion method - Gaussian elimination method - Gauss Jordan Method.

UNIT – IV: Solution of Simultaneous Linear systems of Equations – II

Method of factorization - solution of Tridiagonal systems - Iterative methods - Jacobi's method - Gauss - Seidel method.

UNIT – V: Numerical Solution of Ordinary Differential Equations

Introduction - solution of Taylor's series - Picard's method of successive approximations - Euler's method - Modified Euler's method - Runge-Kutta methods.

Activities

Seminar/ Quiz/ Assignments/ Applications of Numerical methods to Real life Problem /Problem Solving Sessions.

Text Book

Numerical Analysis by G. Shanker Rao, New Age International Publications

Reference Books

1. Applied Numerical Analysis by Curtis F. Gerald and Patrick O. Wheatley, Pearson Publications.
2. Numerical Methods for Scientific and Engineering Computation by M. K. Jain, S .R. K. Iyengar and R. K. Jain, New Age International Publishers.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 15A: NUMBER THEORY

(w.e.f. 2023-24)

Course Code: 23MATM54A

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand the fundamental theorem of arithmetic

CO2. understand Mobius function, Euler quotient function, The Mangoldt function, Liouville's function, The divisor functions and the generalized convolutions.

CO3. understand Euler's summation formula, application to the distribution of lattice points and the applications to $\mu(n)$ and $\Lambda(n)$

CO4. understand the concepts of congruencies, residue classes and complete residues systems.

CO5. Comprehend the concept of quadratic residues mod p and quadratic non residues mod p .

Course Content

UNIT – 1: The Fundamental Theorem of Arithmetic

Introduction, Divisibility, Greatest common divisor, Prime numbers, The fundamental theorem of arithmetic, The series of reciprocals of the primes, The Euclidean algorithm, The greatest common divisor of more than two numbers

UNIT-2: Arithmetical Functions And Dirichlet Multiplication

Introduction- The Mobius function $\mu(n)$ – The Euler quotient function $\varphi(n)$ - A relation connecting φ and μ - A product formula for $\varphi(n)$ - The Dirichlet product of arithmetical functions- Dirichlet inverses and the Mobius inversion formula- The Mangoldt function $\Lambda(n)$ - multiplicative functions- multiplicative functions and Dirichlet multiplication- The inverse of a completely multiplicative function- Liouville's function $\lambda(n)$ - The divisor functions $\sigma_\alpha(n)$

UNIT-3: Averages Of Arithmetical Functions

Introduction- The big oh notation. Asymptotic equality of functions- Euler's summation formula- Some elementary asymptotic formulas- The average order of $d(n)$ - The average order of the divisor functions $\sigma_\alpha(n)$ - The average order of $\varphi(n)$ - An application to the distribution of lattice points visible from the origin- The average order of $\mu(n)$ and $\Lambda(n)$ - The partial sums of a Dirichlet product- Applications to $\mu(n)$ and $\Lambda(n)$

UNIT-4: Congruences

Definition and basic properties of congruences- Residue classes and complete residue systems- Linear congruences- Reduced residue systems and the Euler- Fermat theorem- Polynomial congruences modulo p . Lagrange's theorem- Applications of Lagrange's theorem- Simultaneous linear congruences. The Chinese remainder theorem- Applications of the Chinese remainder theorem

UNIT-5: Quadratic Residues and the Quadratic Reciprocity Law

Quadratic Residues, Legendre's symbol and its properties, Evaluation of $(-1/p)$ and $(2/p)$, Gauss lemma, The Quadratic reciprocity law, Applications of the reciprocity law, The Jacobi Symbol, Gauss sums and the quadratic reciprocity law, the reciprocity law for quadratic Gauss sums, Another proof of the quadratic reciprocity law.

Activities

Seminar/ Quiz/ Assignments/ Applications of Number theory to Real life Problem /Problem Solving Sessions

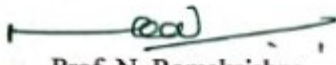
Text Book

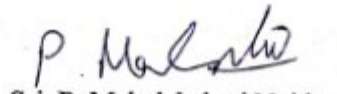
Introduction to Analytic Number Theory by T.M.Apostol, Springer Verlag-New York, Heidelberg-Berlin-1976.

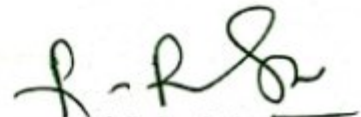
Reference Books

1. Elementary Number Theory by G.A.Jones and J.M.Jones, , Springer
2. Elementary Number Theory by David, M. Burton, 2nd Edition UBS Publishers.
3. Number Theory by Hardy & Wright, Oxford Univ., Press.
4. Elements of the Theory of Numbers by Dence, J. B &Dence T.P, Academic Press

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 15 B: MATHEMATICAL STATISTICS

(w.e.f. 2023-24)

Course Code: 23MATM54B

Course Outcomes

After completion of the course, student will be able to

CO1. understand the probability set function and conditional probability

CO2. understand about random variables, discrete and continuous type distributions

CO3. understand the distribution of two random variables and expectation of a random variables

CO4. know binomial and related distributions

CO5. normal distributions and the applications of normal distributions

Course Content

Unit – 1: Probability and

Distributions

Sets – set functions – The probability set function – counting rules – additional properties of probability- conditional probability and independence - simulations

Unit – 2: Probability and Distributions continued..

Random Variables - Discrete Random Variables - Continuous Random Variables -Quantiles- Transformations - Mixtures of Discrete and Continuous Type Distributions

Expectation of a Random Variable - Computation for an Estimation of the Expected Gain - Some Special Expectations - Important Inequalities

Unit – 3: Multivariate Distributions

Distributions of Two Random Variables - Marginal Distributions - Expectation –Transformations Bivariate Random Variables - Conditional Distributions and Expectations - Independent Random Variables - The Correlation Coefficient - Extension to Several Random Variables

Multivariate Variance-Covariance Matrix- Transformations for Several Random Variables - Linear combinations of Random Variables

Unit – 4: Some Special Distributions

The Binomial and Related Distributions - Negative Binomial and Geometric Distributions - multinomial Distribution- Hypergeometric Distribution - The Poisson Distribution - The Γ , χ^2 and β Distributions - The χ^2 -Distribution - The β -Distribution

Unit – 5: Normal

Distribution

The Normal Distribution. - Contaminated Normals - The Multivariate Normal Distribution - Bivariate Normal Distribution - Multivariate - Normal Distribution. General Case- Applications -t- and F-Distribution

Activities

Seminar/ Quiz/ Assignments/ Applications of Mathematical statistics to Real life Problem /Problem Solving Sessions.

Text Book

Introduction to Mathematical Statistics by Robert V Hogg, Joseph W MacKeen, Eighth Edition, Allen T Craig, Pearson

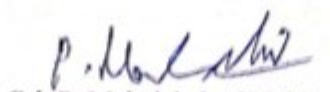
Reference Books

1. Fundamentals of Statistics by Goon A.M., Gupta M.K. and Dasgupta B., (2002) Vol. I & II, 8th Edn. The World Press, Kolkata.
2. Fundamentals Of Mathematical Statistics by Gupta, S. C. and Kapoor, V.K. (2008): 4th Edition (Reprint), Sultan Chand & Sons
3. Mathematical Statistics with Applications by Miller, Irwin and Miller, Marylees (2006) John E. Freund's, (7th Edn.), Pearson Education, Asia.
4. Introduction to the Theory of Statistics by Mood, A.M. Graybill, P.A. and Boes, D.C., (2007), 3rd Edn., (Reprint), Tata McGraw-Hill Pub. Co. Ltd.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 16A: ALGEBRA

(w.e.f. 2023-24)

Course Code: 23MATM71A

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand the direct product of groups and application of Sylow's theorems

CO2. understand the homomorphic relation between the groups, sum and direct sum of ideals

CO3. know factorizing the domains and factorization of polynomials

CO4. know about submodules and direct sums

CO5. about Free modules and Representation of linear mappings

Unit-1: Structure theorems of groups

Direct products-Finitely generated abelian groups-Invariants of a finite abelian group-Sylow theorems.
(Sections 8.1 to 8.4 of the Chapter 8 in the Prescribed Text Book.)

Unit-2: Ideals and Homomorphisms

Ideals-Homomorphisms-Sums and direct sums of ideals- Maximal and prime ideals- Nilpotent and nil ideals-Zorn's lemma. (Sections 10.1 to 10.6 of the Chapter 10 in the Prescribed Text Book.)

Unit-3: Unique factorization domains and Euclidean domains

Unique factorization domains-Principal ideal domains-Euclidean domains-Polynomial rings over UFD
(Sections 11.1 to 11.4 of the Chapter 11 in the Prescribed Text Book.)

Unit-4: Modules and Vector Spaces

Definition and examples – Submodules and direct sums – R-homomorphisms and quotient modules
(Sections 1,2& 3 of Chapter – 14)

Unit-5: Free Modules

Completely reducible modules – Free modules – Representation of linear mappings – Rank of linear mapping (Sections 4 to 7 of Chapter - 14)

Activities

Seminar/ Quiz/ Assignments/ Applications of Algebra to Real life Problem /Problem Solving

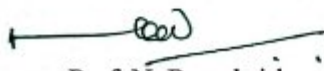
Text Book

Basic Abstract Algebra by P.B.Battacharya,S.K.jain, S.R.Nagpaul, Cambridge University Press.

Reference Book

1. Topics in Algebra by I.N.Herstein, 2nd Edition, John Wiley & Sons
2. Algebra by Serge Lang, Revised Third Edition, Springer
3. Algebra by Thomas W. Hungerford, Springer

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**B.A./B.Sc. Hons. MATHEMATICS
COURSE 16B: CLASSICAL MECHANICS**

(w.e.f. 2023-24)

Course Code: 23MATM71B

Course Outcomes

After successful completion of the course, students will be able to

CO1. identify the basic concepts of mechanics and also learn applications of Lagrangian formulation.

CO2. Understand derivation of Lagrange's equations from Hamilton's principle and advantages of variational principle formulation

CO3. Understand the simplistic approach to canonical transformations,

CO4. Understand Poisson and Lagrange brackets and their invariance and the Hamilton Jacobi Equations for Hamilton's principal function

CO5. Understand special theory of relativity, Lorentz transformation and contractions and Lorentz transformations

Course Content

Unit-1: Lagrangian Formulation

Mechanics of a particle, mechanics of a system of particles, constraints, generalized coordinates generalized velocity, generalized force and potential. D'Alembert's principle and Lagrange's equations, some applications of Lagrangian formulation .

Unit-2: Hamilton's principle to non-holonomic systems

Hamilton's principle, derivation of Lagrange's equations from Hamilton's principle, extension of Hamilton's principle to non-holonomic systems, advantages of variational principle formulation, conservation theorems and symmetry properties.

Unit-3: Hamiltonian formulation

Legendre transformations and the Hamilton equations of motion, cyclic coordinates and conservation theorems, derivation of Hamilton's equations from a vibrational principle, the principle of least action, the equation of canonical transformation, examples of canonical transformation, the Harmonic Oscillator, the simplistic approach to canonical transformations .

Unit-4: Canonical transformations

Poisson and Lagrange brackets and their invariance under canonical transformation. Jacobi's identity; Poisson's Theorem. Equations of motion infinitesimal canonical transformation in the Poisson bracket formulation. Hamilton Jacobi Equations for Hamilton's principal function, The harmonic oscillator problem as an example of the Hamilton – Jacobi method, the Hamilton – Jacobi equation for Hamilton's characteristic function .

Unit-5: Lorentz transformation equations

New concept of space and Time, postulates of special theory of relativity, Lorentz transformation equations, Lorentz contraction, Time dilation, simultaneity, Relativistic formulae for composition of velocities and accelerations, proper time, Lorentz transformations form a group .

Activities

Seminar/ Quiz/ Assignments/ Applications of Classical Mechanics to Real life Problem /Problem Solving

Text books

1. Classical mechanics by H.Goldstein, 2nd edition, Narosa Publishing House.
2. Relevant topics from Special relativity by W.Rindler, Oliver & Boyd, 1960.

Reference Book

Classical Mechanics by J.C. Upadhyaya, Himalaya Publishing House

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 17A: REAL ANALYSIS

(w.e.f. 2023-24)

Course Code: 23MATM72A

Course Outcomes

After successful completion of the course, students will be able to

- CO1. understand to form a metric space from any non-empty set, compact sets and connected sets
- CO2. understand continuity of functions, compactness and connectedness
- CO3. know the derivative of a real valued function and the applications of Mean value theorems
- CO4. know the conditions for existence of integrals and some applications of integrals
- CO5. know the vector valued functions, differentiation and integration of vector valued functions and their applications

Course Content

Unit-1: Basic Topology

Finite, countable and uncountable sets – Metric spaces – Compact sets – Perfect sets – Connected sets

Unit-2: Continuity

Limits of functions - Continuous functions – Continuity and Compactness – Continuity and Connectedness – Discontinuities. Monotonic functions

Unit-3: Differentiation

The derivative of a real function – Mean Value Theorems – The continuity of Derivatives L'Hospital's Rule.

Unit-4: Riemann Stieltjes Integrals

Definition and existence of integral – properties of integrals

Unit-5: FTC and Vector Valued Functions

Integration and differentiation -Differentiation of Vector Valued Functions – Integration of Vector valued functions – Rectifiable curves.

(FTC : Fundamental Theorem of Calculus)

Activities

Seminar/ Quiz/ Assignments/ Applications of Real Analysis to Real life Problem /Problem Solving

Text Book

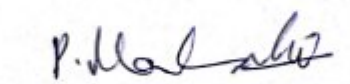
Principles of Mathematical Analysis by Walter Rudin, Mc Graw Hill International Edition

Reference Book

Mathematical Analysis by S C Malik, Savita Arora New age International Publishers

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CBCS/ SEMESTER SYSTEM

**B.A./B.Sc. Hons. MATHEMATICS
COURSE 17B: DISCRETE MATHEMATICS**

(w.e.f. 2023-24)

Course Code: 23MATM72B

Course Outcomes

After successful completion of the course, students will be able to

CO1. learn the applications of graph theory in other subjects.

CO2. understand representations of different problems by means of graphs.

CO3. learn the relation between bipartite graphs and odd cycles.

CO4. learn the concepts of forest, binary trees, eccentricity of a vertex and radius of connected graphs.

CO5. learn the importance of multi graphs in other subjects like physics and chemistry.

CO6. learn different characterizations of modular and distributive lattices.

Course Content

Unit – 1: Basics of Graphs

Basic Ideas, History, Initial Concepts, Summary, Connectivity , Elementary Results, Structure Based on Connectivity

Unit –2: Trees

Trees, Characterizations, Theorems on Trees, Tree Distances, Binary trees, Tree Enumeration, Spanning trees, Fundamental Cycles, Summary

Unit – 3: Spanning trees

Traversability, Introduction, Eulerian Graphs, Hamiltonian Graphs, Minimal Spanning Trees, J.B.Kruskal's Algorithm, R.C.Prim's Algorithm.

Unit –4: Posets and Lattices

Poset Definition, Properties of Posets, Lattice Definition, Properties of Lattices

Unit –5: Modular and Distributive Lattices

Definitions of Modular and Distributive Lattices and its Properties

Activities

Seminar/ Quiz/ Assignments/ Applications of Discrete Mathematics to Real life Problem /Problem Solving

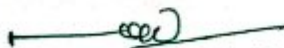
Text books

1. Graph Theory Applications by L.R.Foulds, Narosa Publishing House, New Delhi.
2. Discrete Mathematical Structures by Kolman and Busby and Sharen Ross, Prentice Hall of India – 2000, 3rd Edition
3. Applied Abstract Algebra by Rudolf Lidl and Gunter Pilz , Published by Springer- Verlag.

Reference Book

A text Book of Discrete Mathematics by Harish Mittal, Vinay Kumar Goyal, Deepak Kumar Goyal, IK International Publishing House Pvt.Ltd, New Delhi.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 18A: BASIC TOPOLOGY

(w.e.f. 2023-24)

Course Code: 23MATM73A

Course Outcomes

After successful completion of the course, students will be able to

CO1. handle operations on sets and functions and their properties

CO2. understand the concepts of Metric spaces, open sets, closed sets, convergence, some important theorems like Cantor's intersection theorem and Baire's theorem

CO3. familiar with the concept of Topological spaces, continuous functions in more general and characterize continuous functions in terms of open sets, closed sets etc.

CO4. explain the concept of compactness in topological spaces characterize compactness in metric spaces and their properties.

Course Content

Unit-1: Sets and Functions

Sets and Set inclusion – The algebra of sets – Functions – Products of sets – Partitions and equivalence relations – Countable sets – Uncountable sets – Partially ordered sets and lattices.

Unit-2: Metric spaces

The definition and some examples – Open sets – Closed sets – Convergence, Completeness and Baire's theorem .

Unit-3: Metric spaces

Continuous mappings, Spaces of continuous functions – Euclidean and Unitary spaces.(Chapter 2: Sections 13 to 15 of the prescribed text book) Topological spaces: The definition and some examples – Elementary concepts–

Unit-4: Topological spaces

Open bases and open sub bases, Weak Topologies, The function algebras $C(X, \mathbb{R})$ and $C(X, \mathbb{C})$. (Chapter 3: Sections 18 to 20 of the prescribed text book). Compactness: Compact spaces – Heine – Borel theorem

Unit-5: Compactness

Product of Spaces – Tychonoff's theorem and locally Compact spaces – Compactness for metric spaces – Ascoli's theorem.

Activities

Seminar/ Quiz/ Assignments/ Applications of Topology to Real life Problem /Problem Solving

Text Book

Introduction to Topology and Modern Analysis by G. F. Simmons International Student edition
– McGraw – Hill Ltd.

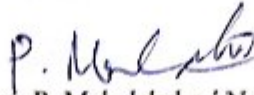
Reference Books

1. Schaum's Outlines : General Topology by Seymour Lipschutz
 2. Topology : A first Course by James Munkres
- *****

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 18B: CRYPTOGRAPHY

(w.e.f. 2023-24)

Course Code: 23MATM73B

Course Outcomes

After successful completion this course, the student will be able to

CO1. understand Divisibility and Euclidean algorithm and congruences

CO2. understand about Enciphering matrices

CO3. understand finite fields and quadratic residues

CO4. understand the idea of public key cryptography

CO5. understand pseudo-primes and Fermat's factorization

Course Content

Unit-1: Elementary Number Theory

Time Estimates for doing arithmetic - Divisibility and Euclidean algorithm - Congruences - Applications to factoring

Unit-2: Cryptography

Some simple crypto systems - Enciphering matrices

Unit-3: Finite Fields and quadratic Residues

Finite fields - Quadratic residues and Reciprocity

Unit-4: Public Key Cryptography

The idea of public key cryptography - RSA - Discrete log - Knapsack

Unit-5: Primality and Factoring

Pseudoprimes - The rho method - Fermat factorization and factor bases - The Continued fraction method - The quadratic sieve method.

Activities

Seminar/ Quiz/ Assignments/ Applications of Cryptography to Real life Problem /Problem Solving

Text Book

A Course in Number Theory and Cryptography by Neal Koblitz, Springer-Verlag, New York, 2002, Second Edition.

Reference Books

1. An Introduction to Theory of Numbers by Niven and Zuckermann, Edn. 3, Wiley Eastern Ltd., New Delhi, 1976.
2. Elementary Number Theory by David M. Burton, Wm C. Brown Publishers, Dubuque, Iowa, 1989.
3. A Classical Introduction to Modern Number Theory by K. Ireland and M. Rosen, Springer Verlag, 1972.

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 19A: LATTICE THEORY & BOOLEAN ALGEBRA

(w.e.f. 2023-24)

Course Code: 23MATS71A

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand the concept of partially ordered set and properties of partial ordered sets

CO2. understand the concept of lattice, semilattice and their properties

CO3. understand the concept of ideals and homomorphisms in lattices

CO4. understand the distributive and the modular lattices

CO5. understand the concept of Boolean algebra and properties of Boolean algebra

Course Content

Unit-1: Partly Ordered Sets

Set Theoretical Notations, Relations, partly ordered Sets, Diagrams, special Subsets of a Partlyordered set, length, Lower and Upper Bounds, The minimum and maximum condition.

Unit-2: Lattices in General

Algebras, lattices, The Lattice Theoretical Duality principle, semi Lattices, lattices as Partly ordered sets, Diagrams of lattices, Sub lattices, Ideals, Bound Elements of a lattice, Atoms and Dual Atoms, Complements, Relative Complements, Semi complements, Irreducible Prime Elements of a lattice, The Homomorphism of a lattice

Unit-3: Complete lattices

Complete lattices, Complete Sub lattices of a Complete lattice, Conditionally Complete Lattices, Compact Elements, Compactly Generated lattices, Subalgebra lattice of an Algebra, Closure Operations

Unit-4: Distributive and Modular Lattices

Distributive lattices, Infinitely Distributive and Completely Distributive lattices, Modular lattices, Characterization of Modular and Distributive lattices by their Sublattices, Distributive Sublattices of Modular Lattices, Isomorphism theorems of modular lattice, Meet representation in modular and distributive lattices

Unit-5: Boolean algebras

Boolean algebras, De Morgan formulae, Complete Boolean algebras, Boolean algebras and Boolean rings, The algebra of relations, The lattice of Propositions, Valuations of Boolean algebras

Activities

Seminar/ Quiz/ Assignments/ Applications of Lattice Theory and Boolean Algebra to Real life Problem /Problem Solving.

Text Book

Introduction to Lattice Theory, Gabor Szasz, Academic press

Reference Books

1. Lattice Theory by G. Birkhoff, Amer. Math. Soc.
2. General Lattice Theory by George Grätzer, Birkhäuser Basel (1978)

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 19B: FINITE ELEMENT ANALYSIS

(w.e.f. 2023-24)

Course Code: 23MATS71B

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand the concepts behind formulation methods in FEM.

CO2. identify the application and characteristics of FEA elements such as bars, beams, plane and isoparametric elements.

CO3. develop element characteristic equation and generation of global equation.

CO4. apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axisymmetric and dynamic problems and solve them displacements, stress and strains induced.

CO5. Know the Finite element modeling, stress calculation and temperature effects

Course Content

Unit – 1: Fundamental Concepts

Introduction, Historical background, Outline of presentation, Stresses and Equilibrium, Boundary conditions, Strain-Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton's principle. Galerkin's method, Saint Venant's principle. (Chapter 1, Section 1.1. to Section 1.11)

Unit – 2: One-dimensional Problems

Introduction, Finite Element Modeling: Element Division, Numbering Scheme, Coordinates and Shape Functions, The Potential Energy Approach: Element Stiffness Matrix, Force Terms The Galerkin Approach: Element Stiffness, Force Terms, Assembly of the global stiffness matrix and load vector. (Chapter 3, Section 3.1 to 3.6)

Unit – 3: One-dimensional Problems (Continued)

Properties of K, The Finite Element Equations: Treatment of boundary conditions: Types of Boundary Conditions - Elimination Approach, Penalty Approach, Multipoint Constraints Quadratic shape functions, Temperature effects, Input data file. (Chapter 3, Section 3.7 to 3.10)

Unit – 4: Trusses

Introduction, Plane trusses - Local and Global Coordinate Systems, Formulas for Calculating l and m, Element Stiffness Matrix, Stress Calculations, Temperature Effects, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions - Assembly for Banded Solution, Input Data File (Chapter 4)

Unit – 5: Two-dimensional Problems

Introduction, Finite element modeling, Constant strain triangle - Isoparametric Representation, Potential Energy Approach, Element Stiffness, Force Terms, Galerkin Approach, Stress Calculations, Temperature Effects (Chapter 5, Section 5.1 to 5.3)

Activities

Seminar/ Quiz/ Assignments/ Applications of Finite Element Analysis to Real life Problem /Problem Solving.

Text Book

Introduction to Finite Elements in Engineering by Tirupathi R. Chandrupatla, Ashok D.Belegundu (chapters 1 to 8 only).

Reference Books

1. Introduction to Finite Element Method, by S.S.Rao, Elsevier
2. Finite Element Method by O.C. Zienkiewicz, Butterworth-Heinemann Ltd.
3. Introduction to Finite Element Method by J.N.Reddy, McGraw Hill Education

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 20A: GRAPH THEORY

(w.e.f. 2023-24)

Course Code: 23MATS72A

Course Outcomes

After successful completion of the course, students will be able to

CO1. Be familiar with the definitions and basic theory of graphs

CO2. Be able to implement standard algorithms of graph theory

CO3. Be able to prove simple results in graph theory.

CO4. Identify trees and obtain spanning trees of graphs.

CO5. Find Euler and Hamiltonian paths and circuits in a graph

Course Content

Unit-1: An Introduction to Graph

The Definition of a Graph, Graph as Models, More Definitions, Vertex Degrees, Subgraphs.

Unit-2: Matrix Representation of graphs

Paths and cycles, The Matrix Representation of graphs, Fusion Trees and Connectivity:

Definitions and Simple Properties, Bridges, Spanning Trees

Unit-3: Trees and Connectivity(Continuity)

Connector Problems, Shortest Path Problems, Cut Vertices and Connectivity

Unit-4: Euler Tours and Hamiltonian Cycles

Euler Tours, The Chinses Postman Problem, Hamiltonian Graphs, The Travelling Sallesman Problem.

Unit-5: Matchings

Matching and Augmenting paths; The marriage problem; The personnel assignment problem; The optimal Assignment problem.

Activities

Seminar/ Quiz/ Assignments/ Applications of Graph Theory to Real life Problem /Problem Solving
Text Book

A first look at Graph Theory by John Clark & Derek Allan Holton, Allied Publishers Limited 1995.

Reference Books

1. A First Course in Graph Theory by S.A. Choudham, Macmillan India Ltd.
2. Introduction to Graph Theory by Robin J. Wilson, Longman Group Ltd.
3. Graph Theory with Applications by J.A. Bondy and U.S.R. Murthy, Macmillan, London

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 20B: MATHEMATICAL FINANCE

(w.e.f. 2023-24)

Course Code: 23MATS72B

Course Outcomes

Upon successful completion of this course student should be able to:

- CO1.Understand the that interest calculations and methods of calculations
- CO2. Understand the annuities and types of Annuities and calculation interest and values of annuities
- CO3.Understand the concept of Mathematics of Capital Budgeting and Depreciation and some methods of calculations
- CO4. know the Comparison on the Discount Rate to the Interest Rate
- CO5. know the net present value, profitability index and other capital budgeting methods

Course Content

Unit-1 : Mathematics of the Time Value of Money

Simple Interest : Total Interest, Rate of Interest, Term of Maturity, Current Value, Future Value, Finding n and r When the Current and Future Values are Both Known, Simple Discount, Calculating the Term in Days, Ordinary Interest and Exact Interest, Obtaining Ordinary Interest and Exact Interest in Terms of Each Other, Focal Date and Equation of Value, Equivalent Time: Finding an Average due Date, Partial Payments, Finding the Simple Interest Rate by the Dollar-Weighted Method(Unit – II section 1.1 to 1.14 of the text book) Bank Interest : Finding FV Using the Discount Formula, Finding the Discount Term and the Discount Rate, Difference Between a Simple Discount and a Bank Discount(Unit – II section 2.1 to 2.3 of the text book)

Unit-2: Mathematics of the Time Value of Money(Continued)

Bank Interest : Comparing the Discount Rate to the Interest Rate, Discounting a Promissory Note, Discounting a Treasury Bill(Unit – II section 2.4 to 2.6 of the text book) Compound Interest: The Compounding Formula, Finding the Current Value, Discount Factor, Finding the Rate of Compound Interest, Finding the Compounding Term, The Rule of 72 and Other Rules, Effective Interest Rate, Types of Compounding, Continuous Compounding, Equations of Value for a Compound Interest, Equated Time For a Compound Interest(Unit – II section 3.1 to 3.11 of the text book)

Unit-3: Mathematics of the Time Value of Money(Continued)

Annuities: Types of Annuities, Future Value of an Ordinary Annuity, Current Value of an Ordinary Annuity, Finding the Payment of an Ordinary Annuity, Finding the Term of an Ordinary Annuity, Finding the Interest Rate of an Ordinary Annuity, Annuity Due: Future and Current Values, Finding the Payment of an Annuity Due, Finding the Term of an Annuity Due, Deferred Annuity, Future and Current Values of a Deferred Annuity, Perpetuities

MATHEMATICS OF DEBT AND LEASING : Credit and Loans :Types of Debt, Dynamics of Interest– Principal Proportions, Premature Payoff, Assessing Interest and Structuring Payments, Cost of Credit, Finance Charge and Average Daily Balance, Credit Limit vs. Debt Limit

Unit-4: Mathematics of debt and leasing (Continued)

Mortgage Debt : Analysis of Amortization, Effects of Interest Rate, Term, and Down Payment on the Monthly Payment, Graduated Payment Mortgage, Mortgage Points and the Effective Rate, Assuming a Mortgage Loan, Prepayment Penalty on a Mortgage Loan, Refinancing a Mortgage Loan, Wraparound and Balloon Payment Loans, Sinking Funds, Comparing Amortization to Sinking Fund Methods Limit

Unit-5: Mathematics of Capital Budgeting and Depreciation

Capital Budgeting: Net Present Value, Internal Rate of Return, Profitability Index, Capitalization and Capitalized Cost, Other Capital Budgeting Methods

Depreciation and Depletion: The Straight-Line Method, The Fixed-Proportion Method, The Sum-of-Digits Method, The Amortization Method, The Sinking Fund Method Limit

Activities

Seminar/ Quiz/ Assignments/ Applications of Mathematical Finance to Real life Problem /Problem Solving

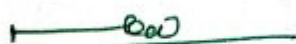
Text Book

Mathematical Finance by M. J. Alhabeeb, A John Wiley & Sons, INC., Publication

Reference Books

1. Investment Science by David G. Luenberger, Oxford University Press, Delhi, 1998.
2. Futures and Other Derivatives by John C. Hull, Options, 6th Ed., Prentice-Hall India, Indian reprint, 2006.
3. An Elementary Introduction to Mathematical Finance by Sheldon Ross, 2nd Ed., Cambridge University Press, USA, 2003

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**B.A./B.Sc. Hons. MATHEMATICS
COURSE 21A: ADVANCED ALGEBRA**

(w.e.f. 2023-24)

Course Code: 23MATM81A

Course Outcomes

After successful completion this course, the student will be able to

CO1. define modules, submodules and give some examples of them.

CO2. understand reducible modules, free modules and be able to find the rank of a linear mapping

CO3. understand Einstein's criteria for irreducible polynomials and algebraic extensions
CO4. understand splitting fields and finite fields

CO4. understand the Fundamental theorem of Galois theory

Course Content

Unit-1: Algebraic extension of fields

Irreducible polynomials and Eisenstein's criterion-Adjunction of roots-Algebraic extensions-Algebraically closed fields.

Unit-2: Normal and separable extensions

Splitting fields-Normal extensions-multiple roots-finite fields

Unit-3: Normal and separable extensions: Separable extensions.

Galois Theory: Automorphism groups and fixed fields- fundamental theorem of Galois Theory.

Unit-4: Galois Theory

Fundamental theorem of algebra. Galois Theory and Applications of Galois Theory to Classical problems: Roots of unity and cyclotomic polynomials-Cyclic extensions

Unit-5: Applications of Galois Theory

Applications of Galois Theory to Classical problems: Polynomials solvable by radicals-symmetric functions-Ruler and compass constructions.

Activities

Seminar/ Quiz/ Assignments/ Applications of Algebra to Real life Problem /Problem Solving

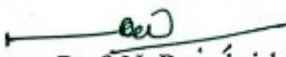
Text Book

Basic Abstract Algebra by P.B.Battacharya, S.K.jain, S.R.Nagpaul, Cambridge University Press.

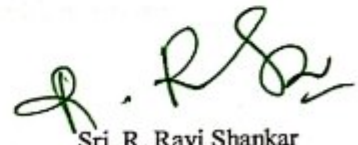
Reference Books

1. Topics in Algebra by I.N.Herstein, 2nd Edition, John Wiley & Sons
2. Algebra by Serge Lang, Revised Third Edition, Springer
3. Algebra by Thomas W. Hungerford, Springer

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 21B: ELEMENTS OF ELASTICITY AND FLUID DYNAMICS

(w.e.f. 2023-24)

Course Code: 23MATM81B

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand the equation of continuity and general analysis of fluid motion.

CO2. understand the equation of motion of a fluid, Bernoulli's equation and circulation theorem.

CO3. understand the two dimensional fluid flows and their properties.

CO4. understand the various deformations and equation of compatibility.

CO5. understand the properties of the stress, Mohr's Diagram and certain examples of stress.

Course Content

Unit-1: Kinematics of fluids

Kinematics of fluids, real and ideal fluids, velocity of fluid at a point, streamlines and path lines, velocity potential, velocity vector, local and particle rates of change, equation of continuity, Acceleration of fluid, conditions at a rigid boundary, General analysis of fluid motion

Unit-2: Equation of motion of a fluid

Equation of motion of a fluid, pressure at a point in a fluid at rest and in a moving fluid, conditions at a boundary of two in viscid immiscible fluids, Euler's equations of motion, Bernoulli's equation. Discussion of the case of steady motion under conservative body forces, Vortex motion, Kelvin's circulation theorem. Some further aspects of vortex motion

Unit-3: Fluid flows

Some two - dimensional flows: Meaning of two - dimensional flow, use of cylindrical polar coordinates, the stream function, the complex potential for two - dimensional, irrotational, incompressible flow, complex potential for standard two - dimensional flows, some worked examples, two - dimensional image systems. The Milne-Thomson circle theorem, the theorem of Blasius

Unit-4: Analysis of strain

Analysis of strain: Deformation, affine deformation, infinitesimal affine deformation, geometrical interpretation of the components of strain, strain quadric of Cauchy, principal directions, invariants, general infinitesimal deformation, Examples of strain, equations of compatibility, finite deformations.

Unit-5: Analysis of stress

Analysis of stress, body and surface forces, stress tensor, equations of equilibrium, transformation of coordinates, stress quadric of Cauchy, Mohr's diagram, examples of stress

Activities

Seminar/ Quiz/ Assignments/ Applications of Elements Elasticity and fluid dynamics to Real life Problem /Problem Solving

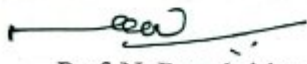
Text books

1. Text Book of Fluid Dynamics by F.Chorlton, CBS publishers and distributors, New Delhi.
2. Mathematical Theory of Elasticity by I.S.Sokolnikoff 2 nd edition; Tata Mc Graw Hill-New Delhi

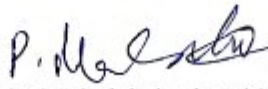
Reference Books

1. Foundations of Fluid Mechanics by S.W. Yuan, Prentice Hall
 2. An introduction to Fluid Dynamics by Bachelor G. K., Cambridge University Press, 2007.
- *****

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CBCS/ SEMESTER SYSTEM

B.A./B.Sc. Hons. MATHEMATICS

COURSE 22A: ADVANCED ANALYSIS

(w.e.f. 2023-24)

Course Code: 23MATM82A

Course Outcomes

After successful completion this course, the student will be able to

- CO1. solve the problems on convergence of Sequences and Series of functions
- 2. understand the Stone – Weierstrass theorem
- CO2. know Exponential and Logarithmic functions and Fourier Series
- CO3. Linear transformations and differentiation
- 5. understand the contraction principle, the rank theorem

Course Content

Unit-1: Sequences and Series of Functions

Discussion of Main Problem – Uniform Convergence - Uniform Convergence and Continuity – Uniform Convergence and Integration – Uniform Convergence and Differentiation

Unit-2: Equicontinuous families of functions and Power Series

Equicontinuous families of functions – the Stone – Weierstrass theorem – Power Series

Unit-3: Some Special Functions

The Exponential and Logarithmic functions – The Trigonometric functions – Algebraic completeness of the complete field – Fourier Series

Unit-4: Functions of several variables

Linear transformation – Differentiation.

Unit-5: Functions of several variables (continued..)

The contraction Principle – The Inverse function Theorem – The implicit function Theorem – The Rank Theorem – Determinants

Activities

Seminar/ Quiz/ Assignments/ Applications of Analysis to Real life Problem /Problem Solving

Text Book

Principles of mathematical Analysis by Walter Rudin, Mc Graw Hill International Edition

Reference Books

1. Mathematical Analysis by .Tom. M. Apostol, Narosa Publishing House
2. ElementsofRealAnalysis by ShanthiNarayan andDr.M.D.Raisinghania,S. Chand &Company Pvt. Ltd., New Delhi
3. An Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, John Wileyand sons(ASIA)Pvt. Ltd.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 22B: ADVANCED LINEAR ALGEBRA

(w.e.f. 2023-24)

Course Code: 23MATM82B

Course Outcomes

Upon successful completion of this course student should be able to

CO1. understand the basic to the analysis of a single linear transformation on a finite-dimensional vector space and the analysis of characteristic values and the rational and Jordan canonical forms.

CO2. understand concept of finite-dimensional inner product spaces and basic geometry, relating orthogonalization and unitary operators and normal operators.

CO3. know the Jordan form, computation of invariant factors

CO4. know the inner product spaces and their properties

CO5. know about unitary operators and Normal operators

Course Content

Unit-1: Elementary Canonical Forms

Introduction – Characteristic Values – Annihilating Polynomials –invariant subspaces – Simultaneous Triangulation – Simultaneous Diagonalization, Simultaneous

Unit-2: Elementary Canonical Forms(Continued)

Direct – sum Decompositions – invariant direct sums – the primary decomposition theorem

The Rational and Jordan Forms: cyclic subspaces and Annihilators – cyclic decompositions and the rational form.

Unit-3: Elementary Canonical Forms(Continued)

The Jordan Form – Computation of Invariant Factors – Semi Simple Operators.

Unit-4: Inner product spaces

Inner products, Inner product spaces, Linear functionals and adjoints

Unit-5: Inner product spaces(continued)

Unitary operations, Normal operators

Activities

Seminar/ Quiz/ Assignments/ Applications of Linear Algebra to Real life Problem /Problem Solving

Text Book

Linear Algebra by Kenneth Hoffman and Ray Kunze, second edition, Prentice Hall of India Private Limited, New Delhi.

Reference Books

1. First Course in Linear Algebra by Bhattacharya, P.B., Jain, S.K and Nagpal, S.R., Wiley Eastern Ltd. New Delhi
2. Linear Algebra by Henry Helson, Hindustan Book Agency (1994)
3. Topics in Algebra by I.N. Herstein, Second edition (Wiley Eastern Ltd.)
4. Algebra by M. Artin, Prentice - Hall of India private Ltd.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 23A: ADVANCED TOPOLOGY

(w.e.f. 2023-24)

Course Code: 23MATM83A

Course Outcomes

After successful completion this course, the student will be able to

CO1. define T_1 -space, T_2 -space

CO2. understand Urysohn's Lemma, and the Tietz's extension theorem

CO3. understand the Stone – Chech compactification,

CO4. understand and can define the Connectedness of a topological space

CO5. understand the Weierstrass approximation theorem and Stone-Weierstrass theorems

Unit-1: Separation

T_1 spaces and Hausdorff spaces – Completely regular spaces and normal spaces – Urysohn's lemma and the Tietze's extension theorem. (Chapter 5: Sections 26 to 28 Prescribed text book).

Unit-2: Separation (continued)

The Urysohn imbedding theorem – The Stone – Chech compactification. . Connectedness: Connected spaces– connectedness of R_n and C_n .

Unit-3: Connectedness (continued)

The components of a space – Totally disconnected spaces – Locally connected spaces.

Unit-4: Approximation

The Weierstrass approximation theorem - The Stone-Weierstrass theorems

Unit-5: Approximation (continued)

Locally compact Hausdorff spaces – The extended Stone-Weierstrass theorems.

Activities

Seminar/ Quiz/ Assignments/ Applications of Topology to Real life Problem /Problem Solving

Text Book

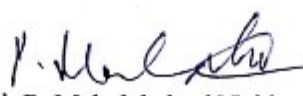
Introduction to Topology and Modern Analysis by G. F. Simmons, International Student edition – McGraw – Hill Kogakusha, Ltd.

Reference Books

1. Schaum's Outlines : General Topology by Seymour Lipschutz
2. Topology : A first Course by James Munkres, Prentice-Hall Pvt. Ltd.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 23B: DIFFERENTIAL GEOMETRY

(w.e.f. 2023-24)

Course Code: 23MATM83A

Course Outcomes

After completion of the course, the student will be able to

CO1. to know about space curves, planar curves

CO2. to calculate Torsion and Curvature

CO3. to know parametric curves on surfaces Rodrigue's formula

CO4. to know about minimal surfaces

CO5. to know contravariant and covariant

Course Contents

Unit-1: Theory of Space Curves

Space curves, Planar curves, Curvature, torsion and Serret-Frenet formulae.

Osculating circles, Osculating circles and spheres. Existence of space curves. Evolutes and involutes of curves.

Unit-2: Theory of Surfaces

Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms. Principal and Gaussian curvatures. Lines of curvature, Euler's theorem. Rodrigue's formula, Conjugate and Asymptotic lines.

Unit-3: Developable

Developable associated with space curves and curves on surfaces, Minimal surfaces.

Unit-4: Geodesics

Canonical geodesic equations. Nature of geodesics on a surface of revolution. Clairaut's theorem. Normal property of geodesics. Torsion of a geodesic. Geodesic curvature. Gauss-Bonnet theorem. Surfaces of constant curvature. Conformal mapping. Geodesic mapping. Tissot's theorem.

Unit-5: Tensors

Summation convention and indicial notation, Coordinate transformation and Jacobian, Contra-variant and Covariant vectors, Tensors of different type, Algebra of tensors and contraction, Metric tensor and 3-index Christoffel symbols, Parallel propagation of vectors, Covariant and intrinsic derivatives, Curvature tensor and its properties, Curl, Divergence and Laplacian operators in tensor form, Physical components.

Activities

Seminar/ Quiz/ Assignments/ Applications of Differential Geometry to Real life Problem /Problem Solving.

Text Book

An Introduction to Differential Geometry by T.J. Willmore, Dover Publications, 2012.

Reference Books

1. Elementary Differential Geometry by B. O. Neill, 2nd Ed., Academic Press, 2006.
2. Differential Geometry of Three Dimensions by C.E. Weatherburn, Cambridge University Press 2003.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 24A: ORDINARY DIFFERENTIAL EQUATIONS

(w.e.f. 2023-24)

Course Code: 23MATSS1A

Course outcomes

After successful completion of the course, students will be able to

CO1. comprehend the bridge between the real function theory and theory of ordinary differential equations

CO2. understand the basic theory behind existence, uniqueness, continuity of solutions of ordinary differential equations

CO3. realize the dependence of solutions on various parameters involved in the differential equations

CO4. recognize the significance studying differential systems and its utility in understanding higher order differential equations

CO5. figure out qualitative behavior of solutions of differential equations of various orders.

Course Content

Unit-1: Real Function Theory

Essential concepts from Real Function Theory – The basic problem -The fundamental existence and uniqueness theorem –examples to demonstrate the theory- continuation of solutions

Unit-2: Existence and Uniqueness

Dependence of solutions on initial conditions – dependence of solutions on parameters (causal function f) - Existence and Uniqueness theorems for systems – existence and uniqueness theorems for Higher order equations – examples

Unit-3: Linear differential systems

Introduction to the theory of Linear differential systems – Theory and properties of Homogeneous linear systems

Unit-4: Homogeneous and Non-homogeneous Systems

Theory of non-homogeneous linear systems – Theory and properties of the nth order homogeneous linear differential equations

Unit -5: Higher order non-homogeneous Linear Equations

Theory of nth order Non homogeneous Linear equations – Sturm theory – Sturm Liouville Boundary value problems



Activities

Seminar/ Quiz/ Assignments/ Applications of Ordinary Differential Equations to Real life Problem / Problem Solving

Text Book

Differential Equations by Shepley L. Ross, Wiley India

Reference books

1. Differential Equations with Applications and Historical Notes by George F. Simmons, (3rd edition). CRC Press. Taylor & Francis.
2. An Introduction to Ordinary Differential Equations by Earl A. Coddington, Prentice-Hall of India

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 24B: APPLICATIONS OF ALGEBRA

(w.e.f. 2023-24)

Course Code: 23MATS81B

Course Outcomes

After completion of the course, the student will be able to

CO1. understand Boolean polynomials and Boolean functions

CO2. understand designing and simplification of circuits

CO3. understand incidence matrix of a BIBD and construction of BIBD from finite fields

CO4. know the concept of coding theory

CO5. generating Functions for non-isomorphic Graphs

Course Content

Unit – 1: Boolean algebra and Swathing Circuits

Boolean Algebras; Switches and Logic Gates; Laws of Boolean algebra; Boolean Polynomials and Boolean Functions; Switching Circuits and Gate Networks; Simplification of Circuits; Designing Circuits

Unit – 2: Balanced Incomplete Block Designs(BIBD)

Basic Definitions and Results; Incidence Matrix of a BIBD; Construction of BIBDs from Difference Sets; construction of BIBD using quadratic residues; Difference set families, construction of BIBD from finite fields.

Unit – 3: Coding Theory

Introduction to Error - Correcting Codes, Linear Codes, Generator and Parity - Check Matrices, Minimum Distance, Hamming Codes, Decoding, Cyclic Codes.

Unit – 4: Symmetry Groups and Color Patterns

Permutation Groups, Groups of Symmetries; Colouring and Colouring Patterns, Polya Theorem and Pattern Inventory, Generating Functions for non-isomorphic Graphs

Unit – 5: Wallpaper Pattern Groups

Group of Symmetries of a Plane; Wallpaper Pattern Groups; Change of Basis in R^2

Activities

Seminar/ Quiz/ Assignments/ /Problem Solving.

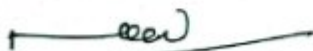
Text Book

Topics in Applied Abstract Algebra by S. R. Nagpaul and S. K. Jain, Thomson Brooks and Cole, Belmont, 2005

Reference Book

Applications of Abstract Algebra with Maple by Richard E. Klima, Neil Sigmon, Ernest Stitzinger, CRC Press LLC, Boca Raton, 2000.

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B.A./B.Sc. Hons. MATHEMATICS

COURSE 25A: OPERATIONS RESEARCH

(w.e.f. 2023-24)

Course Code: 23MATS82A

Course Outcomes

After successful completion of the course, students will be able to

CO1. study on LPP enables to arrive at an optimal decision/solutions in difficult decision making.

CO2. study on LPP applied to problems pertaining to both profit making and low cost related real world situation.

CO3. study on Post optimal analysis enables into manage and control resource allocation.

CO4. study of Transportation problem and Assignment problem introduces to implementing simplex procedure for more variables using Modi method stepping stone method and hungary method

CO5. study on games and strategies helps in decision making for problems with competitive situations like candidates for elections, marketing campaigns by different companies etc.

Course Content

Unit-1: Linear Programming: Simplex Method

Introduction-Fundamental properties of solutions-The computational procedure-Use of artificial variables. 12 hours

Unit-2: Duality in Linear Programming

Introduction-General Primal-Dual pair-Formulating a Dual problem-Primal-Dual Pair in matrix form-Duality theorems-Complementary slackness theorem-Duality and simplex method.

Unit-3: Duality in Linear Programming

Economic Interpretation of Duality, Dual Simplex method Post-optimal Analysis : Introduction-Variation in the cost vector-Variation in the requirement vector-variation in the coefficient matrix-Structural variations- Applications of Post-optimal Analysis. 12 hours

Unit-4: Transportation Problem and Assignment Problem

Introduction-General transportation problem-The transportation table-Solution of a transportation problem-Finding an initial basic feasible solution-Test for optimality-Degeneracy in Transportation problem-Transportation Algorithm (MODI Method)- Introduction -Mathematical formulation of the problem-The Assignment method-Special cases in Assignment problem-A typical Assignment problem. 12 hours

Unit-5: Games and Strategies

Introduction-Two-person zero-sum games-some basic terms-The maximin-minimax principle-Games without saddle points-Mixed strategies-Graphic solution of $2 \times n$ and $m \times 2$ games. 12 hours

Activities

Seminar/ Quiz/ Assignments/ Applications of Operations Research to Real life Problem /Problem Solving

Text Book

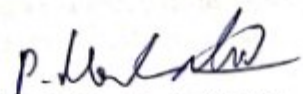
Operations Research by Kanti Swarup, P.K. Gupta and Man Mohan Sultan Chand & Sons, New Delhi, 2006.

Reference Books

1. Operations Research, An Introduction by Hamdy A Taha, Maxwell Macmillan International Edition, New York, 1992.
2. Operations Research Theory, methods and Applications by S.D. Sarma, kedarnath Ramnath publications, 2008.

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B.A./B.Sc. Hons. MATHEMATICS

Proposed syllabus

COURSE 25B: MATHEMATICAL MODELLING

(w.e.f. 2023-24)

Course Code: 23MATS82B

Course Outcomes

After successful completion of the course, students will be able to

CO1. understand concept of modelling and simulation

CO2. construct mathematical models of real world problems

CO3. solve the mathematical models using mathematical techniques

CO4. know the need for mathematical modelling through difference equations

CO5. to know Harrod Model and cobweb application model to Actuarial science

Course Content

Unit-1: Mathematical Modeling

Simple situations requiring mathematical modeling, characteristics of mathematical model.

Unit – 2:Mathematical Modeling through ordinary differential equations of first order

Linear Growth and Decay Models.Non-Linear growth and decay models, Compartment models.

Unit – 3: Mathematical Modeling through system of Ordinary differential equations of first order

Prey-predator models, Competition models, Model with removal and model with immigrations.Epidemics: simple epidemic model, Susceptible-infected-susceptible(SIS) model, SIS model with constant number of carriers.Medicine : Model for Diabetes Mellitus.

Unit – 4:Mathematical Modeling through difference equationsIntroduction to difference equations

The need for mathematical modelling through difference equations : some simple models, basic theoryof linear difference equations with constant coefficients

Unit – 5: Mathematical Modeling through difference equationsIntroduction to difference equations(continued...)

Harrod Model, cobweb model application to Actuarial Science

Activities

Seminar/ Quiz/ Assignments/ Applications of Mathematical Modelling to Real life Problem /Problem Solving

Text book

Mathematical Modeling by J N Kapur, New Age International publishers.(2009)

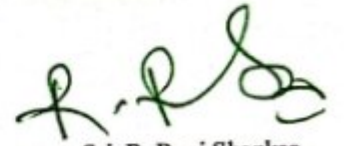
Reference Books

1. Mathematical Modelling with Case Studies by Barnes, B., Fulford, G. R., CRCPress, 2008.
2. An introduction to mathematical modeling by Bender, E. A. (2012), CourierCorporation.
3. Mathematical Modelling by Meerschaert, M. M., (2013) Academic Press.

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B.A./B.Sc. Hons. MATHEMATICS

SKILL COURSE : ANALYTICAL SKILLS

(w.e.f. 2023-24)

Syllabus (30 Hrs.)

Course Objective:

Intended to inculcate quantitative analytical skills and reasoning as an inherent ability in students.

Course Outcomes:

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

CO1. Understand the basic concepts of arithmetic ability, quantitative ability, logical reasoning, business computations and data interpretation and obtain the associated skills.

CO2. Acquire competency in the use of verbal reasoning.

CO3. Apply the skills and competencies acquired in the related areas.

CO4. Solve problems pertaining to quantitative ability, logical reasoning and verbal ability inside and outside the campus.

Course Content

MODULE – I: (10 Hours)

Arithmetic ability: Algebraic operations BODMAS, Fractions, Divisibility rules, LCM & GCD (HCF).

Verbal Reasoning: Number Series, Coding & Decoding, Blood relationship, Clocks, Calendars.

MODULE – II: (10 Hours)

Quantitative aptitude: Averages, Ratio and proportion, Problems on ages, Time-distance – speed.

Business computations: Percentages, Profit & loss, Partnership, simple compound interest.

MODULE – III: (07 Hours)

Data Interpretation: Tabulation, Bar Graphs, Pie Charts, line Graphs. Venn diagrams.

Recommended Co-Curricular Activities (03 hrs)

Surprise tests / Viva-Voice / Problem solving/Group discussion.

Reference Books:

1. Analytical skills by Showick Thorpe, published by S Chand And Company Limited, Ramnagar, New Delhi-110055.
2. Quantitative Aptitude and Reasoning by R V Praveen, PHI publishers.
3. Quantitative Aptitude for Competitive Examination by Abhijit Guha, Tata Mc Graw Hill Publications.
4. Quantitative Aptitude for Competitive Examination by R. S. Agrawal, S.Chand Publications.

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SKILL COURSE ANALYTICAL SKILLS

Module	TOPIC	S.A.Q(including hoice)	E.Q(including hoice)	Total Marks
I	Arithmetic ability n Verbal Reasoning	4	2	40
II	Quantitative aptitude, Business computations	3	2	35
III	Data Interpretation	1	1	15
TOTAL		8	5	90

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

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**B.A./B.Sc. Hons. MATHEMATICS
SKILL COURSE : ANALYTICAL SKILLS**

(w.e.f. 2023-24)

Proposed syllabus MODEL QUESTION PAPER FORMAT

Time: 90 minutes

Max. Marks: 50

PART - A

I. Answer any **four** questions. Each answer carries **5 marks** 4*5=20 Marks
(Total 8 questions, at least 1 question should be given from each unit)

1. If H.C.F., L.C.M of two numbers are 16 and 240 respectively and one number is 40; find the other number ?
2. Explain "Pie Charts" ?
3. If $A : B = 2 : 3$ and $B : C = 4 : 5$ Then $A : B : C = ?$
4. Devide Rs. 672 in 5 : 3 ratio ?
5. A train travelled 450 Kms in 7 hours and 740 kms in 10 hours. Find the average speed of the train ?
6. October 30, 2020 was a Friday. What day of the week lies on October 30, 2021?
7. If A is a brother of B ; B is the sister of C ; and C is the father of D, how D is related to A.?
8. Find the value of $78 - [5 + 3 \text{ of } (25 - 2 * 10)] = ?$

PART - B

II. Answer any **three** questions. Each answer carries **10 marks** 3*10=30
Marks (Total 5 questions, at least 1 question should be given from each unit)

9. (a) Find the angle between the hour hand and the minute hand of a clock when the time is 4 : 10
(b) How many natural numbers between 17 and 80 are divisible by 6?
10. Find the missing terms in the following sequences with suitable explanations.
 - (i) 22, 21, 23, 22, 24, 23,
 - (ii) 6, 11, 21, 36, 56, ----?
 - (iii) $2:8 :: 4 : ?$
 - (iv) Manager : Assistant :: Doctor :
 - (v) SCD, TEF, UGH ----- WKL

11. Sachin is younger than Rahul by 4 years. If their ages are in the respective ratio of 7:9, find their present ages?
12. A man travelled from the village to the post office at the rate of 25kmph and walked back at the rate of 4kmph. If the whole journey took 5 hours 48 minutes, find the distance of post office from the village?
13. Study the following table and answer the questions based on it.

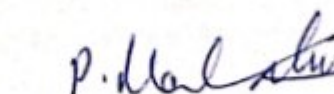
Expenditure of a company (in pesetas) per annum over the given years

Year	Item of expenditure				
	Salary	Fuel and Transport	Bonus	Interest on Loans	Taxes
1998	288	98	3.00	23.4	83
1999	342	112	2.52	32.5	108
2000	324	101	3.84	41.6	94
2001	336	133	3.68	36.4	88
2002	420	142	3.96	49.4	98

- (i). What is the average amount of interest per year which the company had to pay during this period?
a) 32.43 b) 33.72 c) 34.18 d) 36.66 []
- (ii). The total amount of bonus paid by the company during the given period is approximately what percent of the total amount of salary paid during this period.
(a) 0.1% b) 0.5% c) 1.0% d) 1.25% []
- (iii). Total expenditure on all these items in 1998 was approximately what percent of the total expenditure in 2002?
a) 0.62% b) 0.66% c) 0.69% d) 0.71% []
- (iv). The total expenditure of the company over these items during the year 2000 is?
a) 544.44 b) 501.11 c) 446.46 d) 478.87 []
- (v). The ratio between the total expenditure and taxes for all the years and the total expenditure on Fuel and Transport for all the years respectively is approximately?
a) 4:7 b) 10:13 c) 15:18 d) 5:8 []

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ADD-ON Course : Introduction to Statistics

(w.e.f. 2023-24)

Syllabus (60 Hrs.)

Unit-I (12 Hours)

Primary and Secondary Data:

Concepts of primary and secondary data. Diagrammatic and graphical representation of data: Histogram, frequency polygon, Ogive curve, Pie definitions and problems.

Unit-II (10 Hours)

Measures of Central Tendency and Dispersion:

Measures of central tendency: Mean, median, mode. Range, Quartile deviation, mean deviation, standard deviation and variance definitions and problems.

Unit-III (12 Hours)

Introduction to Probability:

Basic concepts of Probability, random experiment, trial, outcome, sample space, event. Definition of probability, conditional probability, independent events, addition and multiplication theorems of probability for 2 events. Bayes theorem and problems.

Unit-IV (14 Hours)

Random Variables:

Definition of random variable, discrete and continuous random variables, functions of random variable. Probability mass function and density function, distribution function and its properties. Simple problems on p.m.f, p.d.f.

Unit-V (12 Hours)

Correlation and Regression:

Correlation definition meaning, types of correlation and scatter diagram. Karl Pearson's rank correlation coefficient problems and Regression lines and problems

Text Books:

1. V. K. Kapoor and S.C. Gupta: Fundamentals of Mathematics and Statistics, Sultan Chand & Sons, New Delhi.
2. BA/B.Sc. I-Year statistics- descriptive statistics, Probability distributions-Telugu Academy- Dr. M. Jaganmohan Rao, Dr. N. Srinivasa Rao, Dr. Tirupathi Rao, Smt. D. Vijayalakshmi.
3. B.Sc. Statistics (Paper-1): Descriptive statistics and Probability Distributions- D.V.L.N. Jogiraju, C. Sriakal, L.P. Raj Kumar.

Proposed syllabus MODEL QUESTION PAPER FORMAT

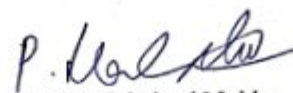
Answer any five questions. Each question carries equal marks.

5 x 10 = 50

1. What is primary and secondary data.
2. Explain frequency polygon and ogive curve.
3. Explain Measures of central tendency with suitable formulas.
4. Explain standard deviation.
5. Define probability with properties.
6. Define random variables and its types.
7. Explain correlation coefficient, types and properties.
8. Difference between discrete and continuous distributions.

Signed and approved by


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