Himachal Pradesh University

Summer Hill, Shimla-171005

Syllabus and Scheme of Examination

For

B. Sc. Physical Sciences

(Physics, Chemistry & Mathematics)

&

B.Sc. Physical Sciences

(Physics, Computer Science & Mathematics)

&

B. Sc. with Mathematics

&

B.A. with Mathematics

Courses

under the

Choice Based Credit System

(ANNUAL SYSTEM) ***w.e.f.***

Session 2018 -19 onwards

Details of Courses Under B.Sc. Physical Sciences (Physics, Chemistry/Computer Science, Mathematics)

Course	***Credits**	
	Theory+ Practical	Theory +Tutorials
I. Core Course	12X4= 48	12X5=60
(12 Papers)		
04 Courses from each of the 03 disciplines of choice		
Core Course Practical / Tutorial*	12X2=24	12X1=12
(12 Practical/ Tutorials*)		
04 Courses from each of the 03 Disciplines of choice		
II. Discipline Specific Course Elective Course	6x4=24	6X5=30
(6 Papers)		
Two papers from each discipline of choice including paper of interdisciplinary nature.		
Discipline Specific Course Practical / Tutorials*	6 X 2=12	6X1=6
(6 Practical / Tutorials*)		
Two Papers from each discipline of choice including paper of interdisciplinary nature		

- **Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 3rd year**

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III. Ability Enhancement Courses

1**. Ability Enhancement Compulsory**	2 X 4=8	2X4=8
(2 Papers of 4 credits each) **Environmental Science English/MIL Communication**		
2**. Skill Enhancement Course**	4 X 4=16	4 X 4=16
(Skill Based) **(4 Papers of 4 credits each)**		
	Total credit= 132	**Total credit= 132**

College should evolve a system/policy about ECA/ General Interest/ Hobby/ Sports/ NCC/ NSS/ related courses on its own.

***wherever there is practical there will be no tutorials and vice –versa.**

Details of Courses under B.Sc. with Mathematics

Course	*Credits	
	Theory + Practical	**Theory + Tutorials**
I. Core Course	12×4 = 48	12×5 = 60
(12 Papers) 04 Courses from each of the 03 disciplines of choice		
Core Course Practical / Tutorial*	12×2 = 24	12×1 = 12
(12 Practical/ Tutorials*) 04 Courses from each of the 03 Disciplines of choice		
II. Elective Course **(6 Papers)** Two papers from each discipline of choice including paper of interdisciplinary nature.	6×4 = 24	6×5 = 30
Elective Course Practical / Tutorials*	**6**×2 = 12	6×1 = 6
(6 Practical / Tutorials*) Two Papers from each discipline of choice including paper of interdisciplinary nature		
• Optional Dissertation or project work in place of one Discipline elective paper (6 credits) in 3rd Year		
III. Ability Enhancement Courses		
1.**Ability Enhancement Compulsory** (2 Papers of 4 credits each) **Environmental Science** **English/MIL Communication**	**2×4 = 8**	**2×4 = 8**
2. **Skill Enhancement Course** **(Skill Based) (4 Papers of 4 credits each)**	**4×4 = 16**	**4×4 = 16**
	Total credit = 132	**Total credit = 132**

***wherever there is practical there will be no tutorials and vice -versa**

Details of Courses under B.A. with Mathematics

Course		*Credits
	Theory + Practical	**Theory + Tutorials**
I. Core Course (12 Papers) Two Papers- English Two Papers- MIL Four Papers- Discipline 1 specific Four Papers- Discipline 2 specific	12×4 = 48	12×5 = 60
Core Course Practical / Tutorial* (12 **Practical/Tutorials*)**	12×2 = 24	12×1 = 12
II. Elective Course **(6 Papers)** Two papers –Discipline 1 specific Two papers –Discipline 2 specific Two papers – Generic Elective (Interdisciplinary) *Two Papers from each discipline of choice and Two Papers of Interdisciplinary nature.(**GE**)*	6×4 = 24	6×5 = 30
Elective Course Practical / Tutorials* **(6 Practical / Tutorials*)** Two papers –Discipline 1 specific Two papers –Discipline 2 specific Two papers – Generic Elective (Interdisciplinary) *Two Papers from each discipline of choice including paper of interdisciplinary nature*	6×2 =12	6x1=6
III. Ability Enhancement Courses **1. Ability Enhancement Compulsory Courses(AECC)** (2 Papers of 4 credits each) **Environmental Science** **English/MIL Communication**	**2×4 = 8**	**2×4 = 8**

2. Skill Enhancement Course(SEC) (4 Papers of 4 credits each)	**4×4 = 16**	**4×4 = 16**
	Total credit = 132	**Total credit = 132**

***wherever there is practical there will be no tutorials and vice –versa**

Scheme for Choice Based Credit System (CBCS) in Bachelor of Science Physical Science and Bachelor of Science with Mathematics Annual Pattern

Year	Core Course (12)	Ability Enhancement Compulsory Course AECC (2)	Skill Enhancement Courses SEC (4)	Elective Course Discipline Specific Elective DSE (6)	Total Credits
I	DSC-1A = 6 Credit DSC-1B = 6 Credit DSC-2A = 6 Credit DSC-2B = 6 Credit DSC-3A = 6 Credit DSC-3B = 6 Credit **Credits = 36**	Eng/MIL Communi/EVS = 4 Credit Eng/MIL Communi/EVS = 4 Credit **Credits = 08**	NIL	NIL	**44**
II	DSC-1C = 6 Credit DSC-1D = 6 Credit DSC-2C = 6 Credit DSC-2D = 6 Credit DSC-3C = 6 Credit DSC-3D = 6 Credit **Credits = 36**	NIL	SEC-1 = 4 Credit SEC-2 = 4 Credit **Credits = 08**	NIL	**44**
III	NIL	NIL	SEC-3 = 4 Credit SEC-4 = 4 Credit **Credits = 08**	DSE-1A = 6 Credit DSE-1B = 6 Credit DSE-2A = 6 Credit DSE-2B = 6 Credit DSE-3A = 6 Credit DSE-3B = 6 Credit **Credits = 36**	**44**
Total Credits in B.Sc. Physical Science and B.Sc. with Mathematics Degree Courses = 44 × 3					**132**

Credits Split:

Theory = 04 **Theory = 05**
Practical = 02 **Tutorial = 01**
For SEC:
Theory = 03
Skill Exam (SE) = 01

Scheme for Choice Based Credit System (CBCS) in Bachelor of Science Physical Science and Bachelor of Arts with Mathematics Annual Pattern

Year	Core Course (12)	Ability Enhancement Compulsory Course AECC (2)	Skill Enhancement Courses SEC (4)	Elective Course Discipline Specific Elective DSE (6)	Generic Elective (GE)	Total Credits
I	Eng-1 = 6 Credit Skt/Hindi-1 = 6 Credit DSC-1A = 6 Credit DSC-1B = 6 Credit DSC-2A = 6 Credit DSC-2B = 6 Credit **Credits = 36**	Env. Studies = 4 Credit Hindi/Eng/Skt = 4 Credit **Credits = 08**	NIL	NIL	NIL	**44**
II	Eng-2 = 6 Credit Skt/Hindi-2 = 6 Credit DSC-1C = 6 Credit DSC-1D = 6 Credit DSC-2C = 6 Credit DSC-2D = 6 Credit **Credits = 36**	NIL	SEC-1 = 4 Credit SEC-2 = 4 Credit **Credits = 08**	NIL	NIL	**44**
III	NIL	NIL	SEC-3 = 4 Credit SEC-4 = 4 Credit **Credits = 08**	DSE-1A = 6 Credit DSE-1B = 6 Credit DSE-2A = 6 Credit DSE-2B = 6 Credit **Credits = 24**	GE-1 =6 Credit GE-2 =6 Credit **Credits = 12**	**44**
Total Credits in B.A Degree Courses = 44 × 3						**132**

Credits Split:

Theory = 04 **Theory = 05**
Practical = 02 **Tutorial = 01**
For SEC:
Theory = 03, **Skill Exam (SE) = 01**

Details of CBCS Scheme for Undergraduate Three Year Degree Course: B.Sc. Physical Science and B.Sc. with Mathematics: Teaching Hours and Credits Plan in Annual System for Three years

S. No.	Name of Course (6 Credits)	Teaching Hrs.		Credits as per annual Plan				
				Non Practical Course (2Weeks Teaching Hours)		Practical Course (2Weeks Teaching Hours)		Total Credits in a Year
1	Core Courses (12)	1st Week	2nd Week	Theory	Tutorial	Theory	Practical	
a	Discipline Specific Courses (4+4+4 =12)							
i	DSC-1A	03	06	05	01	04	02	06
	DSC-1B	03	06	05	01	04	02	06
	DSC-1C	03	06	05	01	04	02	06
	DCS-1D	03	06	05	01	04	02	06
ii	DSC-2A	03	06	05	01	04	02	06
	DSC-2B	03	06	05	01	04	02	06
	DSC-2C	03	06	05	01	04	02	06
	DCS-2D	03	06	05	01	04	02	06
iii	DSC-3A	03	06	05	01	04	02	06
	DSC-3B	03	06	05	01	04	02	06
	DSC-3C	03	06	05	01	04	02	06
	DCS-3D	03	06	05	01	04	02	06
Total Credits of Core Courses								72
2	Ability Enhancement Courses (6)							
a	Ability Enhancement Compulsory Courses (2)							
i	Eng/MIL Communication/EVS	02	04	03	01	--	--	04
	Eng/MIL Communication/EVS	02	04	03	01	--	--	04
Total Credits of Ability Enhancement Compulsory Courses (AECC)								08
b	Skill Enhancement Courses (4)					Theory	Practical Skill Exam	
	SEC-1	02	04	04	--	03	01	04
	SEC-2	02	04	04	--	03	01	04
	SEC-3	02	04	04	--	03	01	04
	SEC-4	02	04	04	--	03	01	04
Total Credits of Skill Enhancement Courses (SEC)								16

Total Credits of Ability Enhancement Courses (AEC) = 08 + 16								**24**
3	**Elective Courses (6)**							
a	**Discipline Specific Elective Courses**					**Theory**	**Practical**	
i	DSE-1A	03	06	05	01	04	02	06
	DSE-1B	03	06	05	01	04	02	06
	DSE-2A	03	06	05	01	04	02	06
	DSE-2B	03	06	05	01	04	02	06
	DSE-3A	03	06	05	01	04	02	06
	DSE-3B	03	06	05	01	04	02	06
Total Credits of Discipline Specific Elective (DSE) Courses								**36**
Grand Total Credits in Three Year Degree Course: B.Sc. Physical Science and B.Sc. with Mathematics: 72 + 24 +36								**132**

Annual Examination (A.E.) and Internal Assessment (I.A.) Scheme of Three years Degree of

B.Sc. Physical Sciences/ B.Sc. Mathematics /B.A Mathematics

Scheme for Examination for each course

- **The medium of instructions and Examinations shall be English only.**
- **AE & Practical Examinations shall be conducted at the end of each year as per the Academic Calendar notified by H.P. University, Shimla-5, time to time.**
- **Each course of 4/6 credits (theory + Practicals) will carry 100 marks and will have following components:**

(FOR COURSES WITHOUT PRACTICALS)

I.	**Theory**	**marks**
	Annual Examination (AE)	**70 marks**
II.	**Internal Assessment (IA)**	**30 marks**
	a) Assignment/Class Test/Quiz/Seminar/Model	**10 marks**
	a) Mid-Term Examination (One Test)	**15 marks**
	b) Attendance	**05**

(FOR COURSES WITH PRACTICALS)

III.	**Theory**	**marks**
	Annual Examination (AE)	**50 marks**
IV.	**Internal Assessment (IA)**	**30 marks**
	a) Assignment/Class Test/Quiz/Seminar/Model	**10 marks**
	c) Mid-Term Examination (One Test)	**15 marks**
	d) Attendance	**05**

V. Practical 20 marks

- **Minimum Pass Percentage in each component (AE, IA & Practical) shall be 40%, separately**

- **Criterion for Class-room attendance (05 marks)**

  75% Attendance is minimum eligibility condition.

i) Attendance 75% to 80% 1 mark
ii) Attendance above 80% to 85% 2 marks
iii) Attendance above 85% to 90% 3 marks
iv) Attendance above 90% to 95% 4 marks
v) **Attendance above 95% 5 marks**

HIMACHAL PRADESH UNIVERSITY
SYLLABUS AND SCHEME OF EXAMINATIONFOR B.SC. PHYSICAL SCIENCE
(PHYSICS, CHEMISTRY AND MATHEMATICS) W.E.F. 2018-19

Year	Course Type	Course Code	Title of Paper	Credits
1	CORE COURSE-1	PHYS101TH PHYS101IA	MECHANICS THEORY	4
		PHYS101PR	MECHANICS LAB	2
	CORE COURSE-II	CHEM101TH CHEM101IA CHEM101PR	ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS	6
	CORE COURSE-III	MATH101TH MATH101IA	DIFFERENTIAL CALCULUS	6
	A.E.C. COURSE-I		ENVIRONMENTAL SCIENCE	4
	CORE COURSE-IV	PHYS102TH PHYS102IA	ELECTRICITY, MAGNETISIM AND EMT THEORY	4
		PHYS102PR	ELECTRICITY, MAGNETISIM AND EMT LAB	2
	CORE COURSE-V	CHEM102TH CHEM102IA CHEM102PR	STATES OF MATTER, CHEMICAL KINETICS & FUNCTIONAL ORGANIC CHEMISTRY	6
	CORE COURSE-VI	MATH102TH MATH102IA	DIFFERENTIAL EQUATIONS	6
	A.E.C. COURSE-II		ENGLISH/MIL COMMNICATION	4
II	CORE COURSE-VII	PHYS201TH PHYS201IA	STATISTICAL AND THERMAL PHYSICS THEORY	4
		PHYS201PR	STATISTICAL AND THERMAL PHYSICS LAB	2
	CORE COURSE-VIII	CHEM201TH CHEM201IA CHEM201PR	SOLUTIONS, PHASE EQUILIBRIUM, CONDUCTANCE, ELECTROCHEMISTRY & ORAGANIC CHEMISTRY	6
	CORE COURSE-IX	MATH201TH MATH201IA	REAL ANALYSIS	6
	CORE COURSE-X	PHYS202TH PHYS202IA	WAVES AND OPTICS THEORY	4
		PHYS202PR	WAVES AND OPTICS LAB	2
	CORE COURSE-XI	CHEM202TH CHEM202IA CHEM202PR	CHEMISTRY OF MAIN GROUP ELEMENTS, CHEMICAL ENERGETICS AND EQUILIBRIA	6
	CORE COURSE-XII	MATH202TH MATH202IA	ALGEBRA	6
	SEC 1 (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS203TH PHYS203IA	PHYSICS WORKSHOP SKILLS THEORY	3 + 1=4 (TH+IA=3 SE=1)
		PHYS203SE	PHYSICS WORKSHOP SKILLS SKILL EXAM	
		PHYS204TH PHYS204IA	COMPUTATIONAL PHYSICS THEORY	
		PHYS204SE	COMPUTATIONAL PHYSICS SKILL EXAM	

		PHYS205TH PHYS205IA	ELECTRICAL CIRCUITS AND NETWORK SKILL THEORY	
		PHYS205SE	ELECTRICAL CIRCUITS AND NETWORK SKILLS SKILL EXAM	
	SEC2 (CHOOSE ANY ONE FROM GIVEN TWO)	CHEM203TH CHEM203IA	BASIC ANALYTICAL CHEMISTRY	4
		CHEM204TH CHEM204IA	FUEL CHEMISTRY & CHEMISTRY OF COSMETICS & PERFUMES	
III	DISCIPLINE SPECIFIC ELECTIVES DSE:1A (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS301TH PHYS301IA	ELEMENTS OF MODERN PHYSICS THEORY	4+2 =6 (TH+IA=4 PR=2)
		PHY301PR	ELEMENTS OF MODERN PHYSICS LAB	
		PHYS302TH PHYS302IA	SOLID STATE PHYSCS AND ELECTRONICS THEORY	
		PHYS302PR	SOLID STATE PHYSCS AND ELECTRONICS LAB	
		PHYS303TH PHYS303IA	ASTRONOMY AND ASTROPHYSICS THEORY	
		PHYS303TU	ASTRONOMY AND ASTROPHYSICS TUTORIALS	
	DISCIPLINE SPECIFIC ELECTIVES DSE:2A (CHOOSE ANY ONE FROM GIVEN THREE)	CHEM301TH CHEM301IA CHEM301PR	POLYNUCLEAR HYDROCARBONS DYES, HETROCYCLIC COMPOUNDS AND SPECTROSCOPY (UV, IR, NMR)	6
		CHEM302TH CHEM302IA CHEM302PR	INDUSTRIAL CHEMICALS AND ENVIRONMENT	
		CHEM303TH CHEM303IA CHEM303PR	QUANTUM CHEMISTRY, SPECTROSCOPY AND PHOTOCHEMISTRY	
	DISCIPLINE SPECIFIC ELECTIVE DSE:3A (CHOOSE ANY ONE FROM GIVEN THREE)	MATH301TH MATH301IA	MATRICES	4+2 =6 (TH+IA=6
		MATH302TH MATH302IA	MECHANICS	
		MATH303TH MATH303IA	LINEAR ALGEBRA	
	DISCIPLINE SPECIFIC ELECTIVES DSE: 1B (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS304TH PHYS304IA	NUCLEAR AND PARTICLE PHYSICS THEORY	5+1 (TH+IA=5 TU=1) OR 4+2 (TH+IA=4 PR=2)
		PHYS304TU	NUCLEAR AND PARTICLE PHYSICS TUTORIALS	
		PHYS305TH PHYS305IA	QUANTUM MECHANICS THEORY	
		PHYS305PR	QUANTUM MECHANICS LAB	
		PHYS306TH PHYS306IA	PHYSICS OF DEVICES AND INSTRUMENTS THEORY	
		PHYS306PR	PHYSICS OF DEVICES AND INSTRUMENTS LAB	

	DISCIPLINE SPECIFIC ELECTIVE DSE: 2B (CHOOSE ANY ONE FROM GIVEN THREE)	CHEM304TH CHEM304IA CHEM304PR	CHEMISTRY OF TRANSITION AND INNER TRANSITION ELEMENTS, COORDINATION CHEMISTRY, ORGANOMETTALICS, ACIDS AND BASES	6
		CHEM305TH CHEM305IA CHEM305PR	POLYMER CHEMISTRY	
		CHEM306TH CHEM306IA CHEM306PR	MOLECULES OF LIFE	
	DISCIPLINE SPECIFIC ELECTIVE DSE: 3B (CHOOSE ANY ONE FROM GIVEN THREE)	MATH304TH MATH304IA	NUMERICAL METHODS	4+2 =6 (TH+IA=6
		MATH305TH MATH305IA	COMPLEX ANALYSIS	
		MATH306TH MATH306IA	LINEAR PROGRAMMING	
	SKILL ENHANCEMENT COURSE SEC3 (CHOOSE ANY ONE FROM GIVEN TWELVE))	MATH307TH MATH307IA	LOGIC AND SETS	4
		MATH308TH MATH308IA	ANALYTIC GEOMETRY	
		MATH309TH MATH309IA	INTEGRAL CALCULUS	
		MATH310TH MATH310IA	VECTOR CALCULUS	
		MATH311TH MATH311IA	BOOLEAN ALGEBRA	
		MATH312TH MATH312IA	NUMBER THEORY	
		MATH313TH MATH313IA	PROBABILITY AND STATISTICS	
		MATH314TH MATH314IA	MATHEMATICAL FINANCE	
		MATH315TH MATH315IA	MATHEMATICAL MODELING	
		MATH316TH MATH316IA	THEORY OF EQUATIONS	
		MATH317TH MATH317IA	TRANSPORTATION AND GAME THEORY	
		MATH318TH MATH318IA	GRAPH THEORY	
	SEC4 (IN CASE OF CHEMISTRY CHOSE ANY ONE FROM GIVEN TWO)	CHOOSE ONE COURSE OUT OF THE LIST OF SEC COURSES OF PHYSICS/MATHEMATICS, BUT NOT CHOSEN EARLIER IN SEC1 AND SEC3.		4
		CHEM307TH	CHEMICAL TECHNOLOGY & SOCIETY AND BUSINESS SKILLS FOR CHEMISTRY	
		CHEM308TH	PESTICIDE CHEMISTRY & PHARMACEUTICAL CHEMISTRY	

TH= Theory, IA=Internal Assessment, PR= Practical, TU= Tutorial, SE= Skill Exam

HIMACHAL PRADESH UNIVERSITY
SYLLABUS AND SCHEME OF EXAMINATIONFOR B.SC. PHYSICAL SCIENCE
(PHYSICS, COMPUTER SCIENCE AND MATHEMATICS) W.E.F. 2018-19

Year	Course Type	Course Code	Title of Paper	Credits
1	CORE COURSE-1	PHYS101TH PHYS101IA	MECHANICS THEORY	4
		PHYS101PR	MECHANICS LAB	2
	CORE COURSE-II	COMP101TH COMP101IA	PROBLEM SOLVING USING COMPUTER	4
		COMP101PR	SOFTWARE LAB USING PYTHON	2
	CORE COURSE-III	MATH101TH MATH101IA	DIFFERENTIAL CALCULUS	6
	A.E.C. COURSE-I		ENVIRONMENTAL SCIENCE	4
	CORE COURSE-IV	PHYS102TH PHYS102IA	ELECTRICITY, MAGNETISIM AND EMT THEORY	4
		PHYS102PR	ELECTRICITY, MAGNETISIM AND EMT LAB	2
	CORE COURSE-V	COMP102TH COMP102IA	OFFICE AUTOMATION TOOLS	4
		COMP102PR	OFFICE AUTOMATION TOOLS LAB	2
	CORE COURSE-VI	MATH102TH MATH102IA	DIFFERENTIAL EQUATIONS	6
	A.E.C. COURSE-II		ENGLISH/MIL COMMNICATION	4
II	CORE COURSE-VII	PHYS201TH PHYS201IA	STATISTICAL AND THERMAL PHYSICS THEORY	4
		PHYS201PR	STATISTICAL AND THERMAL PHYSICS LAB	2
	CORE COURSE-VIII	COMP201TH COMP201IA	COMPUTER SYSTEM ARCHITECTURE	6
	CORE COURSE-IX	MATH201TH MATH201IA	REAL ANALYSIS	6
	CORE COURSE-X	PHYS202TH PHYS202IA	WAVES AND OPTICS THEORY	4
		PHYS202PR	WAVES AND OPTICS LAB	2
	CORE COURSE-XI	COMP202TH COMP 202IA	DATABASE MANAGEMENT SYSTEM	4
		COMP202PR	DATABASE MANAGEMENT SYSTEM LAB	2
	CORE COURSE-XII	MATH202TH MATH202IA	ALGEBRA	6
	SEC 1 (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS203TH PHYS203IA	PHYSICS WORKSHOP SKILLS THEORY	3 + 1=4 (TH+IA=3 SE=1)
		PHYS203SE	PHYSICS WORKSHOP SKILLS SKILL EXAM	
		PHYS204TH PHYS204IA	COMPUTATIONAL PHYSICS THEORY	
		PHYS204SE	COMPUTATIONAL PHYSICS	

			SKILL EXAM	
		PHYS205TH PHYS205IA	ELECTRICAL CIRCUITS AND NETWORK SKILL THEORY	
		PHYS205SE	ELECTRICAL CIRCUITS AND NETWORK SKILLS SKILL EXAM	
	SEC2	COMP203TH COMP203IA	PHP PROGRAMMING	4
III	DISCIPLINE SPECIFIC ELECTIVES DSE:1A (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS301TH PHYS301IA	ELEMENTS OF MODERN PHYSICS THEORY	4+2 =6 (TH+IA=4 PR=2)
		PHY301PR	ELEMENTS OF MODERN PHYSICS LAB	
		PHYS302TH PHYS302IA	SOLID STATE PHYSCS AND ELECTRONICS THEORY	
		PHYS302PR	SOLID STATE PHYSCS AND ELECTRONICS LAB	
		PHYS303TH PHYS303IA	ASTRONOMY AND ASTROPHYSICS THEORY	
		PHYS303TU	ASTRONOMY AND ASTROPHYSICS TUTORIALS	
	DSE: 2A	COMP301TH COMP301IA	OPERATING SYSTEM	6
	DISCIPLINE SPECIFIC ELECTIVE DSE:3A (CHOOSE ANY ONE FROM GIVEN THREE)	MATH301TH MATH301IA	MATRICES	4+2 =6 (TH+IA=6
		MATH302TH MATH302IA	MECHANICS	
		MATH303TH MATH303IA	LINEAR ALGEBRA	
	DISCIPLINE SPECIFIC ELECTIVES DSE: 1B (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS304TH PHYS304IA	NUCLEAR AND PARTICLE PHYSICS THEORY	5+1 (TH+IA=5 TU=1) OR 4+2 (TH+IA=4 PR=2)
		PHYS304TU	NUCLEAR AND PARTICLE PHYSICS TUTORIALS	
		PHYS305TH PHYS305IA	QUANTUM MECHANICS THEORY	
		PHYS305PR	QUANTUM MECHANICS LAB	
		PHYS306TH PHYS306IA	PHYSICS OF DEVICES AND INSTRUMENTS THEORY	
		PHYS306PR	PHYSICS OF DEVICES AND INSTRUMENTS LAB	

	DSE: 2B	COMP302TH COMP302IA	DATA STRUCTURE AND FILE PROCESSING	4
		COMP302PR	DATA STRUCTURE AND FILE PROCESSING LAB	2
	DISCIPLINE SPECIFIC ELECTIVE DSE: 3B (CHOOSE ANY ONE FROM GIVEN THREE)	MATH304TH MATH304IA	NUMERICAL METHODS	4+2 =6 (TH+IA=6
		MATH305TH MATH305IA	COMPLEX ANALYSIS	
		MATH306TH MATH306IA	LINEAR PROGRAMMING	
	SKILL ENHANCEMENT COURSE SEC3 (CHOOSE ANY ONE FROM GIVEN TWELVE)	MATH307TH MATH307IA	LOGIC AND SETS	4
		MATH308TH MATH308IA	ANALYTIC GEOMETRY	
		MATH309TH MATH309IA	INTEGRAL CALCULUS	
		MATH310TH MATH310IA	VECTOR CALCULUS	
		MATH311TH MATH311IA	BOOLEAN ALGEBRA	
		MATH312TH MATH312IA	NUMBER THEORY	
		MATH313TH MATH313IA	PROBABILITY AND STATISTICS	
		MATH314TH MATH314IA	MATHEMATICAL FINANCE	
		MATH315TH MATH315IA	MATHEMATICAL MODELING	
		MATH316TH MATH316IA	THEORY OF EQUATIONS	
		MATH317TH MATH317IA	TRANSPORTATION AND GAME THEORY	
		MATH318TH MATH318IA	GRAPH THEORY	
	SEC4 (IN CASE OF COMPUTER SCIENCE CHOOSE THE GIVEN COURSE)	CHOOSE ONE COURSE OUT OF THE LIST OF SEC COURSES OF PHYSICS/MATHEMATICS, BUT NOT CHOSEN EARLIER IN SEC1 AND SEC3.		4
		COMP303TH COMP303IA	SOFTWARE ENGINEERING	

TH= Theory,IA=Internal Assessment, PR= Practical, TU= Tutorial, SE= Skill Exam

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SYLLABUS AND SCHEME OF EXAMINATION FOR B.SC. MATHEMATICS
W.E.F. 2018-19

Year	Course Type	Course Code	Title of Paper	Credits
I	CORE COURSE-1	PHYS101TH PHYS101IA	MECHANICS THEORY	4
		PHYS101PR	MECHANICS LAB	2
	CORE COURSE-II	CHEM101TH CHEM101IA CHEM101PR	ATOMIC STRUCTURE, BONDING, GENERAL ORGANIC CHEMISTRY & ALIPHATIC HYDROCARBONS	6
	CORE COURSE-III	MATH101TH MATH101IA	DIFFERENTIAL CALCULUS	6
	A.E.C. COURSE-I		ENVIRONMENTAL SCIENCE	4
	CORE COURSE-IV	PHYS102TH PHYS102IA	ELECTRICITY, MAGNETISIM AND EMT THEORY	4
		PHYS102PR	ELECTRICITY, MAGNETISIM AND EMT LAB	2
	CORE COURSE-V	CHEM102TH CHEM102IA CHEM102PR	STATES OF MATTER, CHEMICAL KINETICS & FUNCTIONAL ORGANIC CHEMISTRY	6
	CORE COURSE-VI	MATH102TH MATH102IA	DIFFERENTIAL EQUATIONS	6
	A.E.C. COURSE-II		ENGLISH/MIL COMMNICATION	4
II	CORE COURSE-VII	PHYS201TH PHYS201IA	STATISTICAL AND THERMAL PHYSICS THEORY	4
		PHYS201PR	STATISTICAL AND THERMAL PHYSICS LAB	2
	CORE COURSE-VIII	CHEM201TH CHEM201IA CHEM201PR	SOLUTIONS, PHASE EQUILBRIUM, CONDUCTANCE, ELECTROCHEMISTRY AND ORAGANIC CHEMISTRY	6
	CORE COURSE-IX	MATH201TH MATH201IA	REAL ANALYSIS	6
	CORE COURSE-X	PHYS202TH PHYS202IA	WAVES AND OPTICS THEORY	4
		PHYS202PR	WAVES AND OPTICS LAB	2
	CORE COURSE-XI	CHEM202TH CHEM202IA CHEM202PR	CHEMISTRY OF MAIN GROUP ELEMENTS, CHEMICAL ENERGETICS AND EQUILIBRIA	6
	CORE COURSE-XII	MATH202TH MATH202IA	ALGEBRA	6
	SEC 1 (CHOOSE ANY ONE FROM GIVEN THREE)	MATH307TH MATH307IA	LOGIC AND SETS	TH+IA=4
		MATH308TH MATH308IA	ANALYTIC GEOMETRY	
		MATH309TH MATH309IA	INTEGRAL CALCULUS	

	SEC2 (CHOOSE ANY ONE FROM GIVEN THREE)	MATH310TH MATH310IA	VECTOR CALCULUS	TH+IA=4
		MATH311TH MATH311IA	BOOLEAN ALGEBRA	
		MATH312TH MATH312IA	NUMBER THEORY	
III	DISCIPLINE SPECIFIC ELECTIVES DSE: IA (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS301TH PHYS301IA	ELEMENTS OF MODERN PHYSICS THEORY	4+2=6 (TH+IA=4 PR=2)
		PHYS301PR	ELEMENTS OF MODERN PHYSICS LAB	
		PHYS302TH PHYS302IA	SOLID STATE PHYSICS AND ELECTRONICS THEORY	
		PHYS302PR	SOLID STATE PHYSICS AND ELECTRONICS LAB	
		PHYS303TH PHYS303IA	ASTRONOMY AND ASTROPHYSICS THEORY	
		PHYS303TU	ASTRONOMY AND ASTROPHYSICS TUTORIALS	
	DISCIPLINE SPECIFIC ELECTIVES DSE:2A (CHOOSE ANY ONE FROM GIVEN THREE)	CHEM301TH CHEM301IA CHEM301PR	POLYNUCLEAR HYDROCARBONS DYES, HETROCYCLIC COMPOUNDS AND SPECTROSCOPY (UV, IR, NMR)	6
		CHEM302TH CHEM302IA CHEM302PR	INDUSTRIAL CHEMICALS AND ENVIRONMENT	
		CHEM303TH CHEM303IA CHEM303PR	QUANTUM CHEMISTRY, SPECTROSCOPY & PHOTOCHEMISTRY	
	DISCIPLINE SPECIFIC ELECTIVES DSE:3A (CHOOSE ANY ONE FROM GIVEN THREE)	MATH301TH MATH301IA	MATRICES	4+2 =6 (TH+IA=6
		MATH302TH MATH302IA	MECHANICS	
		MATH303TH MATH303IA	LINEAR ALGEBRA	
	DISCIPLINE SPECIFIC ELECTIVES DSE:1B (CHOOSE ANY ONE FROM GIVEN THREE)	PHYS304TH PHYS304IA	NUCLEAR AND PARTICLE HYSICS THEORY	5+1 (TH+IA=5 TU=1) OR 4+2)TH+IA=4 PR=2)
		PHYS304TU	NUCLEAR AND PARTICLE HYSICS TUTORIALS	
		PHYS305TH PHYS305IA	QUANTUM MECHANICS THEORY	
		PHYS305PR	QUANTUM MECHANICS LAB	
		PHYS306TH PHYS306IA	PHYSICS OF DEVICES AND INSTRUMENTS THEORY	
		PHYS306PR	PHYSICS OF DEVICES AND INSTRUMENTS LAB	

	DISCIPLINE SPECIFIC ELECTIVES DSE:2B (CHOOSE ANY ONE FROM GIVEN THREE)	CHEM304TH CHEM304IA CHEM304PR	CHEMISTRY OF TRANSITION AND INNER TRANSITION ELEMENTS, COORDINATION CHEMISTRY, ORGANOMETTALICS, ACIDS AND BASES	6
		CHEM305TH CHEM305IA CHEM305PR	POLYMER CHEMISTRY	
		CHEM306TH CHEM306IA CHEM306PR	MOLECULES OF LIFE	
	DISCIPLINE SPECIFIC ELECTIVES DSE: 3B (CHOOSE ANY ONE FROM GIVEN THREE)	MATH304TH MATH304IA	NUMERICAL METHODS	4+2 (TH+IA=6)
		MATH305TH MATH305IA	COMPLEX ANALYSIS	
		MATH306TH MATH306IA	LINEAR PROGRAMMING	
	SKILL ENHANCEMENT COURSE SEC3 (CHOOSE ONE COURSE OUT OF THREE COURSES)	MATH313TH MATH313IA	PROBABILITY AND STATISTICS	4
		MATH314TH MATH314IA	MATHEMATICAL FINANCE	
		MATH315TH MATH315IA	MATHEMATICAL MODELING	
	SKILL ENHANCEMENT COURSE SEC4 (CHOOSE ONE COURSE OUT OF THREE COURSES)	MATH316TH MATH316IA	THEORY OF EQUATIONS	4
		MATH317TH MATH317IA	TRANSPORTATION AND GAME THEORY	
		MATH318TH MATH318IA	GRAPH THEORY	

TH= Theory,IA=Internal Assessment, PR= Practical, TU= Tutorial, SE= Skill Exam

HIMACHAL PRADESH UNIVERSITY
SYLLABUS AND SCHEME OF EXAMINATION
FOR B.A. WITH MATHEMATICS
w.e.f. session 2018-19

Year	Course Code	Course Type	Title of Paper	Credits (TH+T)*
I	MATH101TH	CORE COURSE	DIFFERENTIAL CALCULUS	5+1=6
	MATH102TH	CORE COURSE	DIFFERENTIAL EQUATIONS	5+1=6
		CORE COURSE	DSC-2A	6
		CORE COURSE	DSC-2B	6
		CORE COURSE	ENGLISH-1	6
		CORE COURSE	SKT./ HINDI-1	6
		A.E.C. COURSE	ENV. STUDIES	4
		A.E.C. COURSE	HINDI/ENG./SKT.	4
II	MATH201TH	CORE COURSE	REAL ANALYSIS	5+1=6
	MATH202TH	CORE COURSE	ALGEBRA	5+1=6
		CORE COURSE	DSC-2C	6
		CORE COURSE	DSC-2D	6
		CORE COURSE	ENGLISH-2	6
		CORE COURSE	SKT./ HINDI-2	6
		SKILL ENHANCEMENT COURSE	SEC 1: CHOOSE ONE OUT OF THE FOLLOWING	4
	MATH307TH	SEC 1	LOGIC AND SETS	4
	MATH308TH	SEC 1	ANALYTICAL GEOMETRY	
	MATH309TH	SEC 1	INTEGRAL CALCULUS	
		SKILL ENHANCEMENT COURSE	SEC 2: CHOOSE ONE OUT OF THE FOLLOWING	4
	MATH310TH	SEC 2	VECTOR CALCULUS	4
	MATH311TH	SEC 2	BOOLEAN ALGEBRA	
	MATH312TH	SEC 2	NUMBER THEORY	
III		DISCIPLINE SPECIFIC ELECTIVE	DSE 1A (MATH): CHOOSE ONE CHOOSE ONE OUT OF THE FOLLOWING	5+1=6
	MATH301TH	DSE 1A	MATRICES	
	MATH302TH	DSE 1A	MECHANICS	
	MATH303TH	DSE 1A	LINEAR ALGEBRA	
		DISCIPLINE SPECIFIC ELECTIVE	DSE 1B (MATH): CHOOSE ONE OUT OF THE FOLLOWING	5+1=6
	MATH304TH	DSE 1B	NUMERICAL METHODS	

	MATH305TH	**DSE 1B**	**COMPLEX ANALYSIS**	
	MATH306TH	**DSE 1B**	**LINEAR PROGRAMMING**	
		DISCIPLINE SPECIFIC ELECTIVE	**DSE2A**	**6**
		DISCIPLINE SPECIFIC ELECTIVE	**DSE2B**	**6**
		SKILL ENHANCEMENT COURSE	**SEC 3: CHOOSE ONE OUT OF THE FOLLOWING**	**4**
	MATH313TH	**SEC 3**	**PROBABILITY AND STATISTICS**	
	MATH314TH	**SEC 3**	**MATHEMATICAL FINANCE**	
	MATH315TH	**SEC 3**	**MATHEMATICAL MODELING**	
		SKILL ENHANCEMENT COURSE	**SEC 4: CHOOSE ONE OUT OF THE FOLLOWING**	**4**
	MATH316TH	**SEC 4**	**THEORY OF EQUATIONS**	
	MATH317TH	**SEC 4**	**TRANSPORTATION AND GAME THEORY**	
	MATH318TH	**SEC 4**	**GRAPH THEORY**	
		GENERIC ELECTIVE	**GE 1: CHOOSE ONE OUT OF THE FOLLOWING**	**5+1=6**
	MATH319TH	**GE 1**	**PORTFOLIO OPTIMIZATION**	
	MATH320TH	**GE 1**	**QUEUING AND RELIABILITY THEORY**	
		GENERIC ELECTIVE	**GE 2: CHOOSE ONE OUT OF THE FOLLOWING**	**5+1=6**
	MATH321TH	**GE 2**	**DESCRIPTIVE STATISTICS AND PROBABILITY THEORY**	
	MATH322TH	**GE 2**	**SAMPLE SURVEYS AND DESIGN OF EXPERIMENTS**	
			TOTAL CREDITS	**132**

*** In B.A. Mathematics, DSE1A and DSE1B are respectively same as DSE3A and DSE3B in B.Sc. Mathematics**

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH101TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Differential Calculus
Type of the Course	Core Course
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

Core 1.1: Differential Calculus

Unit-I (19 **hrs.**)

Limit and Continuity (epsilon and delta definition), Types of discontinuities, Differentiability of functions, Successive differentiation, Leibnitz's theorem.

Unit-II (19**hrs.**)

Indeterminate forms, Rolle's theorem, Lagrange's & Cauchy Mean Value theorems, Taylor's theorem with Lagrange's and Cauchy's forms of remainder, Taylor's series. Maclaurin's series of sin x, cos x, e^x, log(l+x), $(l+x)^m$.

Unit-III (19 **hrs.**)

Concavity, Convexity & Points of Inflexion, Curvature, Radius of curvature, center of curvature, Asymptotes, Singular points, Double point, Polar coordinates, Relation between Cartesian and polar coordinates.

Unit-IV (18 **hrs.**)

Functions of several variables (upto three variables): Limit and Continuity of these functions Partial differentiation, Euler's theorem on homogeneous functions, Maxima and Minima with Lagrange Multipliers Method (two variables), Jacobian (upto three variables).

Books Recommended:

1. H. Anton, I. Birens and S. Davis, *Calculus*, John Wiley and Sons, Inc., 2002.

2. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH102TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Differential Equations
Type of the Course	Core Course
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

Core 1.2: Differential Equations

Unit-I (19 **hrs.**)

Basic theory of linear differential equations, Wronskian, and its properties. First order exact differential equations. Integrating factors, rules to find an integrating factor. First order higher degree equations solvable for x, y, p. Clairut's form

Unit-II (19 **hrs.**)

Methods for solving higher-order differential equations. Solving a differential equation by reducing its order. Linear homogenous equations with constant coefficients, Linear non-homogenous equations.

Unit-III (19 **hrs.**)

The method of variation of parameters with constant coefficients. The Cauchy-Euler equation

and Legendre equation. Simultaneous differential equations, Total differential equations.

Unit-IV(18 **hrs.**)

Order and degree of partial differential equations, Concept of linear and non-linear partial differential equations.Formation of first order partial differential equations(PDE). Linear partial differential equation of first order, Lagrange's method. Classification of second order partial differential equations into elliptic, parabolic and hyperbolic through illustrations only.

Books Recommended

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.

2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH201TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Real Analysis
Type of the Course	Core Course
Number of teaching hours required for this course	75hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

Core 2.1: Real Analysis

Unit-I(19 **hrs.**)

Real line, bounded sets, suprema and infima, completeness property of R, Archimedean property of R, intervals. Concept of cluster points and statement of Bolzano-Weierstrass theorem.

Unit-II (19 **hrs.**)

Real Sequence, Bounded sequence, Cauchy convergence criterion for sequences. Cauchy's theorem on limits, order preservation and squeeze theorem, monotone sequences and their convergence (monotone convergence theorem without proof).

Unit-III(19 **hrs.**)

Infinite series. Cauchy convergence criterion for series, positive term series, geometric series, comparison test, convergence of p-series, Root test, Ratio test, alternating series, Leibnitz's test

(Tests of Convergence without proof). Definition and examples of absolute and conditional convergence.

Unit-IV (18 **hrs.**)

Sequences and series of functions, Pointwise and uniform convergence. M_n-test, M-test, Results about uniform convergence, Power series and radius of convergence.

Books Recommended

1. T. M. Apostol, *Calculus* (Vol. I), John Wiley and Sons (Asia) P. Ltd., 2002.
2. R.G. Bartle and D. R Sherbert, *Introduction to Real Analysis*, John Wiley and Sons (Asia) P. Ltd., 2000.
3. E. Fischer, *Intermediate Real Analysis*, Springer Verlag, 1983.
4. K.A. Ross, *Elementary Analysis- The Theory of Calculus Series*- Undergraduate Texts in Mathematics, Springer Verlag, 2003.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH202TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Algebra
Type of the Course	Core Course
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

Core 2.2: Algebra

Unit-I (19 **hrs.**)

Definition and examples of groups, examples of abelian and non-abelian groups, the group Z_n of integers under addition modulo n and the group U(n) of units under multiplication modulo n. Cyclic groups from number systems, complex roots of unity.

Unit-II (19 **hrs.**)

Subgroups, cyclic subgroups, the concept of a subgroup generated by a subset and the commutator subgroup of group, examples of subgroups including the center of a group. Cosets, Index of subgroup, Lagrange's theorem, order of an element.

Unit-III (19 **hrs.**)

Normal subgroups: their definition, examples, and characterizations, Quotient groups. Definition of Kernel, Basic theorems of homomorphism. First theorem of Homomorphism.

Unit-IV (18 **hrs.**)

Definition and examples of rings, examples of commutative and non-commutative rings: rings from number systems, Z_n the ring of integers modulo n. Rings of matrices, Subrings and ideals, Definition of Integral domains and fields.

Books Recommended

1. John B. Fraleigh, *A First Course in Abstract Algebra*, 7th Ed., Pearson, 2002**.**
2. M. Artin, *Abstract Algebra*, 2nd Ed., Pearson, 2011.

3. Joseph A Gallian, *Contemporary Abstract Algebra*, 4th Ed., Narosa, 1999.
4. George E Andrews, *Number Theory*, Hindustan Publishing Corporation, 1984

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH301TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Matrices
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3A.1: Matrices

Unit-I (19 **hrs.**)

Types of matrices. Rank of a matrix. Invariance of rank under elementary transformations. Reduction to normal form, Solutions of linear homogeneous and non-homogeneous equations with number of equations and unknowns upto three.

Unit-II(19 **hrs.**)

Matrices in diagonal form. Reduction to diagonal form upto matrices of order 3. Computation of matrix inverses using elementary row operations. Rank of matrix. Solutions of a system of linear equations using matrices. Illustrative examples of above concepts from Geometry, Physics, Chemistry, Combinatorics and Statistics.

Unit-III(19 **hrs.**)

Definition of Vector space, R, R2, R3 as vector spaces over R, Concept of Linear dependence/Independence, Standard basis for R, R2, R3, Examples of different bases. Subspaces of R2, R3.

Unit-IV (18 **hrs.**)

Translation, Dilation, Rotation, Reflection in a point, line and plane. Matrix form of basic geometric transformations. Interpretation of eigenvalues and eigen vectors for such transformations and eigen spaces as invariant subspaces.

Books Recommended

1. A.I. Kostrikin, *Introduction to Algebra*, Springer Verlag, 1984.
2. S. H. Friedberg, A. L. Insel and L. E. Spence, *Linear Algebra*, Prentice Hall of India Pvt. Ltd., New Delhi, 2004.
3. Richard Bronson, Theory and Problems of Matrix Operations, Tata McGraw Hill, 1989.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH302TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Mechanics
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3A.2: Mechanics

Unit-I (19 **hrs.**)

Conditions of equilibrium of a particle and of coplanar forces acting on a rigid Body.

Unit-II(19 **hrs.**)

Laws of friction, Problems of equilibrium under forces including friction, Centre of gravity.

Unit-III(19 **hrs.**)

Work and potential energy. Velocity and acceleration of a particle along a curve, Radial and transverse components (plane curve), tangential and normal components (space curve).

Unit-IV(18 **hrs.**)

Newton's Laws of motion, Simple harmonic motion, Simple Pendulum, Projectile Motion.

Books Recommended

1. A.S. Ramsay, *Statics*, CBS Publishers and Distributors (Indian Reprint), 1998.
2. A.P. Roberts, *Statics and Dynamics with Background in Mathematics*, Cambridge University Press, 2003.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH303TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Linear Algebra
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3A.3: Linear Algebra

Unit-I (19 **hrs.**)

Vector spaces, subspaces, algebra of subspaces, quotient spaces.

Unit-II (19**hrs.**)

Linear combination of vectors, linear span, linear independence, basis and dimension, dimension of subspaces.

Unit-III (19 **hrs.**)

Linear transformations, null space, range, rank and nullity of a linear transformation, matrix representation of a linear transformation, algebra of linear transformations.

Unit-IV (18 **hrs.**)

Dual Space, Dual Basis, Double Dual, Eigen values and Eigen vectors, Characteristic Polynomial.

Isomorphisms, Isomorphism theorems, invertibility and isomorphisms, change of coordinate matrix.

Books Recommended

1. Stephen H. Friedberg, Arnold J. Insel, Lawrence E. Spence, *Linear Algebra,* 4th Ed., Prentice-Hall of India Pvt. Ltd., New Delhi, 2004.
2. David C. Lay, *Linear Algebra and its Applications*, 3rd Ed., Pearson Education Asia, Indian Reprint, 2007.
3. S. Lang, *Introduction to Linear Algebra,* 2nd Ed., Springer, 2005.
4. Gilbert Strang, *Linear Algebra and its Applications*, Thomson, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH304TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Numerical Methods
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3B.1: Numerical Methods

Unit-I (19 **hrs.**)

Algorithms, Convergence, Bisection method, False position method, Fixed point iteration method, Newton's method, Secant method, LU decomposition.

Unit-II (19 **hrs.**)

Gauss-Jacobi, Gauss-Siedel and SOR iterative methods, Lagrange and Newton interpolation: linear and higher order.

Unit-III (19 **hrs.**)

Finite difference operators, Numerical differentiation: Newton's forward difference and backward difference method, Sterling's Central difference method.

Unit-IV (18 **hrs.**)

Integration: Trapezoidal rule, Simpson's rule, Euler's method.

Recommended Books

1. B. Bradie, *A Friendly Introduction to Numerical Analysis*, Pearson Education, India, 2007.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation*, 5th Ed., New age International Publisher, India, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH305TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Complex Analysis
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3B.2: Complex Analysis

Unit-I (19 **hrs.**)

Limits, Limits involving the point at infinity, continuity. Properties of complex numbers, regions in the complex plane, functions of complex variable, mappings. Derivatives, differentiation formulas, Cauchy-Riemann equations, sufficient conditions for differentiability.

Unit-II (19 **hrs.**)

Analytic functions, examples of analytic functions, exponential function, Logarithmic function, trigonometric function, derivatives of functions, definite integrals of functions.

Unit-III (19 **hrs.**)

Contours, Contour integrals and its examples, upper bounds for moduli of contour integrals. Cauchy- Goursat theorem, Cauchy integral formula.

Unit-IV (18 **hrs.**)

Liouville's theorem and the fundamental theorem of algebra. Convergence of sequences and series, Taylor series and its examples.

Books Recommended

1. James Ward Brown and Ruel V. Churchill, *Complex Variables and Applications*, 8th Ed., McGraw – Hill International Edition, 2009.

2. Joseph Bak and Donald J. Newman, *Complex analysis*, 2nd Ed., Undergraduate Texts in Mathematics, Springer-Verlag New York, Inc., New York, 1997.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH306TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Linear Programming
Type of the Course	Discipline Specific Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

DSE 3B.3: Linear Programming

Unit-I (19 **hrs.**)

Linear Programming Problems, Graphical Approach for Solving some Linear Programs. Convex Sets, Supporting and Separating Hyperplanes.

Unit-II (19 **hrs.**)

Theory of simplex method, optimality and unboundedness, the simplex algorithm, simplex method in tableau format.

Unit-III (19 **hrs.**)

Introduction to artificial variables, two-phase method, Big-M method and their comparison.

Unit-IV (18 **hrs.**)

Duality, formulation of the dual problem, primal- dual relationships, economic interpretation of

the dual, sensitivity analysis.

Recommended Books

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F.S. Hillier and G.J. Lieberman, *Introduction to Operations Research*, 8th Ed., Tata McGraw Hill, Singapore, 2004.
Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Third Semester

Course Code	MATH307TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Logic and Sets
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.1: Logic and Sets
(In B.Sc/B.A. Mathematics this course is Sec 1.1)

Unit-I (15 **hrs.**)

Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.

Unit-II (15**hrs.**)

Propositional equivalence: Logical equivalences. Predicates and quantifiers: Introduction,

Quantifiers, Binding variables and Negations.

Unit-III(15 **hrs.**)

Sets, subsets, Set operations, the laws of set theory and Venn diagrams. Examples of finite and infinite sets. Finite sets and counting principle. Empty set, properties of empty set. Standard set operations. Classes of sets. Power set of a set.

Unit-IV (15 **hrs.**)

Difference and Symmetric difference of two sets. Set identities, Generalized union and intersections. Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation.

Book Recommended

1. R.P. Grimaldi, *Discrete Mathematics and Combinatorial Mathematics*, Pearson Education, 1998.
2. P.R. Halmos, *Naive Set Theory*, Springer, 1974.
3. E. Kamke, *Theory of Sets*, Dover Publishers, 1950.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH308TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Analytical Geometry
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.2: Analytical Geometry
(In B.Sc/B.A. Mathematics this course is Sec 1.2)

Unit-I (15 **hrs.**)

Techniques for sketching parabola, ellipse and hyperbola, Reflection properties of parabola, ellipse and hyperbola.

Unit-II (15**hrs.**)

Classification of quadratic equations representing lines, parabola, ellipse and hyperbola,

Unit-III (15 **hrs.**)

Sphere. Plane section of a sphere. Sphere through a given circle. Intersection of two spheres.

Radical plane. Radical line and Radical point in spheres. Co-axial system of spheres.

Unit-IV (15 **hrs.**)

Cylindrical surfaces, Illustrations of graphing standard quadric surfaces like cone, ellipsoid.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) Pvt. Ltd., 2002.

3. S.L. Loney, *The Elements of Coordinate Geometry*, McMillan and Company, London.

4. R.J.T. Bill, *Elementary Treatise on Coordinate Geometry of Three Dimensions*, McMillan India Ltd., 1994.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH309TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Integral Calculus
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.3: Integral Calculus
(In B.Sc/B.A. Mathematics this course is Sec 1.3)

Unit-I (15 **hrs.**)

Integration by Partial fractions, integration of rational and irrational functions. Properties of definite integrals.

Unit-II (15 **hrs.**)

Reduction Formulae, $\int Sin^n x\,dx$, $\int Cos^n x\,dx$, $\int e^{ax}\,x^n dx$, $\int x^n (logx)^m dx$, $\int x^n Sinx dx$, $\int x^n cosx dx$, $\int Sin^n x\,Cox^n x dx$, , $\int_0^{\pi/2} Sin^n x\mathrm{dx}$, $\int_0^{\pi/2} Cos^n x\mathrm{dx}$, $\int_0^{\pi/2} Sin^n x Cox^n x\mathrm{dx}$. Reduction by connecting two integrals (Smaller Index + 1 Method).

Unit-III (15 **hrs.**)

Areas and lengths of curves in the plane, volumes and surfaces of solids of revolution, Cartesian

and parametric form.

Unit-IV (15 **hrs.**)

Double and Triple integrals.

Books Recommended:

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., 2002.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH310TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Vector Calculus
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.4: Vector Calculus
(In B.Sc/B.A. Mathematics this course is Sec 2.1)

Unit -I(15 hrs.)

Scalar and vector product of three vectors. Product of four vectors. Reciprocal vectors. Vector differentiation, Scalar valued point functions, vector valued point functions. Derivative along a curve, directional derivatives.

Unit –II(15 hrs.)

Gradient of a scalar point function. Divergence and curl of a vector point function. Gradient,

Divergence and curl of sums and products. Laplacian operator.

Unit -III(15 hrs.)

Orthogonal curvilinear coordinates. Conditions for orthogonality. Fundamental triads of mutually orthogonal unit vectors. Gradient, Divergence, Curl and Laplacian operators in terms of orthogonal curvilinear coordinators.

Unit - IV(15 hrs.)

Vector integration: line integral, surface integral, Volume integral
Theorems of Gauss, Green and Stokes (without proof) and the problems based on these theorems.

Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.

2. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd. 2002.
3. P.C. Matthew's, *Vector Calculus*, Springer Verlag London Limited, 1998.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH311TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Boolean Algebra
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC3.5:Boolean Algebra
(In B.Sc/B.A. Mathematics this course is Sec 2.2)

Unit-I (15 **hrs.**)

Definition, examples and basic properties of ordered sets, maps between ordered sets, duality principle, maximal and minimal elements.

Unit-II (15 **hrs.**)

Lattices as ordered sets, complete lattices, lattices as algebraic structures, sub lattices, products and homomorphisms.

Unit-III (15 **hrs.**)

Definition, examples and properties of modular and distributive lattices, Boolean algebras, Boolean polynomials, minimal forms of Boolean polynomials.

Unit-IV (15 **hrs.**)

Quinn-McCluskey method, Karnaugh diagrams, switching circuits and applications of switching circuits

Books Recommended:

1. BA.Davey and H.A.Priestley,*IntroductiontoLatticesandOrder*,CambridgeUniversityPress, Cambridge,1990.
2. Rudolf Lidl and Günter Pilz,*AppliedAbstractAlgebra*,2ndEd.,UndergraduateTextsinMathematics, Springer(SIE), Indianreprint,2004.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH312TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Number Theory
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.6: Number Theory
(In B.Sc/B.A. Mathematics this course is Sec 2.3)

Unit-I (15 **hrs.**)

Division algorithm, Lame's theorem, linear Diophantine equation, fundamental theorem of arithmetic, prime counting function, statement of prime number theorem, Goldbach conjecture.

Unit-II (15 **hrs.**)

Binary and decimal representation of integers, linear congruences, complete set of residues.

Unit-III (15 **hrs.**)

Number theoretic functions, sum and number of divisors, totally multiplicative functions.

Unit-IV (15 **hrs.**)

Definition and properties of the Dirichlet product, the Möbius inversion formula, the greatest integer function, Euler's phi-function.

Books Recommended:

1. David M. Burton, *Elementary Number Theory* 6th Ed., Tata McGraw-Hill Edition, Indian reprint, 2007.
2. Richard E. Klima, Neil Sigmon, Ernest Stitzinger, *Applications of Abstract Algebra with Maple*, CRC Press, Boca Raton, 2000.
3. Neville Robinns, *Beginning Number Theory*, 2nd Ed., Narosa Publishing House Pvt. Limited, Delhi, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH313TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Probability and Statistics
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(2), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.7: Probability and Statistics
(In B.Sc/B.A. Mathematics this course is Sec 3.1)

Unit-I (15 **hrs.**)

Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions.

Unit-II (15 **hrs.**)

Mathematical expectation, moments, moment generating function, characteristic function, discrete distributions: uniform.

Unit-III (15 **hrs.**)

Binomial, Poisson, continuous distributions: uniform, normal, exponential.

Unit-IV (15 **hrs.**)

Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions, expectation of function of two random variables, conditional expectations, independent random variables.

Books Recommended:

1. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Pearson Education, Asia, 2007.
2. Irwin Miller and Marylees Miller, John E. Freund, *Mathematical Statistics with Application*, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Model*, 9th Ed., Academic Press, Indian Reprint, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH314TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Mathematical Finance
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(2), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.8: Mathematical Finance
(In B.Sc/B.A. Mathematics this course is Sec 3.2)

Unit-I (15 **hrs.**)

Basic principles: Comparison, arbitrage and risk aversion, Interest (simple and compound, discrete and continuous), time value of money.

Unit-II (15 **hrs.**)

Inflation, net present value, internal rate of return (calculation by bisection and Newton-Raphson methods), comparison of NPV and IRR.

Unit-III (15 **hrs.**)

Bonds, bond prices and yields. Floating-rate bonds, immunization.
Asset return, short selling, portfolio return, (brief introduction to expectation, variance, covariance and correlation).

Unit-IV (15 **hrs.**)

Random returns, portfolio mean return and variance, diversification, portfolio diagram, feasible set, Markowitz model (review of Lagrange multipliers for 1 and 2 constraints).

Books Recommended:

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

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH315TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Mathematical Modeling
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.9: Mathematical Modeling
(In B.Sc/B.A. Mathematics this course is Sec 3.3)

Unit-I (15 **hrs.**)

Applications of differential equations: the vibrations of a mass on a spring, mixture problem, free damped motion, forced motion.

Unit-II (15 **hrs.**)

Resonance phenomena, electric circuit problem, mechanics of simultaneous differential equations.

Unit-III (15 **hrs.**)

Applications to Traffic Flow. Vibrating string, vibrating membrane.

Unit-IV (15 **hrs.**)

Conduction of heat in solids, gravitational potential, conservation laws.

Books Recommended:

1. Shepley L. Ross, *Differential Equations*, 3rd Ed., John Wiley and Sons, 1984.
2. I. Sneddon, *Elements of Partial Differential Equations*, McGraw-Hill, International Edition, 1967.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH316TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Theory of Equations
Type of the Course	Skill Enhancement Course
Number of teaching hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.10: Theory of Equations
(In B.Sc/B.A. Mathematics this course is Sec 4.1)

Unit-I (15 **hrs.)**

General properties of polynomials, Graphical representation of a polynomials, maximum and minimum values of a polynomials, General properties of equations,

Unit-II (15 **hrs.**)

Descarte's rule of signs for positive and negative roots, Relation between the roots and the coefficients of equations.

Unit-III (15 **hrs.**)

Symmetric functions, Applications symmetric function of the roots, Transformation of equations. Solutions of reciprocal and binomial equations.

Unit-IV (15 **hrs.**)

Algebraic solutions of the cubic (Carden's method) and biquadratic (Descarte's & Ferrari's method). Properties of the derived functions.

Books Recommended

1. W.S. Burnside and A.W. Panton, *The Theory of Equations*, Dublin University Press, 1954.
2 C. C. MacDuffee, *Theory of Equations*, John Wiley & Sons Inc., 1954.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH317TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Transportation and Game Theory
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC 3.11: Transportation and Game Theory
(In B.Sc/B.A. Mathematics this course is Sec 4.2)

Unit-I (15 **hrs.**)

Transportation problem and its mathematical formulation. northwest-corner method, least cost method.

Unit-II (15 **hrs.**)

Vogel approximation method for determination of starting basic solution, algorithm for solving transportation problem.

Unit-III (15 **hrs.**)

Assignment problem and its mathematical formulation, Hungarian method for solving assignment problem.

Unit-IV (15 **hrs.**)

Game theory: formulation of two person zero sum games, solving two person zero sum games, games with mixed strategies, graphical solution procedure.

Books Recommended:

1. Mokhtar S. Bazaraa, John J. Jarvis and Hanif D. Sherali, *Linear Programming and Network Flows*, 2nd Ed., John Wiley and Sons, India, 2004.
2. F. S. Hillier and G. J. Lieberman, *Introduction to Operations Research,* 9th Ed., Tata McGraw Hill, Singapore, 2009.
3. Hamdy A. Taha, *Operations Research, An Introduction*, 8th Ed., Prentice-Hall India, 2006.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH318TH
Credits= 4	L-4,T-0,P-0
Name of the Course	Graph Theory
Type of the Course	Skill Enhancement Course
Number of hours required for this course	60 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	Nil
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Lectures to be Delivered (One Hour Each)	60

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

SEC3.12: Graph Theory
(In B.Sc/B.A. Mathematics this course is Sec 4.3)

Unit-I (15 **hrs.**)

Definition, examples and basic properties of graphs, pseudographs, complete graphs, bi-partite graphs.

Unit-II (15 **hrs.**)

Isomorphism of graphs, paths and circuits, Eulerian circuits.

Unit-III (15 **hrs.**)

Hamiltonian cycles, the adjacency matrix, weighted graph, travelling salesman's problem.

Unit-IV (15 **hrs.**)

Shortest path, Dijkstra's algorithm, Floyd-Warshall algorithm.

Books Recommended:

1. Edgar G. Goodaire and Michael M. Parmenter, *Discrete Mathematics with Graph Theory* 2nd Ed., Pearson Education (Singapore) P. Ltd., Indian Reprint, 2003.
2. Rudolf Lidl and Günter Pilz, *Applied Abstract Algebra*, 2nd Ed., Undergraduate Texts in Mathematics, Springer (SIE), Indian reprint, 2004.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH319TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Portfolio Optimization
Type of the Course	Generic Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15hours
Yearly Based Examination	Max Marks: 70 Maximum Times: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

GE1.1: Portfolio Optimization

Unit-I (19 **hrs.**)

Financial markets. Investment objectives. Measures of return and risk. Types of risks.

Unit-II (19 **hrs.**)

Portfolio of assets. Expected risk and return of portfolio. Diversification.

Unit-III (19 **hrs.**)

Mean-variance portfolio optimization- the Markowitz model and the two-fund theorem,

Unit-IV (18 **hrs.**)

Risk-free assets and one fund theorem, efficient frontier. Portfolio performance evaluation measures.

Books Recommended

1. F.K. Reilly, Keith C. Brown, *Investment Analysis and Portfolio Management*, 10th Ed., South-Western Publishers, 2011.
2. H.M. Markowitz, *Mean-Variance Analysis in Portfolio Choice and Capital Markets*, Blackwell, New York, 1987.
3. D.G. Luenberger, *Investment Science*, 2nd Ed., Oxford University Press, 2013.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH320TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Queuing and Reliability Theory
Type of the Course	Generic Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

GE 1.2: Queuing and Reliability Theory

Unit-I (19 **hrs.**)

General concepts of queueing system, Measures of performance, Arrival and Service Processes, Single server and multi server models, channels in parallel with limited and unlimited queues- M/M/1/K, M/M/C.

Unit-II (19 **hrs.**)

Queues with unlimited service. Finite source queues. Application of simple queueing decision model's, Design and control models.

Unit-III (19 **hrs.**)

Basics of reliability. Classes of life distributions. Series, parallel, configurations. Reliability models,

Unit-IV (18 **hrs.**)

Reliability, Mean Time before failure and Hazard rate of Exponential and Weibull distributions. Concepts and definitions of preventive maintenance, corrective maintenance and age replacement.

Books Recommended

1. R.B. Cooper, *Introduction to Queueing Theory*, 2nd Ed., North Holland, 1981.

2. D. Gross, C. M. Harris, *Fundamentals of Queueing Theory*, 3rd Ed., John Wiley and Sons Inc. P. Ltd., 2002.

3. U.N. Bhat, *An Introduction to Queueing Theory: Modelling and Analysis in Applications* (*Statistics for Industry and Technology*), Birkhauser Boston, 2008.

4. U.N. Prabhu, *Foundations of Queueing Theory*, International Series in Operations Research & Management Science, Kluwer Academic Publishers, 2nd Ed., 2002.

5. John G. Rau, *Optimization and Probability in Systems Engineering*, V.N. Reinhold Co., 1970.

6. Riccardo Manzini, Alberto Regattieri, Hoang Pham, Emilio Ferrai, *Maintenance for Industrial Systems*, Springer-Verlag, London Limited, 2010.

7. P.K. Kapur, R.B. Garg, S. Kumar, *Contributions to Hardware and Software Reliability*, World Scientific, Singapore, 1999.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH321TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Descriptive Statistics and Probability Theory
Type of the Course	Generic Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

GE 2.1: Descriptive Statistics and Probability Theory

Unit-I (19**hrs.**)

Concepts of a statistical population and sample from a population, quantitative and qualitative data, nominal, ordinal and time-series data, discrete and continuous data. Presentation of data by tables and by diagrams, frequency distributions for discrete and continuous data, graphical representation of a frequency distribution by histogram and frequency polygon, cumulative frequency distributions (inclusive and exclusive methods).

Unit-II (19 **hrs.**)

Measures of location (or central tendency) and dispersion, moments, measures of skewness and kurtosis, cumulants. Bivariate data: Scatter diagram, principle of least-square and fitting of

polynomials and exponential curves.

Unit-III(19 **hrs.**)

Correlation and regression. Karl Pearson coefficient of correlation, Lines of regression, Spearman's rank correlation coefficient, multiple and partial correlations (for 3 variates only).

Unit-IV(18 **hrs.**)

Random experiment, sample point and sample space, event, algebra of events, Definition of Probability - classical, relative frequency and axiomatic approaches to probability, merits and demerits of these approaches (only general ideas to be given). Theorem on probability, conditional probability, independent events. Baye's theorem and its applications.

Books Recommended

1. J.E. Freund, *Mathematical Statistics with Applications*, 7th Ed., Pearson Education, 2009.

2. A.M. Goon, M.K. Gupta and B. Dasgupta, *Fundamentals of Statistics*, Vol. I, 8th Ed., World Press, Kolkatta, 2005.

3. S.C. Gupta and V.K. Kapoor, *Fundamentals of Mathematical Statistics*, 11th Ed., Sultan Chand and Sons, 2007.

4. R.V. Hogg, A.T. Craig and J.W. Mckean, *Introduction to Mathematical Statistics*, 6th Ed., Pearson Education, 2005.

5. A.M. Mood, F.A. Graybill and D.C. Boes, *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw Hill Publication, 2007.

HIMACHAL PRADESH UNIVERSITY

B.Sc (Physics, Chemistry/Computer Science, Mathematics),

B.Sc./ B.A. with Mathematics

Syllabus and Examination Scheme

Course Code	MATH322TH
Credits= 6	L-5,T-1,P-0
Name of the Course	Sample Surveys and Design of Experiments
Type of the Course	Generic Elective
Number of teaching hours required for this course	75 hrs.
Continuous Comprehensive Assessment: Based on Minor Test(1), Class tests, Assignments, Quiz, Seminar and Attendance (Marks Attendance: 5 marks to be given as per the regulations)	Max. Marks:30
Tutorials : Solving Problems and exercises	15 hours
Yearly Based Examination	Max Marks: 70 Maximum Time: 3 hrs.
Total Lectures to be Delivered (One Hour Each)	75

Instructions

Instructions for paper setter: The question paper will consist of **two Sections A & B** of 70 marks. **Section A** will be **Compulsory** and will contain 8 questions of 16 marks (each of 2 marks) of short answer type having two questions from each Unit of the syllabus. **Section B** of the question paper shall have four Units I, II, III, and IV. Two questions will be set from each unit of the syllabus and the candidates are required to attempt one question from each of these units. Each question in Units I, II, III and IV shall be of 13.5 marks each.

Instructions for Candidates: Candidates are required to attempt five questions in all. Section A is Compulsory and from Section B they are required to attempt one question from each of the Units I, II, III and IV of the question paper.

GE 2.2: Sample Surveys and Design of Experiments

Unit-I (19 **hrs.**)

Sample Surveys: Concepts of population and sample. Complete enumeration vs. sampling. Need for sampling. Principal and organizational aspects in the conduct of a sample survey. Properties of a good estimator, Sampling and non-sampling errors.

SRSWR & SRSWOR, determination of sample size. Stratified random sampling and different allocations. Systematic sampling, comparison of known sampling strategies under linear trend.

Ratio and Regression estimators and their comparison with SRSWOR estimator.Unit-II (19 **hrs.**)

Indian Official Statistics: Present Official Statistical System in India relating to census of population, agriculture, industrial production, and prices; methods of collection of official statistics, their reliability and limitation and the principal publications containing such statistics. Also the various agencies responsible for the data collection- C.S.O., N.S.S.O., Office of Registrar General, their historical development, main functions and important publications.
Analysis of variance and covariance: Analysis of variance and covariance (with one concomitant variable) in one-way and two-way classified data with equal number of observations per cell.

Unit-III (19 **hrs.**)

Design of experiments: Principles of experimentation, uniformity trails, completely randomized, Randomized block and Latin square designs. Missing plot technique, 2^2 and 2^3 Factorial experiments: construction and analysis.

Unit-IV (18 **hrs.**)

Regression Analysis: Two variable linear model – estimation, testing and problems of predication. Predication of the estimated regression equation, interval estimation, variance estimation.

Books Recommended

1. W.G. Cochran, *Sampling Techniques*, John Wiley and Sons, New York, 1997.
2. A.M. Goon, M.K. Gupta, and B. Dasgupta, *Fundamentals of Statistics* (Vol. II), 8th Ed., World Press, Kolkata, 2005.
3. A.M. Goon, M.K. Gupta and B. Dasgupta, *An Outline of Statistical Theory* (Vol. II), 3rd Ed., World Press, Kolkata, 2005.
4. S.C. Gupta and V.K. Kapoor, *Fundamentals of Applied Statistics*, 4th Ed., Sultan Chand and Sons, 2008.
5. A.M. Kshirsagar, *A Course in Linear Models*, Marcel Dekker, Inc., N.Y., 1983.
6. D.C. Montgomery, *Designs and Analysis of Experiments*, John Wiley and Sons, New York, 2001.
7. D.C. Montgomery, E.A. Peak and G.G. Vinning, *Introduction to Linear Regression Analysis*, 3rd Ed., John Wiley and Sons, 2006.
8. P. Mukhopadhyay, *Theory and Methods of Surveys Sampling*, Prentice Hall of India, 1998.
9. D. Singh and F.S. Chaudhary, *Theory and Analysis of Sample Survey Designs*, New Age International (P) Ltd., 1995.
10. P.V. Sukhatme, B.V. Sukhatme, S. Sukhatme and C. Ashok, *Sampling Theory of Surveys with Applications*, Lowa State University Press, Lowa, USA, 1984.

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