

**BACHELOR OF SCIENCE (PCM)**  
Duration: 36 Months (3 Years) Eligibility: 12th Pass

**COURSE STRUCTURE OF B.SC MATHEMATICS (HONOURS) 1st SEMESTER**

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3HBHL101H	Ability Enhancement	हिन्दी भाषा और संरचना	50	25	08	10	04	15	06	2	-	-	2
3CBCA201H	Ability Enhancement	Basic Information Computer Technology - I	50	25	08	-	-	-	-	1	-	1	2
3SBMA105H	Core Course -1	Algebra, Trigonometry & Geometry	150	75	25	30	12	45	18	5	1	-	6
3SBMA106H	Core Course -2	Logic & Sets	150	75	25	30	12	45	18	5	1	-	6
	Generic Elective -1	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				<b>Term End Practical Exam</b>				<b>Sessional</b>					
	Practical	(Select From Below Given Specialised Subject)*	50	25	8	25	8	-	-	-	-	2	2
3CBCA201H	Practical	Basic of Computer & Information technology-I	-	-	-	10	04	15	06	-	-	-	-
<b>Grand Total</b>			<b>550</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>17</b>	<b>02</b>	<b>03</b>	<b>22</b>

Minimum Passing Marks are equivalent to Grade C

L- Lectures T- Tutorials P- Practical

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

\* Generic Elective Specialization: Opted Specialization by student in 1<sup>st</sup> Semester will remain same in II<sup>nd</sup>, III<sup>rd</sup> and IV<sup>th</sup> Semester (See the specialisation subject as mentioned below)\*

Generic Elective- 1		
Specialisation	Course Code	Subject
Physics	3SBPH103H	Mechanics, Oscillations and Properties of Matter
Chemistry	3SBCH104H	Chemistry -I

# BACHELOR OF SCIENCE

Duration: 36 Months (3 Years) Eligibility: 12th Pass

## COURSE STRUCTURE OF B.SC MATHEMATICS (HONOURS) IInd SEMESTER

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3HBEL201H	Ability Enhancement	English Language and Indian Culture	50	25	08	10	04	15	06	2	-	-	2
3MBFE101H	Ability Enhancement	Fundamental of Entrepreneurship	50	25	08	10	04	15	06	2	-	-	2
3SBMA205H	<b>Core Course-3</b>	Calculus, Differential Equations & Vector Calculus	150	75	25	30	12	45	18	5	1	-	6
3SBMA206H	<b>Core Course-4</b>	Theory of real functions	150	75	25	30	12	45	18	5	1	-	6
	<b>Generic Elective-2</b>	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				<b>Term End Practical Exam</b>				<b>Sessional</b>					
	<b>Practical</b>	(Select From Below Given Specialised Subject)*	50	25	08	25	08	-	-	-	-	2	2
<b>Skill Courses</b>								<b>Sessional</b>					
***	<b>Skill Enhancement</b>	Skill Enhancement Elective Course-I	50	-	-	-	-	50	20	1	-	1	2
<b>Grand Total</b>			<b>600</b>	-	-	-	-	-	-	<b>19</b>	<b>02</b>	<b>03</b>	<b>24</b>

Minimum Passing Marks are equivalent to Grade C

L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Skill Elective I – Any other course being offered in this semester as per the list given at the end of course structure.

\* Generic Elective Specialization: Opted Specialization by student in 1<sup>st</sup> Semester will remain same in IInd, IIIrd and IVth Semester (See the specialisation subject as mentioned below)\*

Generic Elective- 2		
Specialisation	Course Code	Subject
Physics	3SBPH203H	Mathematical Background, Electrostatics, and Steady
Chemistry	3SBCH204H	Chemistry –II

# BACHELOR OF SCIENCE

Duration: 36 Months (3 Years) Eligibility: 12th Pass

## COURSE STRUCTURE OF B.SC MATHEMATICS (HONOURS) IIIrd SEMESTER

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3HBHL302H	Ability Enhancement	हिन्दी भाषा संरचना एवं संचार साधन	50	25	08	10	04	15	06	2	-	-	2
3CBCA502H	Ability Enhancement	Basic Information Computer Technology - II	50	25	08	-	-	-	-	1	-	1	2
3SBMA305H	<b>Core Course-5</b>	Calculus, Differential Equation and Mechanics	150	75	25	30	12	45	18	5	1	-	6
3SBMA306H	<b>Core Course-6</b>	Multivariate Calculus	150	75	25	30	12	45	18	5	1	-	6
	<b>Generic Elective-3</b>	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				<b>Term End Practical Exam</b>				<b>Sessional</b>					
	<b>Practical</b>	(Select From Below Given Specialised Subject)*	50	25	8	25	8	-	-	-	-	2	2
3CBCA502H	<b>Practical</b>	Basic of Computer & Information technology-II	-	-	-	10	04	15	06	-	-	-	-
<b>Skill Courses</b>								<b>Sessional</b>					
***	<b>Skill Enhancement</b>	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2
<b>Grand Total</b>			<b>600</b>	-	-	-	-	-	-	<b>18</b>	<b>02</b>	<b>04</b>	<b>24</b>

Minimum Passing Marks are equivalent to Grade C

L- Lectures T- Tutorials P- Practicals

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Skill Elective II – Any other course being offered in this semester as per the list given at the end of course structure.

\* Generic Elective Specialization: Opted Specialization by student in 1<sup>st</sup> Semester will remain same in II<sup>nd</sup>, III<sup>rd</sup> and IV<sup>th</sup> Semester (See the specialisation subject as mentioned below)\*

<b>Generic Elective- 3</b>		
Specialisation	Course Code	Subject
Physics	3SBPH303H	Kinetic Theory of Gases, Thermo-dynamics and Statistical Mechanics.
Chemistry	3SBCH304H	Chemistry –III

# BACHELOR OF SCIENCE (PCM)

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## COURSE STRUCTURE OF B.SC MATHEMATICS (HONOURS) IVth SEMESTER

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3HBEL402H	Ability Enhancement	English language and scientific temper	50	25	08	10	04	15	06	2	-	-	2
3HBHP401H	Ability Enhancement	Human Values & Ethics	50	25	08	10	04	15	06	2	-	-	2
3SBMA405H	<b>Core Course -7</b>	Advanced Calculus, Partial Differential Equations, Complex Analysis and Abstract Algebra	150	75	25	30	12	45	18	5	1	-	6
3SBMA406H	<b>Core Course -8</b>	Probability & Statistics	150	75	25	30	12	45	18	5	1	-	6
	<b>Generic Elective -4</b>	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				<b>Term End Practical Exam</b>				<b>Sessional</b>					
	<b>Practical</b>	(Select From Below Given Specialised Subject)*	50	25	8	25	8	-	-	-	-	2	2
<b>Grand Total</b>			<b>550</b>	-	-	-	-	-	-	<b>18</b>	<b>02</b>	<b>02</b>	<b>22</b>

Minimum Passing Marks are equivalent to Grade C

Major- Term End Theory Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

\* Generic Elective Specialization: Opted Specialization by student in 1<sup>st</sup> Semester will remain same in II<sup>nd</sup>, III<sup>rd</sup> and IV<sup>th</sup> Semester (See the specialisation subject as mentioned below)\*

L- Lectures T- Tutorials P- Practical

<b>Generic Elective- 4</b>		
Specialisation	Course Code	Subject
Physics	3SBPH403H	Group Waves, Acoustics and Optics
Chemistry	3SBCH404H	Chemistry -IV

**BACHELOR OF SCIENCE (HONOURS)**

**Duration: 36 Months (3 Years) Eligibility: 12th Pass from Science with Minimum 60%**

**COURSE STRUCTURE OF Physics (HONOURS ) SEMESTER Vth**

Course Details				External Assessment		Internal Assessment				Credit Distribution			Allocated Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3SBPH501 H	Core Course - 9	Physics-V (Quantum Mechanics, Atomic, Molecular and Nuclear Physics)	100	50	17	20	08	30	12	4	-	-	4
3SBPH502 H	Core Course - 10	Physics-V (Astro Physics & Atmospheric Science)	100	50	17	20	08	30	12	4	-	-	4
3SBPH503 H	Core Course -11	Analog Systems And Applications	100	50	17	20	08	30	12	4	-	-	4
**	Discipline Specific Elective -I	Elective table-I	100	50	17	20	08	30	12	4	-	-	4
***	Discipline Specific Elective - II	Elective table-II	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				<b>Term End Practical Exam</b>		<b>Lab Performance</b>		<b>Sessional</b>					
3SBPH501 H	Practical	Physics-V (Quantum Mechanics, Atomic, Molecular and Nuclear Physics)	50	25	08	25	08	-	-	-	-	2	2
3SBPH502 H	Practical	Physics-V (Astro Physics & Atmospheric Science)	50	25	08	25	08	-	-	-	-	2	2

3SBPH503 H	<b>Practical</b>	Analog Systems and applications	50	25	08	25	08	-	-	-	-	2	2		
**	<b>Practical</b>	Elective table-I	50	25	08	25	08	-	-	-	-	2	2		
***	<b>Practical</b>	Elective table-II	50	25	08	25	08	-	-	-	-	2	2		
								<b>Sessional</b>							
*****	<b>Skill Enhancement</b>	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2		
<b>Grand Total</b>			<b>800</b>									<b>21</b>	<b>-</b>	<b>11</b>	<b>32</b>

Minimum Passing Marks are equivalent to Grade C L- Lectures T- Tutorials P- Practical

Major- Term End Theory / Practical Exam

Minor- Pre University Test

Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%

Skill Elective III – Any other course being offered in this semester as per the list given at the end of course structure

## BACHELOR OF SCIENCE (HONOURS)

Duration: 36 Months (3 Years) Eligibility: 12th Pass from Science with Minimum 60%

<b>COURSE STRUCTURE OF Physics (HONOURS) SEMESTER VIth</b>													
Course Details				External Assessment		Internal Assessment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional ***		L	T	P	Subject wise Distribution
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
<b>Theory Group</b>													
3SBPH601H	Core Course - 12	<b>Physics-VI (Solid State Physics, Electronics and Laser)</b>	100	50	17	20	08	30	12	4	-	-	4
3SBPH602H	Core Course - 13	<b>Physics-VI (Nano Technology and Material Science)</b>	100	50	17	20	08	30	12	4	-	-	4
3SBPH603H	Core Course - 14	<b>Nuclear and Particle Physics</b>	100	50	17	20	08	30	12	4	-	-	4
**	Discipline Specific Elective	Elective table-III	100	50	17	20	08	30	12	4	-	-	4
***	Discipline Specific Elective//Project/Dissertation	Elective table-IV / Group B DISSERTATION	100	50	17	20	08	30	12	4	-	-	4
<b>Practical Group</b>				Term End Practical Exam		Lab Performance		Sessional					
3SBPH601H	Practical	<b>Physics-VI (Solid State Physics, Electronics and Laser)</b>	50	25	08	25	08	-	-	-	-	2	2
3SBPH602H	Practical	<b>Physics-VI (Nano Technology and Material Science)</b>	50	25	08	25	08	-	-	-	-	2	2

3SBPH603H	Practical	<b>Nuclear and Particle Physics</b>	50	25	08	25	08	-	-	-	-	2	2
**	Practical	Elective table-III	50	25	08	25	08	-	-	-	-	2	2
***	Practical/ Project/Dissertation	Elective table-IV / Group B DISSERTATION	50	25	08	25	08	-	-	-	-	2	2
<b>Grand Total</b>			<b>750</b>							<b>20</b>	<b>-</b>	<b>10</b>	<b>30</b>

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**Minimum Passing Marks are equivalent to Grade C L- Lectures T- Tutorials P- Practical**

**Major- Term End Theory / Practical Exam**

**Minor- Pre University Test**

**Sessional weightage – Attendance 50%, Three Class Tests/Assignments 50%**

**Compulsory Project/Dessertation with choice in any Disciplinary specific elective. Compulsory one paper presentation certificate in related dicipline.**



## DISCIPLINE SPECIFIC ELECTIVE

**\*Note** - Students need to select any two from below mentioned four papers from Each Group Elective's for Fifth and Sixth semester of **B.Sc. Physics (Honours)**.

ELECTIVES FOR SEMESTER 5 <sup>TH</sup>			ELECTIVES FOR SEMESTER 6 <sup>TH</sup>		
Course Code	Course Type	List of Electives	Course Code	Course Type	List of Electives
GROUP ELECTIVE -I			GROUP ELECTIVE -III		
3SBPH504H	Discipline Specific Elective-I	EXPERIMENTAL TECHNIQUES	3SBPH604H	Discipline Specific Elective-I	Biological Physics
3SBPH505H	Discipline Specific Elective-II	Astronomy and Astrophysics	3SBPH605H	Discipline Specific Elective-II	Physics of Earth
GROUP ELECTIVE -II			GROUP ELECTIVE -IV		
3SBPH506H	Discipline Specific Elective-III	Atmospheric Physics	3SBPH606H	Discipline Specific Elective-III	Medical Physics
3SBPH507H	Discipline Specific Elective-IV	RENEWABLE ENERGY AND ENERGY HARVESTING	3SBPH607H	Discipline Specific Elective-IV	TECHNICAL DRAWING

**COURSE CODE: 3SBCH608H**

**Dissertation/Project**

**Guidelines**

### SKILL ENHANCEMENT ELECTIVE COURSES

<b>Non-Technical</b>			
Elective No.	Department/ Faculty Name		
	<b>Faculty of Information Technology</b>		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	<b>Faculty of Management</b>		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	<b>Faculty of Commerce</b>		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	<b>Faculty of Humanities</b>		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	<b>Faculty of Science</b>		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	<b>Faculty of Education</b>		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

**SKILL ENHANCEMENT ELECTIVE COURSES**

<b>Non-Technical</b>			
<b>Elective No.</b>	<b>Department/ Faculty Name</b>		
	<b>Faculty of Information Technology</b>		
I	SCIT 201	Data Entry Operation	2(1+0+1)
II	SCIT 301	Multimedia	2(1+0+1)
III	SCIT 501	Web Designing with HTML	2(1+0+1)
IV	SCMIT 201	Web Development	2(1+0+1)
V	SCMIT 301	LINUX	2(1+0+1)
	<b>Faculty of Management</b>		
I	SMGT 201	Briefing and Presentation Skills	2(1+0+1)
II	SMGT 301	Resolving Conflicts and Negotiation Skills	2(1+0+1)
III	SMGT 802	Entrepreneurship Development	2(1+0+1)
	<b>Faculty of Commerce</b>		
I	SCOM 201	Tally ERP 9	2(1+0+1)
II	SCOM 302	Multimedia	2(1+0+1)
III	SCOM 803	Data Analyst	2(1+0+1)
	<b>Faculty of Humanities</b>		
I	SHBA 301	Pursuing Happiness	2(1+0+1)
II	SHBA302	Communication Skill and Personality Development	2(1+0+1)
III	SHMA301	Tourism in M.P	2(1+0+1)
	<b>Faculty of Science</b>		
I	SSBI 301	Mushroom Cultivation	2(1+0+1)
II	SSPH 301	House Hold Wiring	2(1+0+1)
III	SSPH 301	Basic Instrumentation	2(1+0+1)
IV	SSPH 301	DTP Operator	2(1+0+1)
V	SSCH 301	Graphic Designing	2(1+0+1)
	<b>Faculty of Education</b>		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)



## हिन्दी भाषा और संरचना

### पाठ्यक्रम के उद्देश्य:

1. विद्यार्थियों में राष्ट्र प्रेम की भावना का विकास करना।
2. हिन्दी के समृद्ध साहित्य को नयी पीढ़ी तक पहुँचाना।
3. पत्र-लेखन, सार लेखन, भाव पल्लवन एवं साक्षात्कार के कौशल का विकास करना।
4. डायरी, संस्मरण, लेखन, पारिभाषिक, शब्दावली, तत्सम, तद्भव, देशज, विदेशी शब्दों इत्यादि के ज्ञान का परिमार्जन करना।

### पाठ्यक्रम

#### इकाई-1

भारत वंदना) काव्य(	सूर्यकांत त्रिपाठी निराला
जाग तुझको दूर जाना	सुश्री महादेवी वर्मा
स्वतंत्रता पुकारती) काव्य(	जयशंकर प्रसाद
हम अनिकेतन) काव्य(	बालकृष्ण शर्मा नवीन
भाषा की महत्ता और उसके विविध रूप	
भाषा-कौशल	

#### इकाई-2

करुणा) निबंध (	आचार्य रामचन्द्र शुक्ल
समन्वय की प्रक्रिया) निबंध(	रामधारी सिंह दिनकर
बिच्छी बुआ) कहानी(	डॉ. लक्ष्मण विष्ट बटरोही
अनुवाद	परिभाषा प्रकारण महत्व विशेषताएं
हिन्दी की शब्द-संपदा	
परिभाषिक शब्दावली	

#### इकाई-3

विलायत पहुंच ही गया) आत्मकथांश (	महात्मा गांधी
अफसर (व्यंग्य)	शरद जोशी
तीर्थयात्रा) कहानी(	डॉ. मिथिलेश कुमार मिश्र
मकड़ी का जाला) व्यंग्य(	डॉ. रामप्रकाश सक्सेना
वाक्य- संरचना : तत्समए तद्भव देशज विदेशी	

#### इकाई-4

अप्प दीपो भव) वक्तृत्व कला(	स्वामी श्रद्धानंद
भारत का सामाजिक व्यक्तित्व) प्रस्तावना (	जवाहरलाल नेहरू
पत्र मैसूर के महाराजा को) पत्र-लेखन (	स्वामी विवेकानंद
बनी रहेंगी किताबें) आलेख(	डॉ. सुनीता रानी घोष
पत्र-लेखन: महत्व और उसके विविध रूप	
सड़क पर दौड़ते ईहा मृग) निबंध (	डॉ. श्यामसुन्दर दुबे

#### इकाई-5

योग की शक्ति) डायरी (	डॉ. हरिवंश राय बच्चन
कोश के अखाड़े में कोई पहलवान नहीं उतरता) साक्षात्कार (—	भाषाविद् डॉ. हरिदेव बाहरी से प्रो. त्रिभुवननाथ शुक्ल
नीग्रो सैनिक से भेंट) यात्रा-संस्मरण(	डॉ. देवेन्द्र सत्यार्थी
यदि बा न होती तो शायद गांधी को यह ऊँचाई न मिलती) साक्षात्कार (कथाकार.	गिरिराज किशोर से सत्येन्द्र शर्मा

सार- लेखनए भाव-पल्लवन साक्षात्कार और कौशल

अपेक्षित परिणाम:

1. विद्यार्थी भारत भूमि से प्रेम व स्नेह के भावों को बढ़ा सकेंगे।
2. विद्यार्थियों की हिन्दी की शब्द संपदा में वृद्धि होगी।
3. पत्र-लेखन ,सार लेखन, भाव पल्लवन साक्षात्कार के कौशल का विकास होगा।
4. डायरी एवं संस्मरण लेखन विद्या का परिमार्जन होगा।
5. हिन्दी के समृद्ध साहित्य कोश से लाभान्वित होंगे।

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## BASIC COMPUTER & INFORMATION TECHNOLOGY-I

### COURSE OBJECTIVE:-

To educate students to analyze, design, integrate & manage information systems using information technology.

### Syllabus:

- UNIT – I** Introduction to computer organization History of development of Computer system concepts. Characteristics, Capability and limitations.  
Generation of computer. Types of PC's Desktop. Laptop, Notebook. Workstation & their Characteristics.
- इकाई – 1** कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर का इतिहास, कम्प्यूटर सिस्टम विचारधारा, विशेषताएं, योग्यता एवं सीमाएं, कम्प्यूटर की पीढ़ियां, पी.सी. के प्रकार, डेस्कटॉप के प्रकार, लेपटॉप के प्रकार, नोटबुक, वर्क स्टेशन आदि की विशेषताएं।
- UNIT – II** Introduction to computer organization Basic components of a computer system Control Unit, ALU, Input / Output function and Characteristics, memory RAM, ROM, EPROM, PROM.
- इकाई – 2** कम्प्यूटर ऑर्गनाइजेशन का परिचय कम्प्यूटर सिस्टम के आधार उपकरण, कंट्रोल युनिट, ए.एल. यू. इनपुट/आउटपुट फंक्शन और विशेषताएं, मेमोरी रेम, रोम, इपी रोम, पी रोम, और अन्य प्रकार की मेमोरी।
- UNIT – III** Input & output devices Input Devices : Keyboard, Mouse, Trackball. Joystick, Digitizing tablet, Scanners, Digital Camera, MICR, OCR, OMR, Bar-code Reader, Voice Recognition, Light pen, Touch Screen.  
Output Devices: Monitors Characteristics and types of monitor, Video Standard VGA, SVGA, XGA,  
LCD Screen etc. Printer, Daisy wheel, Dot Matrix, Inkjet, Laser, Line Printer. Plotter, Sound Card and Speakers.
- इकाई – 3** इनपुट तथा आउटपुट डिवाइसेस **इनपुट डिवाइस:** कीबोर्ड, माउस, ट्रेकबॉल, जॉयस्टिक, डिजिटल टैबलेट, स्केनर्स, डिजिटल कैमरा, एमआईसीआर, ओसीआर, ओएमआर, बार कोड रीडर, आवाज को पहचानने वाला, लाइटपेन, टच स्क्रीन।  
**इनपुट डिवाइस:** मॉनीटर की विशेषताएं एवं मॉनीटर के प्रकार, वीडियो स्टैंडर्ड VGA, SVGA, XGA, LCD स्क्रीन आदि, प्रिंटर्स, डेजी व्हील, डॉट मैट्रिक्स, इंकजेट, लेजर, लाइन प्रिंटर, प्लॉटर, साउंड कार्ड्स एवं स्पीकर्स।
- UNIT – IV** Storage Devices Storage fundamental primary Vs Secondary. Various Storage Devices magnetic Tape. Cartridge Tape, Data Drives, Hard Drives, Floppy Disks, CD, VCD, CD-R, CD-RW, Zip Drive, DVD, DVD-RW.
- इकाई – 4** स्टोरेज डिवाइसेस स्टोरेज फंडामेंटल्स प्राइमरी विरुद्ध भिन्न स्टोरेज डिवाइसेस मैग्नेटिक टेप, कार्ट्रिज टेप, डाटा ड्राइव्स, हार्ड डिस्क ड्राइव्स फ्लोपी डिस्कस, सी.डी., वी.सी.डी., सी.डी.-आर. सी.डी.-आर. डब्ल्यू, जीप ड्राइव, डी.वी.डी., डी.वी.डी., – आर. डब्ल्यू।
- UNIT – V** Operating System Introduction to operating systems, its functioning and types. Basic commands of dos & Windows operating System.
- इकाई – 5** ऑपरेटिंग सिस्टम का परिचय ऑपरेटिंग सिस्टम का परिचय, उसके लक्षण एवं प्रकार, डॉस एवं विन्डोज का मूल कमांड।

## **PRACTICALS:-**

### **DOS:**

- DOS commands: Internal & External Commands.
- Special batch file: Autoexec, Bar Hard disk setup.

### **Windows 98:**

- Desktop setting: New folder, rename bin operation, briefcase, and function. Control panel utility.
- Display properties: Screen saver, background settings.

### **MS Word:**

- Creating file; save, save as HTML, Save as Text, Template, RTF Format.
- Page setup utility: Margin settings, paper size setting, paper source, layout.
- Editing: Cut, past special, undo, redo, find, replace, go to etc.
- View file: page layout, Normal Outline, master document, ruler header, footer, footline, full screen.
- Insert: break, page number, symbol, date & time, auto text, caption file, object, hyperlink, picture etc.
- Format: font, paragraph, bullets & numbering, border & shading, change case, columns.
- Table: Draw label, insert table, cell handling, table auto format, sort formula.

## **COURSE OUTCOME:-**

Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.



## ALGEBRA, TRIGONOMETRY & GEOMETRY

### COURSE OBJECTIVES:-

- Apply the concepts of matrices in solving a system of linear equations.
- Be familiar with the theory of equations.
- Expand trigonometric functions and also find the summation of T-series.
- To have knowledge about Cone and Cylinder with conicoides.  
Be familiar with group theory, ring, integral domain, field and make their fundamental strong

### Syllabus:

- UNIT – I** Rank of a matrix. Eigen values, eigen vectors.Characteristic equation of a matrix. Cayley Hamilton theorem and its use in finding inverse of marix. Application of matrix to a system of linear ( both homogenous and non - homogenous) equations. Theorems on consistency and inconsistency of a system of linear equations. Solving the linear equations with three unknowns. Relation between the roots and coefficients of a general polynomial equation in one variable. Transformation of equations, Descarte’s rule of signs.
- UNIT – II** De Moivre’s theorem and its application. Direct and inverse circular and hyperbolic functions, Expansion of trigonometrical function. Gregory’s Series, Summation of Series,
- UNIT – III** Definition and basic properties of group. Order of an element of a group. Subgroups, algebra of subgroups. Cyclic groups and their simple properties. Coset decomposition and related theorems. Lagrange’s theorem and its consequences, Normal sub groups, quotient groups.
- UNIT- IV** Homomorphism and isomorphism of groups, kernel of Homomorphism and fundamental theorem of Homomorphism of groups Permutation groups (even and odd permutations) Alternating groups  $A_n$ , Cayley’s theorem. Introduction to rings, subrings, integral domains and fields, simple properties and examples.
- UNIT – V** General equation of second degree. Tracing of conics. Equation of cone with given base, generators of cone, condition for three mutually perpendicular generators, Right circular cone. Equation of Cylinder and its properties. Right circular cylinder, enveloping cylinder and their properties Central conicoids, Paraboloids. Plane sections of Conicoids.

### COURSE OUTCOMES:-

- Understanding the ideas of matrices and ability to solve system of linear equations.
- The student will be able to acquire sound knowledge of matrices and techniques in solving equations with the help of theory of equations
- Fluency in solving equations.
- Understanding the concepts of algebra, trigonometry and geometry

## LOGIC AND SETS

- UNIT- I** Introduction, propositions, truth table, negation, conjunction and disjunction. Implications, biconditional propositions, converse, contra positive and inverse propositions and precedence of logical operators.
- UNIT - II** Propositional equivalence: Logical equivalences.
- UNIT- III** Predicates and quantifiers: Introduction, Quantifiers, Binding variables and Negations.
- UNIT - IV** Sets, subsets, Set operations and 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. Difference and Symmetric difference of two sets. Set identities, Generalized union and Intersections.
- UNIT - V** Relation: Product set, Composition of relations, Types of relations, Partitions, Equivalence Relations with example of congruence modulo relation, Partial ordering relations, binary relations.

### Books 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,

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## MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

### COURSE OBJECTIVE:-

1. To understand applications of Newton's Laws of Classical System.
2. Understands the concepts of elasticity and viscosity
3. Understands the damped and driven oscillators
4. Gains and appreciations of surface phenomena.

### Syllabus:

- UNIT – I** Mechanics Laws of motion, centripetal acceleration, Coriolis force and its applications. Kepler's laws. Gravitational law and field,. Gauss &Poisson's Equation of Gravitational self-energy System of. particles,, centre, of mass, equation of motion, conservation of linear and angular, momentum, conservation of energy, single stage and multistage rockets, elastic and inelastic collisions.
- UNIT – II** Oscillations differential equation and its solution, kinetic and potential energy, simple harmonic oscillations and its examples, spring and mass system, Vibrations of a magnet, moments of inertia and their products, principal moments and axes, Euler's equations simple and compound pendulum torsional pendulum, Helmholtz resonator, LC circuit.
- UNIT – III** Superposition Of Harmonic Motion Superposition of two simple harmonic motions of the same frequency along the same line, interference, superposition of two mutually perpendicular simple harmonic vibrations of the same frequency, Lissajous figures, damped harmonic oscillators, power dissipation, quality factor and their examples, driven harmonic oscillator;
- UNIT – IV** Properties of matter Elasticity, Hook's Law, elastic constants for an isotropic solid beams supported at both the ends, cantilever, torsion of a cylinder bending moments and shearing forces. Kinematics of moving fluids, equations of continuity Euler's equation, Bernoulli's theorem, viscous fluids, streamline and turbulent flow, Poiseulle's law, Capillary tube flow, Reynolds number, Stokes law Surface tension and surface energy. surface wetting.
- UNIT - V** Motion of charged Particles in Electric and Magnetic Fields E as an accelerating field, electron gun, case of discharge tube, linear accelerator. E as deflecting field- CRO, sensitivity of CRO. Transverse B field;  $180^\circ$  deflection, mass spectrograph. principles of cyclotron. discovery of isotopes, elements of mass spectrographs, principle of magnetic focusing (lenses).

### COURSE OUTCOMES:-

1. To study the fundamentals of mechanics and oscillations
2. Gain the knowledge about forces help the student in their daily life
3. The information will teach the students about the rolling concepts

### PRACTICAL:-

To determine the acceleration due to gravity ( $g$ ) at a place with the help of Bar pendulum.

1. (Compound Pendulum).
2. To determine the acceleration due to gravity ( $g$ ) at a place with the help of Kater's reversible pendulum.
3. To determine the modulus of rigidity of given wire by Torsional Pendulum.
4. To determine the moment of inertia of a flywheel about its own axis of rotation.
5. To determine the moment of inertia of given body by using inertia table.
6. To determine the moment of inertia of given body by using inertia table with lamp and scale arrangement.
7. To study and prove the perpendicular axis theorem of moment of inertia by using inertia table.  
 $I_z = I_x + I_y$
8. To determine the surface tension of a liquid by the capillary rise method.
9. To determine the co-efficient of viscosity of glycerine or castor oil by falling sphere method.
10. To determine the density of liquid by using steel balls and Teflon spheres.
11. To determine the fall time of different size spheres of same material.
12. To determine the Young's Modulus of elasticity of the given sample material by bending. (Bending of Beam)
13. To study and verify the truth table of Basic, Universal & Compound Logic Gates.

**Note:-**

- ❖ **One experiment will be asked in the semester practical examination.**

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## CHEMISTRY-I

### COURSE OBJECTIVE:

To make the students conversant with basics, acquire sound knowledge to develop an understanding of the basic concepts of mathematical concept, gaseous, liquid & colloidal states, chemical kinetics, structure bonding and stereochemistry.

### Syllabus:

#### UNIT - I

A. Mathematical Concepts : Logarithmic relations, curves stretching, linear graphs and calculation of slopes, Differentiation of functions like  $Kx$ ,  $ex$ ,  $xn$ ,  $\sin x$ ,  $\log x$ ; maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions; permutations and combinations. Factorials, Probability. **B. Gaseous States** : Deviation from ideal behaviour, van der Waals equation of state. Critical phenomenon : PV isotherms of ideal gases, continuity of states, the isotherms of van der Waals equations, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of states.

#### UNIT - II

A. Liquid State : Intermolecular forces, structure of liquids (a qualitative description) Liquid crystals: Difference between liquid crystal, solid and liquid. Classification, structure of nematic and cholestric phases. Thermography and seven segment cell. **B. Colloidal State** : Definition of colloids, classification of colloids. Solids in liquids (sols): properties- kinetic, optical and electrical; stability of colloids, protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions) : types of emulsions, preparation. Emulsifier. Liquids in solids (gels): classification, preparation and properties, inhibition, general applications of colloids.

#### UNIT - III

Chemical Kinetics : Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction concentration, temperature, pressure, solvent, light and catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions- zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction - differential method, method of integration, method of half life period and isolation method. Experimental methods of chemical kinetics - conductometric, potentiometric, optical methods- polarimetry and spectrophotometry. Theories of chemical kinetics: effect of temperature on rate of reaction, Arrhenius equation, concept of activation energy. Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis) Expression for the rate constant based on equilibrium constant and thermodynamic aspects.

#### UNIT - IV

A. Structure and Bonding : Hybridizations, Bond lengths and bond angles, bond energy : Localized and delocalized chemical bond, van-der Waals interactions, inclusion compounds, clathrates, charge transfer complexes, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding. **B. Mechanism of Organic reactions** : Curved arrow notations, drawing electron movements with arrows, half-headed and double headed arrows, homolytic and heterolytic bond breaking. **C. Types of Reagents** : Electrophiles and nucleophiles. Types of organic reactions. Energy consideration. Reactive intermediates- carbocations, carbanions, free radicals and carbenes. Methods of determination of reaction mechanism.

**UNIT - V** A. Stereochemistry : Concept of isomerism, types of isomerism, optical isomerism, elements of symmetry, molecular chirality, enantiomers, stereogeniccentres, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogeniccentres, diastereomers, mesocompounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configurations, sequence rule, D &L , R & S systems of nomenclature. E and Z system of Nomenclature geometrical isomerism in alicyclic compounds. Conformation, conformational analysis of ethane and n-butane. Conformations of cyclohexanes, axial and equatorial bonds, Newman projection and Sawhorse formulae, Fischer and Flying wedge formulae.

### **COURSE OUTCOMES:-**

The knowledge gained on mathematics concept, liquid state, chemical kinetics, structure & bonding and stereochemistry will provide a strong platform to understand the concepts on these subjects for further learning.

### **PRACTICAL: -**

#### **Physical Chemistry**

A. (Any one experiment will be asked in examination form the following carrying )

1. Calibration of thermometer
2. Determination of melting point
3. Determination of boiling point
4. Determination of mixed melting point
5. Preparation of solutions of various concentrations, NaOH, HCl, H<sub>2</sub>SO<sub>4</sub>.

B. (Any one experiment will be asked in examination form the following carrying)

1. To determine the velocity constant (specific reaction rate) of hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. To compare the strength of HCl and H<sub>2</sub>SO<sub>4</sub> by studying the kinetics of hydrolysis of ester.
4. To study kinetically the reaction rate of decomposition of iodide by H<sub>2</sub>O<sub>2</sub>.
5. Determination of surface tension / percentage composition of given organic mixture using surface tension method.
6. Determination of viscosity / percentage composition of given organic mixture using viscosity method.

#### **Organic chemistry**

(Any one experiment will be asked in examination form the following carrying)

1. Distillation
2. Crystallization
3. Decolourisation and crystallization using charcoal
4. Sublimation

### **COURSE OUTCOMES:**

Upon completion of this course, the student will be able to identify different types of melting, boiling point and different methods for organic mixture by their characteristics.

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## ENGLISH LANGUAGE AND INDIAN CULTURE

### COURSE OBJECTIVES:-

- To Study the basic concept and Language Skills of English Language.
- Comprehensive study of different kinds of vocabulary in English Language.
- To Study the different era in every story and moods in poems.

### Syllabus:

#### UNIT – I

1. Amalkanti: Nirendranath Chakrabarti
2. Sita: Toru Dutt
3. Tryst with Destiny: Jawaharlala Nehru
4. Delhi in 1857: Mirza Ghalib
5. Preface to the Mahabharata: C. Rajagopalachari
6. Where the Mind is Without Fear: Rabindranath Tagore
7. A Song of Kabir: Translated by Tagore
8. Satyagraha: M.K. Gandhi
9. Toasted English: R.K. Narayan
10. The Portrait of a Lady: Khushwant Singh
11. Discovering Babasaheb: Ashok Mahadevan

UNIT – II      Comprehension

UNIT – III     Composition and Paragraph Writing (Based on expansion of an idea)

UNIT – IV     Basic Language Skills : Vocabulary – Synonyms, Antonyms, Word Formation, Prefixes and Suffixes, Words likely to be confused and Misused, Words similar in Meaning or Form, Distinction between Similar Expressions, Speech Skill.

UNIT – V     Basic Language Skills : Grammar and usage – The Tense Forms, Propositions, Determiners and Countable/Uncountable Nouns, Verb, Articles, Adverbs.

### COURSE OUTCOMES:-

1. Students will be able to understand the basic concept and Language Skills of English Language.
2. Students will be able to understand the different use of vocabulary in their sentences.
3. Students will be able to understand the varieties of stories on different issues and on different format.

## FUNDAMENTALS OF ENTREPRENEURSHIP

### COURSE OBJECTIVE:-

Understanding basic concepts of entrepreneurship and key steps in the elaboration of business ideas, Developing personal creativity and entrepreneurial initiative.

### Syllabus:

- UNIT – I** Entrepreneurship-Definition, Characteristics and importance, Types and functions of an entrepreneur, merits of a good entrepreneur motivational factors of entrepreneurship.
- UNIT – II** Motivation to achieve targets and establishment of ideas. Setting targets and facing challenges. Resolving problems and creativity. Sequenced planning and guiding capacity, Development of self confidence. Communication skills, Capacity to influence, leadership.
- UNIT – III** Project Report- Evaluation of selected process. Detailed project report - Preparation of main part of project report pointing out necessary and viability.  
Selecting the form of Organization: Meaning and characteristics of sole Proprietorship, Partnership and cooperative committees, elements affecting selection of a form of an organization.  
Economic management -Role of banks and financial institutions banking, financial plans, working capital-evaluation and management, Cost and Price determination, Calculation of Profits, keeping of accounts.
- UNIT – IV** Production management - Methods of purchase. Management of movable assets/goods. Quality management. Employee management. Packing.  
Marketing management Sales and the art of selling. Understanding the market and market policy. Consumer management. Time management.
- UNIT - V** Role of regulatory institutions - district industry centre, pollution control board, food and drug administration, special study of electricity development and municipal corporation.  
Role of development organizations, khadi & village Commission/ Board, State Finance Corporation, scheduled banks, MP Women's Economics Development Corporation.  
Self-employment-oriented schemes, Prime Minister's Employment schemes, Golden Jubilee Urban environment scheme, Rani Durgavati Self-Employment scheme, Pt. Deendayal Self-employment scheme.  
Various grant schemes - Cost-of-Capital grant, interest grant, exemption from entry tax, project report, reimbursement grant, etc.  
Special incentives for women entrepreneurs, prospects & possibilities.  
Schemes of Tribal Finance Development Corporation, schemes of Antyavasai Corporation, schemes of Backward Class and Minorities Finance Development Corporation.  
Special incentives for women entrepreneurs, prospects & possibilities.  
Schemes of Tribal Finance Development Corporation, schemes of Antyavasai Corporation, schemes of Backward Class and Minorities Finance Development Corporation.

### COURSE OUTCOME:-

Understanding basic concepts in the area of entrepreneurship, understanding the stages of the entrepreneurial process, adopting of the key steps in the elaboration of business ideas, Developing personal creativity and entrepreneurial initiative.



# CALCULUS, DIFFERENTIAL EQUATIONS & VECTOR CALCULUS

## COURSE OBJECTIVES:-

- To solve problem using expansion of functions.
- Familiar with curve tracing.
- Apply integral calculus in solving problems.
- To make the student acquire sound knowledge of techniques in solving differential equations.
- Familiar with physical interpretation of divergence and curl of a vector.

## Syllabus:

**UNIT – I** Concept of Partial differentiation, Successive differentiation, Leibnitz theorem, Maclaurin and Taylor series expansions, Asymptotes and Curvature, Tests for concavity and convexity, Points of inflexion. Multiple points. Tracing of curves in cartesian and polar co-ordinates

**UNIT – II** Integration of irrational algebraic functions and transcendental functions. Reduction formulae. Definite Integrals. Quadrature, Rectification, Volumes and Surfaces of solids of revolution of curves.

**UNIT – III** Linear equations and equations reducible to the linear form, Exact differential equation First order higher degree equations for  $x$ ,  $y$ ,  $p$ , Clairaut's form and singular solutions. Linear differential equations with constant coefficients.

**UNIT – IV** Homogenous linear ordinary differential equations, linear differential equations of second order. Transformation of the equation by changing the dependent variable and the independent Variable, Method of variation of parameters, Ordinary simultaneous differential equations.

**UNIT – V** Vector differentiation. Gradient, Divergence and Curl. Vector integration, Theorem of Gauss (without proof) and problems based on it. Theorem of Green (without proof ) and problems based on it. Stoke's theorem (without proof ) and problems based on it.

## COURSE OUTCOMES:-

- Understanding the ideas and concept of calculus and facility in solving standard examples.
- Fluency in integration using standard methods, including the ability to find an appropriate method for a given integral.
- Fluency in solving differential equations and facility in solving standard examples.
- Understanding the ideas of vector calculus and facility in solving standard examples.

## THEORY OF REAL FUNCTIONS

- UNIT-I** Limits of functions ( $\epsilon - \delta$  approach), sequential criterion for limits, divergence criteria. Limit theorems, one sided limits. Infinite limits and limits at infinity.
- UNIT-II** Continuous functions, sequential criterion for continuity and discontinuity. Algebra of continuous functions. Continuous functions on an interval, intermediate value theorem, location of roots theorem, preservation of intervals theorem. Uniform continuity, non-uniform continuity criteria, uniform continuity theorem.
- UNIT-III** Differentiability of a function at a point and in an interval, Caratheodory's theorem, algebra of differentiable functions. Relative extrema, interior extremum theorem. Rolle's theorem, Mean value theorem, intermediate value property of derivatives
- UNIT-IV** Darboux's theorem. Applications of mean value theorem to inequalities and approximation of polynomials, Taylor's theorem to inequalities.
- UNIT-V** Cauchy's mean value theorem. Taylor's theorem with Lagrange's form of remainder, Taylor's theorem with Cauchy's form of remainder, application of Taylor's theorem to convex functions, relative extrema. Taylor's series and Maclaurin's series expansions of exponential and trigonometric functions,  $\ln(1 + x)$ ,  $1/ax+b$  and  $(1 + x)^n$ .

### Books Recommended

1. R. Bartle and D.R. Sherbert, *Introduction to Real Analysis*, John Wiley and Sons, 2003.
2. K.A. Ross, *Elementary Analysis: The Theory of Calculus*, Springer, 2004.
3. A. Mattuck, *Introduction to Analysis*, Prentice Hall, 1999.
4. S.R. Ghorpade and B.V. Limaye, *A Course in Calculus and Real Analysis*, Springer, 2006.

# MATHEMATICAL BACKGROUND, ELECTROSTATICS, AND STEADY CURRENTS

## COURSE OBJECTIVE:-

1. The main objective of this subject is introducing the basic concepts of Electrostatics to student and help in developing problem solving skills.
2. Student will study basic ideology of Scalar and Vector product, double and triple integral.
3. Introducing the basic concepts of electrostatics to student and help in developing problem solving skills.

## Syllabus:

**UNIT - I** Mathematical Background Scalars and vectors, dot and cross products, triple vector product, flux of a vector field, Gauss's divergence theorem. Green's theorem and Stoke's theorem. Functions of two and three variables, partial derivatives, definition of a double and triple integral, evaluation of double and triple integrals as repeated integrals, change of variables of integration, Jacobian applications.

**UNIT - II** Electrostatics Coulombs law in vacuum expressed in vector forms, calculations of E for simple distributions of charge at rest, dipole and quadrupole fields. torque on a dipole in a uniform electric field and its energy, flux of the electric field, Gauss's law and its application. Capacitors, electrostatic field energy,. Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, and displacement vector D, molecular interpretation of Claussius-Mossotti equation.

**UNIT - III** Electric Currents Steady current, current density J, non-steady currents and continuity equation, Kirchhoff 's laws and analysis of multiloop circuits, rise and decay of current in LR and CR circuits, decay constants, transients in LCR circuits. AC circuits, complex numbers and their applications solving AC circuits Problems, complex impedance and reactance, series and parallel resonance., Q factor, power consumed by an A.C. circuit, power factor,

**UNIT - IV** Magneto-statics Force on a moving charge: Lorentz force equation and definition of B, force on a straight conductor carrying current in a uniform magnetic field, torque on a current loop, magnetic dipole moment, angular momentum and gyromagnetic ratio, Biot and Savart's Law, Ampere's Law,  $\vec{\nabla} \times \vec{B} = \mu_0 \vec{J}$ ,  $\vec{\nabla} \cdot \vec{B} = 0$ ; Field due to a magnetic dipole magnetization current magnetization vector, Half order field, magnetic permeability (linear cases).

**UNIT - V** Time Varying Fields Electromagnetic induction, Faraday's Laws, electromotive force  $e = E \cdot dl$ , integral and differential forms of Faraday's laws. self and mutual inductance transformers,. Maxwell's displacement current, Derivations of Maxwell's equations, electromagnetic field energy density., Poynting's vector. The wave equation satisfied by E and B, plane electromagnetic waves in vacuum, polarization by reflection and total internal reflection. Faraday effect, reflection and refraction by the ionosphere.

## COURSE OUTCOMES:-

1. To study the basics of Mathematical Background and to introduce concepts of Electrostatics and magnetics.

## PRACTICAL:-

1. To plot graphs showing the variation of magnetic field with distance along the axis of circular coil carrying current and to estimate the radius of the coil.
2. To Determine the Dielectric Constant of different materials.

3. To determine the impedance, phase angle & power factor of R, L & C are connecting in series with the help of LCR Impedance circuit.
4. To determine the resistance per unit length of the Carrey-Foster's bridge wire.
5. To study and verify the Coulomb's law.
6. To determine the radius of a current carrying coil by using current carrying coil measurement unit.
7. To determine the magnetic field with the variation of distance along the axis of current carrying coil.

### **8. Experiment with Ballistic Galvanometer:**

- 8.1 To determine the ballistic constant by steady deflection method by using ballistic galvanometer.
- 8.2 To determine the charge sensitivity of a moving coil ballistic galvanometer using a known capacitor.
- 8.3 To study the comparison of the capacitance of two condensers by using ballistic galvanometer.
- 8.4 To determine the logarithmic decrement for a ballistic galvanometer.

### **9. Electrostatics Measurement Lab:**

- 9.1 To study the charge induction in electrostatics.
- 9.2 To study the charge conduction in electrostatics.
- 9.3 To study the pith ball pendulum with the help of Electroscope.
- 9.4 To study the relative charges of different rods with the help of Digital Display in millivolt.
- 9.5 To study the electrostatic charge with the help of Charge Demonstration Tube.
- 9.6 To study the electrostatics charge by the combination of different rods & clothes.

**Note:-**

❖ **One experiment will be asked in the semester practical examination.**

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## CHEMISTRY-II

## COURSE OBJECTIVE:

To make the students conversant with basics, acquire sound knowledge to develop an understanding of the basic concepts of atomic structures, gaseous, Molecular Orbital theory, s-Block Elements, Arenes and Aromaticity and Alkenes

## Syllabus:

- UNIT - I**
- A.** Atomic Structure : Idea of de Broglie's matter waves, Heisenberg uncertainty principle, atomic orbitals, Schrödinger wave equation, significance of  $n$  and  $l$ , quantum numbers, radial and angular wave functions and probability distribution curves, effective nuclear charge.
- B.** Periodic Properties : Atomic and ionic radii, ionization energy, electron affinity and electronegativity : definition, method of determination, trends in periodic table and applications.
- C.** Chemical Bonding : Covalent bond- valence bond theory and its limitations, directional characteristic of covalent bond. Hybridization and shapes of simple molecules and ions. Valence Shell Electron Pair Repulsion (VSEPR) theory to  $\text{NH}_3$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{ICl}_2$  - and  $\text{H}_2\text{O}$ .
- UNIT - II**
- A.** Molecular Orbital theory for homonuclear and heteronuclear ( $\text{CO}$  and  $\text{NO}$ ) diatomic molecules, multicenter bonding in electron deficient molecules, bond strength and the bond energy, % ionic character from dipole moment and electronegativity difference. Weak interactions, hydrogen bonding, van der Waals forces.
- B.** Ionic Solids : Ionic structures, radius ratio effect and coordination number, limitation of radius ratio rule, Lattice defects, semiconductors, lattice energy and Born-Haber cycle, solvation energy and solubility of ionic solids, polarizing power and polarizability of ions. Fajan's rule, Metallic bond, free electron, Valence bond and Band theories.
- C.** Noble Gases : Chemical properties of the noble gases, chemistry of xenon, structure and bonding in xenon compounds.
- UNIT - III**
- A.** s-Block Elements : Comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls.
- B.** p-Block Elements : Comparative study (including diagonal relationship) of groups 13-17 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13-16. Hydrides of boron-diborane and higher boranes. Borazine, borohydrides. Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride, basic properties of halogens, interhalogens.
- UNIT - IV**
- A.** Arenes and Aromaticity : Nomenclature of benzene derivatives. The aryl group, Aromatic nucleus and side chain structure of benzene, molecular formula and Kekule structure. Stability and carbon-carbon bond lengths of benzene, resonance structure. MO picture. Aromaticity the Huckel rule, aromatic ions. Aromatic electrophilic substitution, general pattern of the mechanism, role of  $s$  and  $p$  complexes. Mechanism of nitration, halogenation, sulphonation, mercuriation and Friedel-Crafts reaction. Energy profile diagrams. Activating and deactivating substituents. orientation and ortho/para ratio. Side chain reactions of benzene derivatives. Birch reduction. Methods of formation and chemical reactions of alkylbenzenes and biphenyl.
- B.** Alkenes : Nomenclature of alkenes, methods of formation, mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regio-selectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes, mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule, hydroboration-oxidation, oxymercuration-reduction, Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with

KMnO<sub>4</sub>, polymerization of alkenes, Substitution at the allylic and vinylic positions of alkenes, Industrial applications of ethylene and propene.

#### **UNIT – V**

**A.** Cycloalkenes, Dienes and alkynes : Methods of formation, conformation and chemical reactions of cycloalkenes, nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions - 1,2 and 1,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation. Chemical reactions of alkynes, acidity of alkynes. Mechanism of electrophilic and nucleophilic addition reactions, hydroborationoxidation and polymerization.

**B.** Alkyl and Aryl Halides : Nomenclature and classes of alkyl halides, methods of formation, chemical reactions; mechanisms of nucleophilic substitution reaction of alkyl halides, SN<sub>2</sub> and SN<sub>1</sub> reactions with energy profile diagrams.

Polyhalogen compounds: chloroform, carbon tetrachloride. Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition reactions mechanisms of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides versus allyl, vinyl and aryl halides. Synthesis and uses of DDT, BHC and Freon.

#### **PRACTICAL:-**

Inorganic chemistry

Inorganic mixture analysis 1

Macro/Semi-micro Analysis- Cation analysis, separation and identification of ions from group I-VI, anion analysis

Separation of cations by paper chromatography.

Preparation of ferrous alum. 8 marks

Organic Chemistry: (

1. Detection of elements (N, S and halogens) 2 elements,

2. Functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and aniline) in simple organic compounds.

2 functional groups:

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## हिन्दी भाषा संवेदना एवं संचार साधन

### पाठ्यक्रम के उद्देश्य—

- विद्यार्थियों को भारतीय संवेदना, संस्कृति, वैश्विक चेतना से परिचित कराना।
- धर्म, दर्शन, न्याय, नीति, साहित्य की प्राचीन व नवीन मान्यताओं से परिचित करवाना।
- संचार संसाधनों से परिचित करवाना।
- सिनेमा, रंगमंच, संगीत, चित्रकला इत्यादि से परिचित करवाना।

### पाठ्यक्रम:

#### इकाई -1

1. भारतीय संस्कृति
2. भारतीय समाज व्यवस्था
3. सभ्यता एवं संस्कार
4. वैश्विक चेतना
5. समन्वयीकरण भारतीय एवं अंतर्राष्ट्रीय संदर्भ में

#### इकाई - 2

1. धर्म
2. न्याय
3. दर्शन
4. नीति
5. साहित्य

#### इकाई - 3

1. संचार संसाधन रू संपर्क के नए क्षितिज
2. समाचार पत्र
3. भारतीय प्रेस परिषद्
4. रेडियो
5. दूरदर्शन

#### इकाई - 4

1. सिनेमा
2. रंगमंच
3. संगीत
4. चित्र, मूर्ति, स्थापत्य कला
5. शिल्प कला

#### इकाई - 5

1. कम्प्यूटर
2. दूरभाष सौगात विज्ञान की
3. मंत्र रू, कहानी, प्रेमचंद
4. मातृ भूमिगुप्त मैथिलीशरण रू, कविता, द्व
5. साहित्यकार का दायित्व डॉ. भारती प्रेम ष

**अपेक्षित परिणाम:**

1. विद्यार्थी आधुनिक संचार संसाधनों के प्रयोग में कुशल हो सकेंगे।
2. भारत की धर्म, दर्शन, नीति, संस्कृति, सभ्यता, संस्कारों इत्यादि के प्रति ज्ञान प्राप्त कर कुशल एवं संवेदनशील नागरिक बन सकेंगे।

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## BASIC COMPUTER & INFORMATION TECHNOLOGY-II

### Course Objective:

To educate students to analyze , design , integrate & manage information systems using information technology.

### Syllabus:

#### UNIT – I: Word Processing: Word

- MS Word: features, Creating, Saving and Operating Multi document windows, Editing Text selecting, Inserting, deleting moving text.
- Previewing documents, Printing document to file page. Reduce the number of pages by one.
- Formatting Documents: paragraph formats, aligning Text and Paragraph, Borders and shading, Headers and Footers, Multiple Columns.

#### इकाई—1: वर्डप्रोसेसिंग

- वर्डप्रोसेसिंग का परिचय
- एम. एस वर्ड: फीचर्स, क्रीएटिंग, सेविंग एवं ओपनिंग, मल्टी डॉक्यूमेंट विंडोस, एडिटिंग टेक्स्ट सिलेक्टिंग, इंसर्टिंग, डिलीटिंग टेक्स्ट।
- प्रीव्यूविंग डॉक्यूमेंट्स, प्रिंटिंगडॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, प्रिंट डॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, डॉक्यूमेंट को मीनू द्वारा प्रिंट करना, शिकिंग ए डॉक्यूमेंट इन ए फाइल पेज, पेजों को कम करना।
- फॉरमेटिंग डॉक्यूमेंट्स: पैराग्राफ फारमेट, अलाइनिंग टेक्स्ट एंड पैराग्राफ, बार्डर एवं हेडर्स एवं फुटर्स, मल्टीपल कॉलम्स।

#### UNIT – II: Introduction to Excel& Worksheet

- Worksheet basic.
- Creating worksheet, entering data into worksheet, heading information, data text, dates, alphanumeric, values, saving & quitting worksheet.
- Opening and moving around in an existing worksheet.
- Toolbars and Menus, keyboard shortcuts.
- Working with single and multiple workbook coping, renaming, moving, adding and deleting. coping entries and moving between workbooks.
- Working with formulas & cell referencing.
- Autosum.
- Coping formulas
- Absolute & Relative addressing.

#### इकाई—2: एक्सेल एवं वर्कशीट का परिचय

- एक्सेल एंड वर्कशीट
- वर्कशीट का आधार, वर्कशीट बनाना, वर्कशीट में डाटा एंटर करना, हेडिंग इंफॉर्मेशन, डाटा टेक्स्ट डेट, अल्फा न्यूमेरिक, वेल्यूज, सेविंग और वर्कशीट छोड़ना।
- पहले बनी हुई वर्कशीट को खोलना तथा चलाना।
- टूलबार मीनू और कीबोर्ड के शॉर्टकट।
- एक एवं अनेक वर्कशीट पर काम करना, कॉपी, रिनेमिंग, मूविंग, एडिंग एंड डिलीटिंग, एन्टीज को कॉपी तथा विभिन्न वर्कशीट में ले जाना।

- फॉर्मूला एवं सेल रिफ्रेशिंग के साथ काम करना।
- ऑटो सम फॉर्मूला को कॉपी करना, एक्सल्यूट एंड रिलेटिव एड्रेसिंग।

### UNIT – III: INTRODUCTION TO POWER POINT

- Features and various versions.
- Creating presentation using Slide master and template in various colour scheme.
- Working with slides make new slide move, copy, delete, duplicate, lay outing of slide, zoom in or out of a slide.
- Editing and formatting text: Alignment, editing, inserting, deleting, selecting, formatting of text, find and replace text.

#### इकाई-3: पावरपाइंट का परिचय-1

- फीचर्स एंड विभिन्न वर्जन्स
- प्रजेन्टेशन तैयार करना स्लाइड मास्टर एवं टेम्प्लेट इन वेरियस कलर स्कीम।
- पावरपाइंट के भिन्न व्यूस के साथ काम करना एवं पावरपाइंट के मेन्यू।
- स्लाइड्स के साथ काम करना, नये स्लाइड तैयार करना एवं मूव करना, कॉपी करना, डिलीट करना, डुपलीकेट स्लाइड तैयार करना, ले-आउटिंग करना, जूम इन और आउट करना।
- एडिटिंग एवं फॉर्मेटिंग टेक्स्ट: अलाइनमेंट, एडिटिंग, इनसर्टिंग, डिलीटिंग, सिलेक्टिंग, फॉर्मेटिंग ऑफ टेक्स्ट, फाईन्ड एवं रिप्लेस टेक्स्ट।

### UNIT – IV: POWER POINT – II

- Bullets , footer, paragraph formatting, spell checking.
- Printing presentation Print slides, notes, handouts and outlines.
- Inserting objects Drawing and Inserting objects using Clip Arts picture and charts.
- Slide sorter, slide transition effect and animation effects.
- Presenting the show making stand alone presentation, Pack and go wizards.

#### इकाई-4: पावरपाइंट का परिचय-2

- बुलेट्स, फुटर, पैराग्राफ फॉर्मेटिंग, स्पेल चेकिंग।
- प्रिंटिंग प्रजेन्टेशन, प्रिंट स्लाइड्स, नोट्स, हेण्डआउट एवं आउट लाईन्स।
- इंसर्टिंग आब्जेक्ट, ड्राइंग एवं इंसर्टिंग ऑब्जेक्ट्स क्लिपआर्ट पिक्चर्स एवं चार्ट्स का प्रयोग करना।
- स्लाइड्स सोर्टर, स्लाइड ट्रांजिशन के प्रभाव एवं अन्य ऐनिमेशन प्रभाव।
- प्रेजेटिंग शो मेकिंग स्टैंड अलोन प्रजेन्टेशन, पके एवं गोविजार्ड।

### UNIT – V: INTRODUCTION OF INTERNET

Evolution, Protocol, concept, Internet, Dial-up connectivity, leased line, VSAT, Broad band, URLs, Domain names, Portals. E-mail, Pop & web based Email. Basic of sending and receiving Emails, Email

& Internet Ethics, Computer virus, Antivirus software wage, Web Browsers.

#### इकाई-5: इंटरनेट का परिचय:

इवोल्यूशन, प्रोटोकॉल, विचारधारा, इंटरनेट, डायल अप कनेक्टिविटी, डीज्डलाइन, वीएसटी, ब्रोडबैंड, यू.आर.एल्स., डोमेननेम्स, पोस्टल्स, ई-मेल, पॉप एवं वेब बेस्डई-मेल, बेसिक्स ऑफ सेडिंग एवं रिसीविंग इमेल्स, ई-मेल एवं इंटरनेट एथिक्स, कम्प्यूटर वायरस, एंटी वायरस सॉफ्टवेयर, वेब ब्राउसर।

## **PRACTICALS:**

### **MS- Power Point:**

Creating new slide, formatting slide layout, slide show & sorter, Inserting new slide, slide no., date, time, chart, formatting slide, tool operation.

### **List of suggested practical work:**

- Under standing of a dial up connection through modern.
- Configuring a computer for an e-mail and using outlook Express or Netscape Messenger.
- Registration an e-mail address.
- Understanding of e-mail drafting.
- Understanding of address book maintenance for e-mail.
- Understanding of different mail program tools.
- Send and receive functions of e-mail.

### **Course outcome:**

Student will be able to use computer system easily and they will get knowledge about how to use different type of operating system.

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## CALCULUS, DIFFERENTIAL EQUATION AND MECHANICS

### COURSE OBJECTIVES:-

- The goal of this course is for students to gain proficiency in calculus computations..
- To make the student acquire sound knowledge of sequences, series and their convergence.
- To familiarize the student with Laplace and inverse Laplace transforms as well as applications of Laplace transformation in solving linear differential equations.

**Syllabus:** • To acquaint the student with mechanics.

**UNIT – I** Definition of a sequence. Theorems on limits of sequences. Bounded and monotonic sequences. Cauchy's convergence criterion . Series of non-negative terms. Comparison test, Cauchy's integral test, Ratio test. Raabe's test ,logarithmic test. Leibnitz's theorem. Absolute and conditional convergence.

**UNIT – II** Continuity of functions of one variable , sequential continuity. Properties of continuous functions. Uniform continuity. Chain rule of differentiability. Mean value theorems and their geometrical interpretations. Darboux's intermediate value theorem for derivatives. Limit and continuity of functions of two variables.

**UNIT - III** Series Solution of Differential Equations-Power series Method, Bessel's Equation Bessel's function and its properties, recurrence and generating relations. Legendre's

**UNIT – IV** Laplace transformations, Linearity of the Laplace transformation, Existence theorem of Laplace transforms, Laplace transforms of derivatives and integrals. Shifting theorem . Differentiation and integration of transforms. Inverse Laplace transforms, Convolution theorem. Applications of Laplace transformation in solving linear differential equations with constant coefficients.

**UNIT - V** Analytical conditions of equilibrium of Coplanar forces. Catenary. Forces in three dimensions. Velocities and accelerations along Radial and transverse direction.

### COURSE OUTCOMES:-

- Understanding the ideas of sequences and series and ability to find their convergence.
- Understanding of the ideas of limit and continuity and an ability to calculate with them and apply them for function of one and two variables.
- Understanding of the ideas of differential equation and facility in solving standard examples.
- Understanding the ideas of Laplace and inverse Laplace transforms facility in solving standard examples and apply them.
- Understanding of the ideas of Mechanics and facility in solving simple standard examples.

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## MULTIVARIATE CALCULUS

- UNIT-I** Functions of several variables, limit and continuity of functions of two variables Partial differentiation, total differentiability and differentiability, sufficient condition for differentiability.
- UNIT-II** Chain rule for one and two independent parameters, directional derivatives, the gradient, maximal and normal property of the gradient, tangent planes, Extrema of functions of two variables, method of Lagrange multipliers, constrained optimization problems, Definition of vector field, divergence and curl
- UNIT-III** Double integration over rectangular region, double integration over non-rectangular region, Double integrals in polar co-ordinates, Triple integrals, Triple integral over a parallelepiped and solid regions. Volume by triple integrals, cylindrical and spherical co-ordinates.
- UNIT-IV** Change of variables in double integrals and triple integrals. Line integrals, Applications of line integrals: Mass and Work. Fundamental theorem for line integrals, conservative vector fields, independence of path.
- UNIT-V** Green's theorem, surface integrals, integrals over parametrically defined surfaces. Stoke's theorem, The Divergence theorem.

### Books Recommended

1. G.B. Thomas and R.L. Finney, *Calculus*, 9th Ed., Pearson Education, Delhi, 2005.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, 3rd Ed., Dorling Kindersley (India) Pvt. Ltd. (Pearson Education), Delhi, 2007.
3. E. Marsden, A.J. Tromba and A. Weinstein, *Basic Multivariable Calculus*, Springer (SIE), Indian reprint, 2005.
4. James Stewart, *Multivariable Calculus, Concepts and Contexts*, 2nd Ed., Brooks /Cole, Thomson Learning, USA, 2001.

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# KINETIC THEORY OF GASES, THERMO-DYNAMICS AND STATISTICAL MECHANICS

## COURSE OBJECTIVES:-

1. To express the basic assumption of the kinetic theory of gases.
2. Students learn the different laws of Thermodynamics.
3. To learn Thermodynamically function and their relations.

## Syllabus:

- UNIT – I** Kinetic Theory of Gases: Ideal Gas Kinetic model, deduction of Boyle's law, interpretation of temperature, estimation of rms speeds of molecules. Brownian motion, estimation of the Avogadro number. Law of Equipartition of energy, specific heat of monatomic gas, extension to di- and tri- atomic gases, behavior at low temperatures. Adiabatic expansion of an ideal gas, applications to atmospheric physics. Real Gas: Van der Waals gas, Equation of state, nature of Vander Waals forces, comparison with experimental P-V curves. The critical constants; gas and vapour. Joule expansion of ideal gas and Vander Waals gas, Joule coefficient, estimates of J-T cooling. Liquefaction of gases: Boyle temperature and inversion temperature. Principle of regenerative cooling, liquefaction of hydrogen and helium. Refrigeration cycle, meaning of efficiency.
- UNIT – II** Thermodynamics The laws of thermodynamics: The Zeroth law, first law of thermodynamics, internal energy as a state function and other applications. Reversible and irreversible changes, Carnot cycle and its efficiency, Carnot theorem and the second law of thermodynamics, Entropy,. The thermodynamic scale of temperature; its identity with the perfect gas scale. Impossibility of attaining the absolute zero; third law of thermodynamics. Thermodynamic relationships: Thermodynamic variables: Maxwell's general relationships, application to Joule – Thomson cooling and adiabatic cooling in a general system, Clausius-Clapeyron Latent heat equation. Cooling due to adiabatic demagnetization, Production and measurement of very low temperatures.
- UNIT – III** Statistical Physics The statistical basis of thermodynamics: Probability and thermodynamic probability, principle of equal a priori probabilities, probability distribution and its narrowing with increase in number of particles. The expressions for average properties. Constraints, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. Some universal laws: The  $\mu$  space representation, division of  $\mu$  space into energy states and into phase cells of arbitrary size, applications to one-dimensional harmonic oscillator and free particles. Equilibrium between two systems in thermal contact, bridge with macroscopic physics. Probability and entropy, Boltzmann entropy relation. Statistical interpretation of second law of thermodynamics. Boltzmann canonical distribution law and its applications; Rigorous form of equipartition of energy.
- UNIT - IV** Maxwellian distribution of speeds in an ideal gas Distribution of speeds and velocities, experimental verification, distinction between mean, rms and most probable speed values. Doppler broadening of spectral lines. Black Body Radiation :Pure temperature dependence, Stefan-Boltzmann law, pressure of radiation, Spectral distribution of Black Body radiation. Wien's displacement law, Rayleigh-Jean's law, the ultraviolet catastrophe, Planck's quantum postulates, Planck's law, complete fit with experiment. Interpretation of behaviour of specific heats of gases at low temperature.
- UNIT - V** Quantum Statistics Transition to quantum statistics; “h” as a natural constant and its implications, cases of particle in a one dimensional box and one-dimensional harmonic oscillator. Indistinguishability of particles and its.

consequences, Bose- Einstein and Fermi-Dirac conditions; applications to liquid helium, Free electrons in a metal, and photons in blackbody chamber. Fermi level and Fermi energy. Transport Phenomena : Transport phenomena in gases; Molecular collisions, mean free path and collision cross sections. Estimates of molecular diameter and mean free path. Transport of mass, momentum and energy and interrelationship, dependence on temperature and pressure.

### **COURSE OUTCOMES:-**

1. understand the concept of Thermodynamics and their laws.
2. Describe the Thermodynamics function and their relations.
3. Student learn about the concepts of Quantum Statics.

### **PRACTICAL:-**

1. To determine the mechanical equivalent of heat of the water (J) by using Callendar & Barne's method.
2. To study and verify the Stefan's law by electrical method.
3. To study the temperature dependence of total radiation and hence, to verify the Stefan's law.
4. To determine the grid voltage plate current characteristics of a Triode valve (6C5) and then to find the triode constants.
5. To determine the plate current  $I_P$  for different plate voltage  $V_P$  when grid voltage  $V_G$  remains fixed.
6. To study and plot the plate characteristics for different values of grid voltage  $V_G$ .
7. To study and plot the transfer characteristic for different values of plate voltage  $V_P$ .
8. To determine the Coefficient of Thermal Conductivity of bad conductors of given material by Lee's Disc method.
9. Study of Brownian motion.

### **Note:-**

- ❖ **One experiment will be asked in the semester practical examination.**

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**CHEMISTRY –III****Syllabus:****Physical Chemistry**

- UNIT – I** Thermodynamics-I Definition of thermodynamic terms: System, surrounding, Types of systems, intensive and extensive properties. State and path functions and their differentials. Thermodynamic process. Concept of heat and work.  
First Law of Thermodynamics: Statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship. Joule's Law: Joule Thomson coefficient and inversion temperature.  
Calculation of  $w$ ,  $q$ ,  $dU$  and  $dH$  for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process. Thermochemistry: Standard state, standard enthalpy of formation: Hess's Law of heat summation and its application. Heat of reaction at constant pressure and at constant volume. Enthalpy of neutralization. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy, Kirchoff's equation.  
Second Law of Thermodynamics- Need for the law, different statements of the law, Carnot cycle and its efficiency. Carnot theorem. Thermodynamic scale of temperature.
- UNIT – II** Thermodynamics-II (a) Concept of entropy: Entropy as a state function, entropy as a function of P&T, entropy change in physical change, Clausius inequality, entropy as criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases. Third Law of Thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions, Gibbs function (G) and Helmholtz function(A) as a thermodynamic quantities, A and G as a criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.  
(b) Chemical equilibrium Equilibrium constant and free energy. Thermodynamic derivation of law of mass action. Le Chateliers's principle. Reaction isotherm and reaction isochore: Clapeyron equation and Clausius- Clapeyron equation, applications.  
(c) Buffers: Mechanism of buffer action, Henderson-Hazel equation, Hydrolysis of salts.  
(d) Corrosion: types, theories and methods of combating it.

**Inorganic Chemistry**

- UNIT – III** Chemistry of elements of I transition series: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their binary compounds such as carbides, oxides and sulphides. Complexes illustrating relative stability of their oxidation states, coordination number and geometry chemistry of elements of II and III transition series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states, magnetic behaviour, spectral properties and stereochemistry
- UNIT – IV** (a) Coordination Compounds: Werner's coordination theory and its experimental verification, EAN Concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, VBT of transition metal complexes.  
(b) Oxidation and Reduction: Use of redox potential data, analysis of redox cycle, redox stability in H<sub>2</sub>O: Frost, Latimer and Pourbaix diagram. Principles involved in the extraction of elements.



## Organic Chemistry

- UNIT – V**
- (a) Electromagnetic Spectrum: Absorption Spectra; UV absorption spectroscopy: Absorption laws (Beer-Lambert law), molar absorptivity, presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones. IR absorption spectroscopy; molecular vibrations, Hook's law, selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorptions of various functional groups and interpretation of IR spectra of simple organic compounds.
- (b) Alcohols: Classification and nomenclature. Monohydric alcohols: nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding, acidic nature, reactions of alcohols. Dihydric alcohols: nomenclature, methods of formation, chemical reactions of vicinal glycols, oxidative cleavage [Pb(OAc)<sub>4</sub> and HIO<sub>4</sub>] and pinacole-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol
- (c) Phenols: Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols: resonance stabilization of phenoxide ion. Reactions of phenols: electrophilic aromatic substitution, acylation and carboxylation. Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben-Hoesch reaction, Lederer-Manasse reaction and Riemer-Tiemann reaction
- (d) Ethers and Epoxides Nomenclature of ethers and methods of their formation, physical properties. Chemical reactions: cleavage and auto oxidation. Ziesel's method. Synthesis of epoxides. Acid and base-catalysed ring opening of epoxides, orientation of epoxide ring opening, reaction of Grignard and organolithium reagents with epoxides.

### PRACTICAL:-

#### Inorganic Chemistry

Calibration of the fractional weights, pipettes and burettes. Preparation of standard solutions. Dilution of 0.1 M to 0.001 M solutions.

Quantitative analysis -Volumetric analysis.

- Determination of acetic acid in commercial vinegar using NaOH.
- Determination of alkali content- antacid tablet using HCl.
- Estimation of calcium content in chalk as calcium oxalate by permagnometry.
- Estimation of hardness of water by EDTA

Gravimetric analysis:

Barium as barium sulphate

#### Organic Chemistry Laboratory Techniques

A. Thin layer chromatography

Determination of R<sub>f</sub> values and identification of organic compounds.

- Separation of green leaf pigments (spinach leaves may be used).
- Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).
- Separation of a mixture of dyes using cyclohexane and ethylacetate (8:5:1.5). B.

**Paper chromatography:** Ascending and Circular Determination of R<sub>f</sub> values and identification of organic compounds

- Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid. Spray reagent ninhydrin.
- Separation of a mixture of DL-alanine, glycine and L-leucine using nbutanol: acetic acid: water (4:1:5). Spray reagent ninhydrin.
- Separation of monosaccharides- a mixture of D-galactose and Dfructose using n-butanol: acetone: water (4:1:5). Spray reagent-aniline hydrogen phthalate.

## **COURSE OUTCOME:-**

Upon successful completion of this course, students will understand kinetics, equilibrium, LeChatelier's principle, acid and base reactions, pH, buffers, colligative properties, and electrochemical applications in an undergraduate laboratory.

Understand the first law of thermodynamics and the role of energy and enthalpy in chemical reactions and perform thermochemical calculations.

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## ENGLISH LANGUAGE AND SCIENTIFIC TEMPER

### COURSE OBJECTIVES:-

- To Study the basic language skills (speaking, listening, reading, and writing) and grammar.
- Comprehensive study of different kinds of letters and applications.
- To study the different kinds of prose and poetry.

### Syllabus:

#### UNIT – I

- |                      |                                      |
|----------------------|--------------------------------------|
| 1. Tina Morris       | : Tree                               |
| 2. Nissim Ezekiel    | : Night of the Scorpion              |
| 3. C.P. Snow         | : Ramanujan                          |
| 4. Roger Rosenblatt  | : The Power of WE                    |
| 5. George Orwell     | : What is Science?                   |
| 6. C.Rajagopalachari | : Three Questions                    |
| 7. Desmond Morris    | : A short extract from the Naked Ape |
| 8. A.G. Gardiner     | : On the rule of the road            |

**UNIT – II** Comprehension of an unseen passage.

**UNIT – III** Letter Writing : Formal Letters, Informal letters, Applications.

**UNIT – IV** Report Writing.

**UNIT – V** Language Skills  
Correction of common errors in sentence structure : usage of pronouns, subject/ verb agreement word order, gender; compound nouns, collective nouns, possessives, articles and prepositions. (advanced)

### COURSE OUTCOMES:-

- Student will be able to understand correct use of grammar and language skills.
- Student will be familiar with different prose and poetry.
- Student should be able to write analytically in a variety of formats, including essays, report writing and application.



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## HUMAN VALUES AND ETHICS

### COURSE OBJECTIVES:-

- To help students understand the basic guidelines, content and process of Human value and value crisis in contemporary Indian Society
- To help students understand the meaning of happiness and prosperity for a human being.
- To help students reflect critically on gender violence .
- To facilitate the students to understand harmony at all the levels of human living, and live accordingly.

### Syllabus:

#### UNIT – I: Concept of value and value crisis in contemporary Indian Society.

1. Concept of value
2. Value crisis at- individual level
3. Value crisis at- Cultural level
4. Value crisis at- Societal level
5. The Indian concept of value.
6. Modern Approach to the study of Values.

#### UNIT – II: Moral and Ethical Human values.

1. Bases for Moral Judgment
2. Some Canons of Ethics
3. Ethics of Duty
4. Ethics of Responsibility
5. Factors to be considered in making Ethical Judgments.
6. Continuous Happiness and Prosperity- A look at basic Human Aspirations.

#### UNIT – III: Moral Values in Profession.

1. What is Profession?
2. Professional Ethos
3. Code of Professional Ethics
4. Corporate social Responsibility

#### UNIT – IV: Gender sensitization.

1. Socialization of Women
2. Demographic consequences
3. Domestic Violence
4. Women's work, its politics and economics , fact and fiction ,Unrecognized and unaccounted work

#### UNIT – V: Co- Curricular Activities and value Education.

1. Games and sports
2. Literary and cultural Activities
3. NSS, NCC activities
4. A New Approach to Human Value Freedom, Creativity Love & Wisdom

## **COURSE OUTCOMES:-**

On completion of this course, the students will be able to: Understand the significance of value inputs in a classroom and start applying them in their life and profession

1. Understand the value of harmonious relationship based on trust and respect in their life and profession.
2. Students will develop a sense of appreciation of women in all walks of life .
3. Understand the role of a human being in ensuring harmony in society and nature.

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## ADVANCED CALCULUS, PARTIAL DIFFERENTIAL EQUATIONS, COMPLEX ANALYSIS AND ABSTRACT ALGEBRA

### COURSE OBJECTIVES:-

- The goal of this course is for students to gain proficiency in computations of advanced calculus.
- To make the student acquire sound knowledge of techniques in solving partial differential equations.
- To familiarize the student with complex analysis.

### Syllabus:

- UNIT – I** Partial differentiation. Change of variables. Euler’s Theorem on homogeneous function, Taylor’s theorem for functions of two variables. Jacobians, Envelopes, Evolutes.
- UNIT – II** Maxima, minima and saddle points of functions of two variables. Beta and Gamma functions. Double and triple integrals. Dirichlet’s integrals.
- UNIT – III** Partial Differential equations of the first order. Lagrange’s solution. Some special types of equations which can be solved easily by methods other than general methods. Charpit’s general method of solution, Partial differential equations of second and higher orders. Homogeneous and non- Homogeneous equations with constant coefficients. Partial differential equations reducible to equations with constant coefficients.
- UNIT – IV** Complex numbers as ordered pairs. Geometric representation of Complex numbers, Continuity and differentiability of Complex functions. Analytical function, Cauchy Riemann equation, Harmonic function, Mobius transformations, fixed point, cross ratio.
- UNIT – V** Group-Automorphisms, inner automorphism. Group of Automorphism, Conjugacy relation and centraliser. Normaliser. Counting principle and the class equation of a finite group. Cauchy’s theorem for finite abelian groups and non abelian groups. Ring homomorphism. Ideals and Quotient Rings.

### COURSE OUTCOMES:-

- Understanding the ideas of advanced calculus and series and an ability to calculate with them and apply them.
- Understanding of the ideas of partial differential equations and facility in solving standard examples.
- Understanding of the ideas of complex analysis and ability to calculate with them.
- Improved facility in abstract algebra.

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**PROBABILITY AND STATISTICS**

- UNIT-I** Sample space, probability axioms, real random variables (discrete and continuous), cumulative distribution function, probability mass/density functions, mathematical expectation, moments, moment generating function, characteristic function, discrete distributions
- UNIT-II** Uniform, binomial, Poisson, geometric, negative binomial, continuous distributions: uniform, normal, exponential.
- UNIT-III** Joint cumulative distribution function and its properties, joint probability density functions, marginal and conditional distributions
- UNIT-IV** expectation of function of two random variables, conditional expectations, independent random variables, bivariate normal distribution, correlation coefficient, joint moment generating function (jmgf) and calculation of covariance (from jmgf), linear regression for two variables.
- UNIT-V** Chebyshev's inequality, statement and interpretation of (weak) law of large numbers and strong law of large numbers, Central Limit theorem for independent and identically distributed random variables with finite variance, Markov Chains, Chapman-Kolmogorov equations, classification of states.

**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 Applications*, 7th Ed., Pearson Education, Asia, 2006.
3. Sheldon Ross, *Introduction to Probability Models*, 9th Ed., Academic Press, Indian Reprint, 2007.
4. Alexander M. Mood, Franklin A. Graybill and Duane C. Boes, *Introduction to the Theory of Statistics*, 3rd Ed., Tata McGraw- Hill, Reprint 2007

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## GROUP WAVES, ACOUSTICS AND OPTICS

### COURSE OBJECTIVE:-

1. To aware the students about various phenomena of Waves, Acoustics and Optics.
2. Describe the phenomena like Interference, Diffraction.

### Syllabus:

- UNIT - 1** Waves: Waves in Media Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, gravity waves and ripples. Group velocity and phase velocity, their measurements. Superposition of waves : Linear homogeneous equations and the superposition principle, Standing waves harmonics and the quality of sound , examples. Chladni's figures and vibrations of a drum. Production and detection of ultrasonic and infrasonic waves and applications.
- UNIT – II** Acoustics Noise and Music , The human ear and its responses , limits of human audibility, intensity and loudness, bel and decibel, the musical scales, temperament and musical instrument. Reflection, refraction and diffraction of sound; Acoustic impedance of a medium, percentage reflection and refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system, sound ranging. Applied acoustics: Transducers and their characteristics. Recording and reproduction of sound, various systems, measurements of frequency, waveform, intensity and velocity. The acoustics of halls, reverberation period, Sabine's formula.
- UNIT – III** Geometrical Optics Fermat's Principle of extremum path, the aplanatic points of a sphere and other applications. General theory of image formation: cardinal points of an optical system, general relationships for thick lens and lens combinations,. Optical instruments: Entrance and exit pupils, need for a multiple lens eyepiece, common types of eyepieces.
- UNIT – IV** Interference of light; The principle of superposition, twoslit interference, coherence requirement for the sources, thin films, interference by a film with two non-parallel reflecting surfaces, Newton's rings. Haidinger fringes ( Fringes of equal inclination). Michelson interferometer, its application for precision determination of wavelength, Intensity distribution in multiple beam interference, Fabry-Perot interferometer and etalon.
- UNIT – V** Fresnel Diffraction Fresnel half period zones, plates, straight edge, rectilinear propagation. Fraunhofer Diffraction: Diffraction at a slit, phasor diagram and integral calculus methods, the intensity distribution, diffraction at a circular aperture and a circular disc, Rayleigh criterion, resolving power of telescope and microscope. Diffraction & Polarization: Diffraction gratings: Diffraction at N parallel slits, plane diffraction grating, reflection grating and blazed gratings. Concave grating and different mountings. Resolving power of a grating. Double refraction and optical rotation: Refraction in uniaxial crystals. Phase retardation plates.

### COURSE OUTCOMES:-

1. Understand the Physics behind various optical phenomena.
2. Understand various natural phenomena which is happening in their surroundings.
3. Explain the relationship in between various optical phenomena.

### PRACTICAL:-

1. To determine the frequency of A.C. Mains by using sonometer.



2. To determine the frequency of A.C. Mains by Melde's Experiment in transverse arrangement.
3. To Study and analysis of human ear (on the basis of physical concepts).
4. To determine the wavelength of sodium light by Newton's rings method.
5. To determine the wavelength of prominent lines of mercury light by plane diffraction grating.
6. To determine the refractive index of the material of the prism using spectrometer.
7. To determine the resolving power of the Telescope.
8. To determine the resolving power of the Prism.
9. To determine the resolving power of the Diffraction Grating.
10. To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula –

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{x}{f_1 f_2}$$

## 11. ULTRASONIC MEASUREMENT LAB

1. To study the characteristic of ultrasound.
2. To determine of the distance by using ultrasonic sensors.
3. To study the object detection by using ultrasonic sensors.
4. To determine the velocity of ultrasonic waves in a non-electrolytic liquid by ultrasonic interferometer.
5. To determine the compressibility of a non-electrolytic liquid by ultrasonic waves.

**Note:-**

- ❖ **One experiment will be asked in the semester practical examination.**

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## CHEMISTRY-IV

## Syllabus:

## Physical Chemistry

- UNIT – I** Phase equilibrium Statement and the meaning of the terms: phase component and the degree of freedom, derivation of the Gibbs phase rule. Phase equilibria of one component system: water, CO<sub>2</sub> and S system. Phase equilibria of two component system: solid liquid equilibria, simple eutectic: Bi-Cd, Pb-Ag system, desilverisation of lead.  
Solid solutions: compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl-H<sub>2</sub>O) (FeCl<sub>3</sub>-H<sub>2</sub>O) and (CuSO<sub>4</sub>-H<sub>2</sub>O) system. Freezing mixtures, acetone-dry ice.  
Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl-H<sub>2</sub>O and ethanol water systems.  
Partial miscible liquids: Phenol-water, trimethylamine-water and nicotine-water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation, Nernst distribution law: thermodynamic derivation, applications.
- UNIT – II** Electrochemistry Electrical transport- conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance, measurement of equivalent conductance, variation of specific conductance and equivalent conductance with dilution.  
Migration of ions and Kohlrausch law, Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes (elementary treatment only).  
Transport number: Definition and determination by Hittorf method and moving boundary method. Application of conductivity measurements: determination of degree of dissociation, determination of K<sub>a</sub> of acids, determination of solubility product of sparingly soluble salt, conductometric titrations.  
Types of reversible electrodes: gas-metal ion, metal-metal ion, metal- insoluble salt-anion and redox electrodes. Electrode reactions, Nernst equation, derivation of cell E.M.F and single electrode potential, standard hydrogen electrode- reference electrodes-standard electrode potential, sign conventions, electrochemical series and its significance. Electrolytic and Galvanic cells, reversible and irreversible cells. Conventional representation of electrochemical cells.  
EMF of a cell and its measurements. Computation of cell EMF. Calculation of thermodynamic quantities of cell reaction ( G, H and K), polarization, over potential and hydrogen over voltage.  
Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient, potentiometric titration. Definition of pH and pK, determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.
- UNIT - III** (a) Chemistry of Lanthanides Elements: electronic structure, oxidation states, ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.  
(b) Chemistry of Actinides: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, Similarities between the later actinides and later lanthanides.  
(c) Acids and Bases: Arrhenius, Brønsted-Lowry, Lux-Flood, Solvent system and Lewis concepts of acids and bases.  
(d) Non-aqueous Solvents: Types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH<sub>3</sub> and liquid SO<sub>2</sub>

## Organic Chemistry

### UNIT – IV

(a) Aldehydes and ketones: Nomenclature and structure of the carbonyl group. Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes and ketones from acid chlorides, synthesis of aldehydes and ketones using 1,3-dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties. Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol perkin and Knoevenagel condensations. Condensation with ammonia and its derivatives. Wittig reaction, Mannich reaction.

Use of acetals as protecting group. Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction. Meerwein-Ponndorf-Verley (MPV), Clemmensen, Wolf-Kishner,  $\text{LiAlH}_4$  and  $\text{NaBH}_4$  reductions, Halogenation of enolizable ketones. An introduction of alpha, beta unsaturated aldehydes and ketones

(b) Carboxylic Acids: Nomenclature, structure and bonding, physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction.

Synthesis of acid chlorides, esters and amides. Reduction of carboxylic acids. Mechanism of decarboxylation. Methods of formation and chemical reactions of unsaturated monocarboxylic acids. Dicarboxylic acids: Methods of formation and effect of heat and dehydrating agents. Methods of formation and chemical reactions of halo acids, hydroxy acids, malic, tartaric and citric acids.

Carboxylic acid derivatives Structure and nomenclature of acid chlorides, esters, amides (urea) and acid anhydrides. Relative stability of acyl derivatives. Physical properties, interconversion of acid derivatives by nucleophilic acyl substitution. Preparation of carboxylic acid derivatives, chemical reactions. Mechanism of esterification and hydrolysis (acidic and basic).

### UNIT – V

Organic Compounds of Nitrogen Preparation of nitroalkanes and nitroarenes. Chemical reaction of nitroalkanes. Mechanism of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media, Picric acid.

Halonitroarenes: reactivity, structure and nomenclature. Structure and nomenclature of amines, physical properties and stereochemistry of amines. Separation of mixture of primary, secondary and tertiary amines. Structural features affecting basicity of amines. Amine salt as phase transfer catalysts. Preparation of alkyl and aryl amines (reduction of nitro compounds, nitriles), reductive amination of aldehydic and ketonic compounds. Gabriel-Phthalimide reaction, Hoffmann bromamide reaction, Reactions

of amines, electrophilic aromatic substitution in aryl amines, reaction of amines with nitrous acid. Synthetic transformation of aryl diazonium salts, azo coupling.

## PRACTICAL:-

### Organic Chemistry

Qualitative analysis

Identification of an organic compound through the functional group analysis, determination of melting point and preparation of suitable derivatives.

### Physical Chemistry

Transition temperature

1. Determination of transition temperature of given substance by thermometric, dilatometric method (e.g.) ( $\text{MnCl}_2 \cdot 4\text{H}_2\text{O} / \text{SrBr}_2 \cdot 2\text{H}_2\text{O}$ ). Phase equilibrium.
2. To study the effect of solute (e.g. NaCl, acetic acid) on the critical solution temperature of two partially miscible liquid (e.g., phenol water system) and to determine the concentration of that soluble in phenol water system.
3. To construct the phase diagram of two component (e.g., diphenyl amine/benzophenone) by cooling curve method.
1. To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/strong base and determine the enthalpy of ionization of the weak acid/ base.

Inorganic chemistry-Quantitative Volumetric Analysis:

5. Estimation of ferrous and ferric by dichromate method.

6. Estimation of copper using thiosulphate.

**COURSE OUTCOME:**

Upon successful completion of this course students will describe the bonding and properties of transition metal coordination compounds

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## SYLLABUS

### B.SC. MATHEMATICS (HONORS)- 5<sup>TH</sup> SEM

#### CORE COURSE 09: 3SBMA501H

#### REAL ANALYSIS

**Unit – I** Riemann Integral, Integrability of continuous and monotonic functions, Fundamental theorems of integral calculus, Mean Value theorems of integral calculus.

**Unit-II** Improper integrals and their convergence. Comparison test, Abel's and Dirichlet's test, Integral as a function of a parameter and its applications.

**Unit-III** Sequences, Theorems on limits of sequences, Monotone convergence theorem, Cauchy's convergence criterion.

**Unit-IV** Infinite series, series of non-negative terms. Comparison test, Ratio test, Rabbe's, logarithmic, De Morgan and Bertrand's tests.

**Unit-V** Alternating series, Leibnitz's theorem.

#### **Recommended Books:**

1. Shanti Narayan, A Course of Mathematical Analysis. S. Chand & Co. New Delhi.
2. T. M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
3. R.R. Goldberg, Real Analysis, Oxford & IBH Publishing Co., New Delhi, 1970.
4. S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
5. P.K. Jain and S.K. Kaushik, An Introduction to Real Analysis, S. Chand & Co., New Delhi, 2000.

**CORE COURSE 10: 3SBMA502H**  
**LINEAR ALGEBRA**

**Unit-I** Vector spaces, subspaces and linear spans, linear dependence and independence. Finite dimensional vector spaces.

**Unit-II** Linear transformations and their matrix representations. Algebra of linear transformations, the rank and nullity theorem.

**Unit-III** Change of basis. Dual spaces, bi dual space and natural isomorphism. Eigen values and eigen vectors of LT.

**Unit-IV** Diagonalization, Cayley Hamilton theorem. Inner product spaces, Cauchy-Schwarz inequality.

**Unit-V** Orthogonal vectors, Orthonormal basis, Bessel's inequality, Gram-Schmidt orthogonalization process.

**Recommended Books:**

1. N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
2. K. Hoffman and R. Kunze, Linear Algebra, 2nd edition, Prentice-Hall of India, New Delhi, 1971.
3. N. Jacobson, Basic Algebra, Vols I & II, W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
4. K.B. Dutta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd, New Delhi, 2000.
5. I.S. Luther and I.B.S. Passi, Algebra, Vol. I - Groups, Narosa Publishing House, Vol. I 1996.

## **CORE COURSE 11: (3SBMA503H)**

### **NUMERICAL ANALYSIS**

**Unit-I** Finite differences of different orders,  $\Delta$ , E and D operators, factorial representation of a polynomial, separation of symbols, sub-division of intervals, differences of zero.

**Unit-II** Concept of interpolation and extrapolation: Newton Gregory's forward and backward interpolation formulae for equal intervals, divided differences and their properties, Newton's formula for divided difference.

**Unit-III** Lagranges formula for unequal intervals, central difference formula due to Gauss, Stirling, Bessel, Laplace and Everett, concept of error terms in interpolation formula.

**Unit-IV** Numerical differentiation. Numerical Quadrature : trapezoidal rule, Simpson's one-third and three-eighth rules, weddle's rule.

**Unit-V** Numerical solutions of differential equations: Euler's method, Milne's method, Picard's method and Runge-Kutta method.

#### **Recommended Books:**

1. Scarborough J.B.: Numerical Mathematical Analysis, Oxford University, Press and Oxford Book Co.
2. Saxena, H.C.: Calculus of finite Differences,
3. Freeman. H.: Finite Differences for Actuarial Students, Cambridge University Press.
4. Aitkinson U.: Eementary Numerical Analysis.
5. Sastry S.S.: Introductory Methods of Numerical Analysis, Fourth Edition, Prentice Hall of India.
6. Kunz, K.S.: Numerical Analysis, McGraw Hill.

## **ELECTIVE PAPER- I (3SBMA504H)**

### **Dynamics**

**Unit-I** Degrees of freedom. Moments and products of inertia. Momental ellipsoid. Equipomental systems.

**Unit-II** Principal axes. D'Alembert's principle. The general equation of motion. Motion of the centre of inertia.

**Unit-III** Motion relative to the centre of inertia. Motion about a fixed axis. Compound pendulum.

**Unit-IV** Motion of a rigid body in two dimensions under finite and impulsive forces. Conservation of momentum and energy.

**Unit-V** Lagrange's equation in generalized coordinates. Theory of small oscillations.

#### **Recommended Books:**

1. Chakraborty, J. G., and Ghosh, Advanced Higher Algebra.
2. Chakraborty, J. G., and Ghosh, P. R., Advanced Analytical Dynamics.
3. Loney, S. L., An Elementary Treatise on the Dynamics of Particles and of Rigid Bodies



## **ELECTIVE PAPER- II (3SBMA505H):**

### **Number Theory**

**Unit-I** Primes and factorization. Division algorithm.

**Unit-II** Congruence and modular arithmetic. Chinese remainder theorem.

**Unit-III** Euler phi function. Primitive roots of unity.

**Unit-IV** Quadratic law of reciprocity, application. Arithmetical functions.

**Unit-V** Mobius inversion formula. The Diophantine equations  $x^2 + y^2 = z^2$ ,  $x^4 + y^4 = z^4$ . Farey sequences.

#### **Recommended Books:**

- 1 David M. Burton, Elementary Number Theory, Wm. C. Brown Publishers, Dubuque, Iowa 1989.
- 2 K. Ireland, and M. Rosen, A Classical Introduction to Modern Number Theory, GTM Vol. 84, Springer-Verlag, 1972.
- 3 G.A. Jones, and J.M. Jones, Elementary Number Theory, Springer-Verlag, 1998.
- 4 W. Sierpinski, Elementary Theory of Numbers, North-Holland, Ireland, 1988.
- 5 Niven, S.H. Zuckerman, and L.H. Montgomery, An Introduction to the Theory of Numbers, John Wiley, 1991.
- 6 H.B. Mann, Addition Theorems, Krieger, 1976.
- 7 Melvyn B. Nathanson, Additive Number Theory: Inverse Problems and the Geometry of Sumsets, Springer-Verlag, 1996.

## **ELECTIVE PAPER III (3SBMA506H)**

### **Discrete Mathematics**

**Unit-I** Lattices and Boolean algebra: Logic: propositional and predicate.

**Unit-II** Lattices as partially ordered sets and as algebraic systems. Duality, Distributive, complemented and complete lattices.

**Unit-III** Lattices and Boolean Algebra. Boolean functions and expressions. Application of Boolean algebra to switching circuits( using AND, OR and NOT gates)

**Unit-IV** Graphs and Planar Graphs: Graph, Multigraph, Weighted Graphs, Directed graphs. Paths and circuits.

**Unit-V** Matrix representation of graphs. Eulerian Paths and Circuits. Planar graphs.

#### **Recommended Books:**

1. C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, 1986.
2. J.P. Tremblay and R. Manohar, Discrete Mathematical Structures with Applications to Computer Science, McGraw-Hill Book Co., 199
3. S. Wiitala, Discrete Mathematics: A Unified Approach, McGraw-Hill Book Co.
4. N. Deo, Graph Theory with Applications to Computer Science, Prentice-Hall of India.

## **ELECTIVE PAPER- IV (3SBMA507H):**

### **Metric spaces**

**Unit-I** Definition and examples, neighbourhoods, limit points, interior, and boundary points.

**Unit-II** Open and closed sets. Closure, interior, and boundary of a set. Subspaces.

**Unit-III** Cauchy sequences and complete spaces. Cantor's intersection theorem and the contraction mapping principle.

**Unit-IV** Dense and nowhere dense subsets. Baire Category Theorem.

**Unit-V** Compactness: Sequential compactness and Heine-Borel property, totally bounded spaces, finite intersection property, continuous functions on compact sets.

#### **Recommended Books:**

1. Kolmogorov, A. N., and Fomin, S. V., Elements of the Theory of Functions and Functional Analysis, Vol 1, Metric and normed spaces, Graylock, Rochester; Dover, New York.
2. Kolmogorov, A. N., and Fbmin, S. V., Introductory Real Analysis, Dover, New York.
3. Goldberg, Methods of Real Analysis.
4. Rudin, Principles of Mathematical Analysis.
5. Simmons, Introduction to Topology and Modern Analysis

**SYLLABUS**  
**B.SC. MATHEMATICS (HONORS)- 6<sup>TH</sup> SEM**

**CORE COURSE 12: (3SBMA601H)**

**SPECIAL FUNCTIONS**

**Unit-I** Series solution of differential equations – Power series method.

**Unit-II** Definitions of Beta and Gamma functions. Bessel equation and its solution: Bessel functions and their properties.

**Unit-III** Convergence, recurrence, Relations and generating functions, Orthogonality of functions.

**Unit-IV** Legendre and Hermite differentials equations and their solutions: Legendre and Hermite functions and their properties-Recurrence Relations and generating functions.

**Unit-V** Orthogonality of Legendre and Hermite polynomials. Rodrigues' Formula for Legendre & Hermite Polynomials, Laplace Integral Representation of Legendre polynomial.

**Recommended Books:**

1. Erwin Kreyszing : Advanced Engineering Mathematics, John Wiley & Sons, Inc., New York, 1999
2. A.R. Forsyth : A Treatise on Differential Equations, Macmillan and Co. Ltd.
3. I.N. Sneddon : Special Functions on mathematics, Physics & Chemistry.
4. W.W. Bell : Special Functions for Scientists & Engineers.

## **CORE COURSE 12: (3SBMA602H)**

### **OPERATION RESEARCH**

**Unit-I** Linear Programming: Simplex Method, Revised simplex method.

**Unit-II** Duality in Linear programming, Application of Linear Programming to Economic and Industrial Problems.

**Unit-III** Nonlinear Programming: The Kuhn-Tucker conditions, Quadratic programming, Convex programming.

**Unit-IV** Replacement Models: Introduction, Replacement policies for items whose efficiency deteriorates with time, Replacement policies for items that fail completely.

**Unit-V** Sequencing Model: Classification of self problems, processing of n jobs through two machines, three machines, processing of two jobs through m machines.

#### **Recommended Books:**

1. Taha, Operations Research, Macmillan.
2. B.E. Gillet, Introduction to Operations Research, McGraw-Hill.
3. S.S.Rao, Optimization Theory and Applications, Wiley Eastern.
4. G.Hadley, Linear programming, Addison-Wesley

## **CORE COURSE 12: (3SBMA603H)**

### **NUMERICAL METHOD USING C PROGRAMMING**

**Unit-I** Numerical Methods Programming in C of the following set of problems:

- Bisection method.
- Regula Falsi method.
- Newton-Raphson method.

**Unit-II** Numerical Methods Programming in C of the following set of problems:

- Lagrange interpolation.
- Newton's forward and backward interpolation.
- Trapezoidal and Simpson one-third rules.

**Unit-III** Numerical Methods Programming in C of the following set of problems:

- Gauss Quadrature.
- Gauss elimination method.
- LU decomposition.

**Unit-IV** Numerical Methods Programming in C of the following set of problems:

- Gauss-Siedel method.
- Jacobi's method (eigenvalue).

**Unit-V** Numerical Methods Programming in C of the following set of problems:

- Euler's method.
- Runge-Kutta's method.
- Predictor-corrector method.

**Recommended Books:**

1. Kernighan, B. W., and Ritchie, D. M., The C Programming Language, 2nd ed., Prentice Hall, 1989
2. Mullish, Henry, and Herbert, L., Spirit of C: An Introduction to Modern Programming, Jaico publishers.
3. Hancock, Les, and Krieger, Morris, The C primer, McGraw Hill, 1998.
4. Gottfried, Byron S., Theory and Problems of Programming with C, Tata McGraw Hill, 1998.
5. Deitel, H. N., and Deitel, P. J., C How to Program, Prentice Hall.

**ELECTIVE PAPER I**  
**CORE COURSE 12: (3SBMA604H)**

**DIFFERENTIAL GEOMETRY**

**Unit-I** Theory of space curves: Space curves, Planer curves, Serret-Frenet formulae.

**Unit-II** Osculating circles and spheres. Existence of space curves and evolutes and involutes.

**Unit-III** Theory of surfaces: Parametric curves on surfaces. Direction coefficients. First and second Fundamental forms.

**Unit-IV** Principal and Gaussian curvatures. Lines of curvature, Euler's theorem.

**Unit-V** Rodrigue's formula, Conjugate and Asymptotic lines. Developable, Developable associated with space curves, Developable associated with curves on surfaces. Minimal surfaces.

**Recommended Books:**

1. T.J. Willmore - An Introduction to Differential Geometry. Oxford University Press. 1965.
2. B. B. Sinha, Differential Geometry, An Introduction. Shyam Prakashan Mandir Allahabad, 1978.
3. J.A. Thorpe, Introduction to Differential Geometry, Springer-Verlog.
4. M. Docarmo, Differential Geometry of Curves and Surfaces, Prentice-Hall, 1976.
5. C.E. Weatherburn, Differential Geometry of Three Dimensions, Cambridge Univ. Press, 1955.

**ELECTIVE PAPER II**  
**CORE COURSE 12: (3SBMA604H)**

**HYDROSTATICS**

**Unit-I** Pressure of heavy fluid. Conditions of equilibrium for homogeneous, heterogeneous, and elastic fluid.

**Unit-II** Lines of force. Surfaces of equal pressure. Centre of pressure.

**Unit-III** Thrusts on plane and curved surfaces. Rotating fluid.

**Unit-IV** Floating bodies, Stability, Meta-centre. Curves of buoyancy. Surface of buoyancy.

**Unit-V** Vessel containing liquid. Oscillation of floating bodies.

**Recommended Books:**

1. Maliur Rahman, Md., Hydrostatics.
2. Ramsey, A. S., Dynamics (Part I).
3. Sharma, B. D., Hydrostatics
4. Kar, J. M.t Hydrostatics
5. Besant, W. H., Ramsey, A. S., A Treatise on Hydromechanics (Part I).



**ELECTIVE PAPER III**  
**CORE COURSE 12: (3SBMA608H)**

**PROJECT AND VIVA-VOCE**

Some innovation in form of the written project, in Mathematics/application of Mathematics, based on the knowledge gained during the under graduate course of studies in view of the developments in Mathematics.

A project report shall clearly state the problem addressed, the methodology adopted, the assumptions and the hypotheses formulated, any previous reference to the study undertaken, statistical analyses performed and the broad conclusion drawn.0