BACHELOR OF SCIENCE

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

COURSE STRUCTURE OF B.SC PHYSICS (HONOURS) Ist SEMESTER

Course Details				External Assesment		Internal Assesment				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				
Theory Group													
3HBHL101H	**Ability Enhancement**	हिन्दी भाषा और संरचना	50	25	8	10	4	15	6	2	-	-	2
3CBCA201H	**Ability Enhancement**	Basic Information Computer Technology - I	50	25	08	-	-	-	-	1	-	1	2
3SBPH103H	**Core Course -1**	Mechanics, Oscillations and Properties of Matter	100	50	17	20	08	30	12	4	-	-	4
3SBPH106H	**Core Course -2**	Mathematical Physics -I	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective -1	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				**Term End Practical Exam**				**Sessional**					
3SBPH103H	**Practical**	Mechanics, Oscillations and Properties of Matter	50	25	08	25	08	-	-	-	-	2	2
3SBPH106H	**Practical**	Mathematical Physics -I	50	25	08	25	08	-	-	-	-	2	2
3SBPH104H	**Practical**	Chemistry –I	50	25	08	25	08	-	-	-	-	2	2
3CBCA201H	**Practical**	Basic of Computer & Information technology-I	-	-	-	10	04	15	06	-	-	-	-
	Grand Total		**550**	**-**	**-**	**-**	**-**	**-**	**-**	**15**	**-**	**07**	**22**

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 1st Semester will remain same in IInd, IIIrd and IVthSeemster (See the specialisation subject as mentioned below)***

Generic Elective- 1		
Specialisation	**Course Code**	**Subject**
Mathematics	3SBMA105H	Algebra, Trigonometry & Geometry
Chemistry	3SBCH104H	Chemistry –I

BACHELOR OF SCIENCE

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

COURSE STRUCTURE OF PHYSICS (HONOURS) IInd SEMESTER

Course Details				External Assesment		Internal Assesment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wis Distributio
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
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
3SBPH203H	**Core Course-3**	Mathematical Background, Electrostatics, and Steady Currents	100	50	17	20	08	30	12	4	-	-	4
3SBPH206H	**Core Course-4**	Mathematical Physics-II	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective-2	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				**Term End Practical Exam**		**Lab Performance**		**Sessional**					
3SBPH203H	**Practical**	Mathematical Background, Electrostatics, and Steady Currents	50	25	08	25	08	-	-	-	-	2	2
3SBPH206H	**Practical**	Mathematical Physics-II	50	25	08	25	08	-	-	-	-	2	2
3SBCH204H	**Practical**	Chemistry –II	50	25	08	25	08	-	-	-	-	2	2
Skill Courses								**Sessional**					
***	**Skill Enhancement**	Skill Enhancement Elective Course-I	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		**600**	**-**	**-**	**-**	**-**	**-**	**-**	**17**	**-**	**07**	**24**

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 1st Semester will remain same in IInd, IIIrd and IVthSeemster (See the specialisation subject as mentioned below)***

Generic Elective- 2		
Specialisation	**Course Code**	**Subject**
Mathematics	3SBMA205H	Calculus, Differential Equations & Vector Calculus
Chemistry	3SBCH204H	Chemistry –II

BACHELOR OF SCIENCE

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

COURSE STRUCTURE OF PHYSICS (HONOURS) IIIrd SEMESTER

Course Details				External Assesment		Internal Assesment				Credit Distribution			Allotted Credits
Course Code	Course Type	Course Title	Total Marks	Major		Minor		Sessional		L	T	P	Subject wis Distributio
				Max Marks	Min Marks	Max Marks	Min Marks	Max Marks	Min Marks				
Theory Group													
3HBHL302H	**Ability Enhancement**	हिन्दी भाषा सवेधना 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
3SBPH303H	**Core Course-5**	Kinetic Theory of Gases, Thermo-dynamics and Statistical Mechanics	100	50	17	20	08	30	12	4	-	-	4
3SBPH306H	**Core Course-6**	Mathematical Physics-III	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective-3	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				**Term End Practical Exam**		**Lab Performance**		**Sessional**					
3SBPH303H	**Practical**	Kinetic Theory of Gases, Thermo-dynamics and Statistical Mechanics	50	25	08	25	08	-	-	-	-	2	2
3SBPH306H	**Practical**	Mathematical Physics-III	50	25	08	25	08	-	-	-	-	2	2
3SBCH304H	**Practical**	Chemistry –III	50	25	08	25	08	-	-	-	-	2	2
3CBCA502H	**Practical**	Basic Information Computer Technology - II	-	-	-	10	04	15	06	-	-	-	-
Skill Courses								**Sessional**					
***	**Skill Enhancement**	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2
	Grand Total		**600**	**-**	**-**	**-**	**-**	**-**	**-**	**16**	**-**	**08**	**24**

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 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 1st Semester will remain same in IInd, IIIrd and IVthSeemster (See the specialisation subject as mentioned below)***

Generic Elective- 3*		
Specialisation	**Course Code**	**Subject**
Mathematics	3SBMA305H	Calculus, Differential Equation and Mechanics
Chemistry	3SBCH304H	Chemistry –III

BACHELOR OF SCIENCE

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

COURSE STRUCTURE OF PHYSICS (HONOURS) IVth SEMESTER

Course Details				External Assesment		Internal Assesment				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				
Theory Group													
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
3SBPH403H	**Core Course-7**	Group Waves, Acoustics and Optics	100	50	17	20	08	30	12	4	-	-	4
3SBPH406H	**Core Course-8**	Digital System & Application	100	50	17	20	08	30	12	4	-	-	4
	Generic Elective-4	(Select From Below Given Specialised Subject)*	100	50	17	20	08	30	12	4	-	-	4
Practical Group				**Term End Practical Exam**		**Lab Performance**		**Sessional**					
3SBPH403H	**Practical**	Group Waves, Acoustics and Optics	50	25	08	25	08	-	-	-	-	2	2
3SBPH406H	**Practical**	Digital System & Application	50	25	08	25	08	-	-	-	-	2	2
3SBCH404H	**Practical**	Chemistry –IV	50	25	08	25	08	-	-	-	-	2	2
	Grand Total		**550**	**-**	**-**	**-**	**-**	**-**	**-**	**16**	**-**	**06**	**22**

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 1st Semester will remain same in IInd, IIIrd and IVthSeemster (See the specialisation subject as mentioned below)***

Generic Elective- 4*		
Specialisation	**Course Code**	**Subject**
Mathematics	3SBMA405H	Advanced Calculus, Partial Differential Equations, Complex Analysis and Abstract Algebra
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			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				
Theory Group													
3SBPH501H	**Core Course - 9**	**Physics-V (Quantum Mechanics, Atomic, Molecular and Nuclear Physics)**	100	50	17	20	08	30	12	4	-	-	4
3SBPH502H	**Core Course - 10**	**Physics-V (Astro Physics & Atmospheric Science)**	100	50	17	20	08	30	12	4	-	-	4
3SBPH503H	**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
Practical Group				**Term End Practical Exam**		**Lab Performance**		**Sessional**					
3SBPH501H	**Practical**	**Physics-V (Quantum Mechanics, Atomic, Molecular and Nuclear Physics)**	50	25	08	25	08	-	-	-	-	2	2
3SBPH502H	**Practical**	**Physics-V (Astro Physics & Atmospheric Science)**	50	25	08	25	08	-	-	-	-	2	2
3SBPH503H	**Practical**	Analog Systems and applications	50	25	08	25	08	-	-	-	-	2	2
**	**Practical**	Elective table-I	50	25	08	25	08	-	-	-	-	2	2
***	**Practical**	Elective table-II	50	25	08	25	08	-	-	-	-	2	2
								Sessional					
*****	**Skill Enhancement**	Skill Enhancement Elective Course-II	50	-	-	-	-	50	20	1	-	1	2
Grand Total			**800**							**21**	**-**	**11**	**32**

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%

COURSE STRUCTURE OF Physics (HONOURS) SEMESTER VIth

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				
Theory Group													
3SBPH601H	**Core Course - 12**	**Physics-VI (Solid State Physics, Electronics and Laser)**	100	50	17	20	08	30	12	4	-	-	4
3SBPH602H	**Core Course -13**	**Physics-VI (Nano Technology and Material Science)**	100	50	17	20	08	30	12	4	-	-	4
3SBPH603H	**Core Course -14**	**Nuclear and Particle Physics**	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
Practical Group				**Term End Practical Exam**		**Lab Performance**		**Sessional**					
3SBPH601H	**Practical**	**Physics-VI (Solid State Physics, Electronics and Laser)**	50	25	08	25	08	-	-	-	-	2	2
3SBPH602H	**Practical**	**Physics-VI (Nano Technology and Material Science)**	50	25	08	25	08	-	-	-	-	2	2
3SBPH603H	**Practical**	**Nuclear and Particle Physics**	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
Grand Total			**750**							**20**	**-**	**10**	**30**

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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%
Compulosory Project/Dessertation with choice in any Disciplinery 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 5TH			ELECTIVES FOR SEMESTER 6TH		
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

Non-Technical			
Elective No.	**Department/ Faculty Name**		
	Faculty of Information Technology		
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)
	Faculty of Management		
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)
	Faculty of Commerce		
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)
	Faculty of Humanities		
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)
	Faculty of Science		
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)
	Faculty of Education		
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

Non-Technical			
Elective No.	**Department/ Faculty Name**		
	Faculty of Information Technology		
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)
	Faculty of Management		
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)
	Faculty of Commerce		
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)
	Faculty of Humanities		
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)
	Faculty of Science		
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)
	Faculty of Education		
I	SCBE 403	Understanding of ICTC (Information Communication Technology)	2(1+0+1)
II	SCPE 201	Yoga Education	2(1+0+1)

COURSE CODE: 3HBHL101H

हिन्दी भाषा और संरचना

पाठ्यक्रम के उद्देश्यः

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**

करूणा) निबंध (	आचार्य रामचन्द्र शुक्ल
समन्वय की प्रक्रिया) निबंध(	रामधारी सिंह दिनकरश
बिच्छी बुआ) कहानी(	डॉ .लक्ष्मण विष्ट बटरोहीश
अनुवाद	परिभाषा प्रकारए महत्वए विशेषताएं
हिन्दी की शब्द-संपदा	
परिभाषिक शब्दावली	

इकाई-**3**

विलायत पहुंच ही गया) आत्मकथांश (	महात्मा गांधी
अफसर (व्यंग्य)	शरद जोशी
तीर्थयात्रा) कहानी(	डॉ .मिथिलेष 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-लेखनःमहत्व 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

अपेक्षित परिणामः

1. विद्यार्थी भारत भूमि से प्रेम व स्नेह के भावों को बढ़ा सकेगें।
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 होगें।

COURSE CODE: 3CBCA201H

BASIC COMPUTER & INFORMATION TECHNOLOGY-I

COURSE OBJECTIVE:-

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

Syllabus:

UNIT – I Introduction to computer organization History of development of Computer system oncepts. Characteristics, Capability and limitations.
Generation of computer. Types of PC's Desktop. Laptop, Notebook. Workstation & their Characteristics.

इकाई – 1 कम्प्यूटर ऑर्गनाईजेशन 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 ऑर्गनाईजेशन का परिचय कम्प्यूटर सिस्टम के आधार उपकरण, कंट्रोल युनिट, ए.एल. यू. इनपूट/आउटपुट फंक्शन औंर विशेषताएं, मेमोरी रेम, रोम, इपी रोम, पी रोम, और अन्य प्रकार की मैमोरी।

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 andSpeakers.

इकाई – 3 इनपुट तथा आउटपुट डिवाईसेस **इनपुट डिवाइसः** कीबोर्ड, माउस, ट्रेकबॉल, जॉयस्टीक, डिजिटाईजिंग टेबलेट, स्केनर्स, डिजिटल केमरा, एमआईसीआर, ओसीआर, ओएमआर, बार कोड रीडर, आवाज को पहचानने वाला, लाइटपेन, टच स्क्रीन।
इनपुट डिवाइसः मॉनीटर की विशेषताएं एवं मोनीटर के प्रकार, वीडियों स्टैण्डर्ड VGA, SVGA, XGA, LCD स्क्रीन आदि, प्रिंटर्स, डेजी व्हील, डॉट मैट्रिक्स, इंकजेट, लेजर, लाईन प्रिंटर, प्लोटर, साउंड कार्डस एंव 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 डिवाईसेस स्टोरेज फंडामेंटल्स प्रईमेरी विरूद्ध भिन्न स्टोरेज डिवाईजेस मेग्नेटिक टेप, कार्टरेज टेप, डाआ ड्राईव्स, हार्ड डिस्क ड्राईव्स फ्लोपी डिस्कस, सी.डी., वी.सी.डी., सी.डी.–आर. सी.डी– आर. डब्ल्यू, जीप ड्राईव, 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

विन्डोस 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.

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COURSE CODE: 3SBPH103H

MECHANICS, OSCILLATIONS AND PROPERTIES OF MATTER

COURSE OBJECTIVE:-

1.To understands 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 tensional 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° 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.Gate 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 ($\boldsymbol{g}$) 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 & CompoundLogic Gates.

Note:-

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

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COURSE CODE: 3SBPH106H

MATHEMATICAL PHYSICS-I

COURSE OBJECTIVE

The emphasis of course is to equip students with the mathematical and critical skills required in solving problems of interest to physicists. The course will also expose students to fundamental computational physics skills enabling them to solve a wide range of physics problems. The skills developed during course will prepare them not only for doing fundamental and applied research but also for a wide variety of careers.

UNIT- I Calculus Functions: Recapitulate the concept of functions. Plot and interpret graphs of functions using the concepts of calculus.

First Order Differential Equations: First order differential Equations: Variable separable, homogeneous, non-homogeneous, exact and inexact differential equations and Integrating Factors. Application to physics problems.

UNIT- II Second Order Differential Equations: Homogeneous Equations with constant coefficients. Wronskian and general solution. Particular Integral with operator method, method of undetermined coefficients and method of variation of parameters. Cauchy-Euler differential equation and simultaneous differential equations of First and Second order.

UNIT –III Vector Analysis Vector Algebra: Scalars and vectors, laws of vector algebra, scalar and vector product, triple scalar product, interpretation in terms of area and volume, triple cross product, product of four vectors. Scalar and vector fields.

Vector Differentiation: Ordinary derivative of a vector, the vector differential operator. Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Laplacian operator. Vector identities.

UNIT- IV Vector Integration: Ordinary Integrals of Vectors. Double and Triple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Scalar and Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems, their verification (no rigorous proofs) and applications. Orthogonal Curvilinear Coordinates: Orthogonal Curvilinear Coordinates. Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.

UNIT- V Probability and statistics: Independent and dependent events, Conditional Probability. Bayes' Theorem, Independent random variables, Probability distribution functions, special distributions: Binomial, Poisson and Normal. Sample mean and variance and their confidence intervals for Normal distribution.

COURSE LEARNING OUTCOMES

After completing this course, student will be able to

- Draw and interpret graphs of various functions.
- Solve first and second order differential equations and apply these to physics problems.
- Understand the concept of gradient of scalar field and divergence and curl of vector fields.
- Perform line, surface and volume integration and apply Green's, Stokes' and Gauss's Theorems to compute these integrals.
- Apply curvilinear coordinates to problems with spherical and cylindrical symmetries.
- Understand elementary probability theory and the properties of discrete and continuous distribution functions.
- In the laboratory course, the students will be able to design, code and test simple programs in C++ in the process of solving various problems.

PRACTICAL

Topics	Descriptions with Applications
Introduction and Overview	Computer architecture and organization, memory and Input/output devices,
Basics of scientific computing	Binary and decimal arithmetic, Floating point numbers, single and double precision arithmetic, underflow and overflow - emphasize the importance of making equations in terms of dimensionless variables, Iterative methods
Algorithms and Flow charts	Purpose, symbols and description,
Introduction to C++	Introduction to Programming: Algorithms: Sequence, Selection and Repetition, Structured programming, basic idea of Compilers. Data Types, Enumerated Data, Conversion & casting, constants and variables, Mathematical, Relational, Logical and Bit wise Operators. Precedence of Operators, Expressions and Statements, Scope and Visibility of Data, block, Local and Global variables, Auto, static and External variables. Programs: □ To calculate area of a rectangle □ To check size of variables in bytes (Use of sizeof( ) Operator) □ converting plane polar to Cartesian coordinates and vice versa
C++ Control Statements	if-statement, if-else statement, Nested if Structure, Else-if statement, Ternary operator, Goto statement, switch statement, Unconditional and Conditional looping, While loop, Do-while loop, For loop, nested loops, break and continue statements Programs: • To find roots of a quadratic equation • To find largest of three numbers • To check whether a number is prime or not • To list Prime numbers up to 1000
Random Number generator	Generating pseudo random numbers To find value of pi using Monte Carlo simulations. To integrate using Monte Carlo Method

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COURSE CODE: 3SBMA105H

ALGEBRA, TRIGONMETRY & 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 trignometrical 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 An, 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

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COURSE CODE: 3SBCH104H

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, sinx, logx; 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, potentiometic, optical methods- polarimetry and spectrophotometery. 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, clatherates, 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_2SO_4.

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_2SO_4 by studying the kinetics of hydrolysis of ester.
4. To study kinetically the reaction rate of decomposition of iodide by H_2O_2.
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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COURSE CODE: 3HBEL201H

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.

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COURSE CODE: 3MBFE101H

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 8s 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 8s 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.

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COURSE CODE: 3SBPH203H

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 - 1 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, $\tilde{N} \times B = \mu 0J$, $\tilde{N}.B=Q$; 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.dl., integral and differential forms of Faraday's laws. self and mutual inductance9.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 mangnetics.

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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COURSE CODE: 3SBPH206H

MATHEMATICAL PHYSICS-II

COURSE OBJECTIVE

The emphasis of course is to equip students with the mathematical tools required in solving problems interest to physicists and expose them to fundamental computational physics skills thus enabling them to solve a wide range of physics problems. This course will aim at introducing the concepts of Fourier series, special functions, linear partial differential equations by separation of variable method.

UNIT - I Fourier Series: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Even and odd functions and their Fourier expansions (Fourier Cosine Series and Fourier Sine Series). Application. Summing of Infinite Series. Parseval's Identity and its application to summation of infinite series.

UNIT – II Frobenius Method and Special Functions: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations: Legendre, Bessel, Hermite and Laguerre Differential Equations.

UNIT – III Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.

UNIT – IV Some Special Integrals: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions.

UNIT – V Partial Differential Equations: Solutions to partial differential equations (2 or 3 independent variables) using separation of variables: Laplace's Equation in problems of rectangular geometry. Solution of wave equation for vibrational modes of a stretched string, rectangular and circular membranes. Solution of 1D heat flow equation. (Wave/Heat equation not to be derived).

COURSE LEARNING OUTCOMES

On successfully completing this course, the students will be able to

- Represent a periodic function by a sum of harmonics using Fourier series and their applications in physical problems such as vibrating strings etc.
- Obtain power series solution of differential equation of second order with variable coefficient using Frobenius method.
- Understand properties and applications of special functions like Legendre polynomials, Bessel functions and their differential equations and apply these to various physical problems such as in quantum mechanics.
- Learn about gamma and beta functions and their applications.
- Solve linear partial differential equations of second order with separation of variable method.
- In the laboratory course, the students will learn the basics of the Scilab software/Python interpreter and apply appropriate numerical method to solve selected physics problems both using user defined and inbuilt functions from Scilab/Python. They will also learn to generate and plot Legendre polynomials and Bessel functions and verify their recurrence relation.

PRACTICAL :

Topics	Description with Applications
Introduction to Numerical computation software using Scilab or Python	Introduction to Scilab, Advantages and disadvantages, Scilab environment, Command window, Figure window, Edit window, Variables and arrays, Initializing variables in Scilab, Multidimensional arrays, Sub-array, Special values, Displaying output data, data file, Scalar and array operations, Hierarchy of operations, Built in Scilab functions, Introduction to plotting, 2D and 3D plotting, Branching Statements and program design, Relational and logical operators, the while loop, for loop, details of loop operations, break and continue statements, nested loops, logical arrays and vectorization. User defined functions, Introduction to Scilab functions, Variable passing in Scilab, optional arguments, preserving data between calls to a function, Complex and Character data, string function, Multidimensional arrays an introduction to Scilab file processing, file opening and closing, Binary I/o functions, comparing binary and formatted functions, Numerical methods and developing the skills of writing a program.
Interpolation by Newton Gregory Forward and Backward difference formula, Error estimation of linear interpolation. Lagrange Interpolation.	Evaluation of trigonometric functions e.g. *sin(x), cos(x), tan(x)* etc – Given the values at n points in a tabulated form, evaluate the value at an intermediate point.
Numerical Integration: Newton Cotes Integration methods (Trapezoidal and Simpson rules) for definite integrals	Given acceleration with equidistant time data calculate position and velocity and plot them. Application to other mathematical and physical problems

Solution of Linear system of equations: Solve system of linear equations using Gauss elimination method and Gauss Seidal method. Inverse of a matrix (by Gauss elimination)	Application to Solution of mesh equations of electric circuits (3 meshes) Solution of coupled spring mass systems (3 masses)
Generation of Special functions using user defined functions and compare with Scilab built in functions	Generating and plotting Legendre Polynomials Generating and plotting Bessel functions Verification of recurrence relation Use the data obtained above for Legendre polynomials or Bessel's function at N points and find its value at an intermediate point using Lagrange interpolation.
Solution of Ordinary Differential Equations (ODE) First order Differential equation Euler, modified Euler and Runge-Kutta (RK) second and fourth order methods	First order differential equation (Initial value problems) Radioactive decay Current in RC, LC circuits with DC source Newton's law of cooling Classical equations of motion

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COURSECODE: 3SBMA205H

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 quations.
- 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.

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COURSE CODE: 3SBCH204H

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 and 2 , 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 NH3, SF4, ClF3, ICl2 - and H2O.

UNIT - II

A. Molecular Orbital theory for homonuclear and heteronuclear (CO and 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, mercuration 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

KMnO4, 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; mechanims of nucleophilic substitution reaction of alkyl halides, SN2 and SN1 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:

COURSE CODE: 3HBHL302H

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।

पाठ्यक्रमः

इकाई **-1**

1. भारतीय संस्कृति
2. भारतीय समाज व्यवस्था
3. सभ्यता एव 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;कहानीद्ध प्रेमचंद
4. मातृ भूमिगुप्त मैथिलीशरण रू;कविताद्ध
5. साहित्यकार का दायित्व डॉ. भारती प्रेम ण

अपेक्षित परिणामः

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

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COURSE CODE: 3CBCA502H

BASIC INFORMATION COMPUTER 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 वर्डः फीचर्स, क्रीएटिंग, सेविंग एवं ओपनिंग, मल्टी डॉक्यूमेंट विंडोस, एडिटिंग टेक्स्ट सिलेक्टिंग, इंसर्टिंग, डिलीटिंग टेक्स्ट।
- प्रीव्यूविंग डॉक्यूमेंटस, प्रिटिंगडॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, प्रिंट डॉक्यूमेंट फ्रॉम दि स्टेण्डर्ड टूलबार, डॉक्यूमेंट को मीनू द्वारा प्रिंट करना, श्रिकिंग ए डॉक्यूमेंट इन ए फाइल पेज, पेजों को कम करना।
- फॉरमेटिंग डॉक्यूमेंट्सः 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 इंफॉरमेशन, 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 रिफ्रेसिंग के साथ काम करना।
- ऑटो सम फॉर्मूला को कॉपी करना, एब्सल्यूट 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: पॉवरपाइंट का परिचय–1

- फीचर्स एंड विभिन्न वर्जन्स
- प्रजेन्टेशन तैयार करना स्लाइड मास्टर एवं टेम्प्लेट इन वेरियस कलर स्कीम।
- पॉवरपाइंट के भिन्न व्यूस के साथ काम करना एवं पॉवरपाइंट के मेन्यू।
- स्लाईडस के साथ काम करना, नये स्लाईड तैयार करना एवं मूव करना, कॉपी करना, डिलीट करना, डुपलीकेट स्लाईड तैयार करना, ले–आडटिंग करना, जूम इन और आउट करना।
- एडिटिंग एवं फॉरमेटिंग टेक्स्टः अलाइनमेंट, एडिटिंग, इनसर्टिंग, डिलीटिंग, सिलेक्टिंग, फॉरमेटिंग 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: पॉवरपाइंट का परिचय–2

- बुलेट्स, फुटर, पैराग्राफ फॉरमेटिंग, स्पेल चेकिंग।
- प्रिंटिंग प्रजेन्टेशन, प्रिंट स्लाईडस, नोट्स, हेण्डआउट एवं आउट लाईन्स।
- इंसर्टिंग आब्जेक्ट, ड्राइंग एवं इंसर्टिंग ऑब्जेक्टस क्लिपआर्ट पिक्चर्स एवं चार्टस का प्रयोग करना।
- स्लाईडस सोर्टर, स्लाईड ट्रांजिशन के प्रभाव एवं अन्य ऐनिमशन प्रभाव।
- प्रेजेटिंग शो मेकिंग स्टेंड 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 परिचयः

इवोल्यशन, प्रोटोकोल, विचारधारा, इंटरनेट, डायल अप कनेक्टिविटि, डीज्डलाइन, वीएसटी, ब्रोडबेंड, यू.आर. एल्स., डोमेननेम्स, पोसटल्स, 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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COURSE CODE: 3SBPH303

KINETIC THEORY OF GASES, THERMO-DYNAMICS AND STATISTICAL MACHANICS

COURSE OBJECTIVES:-

1. To express the basic assumption of the kinetic theory of gases.
2. Students learns 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 demagenetization, 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. Constrains, accessible and inaccessible states, distribution of particles with a given total energy into a discrete set of energy states. Some universal laws: The μ space representation, division of μ 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 is 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 laus.
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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COURSE CODE: 3SBPH306H

MATHEMATICAL PHYSICS-III

COURSE OBJECTIVE:

The emphasis of the course is on applications in solving problems of interest to physicists. Students are to be examined on the basis of problems, seen and unseen.

UNIT – I Complex Analysis: Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts.

UNIT – II Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.

UNIT – III Integrals Transforms: Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem.

UNIT – IV Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential 25 equations: One dimensional Wave and Diffusion/Heat Flow Equations.

UNIT – V Laplace Transforms: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform.

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J.
- Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A.Krzywicki, 1967, Dover Publications
- Complex Variables, A.S.Fokas & M.J.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
- Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press
- Complex Variables and Applications, J.W. Brown & R.V. Churchill, 7th Ed. 2003,
- Tata McGraw-Hill
- First course in complex analysis with applications, D.G. Zill and P.D. Shanahan,
- 1940, Jones & Bartlett

PHYSICS PRACTICAL-C VIII LAB

Scilab/C++ based simulations experiments based on Mathematical Physics problems like

1. Solve differential equations:

$dy/dx = e^{-x}$ with $y = 0$ for $x = 0$

$dy/dx + e^{-x}y = x^2$

$d^2y/dt^2 + 2\,dy/dt = -y$
$d^2y/dt^2 + e^{-t}dy/dt = -y$
2. Dirac Delta Function:
Show recursion relation
5. Calculation of error for each data point of observations recorded in experiments done in previous semesters (choose any two).
6. Calculation of least square fitting manually without giving weightage to error. Confirmation of least square fitting of data through computer program.
7. Evaluation of trigonometric functions e.g. *sin θ,* Given Bessel's function at N points find its value at an intermediate point. Complex analysis: Integrate $1/(x^2+2)$ numerically and check with computer integration.
8. Compute the n^{th} roots of unity for $n = 2$, 3, and 4.
9. Find the two square roots of $-5+12j$.
10. Integral transform: FFT of □□□□
11. Solve Kirchoff's Current law for any node of an arbitrary circuit using Laplace's transform.
12. Solve Kirchoff's Voltage law for any loop of an arbitrary circuit using Laplace's transform.
13. Perform circuit analysis of a general LCR circuit using Laplace's transform.

Reference Books:

- Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J.
- Bence, 3rd ed., 2006, Cambridge University Press
- Mathematics for Physicists, P. Dennery and A. Krzywicki, 1967, Dover Publications
- Simulation of ODE/PDE Models with MATLAB®, OCTAVE and SCILAB:
- Scientific and Engineering Applications: A. Vande Wouwer, P. Saucez, C. V.
- Fernández. 2014 Springer ISBN: 978-3319067896
- A Guide to MATLAB, B.R. Hunt, R.L. Lipsman, J.M. Rosenberg, 2014, 3rd Edn.,
- Cambridge University Press
- Scilab by example: M. Affouf, 2012. ISBN: 978-1479203444
- Scilab (A free software to Matlab): H.Ramchandran, A.S.Nair. 2011 S.Chand & Company
- Scilab Image Processing: Lambert M. Surhone. 2010 Betascript Publishing

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COURSE CODE: 3SBMA305H

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.
- To acquaint the student with mechanics.

Syllabus:

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

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COURSE CODE: 3SBCH304H

CHEMISTRY –III

Syllabus:

Physical Chemistry

UNIT – I Thermodynamics-1 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 H2O: 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)4 and HIO4] and pinacole-pinacolone rearrangement. Trihydric alcohols-nomenclature and methods of formation, chemical reactions of glycerol
(c) Phenols: Nomenclature, structure and bonding. Prepration of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols: resonance stabilization of phenoxide ion. Reactions of phenols: electrophillic 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:-

Time: 6 hours
Inorganic Chemistry 18 marks
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.
(a) Determination of acetic acid in commercial vinegar using NaOH.
(b) Determination of alkali content- antacid tablet using HCl.
(c) Estimation of calcium content in chalk as calcium oxalate by permagnometry.
(d) Estimation of hardness of water by EDTA

Gravimetric analysis:
Barium as barium sulphate
Organic Chemistry Laboratory Techniques 18 marks
A. Thin layer chromatography
Determination of Rf values and identification of organic compounds.
(a) Separation of green leaf pigments (spinach leaves may be used).
(b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexane-2 and 3-one using toluene and light petroleum (40:6).

(c) Separation of a mixture of dyes using cyclohexane and ethylacetate (8:5:1.5). B. Paper chromatography: Ascending and Circular Determination of Rf values and identification of organic compounds

(a) Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glumatic acid. Spray reagent ninhydrin.

(b) Separation of a mixture of DL-alanine, glycine and L-lucine using nbutanol: acetic acid: water (4:1:5). Spray reagent ninhydrin.

(c) Separation of monosaccharides- a mixture of D-galactose and Dfructose using n-butanol: acetone: water (4:1:5). Spray reagent-aniline hydrogen pthalate.

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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COURSE CODE: 3HBEL402H

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.

Syllabus:

UNIT – I

1. Tina Morries : 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 Morries : 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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COURSE CODE: 3HBHP401H

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 activates
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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COURSE CODE: 3SBPH403H

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 - I 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. Fraunhoffer 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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COURSE CODE: 3SBPH403H

DIGITAL SYSTEM & APPLICATION

UNIT – I Introduction to CRO: Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference.

UNIT – II Integrated Circuits (Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital lCs.

UNIT – III Digital Circuits: Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates. XOR and XNOR Gates and application as Parity Checkers.

UNIT – IV Boolean algebra: De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map.

UNIT – V Data processing circuits: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders.
Arithmetic Circuits: Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor.

Sequential Circuits: SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop.

Timers: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator.

Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).

Counters (4 bits): Ring Counter. Asynchronous counters, Decade Counter. Synchronous Counter.

Computer Organization: Input/Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.

Intel 8085 Microprocessor Architecture: Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI.

Introduction to Assembly Language: 1 byte, 2 byte & 3 byte instructions.

Reference Books:

- Digital Principles and Applications, A.P. Malvino, D.P.Leach and Saha, 7th Ed 2011, Tata McGraw
- Fundamentals of Digital Circuits, Anand Kumar, 2nd Edn, 2009, PHI Learning Pvt. Ltd.
- Digital Circuits and systems, Venugopal, 2011, Tata McGraw Hill.
- Digital Electronics G K Kharate ,2010, Oxford University Press
- Digital Systems: Principles & Applications, R.J.Tocci, N.S.Widmer, 2001, PHI Learning
- Logic circuit design, Shimon P. Vingron, 2012, Springer.

• Digital Electronics, Subrata Ghoshal, 2012, Cengage Learning.
• Digital Electronics, S.K. Mandal, 2010, 1st edition, McGraw Hill
• Microprocessor Architecture Programming & applications with 8085, 2002, R.S. Goankar, Prentice Hall.

PHYSICS PRACTICAL-C VII LAB

1. To measure (a) Voltage, and (b) Time period of a periodic waveform using CRO.
2. To test a Diode and Transistor using a Multimeter.
3. To design a switch (NOT gate) using a transistor.
4. To verify and design AND, OR, NOT and XOR gates using NAND gates.
5. To design a combinational logic system for a specified Truth Table.
6. To convert a Boolean expression into logic circuit and design it using logic gate ICs.
7. To minimize a given logic circuit.
8. Half Adder, Full Adder and 4-bit binary Adder.
9. Half Subtractor, Full Subtractor, Adder-Subtractor using Full Adder I.C.
10. To build Flip-Flop (RS, Clocked RS, D-type and JK) circuits using NAND gates.
11. To build JK Master-slave flip-flop using Flip-Flop ICs
12. To build a 4-bit Counter using D-type/JK Flip-Flop ICs and study timing diagram.
13. To make a 4-bit Shift Register (serial and parallel) using D-type/JK Flip-Flop ICs.
14. To design an astable multivibrator of given specifications using 555 Timer.
15. To design a monostable multivibrator of given specifications using 555 Timer.
16. Write the following programs using 8085 Microprocessor

a) Addition and subtraction of numbers using direct addressing mode

24

b) Addition and subtraction of numbers using indirect addressing mode
c) Multiplication by repeated addition.
d) Division by repeated subtraction.
e) Handling of 16-bit Numbers.
f) Use of CALL and RETURN Instruction.
g) Block data handling.
h) Other programs (e.g. Parity Check, using interrupts, etc.).

Reference Books:

- Modern Digital Electronics, R.P. Jain, 4th Edition, 2010, Tata McGraw Hill.
- Basic Electronics: A text lab manual, P.B. Zbar, A.P. Malvino, M.A. Miller, 1994, Mc-Graw Hill.
- Microprocessor Architecture Programming and applications with 8085, R.S. Goankar, 2002, Prentice Hall.
- Microprocessor 8085:Architecture, Programming and interfacing, A. Wadhwa,
- 2010, PHI Learning.

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COURSE CODE: 3SBMA405H

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.
- To acquaint the student with Abstract Algebra.

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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COURSE CODE: 3SBCH404H

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, CO2 and S system. Phase equilibria of two component system: solid liquid equilibria, simple eutectic: Bi-Cd, Pb-Ag system, desiliverisation of lead.

Solid solutions: compound formation with congruent melting point (Mg-Zn) and incongruent melting point,(NaCl-H2O) (FeCl3-H2O) and (CuSO4-H2O) system. Freezing mixtures, acetone-dry ice.

Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's and Henry's law. Non-ideal system azeotropes: HCl-H2O 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 Ka 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 sepatration 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 NH3 and liquid SO2

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 nucleophillic additions to carbonyl group with particular emphasis on benzoin, aldol perkin and knovenagel 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. Meerwine-Pondrof-Verlay (MPV), Clemmensen, Wolf-Kishner, LiAlH4 and NaBH4 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, hydroxyl 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 esterfication and hydrolysis (acidic and basic).

UNIT – V

Organic Compounds of Nitrogen Preparation of nitroalkanes and nitroarenes.Chemical reaction of nitroalkanes.Mechanism of nucleophillic 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-Phthalamide 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:-

Time: 6 hour
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 bythermometric, dialometric method (e.g.) (MnCl2×4H2O/SrBr2×2H2O).Phase equilibrium.
2. To study the effect of solute (e.g. NaCl, scenic 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 phenolwater system.
3. To construct the phase diagram of two component (e.g., diphenyl aminebenzophenone) 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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COURSE CODE: 3SBPH501H

Physics-V (Quantum Mechanics, Atomic, Molecular and Nuclear Physics)

COURSE OBJECTIVE:-

1. To introduce student to the concept of special relativity and its application to physical sciences.
2. To express the basic postulates of Quantum Mechanics and Atomic Physics.

Syllabus:

UNIT - 1 Theory of Relativity Reference systems, inertial frames, Galilean Invariance and conservation laws, Michelson-Morley experiment; Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, variation of mass with velocity, mass - energy equivalence, particle with zero rest mass. **Origin of Quantum Theory**: photoelectric effect , Ritz combination principle in spectra. stability of an atom,Planck's radiation law, Einstein's explanation of photoelectric effect..

UNIT - 2 Quantum Mechanics Wave-particle duality and uncertainty principle; de Broglie's hypothesis for matter waves; the concept of wave and group velocities, evidence for diffraction and interference of particles, experimental demonstrations of matter waves. Consequence of de Broglie’s concepts; quantization in hydrogen atom; energies of a particle in a box, wave packets, Heisenberg's uncertainty relation for p and x, its extension to energy and time. Consequence of the uncertainty relation; gamma ray microscope, diffraction at a slit, particle in a box, position of an electron in a Bohr's orbit, Schrödinger’s equation. Postulates of quantum mechanics; operators, expectation values.

UNIT - 3 Atomic Physics natural occurrence of quantum numbers-n, l and m, the related physical quantities. Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure. screening constants for alkali spectra for s,p,d and f states, selection rules, Singlet and triplet fine structure in alkaline earth spectra. L-S and J-J couplings. **Weak Spectra**: Continuous X-ray spectrum and its dependence on voltage, Duane and Hundt’s law. Characteristic X-rays. Moseley's law; doublet structure of X-ray spectra. X-ray absorption spectra.

UNIT - 4 Molecular Spectra Quantization of vibrational and rotational energies, pure rotational and rotation-vibration spectra Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. **Spectroscopy** : Raman Effect, Stokes and anti-stokes lines, experimental arrangements for Raman Spectroscopy. Spectroscopic techniques: Sources of excitation, prism and grating spectrographs for visible, UV and IR, absorption spectroscopy, double beam instruments, different recording systems.

UNIT - 5 Nuclear Physics Working of nuclear detectors, G-M counter, proportional counter,scintillation counter, cloud chamber, spark chamberand emulsions technique. Structure of nuclei, basic properties (I, μ, Q and binding energy), energy, p-p and n-p scattering and general concepts of nuclear forces. Beta decay, range of alpha particle, Geiger-Nuttal law. Gamow's explanation of alpha decay, beta decay, Nuclear reactions, compound nucleus,).Shell model, Liquid drop model, Nuclear fission and fusion (concepts), energy production in stars by p-p and carbon - nitrogen cycles (concepts).

COURSE CODE: 3SMPH501H

COURSE OUTCOMES:-

1. Explain the nature of Quantum Mechanics and Lorentz Transformation equations.
2. Understand the concept of constant relative motion of different bodies in different frames of references.
3. Describe theories explaining the structure of atoms and the origin of the observed spectra.

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COURSE OBJECTIVE:-

1. To gain knowledge of modern techniques, theory and observation results in astrophysics and cosmology.
2. Introduce the physics of planetary atmospheres with specialemphasis on the atmosphere of the earth.

Syllabus:

UNIT – 1 Our Universe Introduction, Constituents of the universe, Atmosphere, Planets, Stars, Solar energy, Asteroids, Meteors or Meteoroids, Comets, Pole Star, Galaxies.

UNIT – 2 Solar System and Stars Celestial mechanics, Elliptical orbits, Kepler's laws, Earth - Moon system, Tidal forces, Terrestrial Planets, Solar activity, Helioseismology, Binary stars, White dwarfs, Neutron stars, Formation of proto stars, Degenerate remnants of stars, Chandrasekhar Kimit, pulsars.

UNIT – 3 Physical Meteorology & Radar Meteorology Atmosphere; atmospheric composition; law of thermodynamics of the atmosphere; adiabatic process; law of black body radiation; solar and terrestrial radiation; albedo; green house effect; heat balance of earth-atmosphere system. Basic meteorology-radar principles; use of weather radar in aviation.

UNIT – 4 Dynamic Meteorology & Monsoon Dynamics Fundamental forces; structure of static atmosphere; momentum; thermodynamics of dry atmosphere; voracity; potential vorticity. Wind; temperature & pressure distribution over India in the lower, middle, and upper atmosphere during pre/ post/and mid-monsoon season; energy cycle of monsoon; dynamics of monsoon; depressions and easterly waves.

UNIT – 5 Atmospheric Pollution & Instrumentation System Role of meteorology on atmospheric pollution; atmospheric boundary layer; air stability; wind structure; ekman spiral; turbulence boundary layer scaling; residence time and reaction rates of pollutants; sulpher compounds; nitrogen compounds; organic compounds; aerosol; radioactive particles. Ground based instruments for the measurement of temperature, pressure, humidity, wind and rainfall rate.

COURSE OUTCOMES:-

Students will have understanding of:

1. To understand binary stars as well as our solar system and the associated processes occurring in the Milky Way and other galaxies.
2. To describe the basic structure of an atmosphere and the climate system.
3. The concept of potential temperature and how it relates to static stability.
4. Know the components of the earth radiation balance and understand optical depth and transmission function.
5. [illegible]

COURSE CODE: 3SBPH502H

PRACTICAL:

1. To determine the value of specific charge e/m of an electron by Thomson's Method.
2. To study and verify the Inverse Square Law by using photo cell.
3. To study and analysis the properties of photo cell.
4. To study of colour thin film of given Sample.
5. To study and analysis of long form of the periodic table
6. To study of the time dilation by the concept of twin paradox.

Experiments with Abbey's Refractometer:

1. To find the Refractive Index of the given liquid sample by using Abbey's Refractometer
2. To determine the polarisability of the given liquid samples at a given temperature.
3. To study the variation of refractive index with:

(a) Temperature of liquid sample

(b) Wavelength of the light source.

Experiments with GM COUNTER:

1. To draw the plateau characteristics of GM Counter using radioactive source ($_{55}Cs^{137}$).
2. To study the pulse height with the applied voltage to the GM Tube.
3. To study the absorption of beta and gamma radiation.
4. To study and verify the Inverse Square Law by using GM Counter.
5. To study of GM Counter.
6. To study of design structure of GM Counter.

Experiments with Lissajous Pattern:

1. To study of the Lissajous figures.
2. To determine the unknown frequency calculation by using Lissajous figures.
3. To determine the RLC resonance frequency calculation by using Lissajous figures.
4. To determine the phase difference calculation by using Lissajous figures.

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COURSE CODE: 3SBPH503H

ANALOG SYSTEMS AND APPLICATIONS

Syllabus:

UNIT-I Semiconductor Diodes: P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity.PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Derivation for Barrier Potential, Barrier Width and Current for abrupt Junction. Current Flow Mechanism in Forward and Reverse Biased Diode.

UNIT-II Two-terminal Devices and their Applications: (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and

Rectification Efficiency, C-filter, (2) Zener Diode and Voltage Regulation.
Principle, structure and characteristics of (1) LED, (2) Photodiode and (3) Solar Cell, Qualitative idea of Schottky diode and Tunnel diode. (7 Lectures)

UNIT-III Bipolar Junction transistors: n-p-n and p-n-p Transistors. I-V characteristics of CB and CE Configurations. Active, Cutoff and Saturation Regions. Current gains α and β.
Relations between α and β. Load Line analysis of Transistors. DC Load line and Qpoint. Physical Mechanism of Current Flow. (6 Lectures)
Amplifiers: Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network.h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers. (10 Lectures)

UNIT-IV Feedback in Amplifiers: Positive and Negative Feedback. Effect of negative feedback on Input Impedance, Output Impedance, Gain, Stability, Distortion and Noise.(4 Lectures)
Sinusoidal Oscillators: Barkhausen's Criterion for self-sustained oscillations. RC Phase shift oscillator, determination of Frequency.Hartley & Colpitts oscillators. (4 Lectures)

UNIT-V Operational Amplifiers (Black Box approach): Characteristics of an Ideal and Practical Op-Amp. (IC 741) Open-loop and Closed-loop Gain. Frequency Response. CMRR. Slew Rate and concept of Virtual ground. (4 Lectures)
Applications of Op-Amps: (1) Inverting and non-inverting amplifiers, (2) Adder, (3) Subtractor, (4) Differentiator, (5) Integrator, (6) Log amplifier, (7) Comparator and Zero crossing detector (8) Wein bridge oscillator. (9 Lectures)
Conversion: D/A Resistive networks (Weighted and R-2R Ladder). Accuracy and Resolution. (3 Lectures)

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COURSE CODE:3SBPH504H

DSE-1
EXPERIMENTAL TECHNIQUES

Syllabus:

UNIT:-I Measurements: Accuracy and precision. Significant figures. Error and uncertainty analysis. Types of errors: Gross error, systematic error, random error. Statistical analysis of data (Arithmetic mean, deviation from mean, average deviation, standard deviation, chi-square) and curve fitting. Guassian distribution.

UNIT:-II Signals and Systems: Periodic and aperiodic signals. Impulse response, transfer function and frequency response of first and second order systems. Fluctuations and Noise in measurement system. S/N ratio and Noise figure. Noise in frequency domain. Sources of Noise: Inherent fluctuations, Thermal noise, Shot noise, 1/f noise . Shielding and Grounding: Methods of

safety grounding. Energy coupling. Grounding. Shielding: Electrostatic shielding. Electromagnetic Interference.

UNIT:-III Transducers & industrial instrumentation (working principle, efficiency, applications): Static and dynamic characteristics of measurement Systems. Generalized performance of systems, Zero order first order, second order and higher order systems. Electrical, Thermal and Mechanical systems. Calibration. Transducers and sensors. Characteristics of Transducers. Transducers as electrical element and their signal conditioning. Temperature transducers: RTD, Thermistor, Thermocouples, Semiconductor type temperature sensors (AD590, LM35, LM75) and signal conditioning. Linear Position transducer: Strain gauge, Piezoelectric. Inductance change transducer: Linear variable differential transformer (LVDT), Capacitance change transducers. Radiation Sensors: Principle of Gas filled detector, ionization chamber, scintillation detector.

UNIT:-IV Digital Multimeter: Comparison of analog and digital instruments. Block diagram of digital multimeter, principle of measurement of I, V, C. Accuracy and resolution of measurement. Impedance Bridges and Q-meter: Block diagram and working principles of RLC bridge. Q-meter and its working operation. Digital LCR bridge.

UNIT:-V Vacuum Systems: Characteristics of vacuum: Gas law, Mean free path. Application of vacuum. Vacuum system- Chamber, Mechanical pumps, Diffusion pump & Turbo Modular pump, Pumping speed, Pressure gauges (Pirani, Penning, ionization).

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DSE-II
Astronomy and Astrophysics

Syllabus:

UNIT:-I Astronomical Scales: Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature. Basic concepts of positional astronomy: Celestial Sphere, Geometry of a Sphere, Spherical Triangle, Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale, Distance Modulus; Determination of Temperature and Radius of a star; Determination of Masses from Binary orbits; Stellar Spectral Classification, Hertzsprung-Russell Diagram.

UNIT:-II Astronomical techniques: Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical

Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, 49 detection Limits with Telescopes). Physical principles: Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium.

UNIT:-III The sun (Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology). The solar family (Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, Extra-Solar Planets. Stellar spectra and classification Structure (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification).

UNIT:-IV The milky way: Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus.

UNIT:-V Galaxies: Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms.
Large scale structure & expanding universe: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter).

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DSC-III

Atmospheric Physics

Syllabus:

UNIT:-I General features of Earth's atmosphere: Thermal structure of the Earth's Atmosphere, Composition of atmosphere, Hydrostatic equation, Potential temperature, 50 Atmospheric Thermodynamics, Greenhouse effect, Local winds, monsoons, fogs, clouds, precipitation, Atmospheric boundary layer, Sea breeze and land breeze. Instruments for meteorological observations including RS/RW, meteorological processes and convective systems, fronts, Cyclones and anticyclones, thunderstorms.

UNIT:-II Atmospheric Dynamics: Scale analysis, Fundamental forces, Basic conservation laws, The Vectorial form of the momentum equation in rotating coordinate system, scale analysis of equation of motion, Applications of the basic equations, Circulations and vorticity, Atmospheric oscillations, Quasi biennial oscillation, annual and semiannual oscillations, Mesoscale circulations, The general circulations, Tropical dynamics. (12 Lectures)

UNIT:-III Atmospheric Waves: Surface water waves, wave dispersion, acoustic waves, buoyancy waves, propagation of atmospheric gravity waves (AGWs) in a nonhomogeneous medium, Lamb wave, Rossby waves and its propagation in three dimensions and in sheared flow, wave absorption, non-linear consideration (12 Lectures)

UNIT:-IV Atmospheric Radar and Lidar: Radar equation and return signal, Signal processing and detection, Various type of atmospheric radars, Application of radars to study atmospheric phenomena, Lidar and its applications, Application of Lidar to study atmospheric

phenomenon. Data analysis tools and techniques. (12 Lectures)

UNIT:-V Atmospheric Aerosols: Spectral distribution of the solar radiation, Classification and properties of aerosols, Production and removal mechanisms, Concentrations and size distribution, Radiative and health effects, Observational techniques for aerosols, Absorption and scattering of solar radiation, Rayleigh scattering and Mie scattering, Bouguert-Lambert law, Principles of radiometry, Optical phenomena in atmosphere, Aerosol studies using Lidars. (12 Lectures)

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Syllabus:

UNIT:-I Fossil fuels and Alternate Sources of energy:
Fossil fuels and nuclear energy, their limitation, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

UNIT:-II Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

UNIT:-III Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies.
Ocean Energy: Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.
Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass.

UNIT:-IV Geothermal Energy: Geothermal Resources, Geothermal Technologies. Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

UNIT:-V Piezoelectric Energy harvesting: Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity, Piezoelectric parameters and modeling piezoelectric generators, Piezoelectric energy harvesting applications, Human power
Electromagnetic Energy Harvesting: Linear generators, physics mathematical models, recent

applications

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COURSE OBJECTIVE:-

1. Describe the difference between crystalline and non crystalline materials.
2. Describe the arrangements of atoms and ions in crystalline structure,
3. Explain basic Laser principle Laser behavior properties of Laser radiations, different types of Lasers and Laser applications.

Syllabus:

UNIT - 1 Overview Crystalline and glassy forms, liquid crystals, glass transition. Crystal structure: Periodicity, lattices and bases, unit cell, Wigner-Seitz cell, lattice types, lattice planes. Common crystal structures. Laue's theory of X-ray diffraction, Bragg's law, Laue patterns. Bonding: Potential between a pair of atoms; Lennard-Jones potential, concept of cohesive energy, covalent, Vander Waal, ionic and metallic crystals Magnetism: Atomic magnetic moment, magnetic susceptibility, Dia, Para and Ferromagnetism, Ferro magnetic domains

UNIT - 2 Thermal properties Lattice vibrations, simple harmonic oscillator, Concept of phonons, density of modes (1-D). Debye model; Lattice specific heat low temperature limit, extension (conceptual) to 3-D. Band Structure: Electrons in periodic potential; nearly free electron model (qualitative), energy band, energy gap, metals, insulators, semiconductors. Motion of electrons: Free electrons, conduction electrons, electron collisions, mean free path, conductivity and Ohm's law. Fermi energy, Fermi velocity, Fermi-Dirac distribution.

UNIT - 3 Semiconductors Semiconductors electrons and holes, Fermi Level , Temperature dependence of electron and hole concentrations. Doping: conductivity, mobility, Hall Effect, Hall Coefficient. Semiconductor devices: Metal-semiconductor junction, p-n junction, majority and minority carriers, diode, Zener and tunnel diodes, light emitting diode, transistor, solar cell. Power supply: Diode as a circuit element, load line concept, rectification, ripple factor, Zener diode, voltage stabilization, Transistors : Characteristics of a transistor in CB, CE and CC mode, thermal runaway. FETs: Field effect transistors, JFET volt-ampere curves, biasing JFETMOSFET, biasing MOSFET.

UNIT - 4 Amplifiers- I Small signal amplifiers ; General Principle of operation, classification, distortion, RC coupled amplifier, input and output impedance, multistage amplifiers. Amplifier- II: Transformer coupled amplifiers, Noise in electronic circuits. Oscillators Hartley, Colpitt and Wein bridge oscillators.

UNIT – 5 Laser Laser system: Purity of a spectral line, coherence length and coherence time, spatial coherence of a source, Einstein’s A and B coefficients. Spontaneous and induced emissions, conditions for laser action, population inversion. Types of Lasers (gas and solid state), Pulsed lasers and tunable lasers, spatial coherence and directionality, estimates of beam intensity, temporal coherence and spectral energy density.

COURSE OUTCOMES:-

1. Demonstrate an understanding of the crystal lattice and how the main lattice types ordescribed.
2. Explain different laser used and make a comparison between them.

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COURSE OBJECTIVE:-

1. To give comprehensive exposures to the students regarding various materials, crystiline, non – crystalline materials, crystal structure and their defects the concept of phase and different type of phase diagram.
2. Experimental and computational characterization of nano materials.

Syllabus:

UNIT – I: Core Concept of Nanotechnology Nanotechnology, nanotech generation, nano science, nano composites, nanomaterials, carbon nano tubes, nanohorns, inorganic nanotubes, nanowires.

UNIT – II: Impact of Nanotechnology and its Applications Privacy, social denide, communication, risk, social and ethical impacts, Health & environmental impacts, negative impacts. Types of application, nanotechnology for energy.

UNIT – III: Properties of Nanomaterials Optional properties, mechanical properties, magnetic properties, electrical properties etc.

UNIT – IV: Classification of Materials Crystalline, Polycrystalline, Amorphous (Introduction and their structure),Elementary idea of polymers (Structure and properties, Methods of polymerization), Glasses: Structure andproperties, Type of Glasses, Fracture in glasses, Composite Materials: Introduction, their types andproperties, Different types of bonding.

UNIT – V: Transport Properties of Solids Electrical conductivity of metals and alloys, Extrinsic & intrinsicsemiconductors and amorphous semiconductors, Scattering of electrons by phonons, Impurity, Carriermobility and its temperature dependence, Mathiessio's rule for resistivity, Temperature dependence ofmetallic resistivity.

COURSE OUTCOMES:-

Students will have understanding of:

1. Different type of materials and their structure.
2. Structure dependence of various thermal, optical and mechanical properties.
3. Explain the fundamental principles of nano technology and their application to medical science.

PRACTICAL:-

1. To study and verify the De-Morgan's Theorem.
2. To study and prove the Laws of Boolean Algebra.
3. To study and verify the truth table of Compound logic gates.

4. To study and draw the characteristics curve of P-N Junction diode.
5. To study and draw the characteristics curve of Zener diode.
6. To study and draw the characteristics curve of Tunnel diode.
7. To determine the energy band gap of a semiconductor by using P-N Junction diode.
8. To study and draw the characteristics curve of transistor in CB/CC/CE mode.
9. To determine the wavelength of given laser light.
10. To determine the beam divergence of a laser beam.

COURSE CODE: 3SBPH603H

11. Study of crystal faces & structure by using given model.

Experiment with Malus Law Apparatus:

11.1 Study of polarization of light by reflection and thus verify Brewster's law.
11.2 Study and verify Malus Law using a plain glass plate and a Polaroid.

Experiments with solar cells:

11.3 To study the voltage and current of the solar cells.
11.4 To study the voltage and current of the solar cells in series and parallel combinations.
11.5 To determine the efficiency (η) of the solar cell.

Note:-One experiment will be asked in the semester practical examination.

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COURSE CODE: 3SBPH603H

CORE
Nuclear and Particle Physics

Syllabus:

UNIT:-I General Properties of Nuclei: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

UNIT:-II Nuclear Models: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

UNIT:-III Radioactivity decay:(a) Alpha decay: basics of α-decay processes, theory of αemission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) β-decay: energy kinematics for β-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion.

UNIT:-IV Nuclear Reactions: Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering).
Interaction of Nuclear Radiation with matter, Detector for Nuclear Radiations, Particle Accelerators

UNIT:-IV Particle physics: Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons. (14 Lectures)

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Syllabus:

UNIT:-I The boundary, interior and exterior environment of living cells. Processes: exchange of matter and energy with environment, metabolism, maintenance, reproduction, evolution. Self-replication as a distinct property of biological systems. Time scales and spatial scales. Universality of microscopic processes and diversity of macroscopic form. Types of cells. Multicellularity. Allometric scaling laws. Molecules of life:

UNIT:-II Metabolites, proteins and nucleic acids. Their sizes, types and roles in structures and processes. Transport, energy storage, membrane formation, catalysis, replication, transcription, translation, signaling. Typical populations of molecules of various types present in cells, their rates of production and turnover. Energy required to make a bacterial cell. Simplified mathematical models of transcription and translation, small genetic circuits and signaling pathways. Random walks and applications to biology. Mathematical models to be studied analytically and computationally. 52 The complexity of life.

UNIT:-III At the level of a cell: The numbers of distinct metabolites, genes and proteins in a cell. Complex networks of molecular interactions: metabolic, regulatory and signaling networks. Dynamics of metabolic networks; the stoichiometric matrix. Living systems as complex organizations; systems biology. Models of cellular dynamics. The implausibility of life based on a simplified probability estimate, and the origin of life problem. At the level of a multicellular organism: Numbers and types of cells in multicellular organisms. Cell types as distinct attractors of a dynamical system. Stem cells and cellular differentiation. Pattern formation and development.

UNIT:-IV Brain structure: neurons and neural networks. Brain as an information processing system. Associative memory models. Memories as attractors of the neural network dynamics. At the level of an ecosystem and the biosphere: Foodwebs. Feedback cycles and selfsustaining ecosystems. Evolution.

UNIT:-V The mechanism of evolution: variation at the molecular level, selection at the level of the organism. Models of evolution. The concept of genotype-phenotype map. Examples.

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VITH SEMESTER

COURSE CODE:3SBPH605H

DSE-II
Physics of Earth

Syllabus:

UNIT:-I 1. The Earth and the Universe:
(a) Origin of universe, creation of elements and earth. A Holistic understanding of our dynamic planet through Astronomy, Geology, Meteorology and Oceanography. Introduction to various branches of Earth Sciences.
(b) General characteristics and origin of the Universe. The Milky Way galaxy, solar system, Earth's orbit and spin, the Moon's orbit and spin. The terrestrial and Jovian planets. Meteorites & Asteroids. Earth in the Solar system, origin, size, shape, mass, density, rotational and revolution parameters and its age.
(c) Energy and particle fluxes incident on the Earth.
(d) The Cosmic Microwave Background.

UNIT:-II 2. Structure:
(a) The Solid Earth: Mass, dimensions, shape and topography, internal structure, magnetic field, geothermal energy. How do we learn about Earth's interior?
(b) The Hydrosphere: The oceans, their extent, depth, volume, chemical composition. River systems. (c) The Atmosphere: variation of temperature, density and composition with altitude, clouds.
(d) The Cryosphere: Polar caps and ice sheets. Mountain glaciers.
(e) The Biosphere: Plants and animals. Chemical composition, mass. Marine and land organisms.

UNIT:-III 3. Dynamical Processes:
(a) The Solid Earth: Origin of the magnetic field. Source of geothermal energy. Convection in Earth's core and production of its magnetic field. Mechanical layering of the Earth. Introduction to geophysical methods of earth investigations. Concept of plate tectonics; sea-floor spreading and continental drift. Geodynamic elements of Earth: Mid Oceanic Ridges, trenches, transform faults and island arcs. Origin of oceans, continents, mountains and riftvalleys. Earthquake and earthquake belts. Volcanoes: types products and distribution.
(b) The Hydrosphere: Ocean circulations. Oceanic current system and effect of coriolis forces. Concepts of eustasy, tend – air-sea interaction; wave erosion and beach processes. Tides. Tsunamis. (c) The Atmosphere: Atmospheric circulation. Weather and climatic changes. Earth's heat budget. Cyclones. Climate: i. Earth's temperature and greenhouse effect. ii. Paleoclimate and recent climate changes. iii. The Indian monsoon system.
(d) Biosphere: Water cycle, Carbon cycle, Nitrogen cycle, Phosphorous cycle. The role of cycles in maintaining a steady state.

UNIT:-IV 4. Evolution
Nature of stratigraphic records, Standard stratigraphic time scale and introduction to the concept of time ingeological studies. Introduction to geochronological methods in their application in geological studies. Historyof development in concepts of uniformitarianism, catastrophism and neptunism. Law of superposition and faunal succession.

COURSE CODE:3SBPH605H

UNIT:-V Introduction to the geology and geomorphology of Indian subcontinent.
1. Time line of major geological and biological events.
2. Origin of life on Earth.
3. Role of the biosphere in shaping the environment.
4. Future of evolution of the Earth and solar system: Death of the Earth.

5. Disturbing the Earth – Contemporary dilemmas (4 Lectures)
(a) Human population growth.
(b) Atmosphere: Green house gas emissions, climate change, air pollution.
(c) Hydrosphere: Fresh water depletion.
(d) Geosphere: Chemical effluents, nuclear waste.
(e) Biosphere: Biodiversity loss. Deforestation. Robustness and fragility of ecosystems.

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Syllabus:

UNIT:-I PHYSICS OF THE BODY-I Basic Anatomical Terminology: Standard Anatomical Position, Planes. Familiarity with terms like- Superior, Inferior, Anterior, Posterior, Medial, Lateral, Proximal and Distal. Mechanics of the body: Skeleton, forces, and body stability. Muscles and dynamics of body movement. Physics of Locomotors Systems: joints and movements, Stability and Equilibrium. Energy household of the body: Energy balance in the body, Energy consumption of the body, Heat losses of the body, Thermal Regulation. Pressure system of body: Physics of breathing, Physics of cardiovascular system. (8 Lectures)

UNIT:-II PHYSICS OF THE BODY-II 67 Acoustics of the body: Nature and characteristics of sound, Production of speech, Physics of the ear, Diagnostics with sound and ultrasound. Optical system of the body: Physics of the eye. Electrical system of the body: Physics of the nervous system, Electrical signals and information transfer. (10 Lectures)

UNIT:-III PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-I X-RAYS: Electromagnetic spectrum, production of x-rays, x-ray spectra, Brehmsstrahlung,

Characteristic x-ray. X-ray tubes & types: Coolidge tube, x-ray tube design, tube cooling stationary mode, Rotating anode x-ray tube, Tube rating, quality and intensity of x-ray. X-ray generator circuits, half wave and full wave rectification, filament circuit, kilo voltage circuit. Single and three phase electric supply. Power ratings. Types of X-Ray Generator, high frequency generator, exposure timers and switches, HT cables.

UNIT:-IV RADIATION PHYSICS: Radiation units exposure, absorbed dose, units: rad, gray, relative biological effectiveness, effective dose- Rem & Sievert, inverse square law. Interaction of radiation with matter Compton & photoelectric effect, linear attenuation coefficient. Radiation Detectors: ionization (Thimble chamber, condenser chamber), chamber. Geiger Muller counter, Scintillation counters and Solid State detectors, TFT.
MEDICAL IMAGING PHYSICS: Evolution of Medical Imaging, X-ray diagnostics and imaging, Physics of nuclear magnetic resonance (NMR), NMR imaging, MRI Radiological imaging, Ultrasound imaging, Physics of Doppler with applications and modes, Vascular Doppler. Radiography: Filters, grids, cassette, X-ray film, film processing, fluoroscopy. Computed tomography scanner- principle and function, display, generations, mammography. Thyroid uptake system and Gamma camera (Only Principle, function and display). (9 Lectures)

UNIT:-V RADIATION ONCOLOGY PHYSICS: External Beam Therapy (Basic Idea): Telecobalt, Conformal Radiation Therapy (CRT), 3DCRT, IMRT, Image Guided Radiotherapy, EPID, Rapid Arc, Proton Therapy, Gamma Knife, Cyber Knife. Contact Beam Therapy (Basic Idea): Brachytherapy- LDR and HDR, Intra Operative Brachytherapy. Radiotherapy, kilo voltage machines, deep therapy machines, Telecobalt machines, Medical linear accelerator. Basics of Teletherapy units, deep X-ray, Telecobalt units, Radiation protection, external beam characteristics, dose maximum and build up – bolus, percentage depth dose, tissue maximum ratio and tissue phantom ratio, Planned target Volume and Gross Tumour Volume.

RADIATION AND RADIATION PROTECTION: Principles of radiation protection ,protective materials-radiation effects, somatic, genetic stochastic and deterministic effect. Personal monitoring devices: TLD film badge, pocket dosimeter, OSL dosimeter. Radiation dosimeter. Natural radioactivity, Biological effects of radiation, Radiation monitors. Steps to reduce radiation to Patient, Staff and Public. Dose Limits for Occupational workers and Public. AERB: Existence and Purpose. (5 Lectures)

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PHYSICS OF DIAGNOSTIC AND THERAPEUTIC SYSTEMS-II Diagnostic nuclear medicine: Radiopharmaceuticals for radioisotope imaging, Radioisotope imaging equipment, Single photon and positron emission tomography. Therapeutic nuclear medicine: Interaction between radiation and matter Dose and isodose in radiation treatment. Medical Instrumentation: Basic Ideas of Endoscope and Cautery, Sleep Apnea and Cpap Machines, Ventilator and its modes. (5 Lectures)

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DSE-IV

TECHNICAL DRAWING

Syllabus:

UNIT:-I Introduction: Drafting Instruments and their uses. lettering: construction and uses of various scales: dimensioning as per I.S.I. 696-1972. Engineering Curves: Parabola: hyperbola: ellipse: cycloids, involute: spiral: helix and loci of points of simple moving mechanism.2D geometrical construction. Representation of 3D objects.Principles of projections. (4 Lectures)

UNIT:-II Projections: Straight lines, planes and solids. Development of surfaces of right and oblique solids. Section of solids.

UNIT:-III Object Projections: Orthographic projection. Interpenetration and intersection of solids. Isometric and oblique parallel projection of solids.

UNIT:-IV CAD Drawing: Introduction to CAD and Auto CAD, precision drawing and drawing aids, Geometric shapes, Demonstrating CAD- specific skills (graphical user interface. Create, retrieve, edit, and use symbol libraries. Use inquiry commands to extract drawing data). Control entity properties.

UNIT:-V Demonstrating basic skills to produce 2-D and 3-Ddrawings. 3D modeling with Auto CAD (surfaces and solids), 3D modeling with sketch up, annotating in Auto CAD with text and hatching, layers, templates & design center, advanced plotting (layouts, viewports), office standards, dimensioning, internet and collaboration, Blocks, Drafting symbols, attributes, extracting data. basic printing, editing tools, Plot/Print drawing to appropriate scale. (16 Lectures)