FATIMA MATA NATIONAL COLLEGE

(AUTONOMOUS)

KOLLAM

SCHEME & SYLLABUS OF

B.Sc. Physics

2015 Admission Onwards

I .General Structure for the First Degree Programme in Physics

Sem No.	Course Title		Instructional hours/ week		Credit	End Semester Exam Duration (Hours)	Evaluation		Total Credit
I	15UEN111.1	English Language I	5	--	4	3 Hours	25%	75%	16
	15UML/HN/ FR111.1	Additional language I	4	--	3	3 Hours			
	15UEN121	Foundation Course I	4	--	2	3 Hours			
	15UPY141	Core Course I	2	--	2	3 Hours			
		Core practical I	--	2					
	15UMM131.1	Compl. Course I	4	--	3	3 Hours			
	15UCH131.1	Compl Course II	2	2	2	3 Hours			
II	15UEN211.1	English Language II	5	--	4	3 Hours	25%	75%	17
	15UEN 212.1	English Language III	4	--	3	3 Hours			
	15UML/HN/ FR211.1	Additional language II	4	--	3	3 Hours			
	15UPY221	Foundation Course II	2	--	2	3 Hours			
		Core practical I	--	2					
	15UMM231.1	Compl. Course III	4	--	3	3 Hours			
	15UCH231.1	Compl Course IV	2	2	2	3 Hours			
III	15UEN311.1	English Language IV	5	--	4	3 Hours	25%	75%	18
	15UML/HN/ FR311.1	Additional Language III	5	--	4	3 Hours			
	15UPY341	Core Course II	3	--	3	3 Hours			
		Core Practical I	--	2					
	15UMM331.1	Compl. Course V	5	--	4	3 Hours			
	15UCH331.1	Compl. Course VI	3	2	3	3 Hours			
IV	15UEN411.1	English Language V	5	--	4	3 Hours	25%	75%	25
	15UML/HN/ FR111.1	Additional Language IV	5	--	4	3 Hours			
	15U PY441	Core course III	3	--	3	3 Hours			
	15UPY442	Core course IV - Practical I	--	2	3	3 Hours			
	15UMM431.1	Compl. course VII	5	--	4	3 Hours			
	15UCH431.1	Compl. Course VIII	3	--	3	3 Hours			
	15UCH432.1	Compl Course IX - Practical	--	2	4	3 Hours			

V	15UPY541	Core Course V	4	--	4	3 Hours	25%	75%	18
	15UPY542	Core Course VI	4	--	4	3 Hours			
	15UPY543	Core Course VII	4	--	4	3 Hours			
	15UPY544	Core Course VIII	4	--	4	3 Hours			
		Core Practical II	--	4		3 Hours			
	15UPY551.1/ 15UPY551.2/ 15UPY551.3/ 15UPY551.4/ 15UPY551.5	Open Course	3	--	2	3 Hours			
		Project	--	2		3 Hours			
VI	15UPY641	Core Course IX	4	--	4	3 Hours	25%	75%	26
	15UPY642	Core Course X	4	--	4	3 Hours			
	15UPY643	Core Course XI	4	--	4	3 Hours			
	15UPY644	Core Course XII	4	--	3	3 Hours			
	15UPY645	Core Course XIII - Practical II	--	2	3	3 Hours			
	15UPY646	Core Course XIV - Practical III	--	2	3	3 Hours			
	15UPY651.1/ 15UPY651.2/ 15UPY651.3/ 15UPY651.4/ 15UPY651.5	Elective Course	3	--	2	3 Hours			
	15UPY647	Project	--	2	3	--			

II. COURSE STRUCTURE :

(1a). CORE COURSES (THEORY)

Sem.	Title of Paper		Number of Hours per week	Number of Credits	Total hours per semester	Duration of External Exam	Weightage	
							Internal	External
1	15UPY141	Basic Mechanics & Properties of matter	2	2	36	3 Hrs	1	3
2	15UPY221	Methodology in Physics (Foundation Course 2)	2	2	36	3 Hrs	1	3
3	15UPY341	Thermodynamics & Statistical Physics	3	3	54	3 Hrs	1	3
4	15UPY441	Electrodynamics	3	3	54	3 Hrs	1	3

5	15UPY541	Classical & Relativistic Mechanics	4	4	72	3 Hrs	1	3
	15UPY542	Quantum Mechanics	4	4	72	3 Hrs	1	3
	15UPY543	Electronics	4	4	72	3 Hrs	1	3
	15UPY544	Atomic & Molecular Physics	4	4	72	3 Hrs	1	
	15UPY551	Open Course	3	2	54	3 Hrs	1	3
6	15UPY641	Solid State Physics	4	4	72	3 Hrs	1	3
	15UPY642	Nuclear & Particle Physics	4	4	72	3 Hrs	1	3
	15UPY643	Classical & Modern Optics	4	4	72	3 Hrs	1	3
	15UPY644	Computer Science	4	3	72	3 Hrs	1	3
	15UPY651	Elective Course	3	2	54	3 Hrs	1	3

(1b). Course Structure for Practicals and Project Work For The Core Course

Sem.	Title of Paper		Duration of Exam	Number of Credits	Weightage		Allotted Hours	
					Internal	External	Per Week	Per Year
4	15UPY442	Mechanics, Properties of Matter, Error Measurements, Heat and Acoustics	3 Hours	3	1	3	S1 -- 2 S2 -- 2 S3 -- 2 S4 --2	144
6	15UPY645	Optics, Electricity and Magnetism	3 Hours	3	1	3	S5 -- 2 S6 --2	72
6	15UPY646	Electronics and Computer Science	3 Hours	3	1	3	S5 -- 2 S6 --2	72
6	15UPY647	Project	3 Hours	3	--	4	S5 -- 2 S6 --2	72

Complementary Courses (General Structure)

Semester	Theory			Practical		Weightage (for both theory & Practicals)	
	Number of hours/week	Number of credits	Total hours/sem	Number of hours/week	Number of credits	IA	ESE
1	2	2	36	2	-	1	3
2	2	2	36	2	-	1	3
3	3	3	54	2	-	1	3
4	3	3	54	2	-	1	3

(2b)Complementary Courses (Theory and Practical)

1.Physics for Mathematics B.Sc Programme

Semester	Title of course	Number of hours/ week	Number of credits	Total credits	Total hours per semster	ESE Duration	Weigtage	
							IA	ESE
1	15UPY131.1 Mechanics and Properties of Matter	2	2	2	36	3	1	3
	Practical	2	-	-	36	-	-	-
2	15UPY231.1 Heat and Thermo-dynamics	2	2	2	36	3	1	3
	Practical	2	-	-	36	-	-	-
3	15UPY331.1 Optics, Magnetism and Electricity	3	3	3	54	3	1	3
	Practical	2	--	-	36	-	-	-
4	15UPY431.1 Modern Physics & Electronics	3	3	7	54	3	1	3
	15UPY432 Practical	2	4		36	-	-	-

2.Physics for Chemistry and Polymer Chemistry B.Sc Programme

Semester	Title of course	Number of hours/ week	Number of credits	Total credits	Total hours per semster	ESE Duration	Weigtage	
							IA	ESE
1	15UPY131.2 Rotational Dynamics and Properties of Matter	2	2	2	36	3	1	3
	Practical	2	-	-	36	-	-	-
2	15UPY231.2 Thermal Physics	2	2	2	36	3	1	3
	Practical	2	-	-	36	-	-	-
3	15UPY331.1 Optics, Magnetism and Electricity	3	3	3	54	3	1	3
	Practical	2	--	-	36	-	-	-

4	15UPY431.2-Atomic Physics, Quantum Mechanics & Electronics	3	3	7	54	3	1	3
	15UPY432-Practical	2	4		36	3	1	3

III. Question Paper Pattern

Question Type	Total Number of Questions	Number of Question to be answered	Marks for each Questions	Total Marks
Very short answer type (One word to Maximum of 2 sentences)	10	10	1	10
Short answer (Not to exceed one paragraph)	11	7	2	14
Short essay (Not to exceed 120 words)	5	3	7	21
Long essay	4	2	15	30
Total	30	22		75

Promotion to Higher Semesters: Students who complete the semester by securing the minimum required attendance and who register for the End Semester Evaluation conducted by the University of each semester alone shall be promoted to the next higher semester.

Re-appearance of Failed Students: "Students who fail shall have to reappear for the ESE of the same along with the next regular batch of students." Candidates who fail to score 'E' grade in the ESE in any of the Course/Courses have to reappear for the ESE of the Course / Courses concerned with next regular batch of students. The number of chances or such appearances is limited to 5 and the same have to be done within a period of 12 continuous semesters including the semester in which they have first appeared.

IV. Grading System.

Both CE and ESE will be carried out using Indirect Grading system on a 7-point scale.

Consolidation of Grades

The maximum mark for a Course (ESE theory) is 75. The duration of ESE is 3 hours.

The marks of CE shall be consolidated by adding the marks of Attend-

ance, Assignment/ Seminar and Test paper respectively for a particular Course.

Attendance	5 marks
Assignment/Seminar	5 marks
Test Paper	15 marks
Total	25

Total marks for the ESE of Practical 75. The components of ESE of Practical have to be set by the Chairmen, Boards of Studies, concerned.

The marks for the components of Practical for Continuous Evaluation shall be as shown below.

Attendance	5 marks
Record	5 marks
Test	10 marks
Performance, Punctuality and Skill	5 marks
Total	25

The marks of a Course are consolidated by combining the marks of ESE and.CE (75+25).

A minimum of 40% marks (E Grade)is required for passing a Course with a separate minimum of 40%(E Grade) for Continuous Evaluation and End Semester Evaluation.

Overall Grade in a Programme

Percentage of marks	**CCPA**	**Letter Grade**
90 and above	>or = 9	A+ outstanding
80 to < 90	8to<9	A. Excellent
70 to < 80	7to< 8	B Very Good
60 to < 70	6 to<7	C Good
50 to < 60	5 to < 6	D Satisfactory
40 TO < 50	4 TO< 5	E ADEQUATE
BELOW 40	<4	F FAILURE

The Marks of the Courses taken over and above the minimum prescribed Credits, shall not be counted for computing CCPA.

For the successful completion of a Programme and award of the Degree, a student must pass all Courses satisfying the minimum Credit requirement and must score a minimum CCPA of 4.00 or an overall grade of E.

V. Open/Elective Courses

During the programme the students have to undergo two open/elective courses. The students attached to the Physics department can opt one course from the Physics department (Elective course) and the other from any one of the other departments (Open course). The student has to do the open course during the fifth semester and the elective course during the sixth semester. As a beginning, the department will choose one open course for the fifth semester and one elective course for the sixth semester depending on the faculty and infrastructure available.

(a). Open Courses

i) Bio-Physics
ii) Astronomy & Astrophysics
iii) Applied Physics
iv) Environmental Physics
v) Energy Physics

(b). Elective Courses

i) Photonics
ii) Nano science
iii) Computer hardware and networking
iv) Instrumentation
v) Space Science

VI. Implementation of Project Work

As a part of study the candidate has to do a project work. The aim of the project workis to bring out the talents of students and to introduce research methodology. Thework may be chosen from any branch of Physics, which may be experimental, theoreticalor computational. Emphasis should be given for originality of approach. The project shall be done individually or as a group of maximum 5 students. The projects are to be identified during the 4th semester with the help of the supervising teacher. The report of the project (of about 30-40 pages) in duplicate shall be submitted to the department by the end of the 6th semester well before thecommencement of the examination. The reports are to be produced before the external examiners.

SEMESTER I

Language Course I
15UEN111.1: LISTENING AND SPEAKING SKILLS

No. of credits: 4
No. of instructional hours per week: 5 (Total 90 hrs.)

AIMS

1. To familiarize students with English sounds and phonemic symbols.
2. To enhance their ability in listening and speaking.

OBJECTIVES

On completion of the course, the students should be able to

1. listen to lectures, public announcements and news on TV and radio.
2. engage in telephonic conversation.
3. communicate effectively and accurately in English.
4. use spoken language for various purposes.

COURSE OUTLINE

Module 1

Pronounciation-Phonemic symbols - consonants - vowels - syllables - word stress - strong and weak forms.

Module 2

Listening Skills - difference between listening and hearing - active listening -barriers to listening - academic listening - listening for details - listening and note-taking - listening to talks and descriptions - listening to announcements - listening to news programmes.

Module 3

Speaking Skills - interactive nature of communication - importance of context - formal and informal - set expressions in different situations -greeting - introducing - making requests - asking for / giving permission - giving instructions and directions - agreeing / disagreeing - seeking and giving advice - inviting and apologizing - telephonic skills - conversational manners.

Module 4

Dialogue Practice

(Students should be given ample practice in dialogue, using core and supplementary materials.)

COURSE MATERIAL

Modules 1 - 3

Core reading: Listening and Speaking, Cambridge University Press, India Pvt Ltd, 2010

Further reading:

1. Marks, Jonathan. English Pronunciation in Use. New Delhi: CUP, 2007.
2. Lynch, Tony. Study Listening. New Delhi:CUP, 2008.
3. Kenneth, Anderson, Tony Lynch, Joan MacLean. Study Speaking. New Delhi: CUP, 2008.

Module 4:

Core reading: Dramatic Moments: A Book of One Act Plays. Orient Black Swan, 2013.

The following One-act plays are prescribed:

1. Saki - The Death Trap
2. Philip Moeller - Helena's Husband
3. Serafin and Joaquin Alvarez Quinters - Sunny Morning: A Comedy of Madrid
4. Margaret Wood - Day of Atonement

Reference:

Jones, Daniel. English Pronouncing Dictionary 17th Edition. New Delhi: CUP, 2009.

Language Course II (Additional Language I)
15UML111.1: മലയാള കവിത

No. of credits: 3
No. of instructional hours per week: 4

പുസ്തകം : കാവ്യപഥം

(കോളേജ് പ്രസിദ്ധീകരണം)

പഠനോദ്ദേശ്യം : മലയാള കവിതയെ സംബന്ധിച്ച് സാമാന്യജ്ഞാനം നൽകുക. പഠിതാക്കളിൽ കാവ്യഭിരുചി വളർത്തുക. ആസ്വാദനത്തിനും വിശകലത്തിനും സജ്ജരാക്കുക.

പാഠ്യപദ്ധതി :

മൊഡ്യൂൾ ഒന്ന് (18 മണിക്കൂർ)

1. ചെറുശ്ശേരി - വേണുഗാനം (രാഗങ്ങളോരോന്നേ ഗോകുലനായകൻ... മുതൽ അവസാനം വരെ)
2. എഴുത്തച്ഛൻ - പാർത്ഥസാരഥീവർണ്ണന
3. വടക്കൻ പാട്ട് - ഉണ്ണിയാർച്ചയുടെ അപേക്ഷ
4. കുമാരനാശാൻ - കരുണ (ആദ്യത്തെ 100 വരി)

മൊഡ്യൂൾ രണ്ട് (18 മണിക്കൂർ)

5. പി.കുഞ്ഞിരാമൻ നായർ - കൊടുത്തു മുടിഞ്ഞ മാവ്
6. ചങ്ങമ്പുഴ - രമണൻ (രംഗം - 5 മുഴുവൻ)
7. വൈലോപ്പിള്ളി - കൃഷ്ണാഷ്ടമി
8. ഇടശ്ശേരി - കറുത്ത ചെട്ടിച്ചികൾ

മൊഡ്യൂൾ മൂന്ന് (18 മണിക്കൂർ)

9. വയലാർ - രാവണപുത്രി
10. ഒ.എൻ.വി - പാഥേയം
11. സുഗതകുമാരി - തുലാവർഷപ്പച്ച
12. അയ്യപ്പപ്പണിക്കർ - പകലുകൾ രാത്രികൾ

മൊഡ്യൂൾ നാല് (18 മണിക്കൂർ)

13. കടമ്മനിട്ട രാമകൃഷ്ണൻ - കടമ്മനിട്ട
14. ബാലചന്ദ്രൻ ചുള്ളിക്കാട് - ഗസൽ
15. പി.പി. രാമചന്ദ്രൻ - ലൈബ്രേറിയൻ മരിച്ചതിൽപ്പിന്നെ
16. റഫീക്ക് അഹമ്മദ് - തോരാമഴ

17. എസ്. ജോസഫ് - പെങ്ങളുടെ ബൈബിൾ
18. വി.എം. ഗിരിജ - ജീവജലം

സഹായകഗ്രന്ഥങ്ങൾ

1. ആധുനിക സാഹിത്യ ചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ - ഡോ.കെ.എം.ജോർജ്ജ് (എഡിറ്റർ)
2. കൈരളിയുടെ കഥ - എൻ. കൃഷ്ണപിള്ള
3. മലയാള കവിതാസാഹിത്യ ചരിത്രം - ഡോ.എം. ലീലാവതി
4. കവിയും കവിതയും രണ്ടാം വാലും - പി.നാരായണക്കുറുപ്പ്
5. കവിയരങ്ങ് - കെ.എസ്. നാരായണപിള്ള
6. കുമാരാനാശാന്റെ കാവ്യപ്രപഞ്ചം - മലയാളവിഭാഗം, കേരള സർവ്വകലാശാല
7. ഖണ്ഡകാവ്യ പ്രസ്ഥാനം - എം.വി. പണിക്കർ
8. ചങ്ങമ്പുഴ കൃഷ്ണപിള്ള - എൻ.മുകുന്ദൻ
9. ചങ്ങമ്പുഴ കൃഷ്ണപിള്ള നക്ഷത്രങ്ങളുടെ സ്നേഹ ഭാജനം - എം.കെ.സാനു
10. കുമാരനാശാന്റെ രചനാശിൽപ്പം - എം.എം. ബഷീർ
11. കാല്പനികത - ഹൃദയകുമാരി
12. ആധുനിക മലയാളസാഹിത്യം - പി.കെ. പരമേശ്വരൻ നായർ
13. ഇടശ്ശേരിക്കവിത - മേലത്തു ചന്ദ്രശേഖരൻ
14. സിംബലിസം മലയാളകവിതയിൽ - ഡോ.കെ.എം. വേണുഗോപാൽ
15. ആധുനികത മലയാളകവിതയിൽ - ഡോ.എൻ.അജയകുമാർ
16. കേരളകവിതയിലെ കലിയും ചിരിയും - പ്രസരാജൻ
17. ഉത്തരാധുനികത - ബി.ഉണ്ണികൃഷ്ണൻ
18. മലയാളകവിതാപഠനങ്ങൾ - സച്ചിദാനന്ദൻ
19. മലയാളകവിതയിലെ ഉയർന്നശിരസ്സുകൾ - ഡോ.എം.എൻ. രാജൻ
20. കടമ്മനിട്ടയിലെ കവി - ഡോ.കെ.എസ്.രവികുമാർ
21. ദലിത് പഠനം സ്വത്വം,സംസ്കാരം സാഹിത്യം - ഡോ. പ്രദീപൻ പാമ്പിരിക്കുന്ന്
22. ആധുനിക മലയാള കവിതയിലെ സ്ത്രീപക്ഷസമീപനങ്ങൾ - ഡോ.പി.ഗീത
23. പാഠങ്ങൾ പഠനങ്ങൾ - സച്ചിദാനന്ദൻ
24. കവിതവായനയും പ്രതികരണവും - എൻ.രാജൻ
25. കവിതയിലെ പുതുവഴികൾ - നെല്ലിക്കൽ മുരളീധരൻ

Language Course II (Additional Language I)
15UHN111.1: PROSE AND GRAMMAR

No. of credits: 3
No. of instructional hours per week: 4

Aim of the Course / Objectives

The aim of the course is to sensitize the students to the aesthetic and cultural aspects of literary appreciation and analysis. To introduce Modern Hindi prose to the students and to understand the cultural, social and moral values of modern Hindi prose. To understand the theory and practice of Hindi Grammar.

Module I

Prose (Prescribe a prose collection)

Module 2

Grammar

Parts of speech – varna – Noun – Lingavachan, karak – Pronoun – Adjective – Verb – Tense, voice Grammar Practice – Sentence Correction – Change of Tense – 'Ne' rule.

Prescribed Textbooks

1. Pose (Detailed) - Gadya Prabha Edited by Dr. Alok Gupt Published by Rajpal and sons Kasmiri Gate, Delhi-6.

Lessons to be studied

1. Tyagamoorthy Nirala - Sivapoojan Sahay
2. Bharatheey Sanskriti - Rajendra Prasad
3. Holi aur Onam - Dr. N.E.V. Iyer
4. Ve Bahaduri se Bike - Harisankar Parsay
5. Sukh - Kaseenath Singh
6. Nadiya gahari naav purani - Amritlal Vegad
2. Grammar - Vyavaharik Hindi Vyakaran By Dr. H. Parameswaran Radhakrishna Prakasan, Delhi

Topics to be studied

Varna, Sangya - Ling-vachan-karak, Sarvanam, Visheshan, kriya – kaal – kaal ke prakar – ne prathyay and vachya only.

Course II (Additional Language I)
15UHN111.1: Communication skills in French

No. of credits: 3

No. of instructional hours per week: 4

AIMS:

The aim of the course is to emphasis on conversational French and to develop the communication skills of the students.

OBJECTIVES:

1. To familiarise the students with a modern foreign language.
2. To familiarise the students with the sounds of French.
3. To encourage students to use French for basic communication in everyday situation.
4. To acquaint students with the basics of writing simple sentences and short compositions.

SYLLABUS:

NAME OF TEXT: **CONNEXIONS** – Niveau 1 By Régine Mérieux and Yves Loiseau

Publisher : Didier

Module 1 : Parler de soi

Unit 1 : Bonjour !

Unit 2 : Rencontres

Unit 3 : 100% questions

Reference books :

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet

Cours de langue et de civilisation française Vol I (Mauger Bleu)

Foundation Course I
15UEN121: WRITINGS ON CONTEMPORARY ISSUES

No. of credits: 2

No. of instructional hours per week: 4 (Total 72 hrs.)

AIMS

1. To sensitize students to the major issues in the society and the world.

2. To encourage them to read literary pieces critically.

OBJECTIVES

On completion of the course, the students should be able to

1. have an overall understanding of some of the major issues in the contemporary world.

2. respond empathetically to the issues of the society.

3. read literary texts critically.

COURSE OUTLINE

Module I: Globalization and its Consequences

Essays: (1) "The Globalized World" – AvinashJha.

(2) "Globalization and Education: Third World Experience" – AmitBhaduri.

Poem: "Unending Love" - Rabindranath Tagore

Module II: Environmental Issues

Essay: "Forests and Settlements" - RomilaThapar Poems:

(1) "God's Grandeur" - G.M.Hopkins

(2) "The World is too Much with Us" – Wordsworth

Module III: Human Rights

Essay: "Thinking about Human Rights" - ManishaPriyam, Krishna Menon&Madhulika Banerjee

Poem: "London" - William Blake

Fiction: Untouchable [an extract] – Mulk Raj Anand

Module IV: The Gender Question

Essays: "Gender, Culture and History" – ManishaPriyam, Krishna Menon&Madhulika Banerjee

Fiction: "The Elder Sister" – M. T. Vasudevan Nair

COURSE MATERIAL

Modules 1 - 4

Core reading: Meeting the World: Writings on Contemporary Issues. Pearson, 2013.

Core Course I
15UPY141: BASIC MECHANICS & PROPERTIES OF MATTER

No. of credits: 2

No. of instructional hours per week: 4

MECHANICS (22 hrs.)

Unit 1- Dynamics of Rigid Bodies (7 hrs)

Equations of motion for rotating rigid bodies-angular momentum and M.I-Theorems on M.I-Calculation of M.I of bodies of regular shapes-uniform rod, ring, disc, annular ring, solid cylinder, hollow cylinder and solid sphere-KE of rotating and rolling bodies-torque-Determination of M.I of a fly wheel (theory, experiment and applications)

Unit 2- Conservation of energy (3 hrs)

Conservation laws-Work-power-Kinetic Energy-Work Energy theorem-Conservative Forces-potential energy-Conservation of energy for a particle– energy function-Non Conservative forces- Friction- types of friction

Unit 3-Oscillations and Waves (12 hrs)

Simple harmonic motion – Energy of harmonic oscillators-simple pendulum-mass on a spring-oscillation of two particles connected by a spring, compound bar pendulum, determination of g using symmetric

bar pendulum. Anharmonic oscillator, damping force, damped harmonic oscillator, examples of damped harmonic oscillator, power dissipation, Q-factor, Forced harmonic oscillator, resonance.

Mechanical and electromagnetic wave motion- General equation of a wave motion-expression for a plane progressive harmonic wave- energy density for a plane progressive wave- transverse waves in stretched string (expression) - longitudinal waves in rods- longitudinal waves in gas.

PROPERTIES OF MATTER (14hrs)

Unit 4- Elasticity (8 hours)

Modulus of elasticity (revision)-Relations connecting the three elastic moduli - Poisson's ratio- bending of beams- bending moment-cantilever-centrally loaded beams and uniformly bent beams-I section girders-torsion of a cylinder-expression for torsional couple-work done in twisting a wire-torsion pendulum-static torsion-theory and experiment.

Unit 5– Surface Tension (3 hrs)

Surface tension-molecular explanation of S.T-angle of contact (revision)-shapes of drops -expression for excess of pressure on a curved liquid surface -determination of surface tension by Jaeger's method-capillary rise method-variation of S.T with temperature.

Unit 6 – Fluid Dynamics (3 hours)

Streamline and turbulent flow, equation of continuity, Bernoulli's theorem, venturimeter, viscosity- Newton's law- Poisseulle's equation-derivation-flow of blood in human body-Stoke's formula-theory and experiment.

Books for Study

1. Mechanics – Hans H.S and Puri S.P, TMH: second edition.
2. Mechanics – J.C Upadhyaya (Ramaprasad)
3. Properties of matter – D.S.Mathur
4. Fundamentals of Physics- Halliday and Resnick

References

1.Properties of matter- Brijlal and Subramaniam
2.Principles of Physics- P.V.Naik, PHI.

3. Mechanics and Properties of matter – P.Vivekanandan

Topics for assignments /discussion in the tutorial session (sample)

1. Physics-The fundamental science-historical development of mechanics-some implications of the principle of mechanics-The scope of mechanics.

2. Life of eminent physicists- Newton, Einstein, C.V.Raman, Edison.

3. Study of Young's modulus for different types of wood.

4. Study of variation of surface tension for different detergents.

5. Study of viscosity of different types of ink and to arrive at knowledge of its fluidity.

6. Wide applications of Bernoulli's equation.

7. Variation of surface tension with temperature by Jaeger's method

Complementary Course I
15UMM131.1: Differentiation and Analytic Geometry

No. of credits: 3

No. of instructional hours per week: 4

Overview

The complementary course intended for Physics students lays emphasis on the application of mathematical methods to Physics. The two modules on Calculus links the topic to the real world and the student's own experience as the authors of the text put it. Doing as many of the indicated exercises from the text should prove valuable in understanding the applications of the theory. Analytic geometry presented here is important in applications of calculus.

Module 1: Differentiation with applications to Physics-I

- Functions and graphs of functions with examples from Physics. Interpretations of slope.The graph showing direct and inverse proportional variation. Mathematical models (functions as models). Parametric

equations.Cycloid and Brachistochrone problem.
Exercise set 1.8; Questions 31 - 34, 37 and 39.

- Instantaneous velocity and the slope of a curve. Limits.Infinite limits and vertical asymptotes.Limits at infinity and horizontal asymptotes. Some basic limits.
  Exercise set 2.1; Questions 27 and 28.
- Continuity. Slopes and rates of change.Rates of change in applications.Derivative.
  Exercise set 3.1; Questions 1 - 4 and 15, 16, 18 - 21.
  Exercise set 3.2; Question 39.
- Techniques of differentiation. Higher derivatives.Implicit differentiation. Related rates. Local linear approximation.Differentials.
  Examples 1 - 6.
  Exercise set 3.3; Question 68.
  Exercise set 3.4; Question 32.
  Exercise set 3.8; Questions 57 - 60.
- Rectilinear motion. Speeding up and slowing down. Analysing the position versus time curve. Free fall motion.
  Examples 1 - 7. Exercise set 4.4; Questions 8, 9, 23, 27, 30 - 32.
- Absolute maxima and minima. Applied maximum and minimum problems.
  Exercise set 4.6; Questions 47, 48, 56, 59.
- Statement of Rolle's Theorem and Mean Value Theorem. The velocity interpretation of Mean Value Theorem.Statement of theorems 4.1.2 and 4.83 (consequences of the Mean Value Theorem).
  Exercise set 4.8; Questions 22 - 25.
- Inverse functions. Continuity and differentiability of inverse functions. Graphing inverse functions.exponential and logarithmic functions. Derivatives of logarithmic functions and logarithmic differentiation. Derivatives of the exponential function.Graphs and applications involving logarithmic and exponential functions. Logistic curves. Example 4 of section 7.4 (Newton's Law of Cooling).
  Exercise set 7.4; Questions 31, 35, 49 - 50.
- Definitions of hyperbolic functions. Graphs of hyperbolic functions. Hanging cables and other applications.Hyperbolic identities. Why

they are called hyperbolic functions. Derivatives of hyperbolic functions.Inverse hyperbolic functions. Logarithmic forms of inverse hyperbolic functions. Derivatives of inverse hyperbolic functions.

Exercise set 7.8; Questions 69 and 72.

Module 2: Differentiation with applications to Physics-II

- Power series and their convergence. Results about the region of convergence of a power series(without proof). Radius of convergence. Functions defined by a power series. Results about term by term differentiation and integration of power series (without proof). Taylor's theorem with derivative form of remainder (without proof) and its use in approximating functions by polynomials. Taylor series and Maclaurin series and representation of functions by Taylor series. Taylor series of basic functions and the regions where these series converge to the respective functions.Binomial series as a Taylor series and its convergence.Obtaining Taylor series representation of other functions by differentiation, integration, substitution etc.
- Functions of several variables. Graphs of functions of two variables. Equations of surfaces such as sphere, cylinder, cone, paraboloid, ellipsoid, hyperboloid etc.Partial derivatives and differentials. The chain rule (various forms). Euler's theorem for homogeneous functions. Jacobians.

  Exercise set 14.3; Questions 47 and 48.

  Exercise set 14.4; Questions 49 and 50.

  Exercise set 14.5; Questions 41. 42 and 46.
- Local maxima and minima of functions of two variables. Use of partial derivatives in locating local maxima and minima.Lagrange method for finding maximum/minimum values of functions subject to one constraint.

  Exercise set 14.9; Question 20.

  Module 3: Analytic Geometry
- Geometric definition of a conic-the focus, directrix and eccentricity of a conic. Classification of conics into ellipse, parabola and hyperbola based on the value of eccentricity.Sketch of the graphs of conics. Reflection properties of conic sections.

  Exercise set 11.4; Questions 39 - 43.
- Equations of the conics in standard positions. Equations of the conics

which are translated from standard positions vertically or horizontally. Parametric representation of conics in standard form.Condition for a given straight line to be a tangent to a conic (no proof).Equation of the tangent and normal to a conic at a point.

- Asymptotes of a hyperbola. Equation of the asymptotes.
- Conic sections in polar coordinates. Eccentricity of an ellipse as a measure of flatness.Polar equations of conics.Sketching conics in polar coordinates. Kepler's Laws.

Example 4 of section 11.6.

Text : Howard Anton, et al, Calculus, Seventh Edition, John Wiley

Complementary Course II
15UCH131.1: PRINCIPLES OF CHEMISTRY I

No. of credits: 2

No. of instructional hours per week: 4

Module – 1: Atomic Structure (9 Hrs)

Atomic spectrum of Hydrogen – different series, Rydberg equation, Bohr theory –postulates – statement of Bohr energy equation – derivation of spectral frequency from Bohr equation. Schrodinger wave equation (no derivation mention only) concept of orbitals, the four quantum numbers and their significances. Orbital wise electron configuration, energy sequence rule – Pauli's principle, Hund's rule, stability of filled and half filled orbitals.

Module II - Chemical bonding (9 Hrs)

Energetic of bond formation – Types of Chemical bonds – Energetics of ionic bond formation – Lattice energy – Born Haber Cycle – partial covalent nature of ionic bond – Fajan's rules, polarity of covalent bond its relation with ectronegativity – electro negativity scales – Paulings and Mullikan's approaches, factors influencing polarity, dipole moment – its relation to geometry. Hydrogen bond – inter and intra molecular – its

consequences on boiling point –volatility and solubility. Hybridisation and structure of molecules – SP, SP2, SP3, dSP2, dSP3, SP3d2, and SP3d3 hybridisation with examples. Explanation of bond angle in water and ammonia, VSEPR theory, geometry of molecules with bond pairs of electrons only, geometry of molecules containing bond pairs and lone pairs of electrons, limitations. A brief review of molecular orbital approach, LCAO method – bond order, bond distance and stability of O2, O22+,O22-, NO,NO+,CO and HF.

Module III – Thermodynamics (9 Hrs)

First law of thermodynamics, mathematical form, intrinsic energy, enthalpy, reversible, process and maximum work, work of expansion of an ideal gas in reversible isothermal process. Heat capacity of gases at constant volume and constant pressure, derivation of CP – CV = R. Second law of thermodynamics, entropy and free energies, significance of ΔG, ΔH and available work – criteria of equilibrium, and spontaneity, on the basis of entropy and free energy.

Module IV Thermochemistry (9 Hrs)

Enthalpies of formation, combustion, neutralization,solution and hydration. Relation between heat of reaction at constant volume and constant pressure, variation of heat of reaction with temperature. Kirchoff's equation, Hess's law and application – bond dissociation energies and bond energies of different types of bonds, their calculation and enthalpies of reaction.

References

1. Atomic structure and chemical bonding with introduction to Molecular spectroscopy – Manas Chanda.

2. Concise Inorgantic Chemistry – J.D. Lee

3. Principles of Physical Chemistry- Puri, Sharma, Pathania.

4. Physical Chemistry - N. M. Kapoor.

SEMESTER II

Language Course III
15UEN211.1: READING SKILLS

No. of credits: 4
No. of instructional hours per week: 5 (Total 90 hrs)

AIMS

1. To make students competent in advanced reading skills like skimming, scanning and reading for meaning and pleasure.
2. To make them familiar with the concepts of extensive and intensive reading.
3. To help them increase their active and passive vocabulary.
4. To help them broaden their mental vision.

OBJECTIVES

On completion of the course, the students should be able to

1. Identify various text types and comprehend them.
2. Apply reading techniques like skimming and scanning to understand the main arguments and themes and distinguish supporting details.
3. Use and comprehend a reasonable vocabulary and reinforce their language proficiency.
4. Have a broader outlook resultant from the exposure to the study of fine specimens of reading.

COURSE OUTLINE

Module 1

Intensive reading - reading for information - application of scanning and skimming – silent and loud reading - various techniques - advantages and disadvantages. (Pull Out - Reading Tips)

Module 2

Introducing students to different text types – poetry (Henry IV, Nobody, I Am, Musee des Beaux Arts, Paradise Lost, Heaven, Kubla Khan, Message Clear)

Drama (Loot, Macbeth, Happy Days)

Module 3

Introducing students to different text types - prose – fictional - (Alice in Wonderland, Nineteen Eighty Four, Catch -22, Animal Farm, The Sacred and Profane Love Machine)

Nonfictional – (Civilized Man, Our Bodies Ourselves)

Module 4

Extensive reading – reading for pleasure and knowledge (Poem – Father and Son, The Poplar Field, Going Going, Anthem for Doomed Youth, A Refusal to Mourn, Ulysses, Andrea del Sarto)

Drama (Chicken Soup with Barley, A Night Out, The Importance of Being Earnest)

Prose –Fictional – (Sons and Lovers, Emma, Middlemarch, Down There on a Visit, Bleak House, The Picture of Dorian Gray)

Non –fictional – (Churchill's Speech, Russell's Autobiography)

COURSE MATERIAL

Modules 1 – 4

Core reading: Reading Between the Lines. Cambridge University Press,India Pvt Ltd, 2010

Further reading:

1. Brown, Katherine and Susan Hood. Academic Encounters: Life in a Society. New Delhi: CUP, 2006.
2. Longman Essential Activator. London: Pearson Longman, 2009.
3. Glendinning, Eric H and Beverly Holmstrom. Study Reading.South Asian Edition.CUP, 2008.
4. Oxford Dictionary of Collocations in English, Oxford University Press, 2009.
5. Wainwright, Gordon. How to Read Faster and Recall More. Macmillan India Ltd, 2008.
6. McCarthy, Michael et al. English Collocation in Use. CUP, 2007.

Reference:

Mayor, Michael, et al, Ed. Longman Dictionary of Contemporary English.5th Edition. London: Pearson Longman Ltd, 2009.

Language Course IV

15UEN212.1: MODERN ENGLISH GRAMMAR AND USAGE

No. of credits: 3
No. of instructional hours per week: 4 (Total 72 hrs)

AIMS:

1. To help students have a good understanding of modern English grammar.
2. To enable them produce grammatically and idiomatically correct language.
3. To help them improve their verbal communication skills.
4. To help them minimise mother tongue influence.

OBJECTIVES:

On completion of the course, the students should be able to

1. Have an appreciable understanding of English grammar.
2. Produce grammatically and idiomatically correct spoken and written discourse.
3. Spot language errors and correct them.

COURSE CONTENTS

Module 1:

→ Words - parts of speech – nouns – pronouns - adjectives - verbs - adverbs – prepositions – conjunctions - determinatives.

→ Sentence as a self-contained unit – various types of sentence – simple – compound – complex – declaratives – interrogatives – imperatives – exclamatives.

→ Basic sentence patterns in English - constituents of sentences – subject – verb - object - complement – adverbials.

→ Phrases - various types of phrases - noun, verb, adjectival and prepositional phrases.

Module 2:

→ Nouns - different types - count and uncount – collective - mass - case - number – gender.

→ Pronoun - different types - personal, reflexive - infinite-emphatic – reciprocal

→ Adjectives - predicative - attributive - pre- and post-modification of nouns.

→ Verbs - tense-aspect - voice -mood - Concord - types of verbs – transitive - intransitive-finite - non-finite

→ Helping verbs and modal auxiliaries - function and use.

Module 3:

→ Adverbs - different types - various functions - modifying and connective.

→ Prepositions - different types - syntactic occurrences - prepositional phrases - adverbial function.

→ Conjunctions - subordinating and coordinating - Determinatives - articles - possessives - quantifiers

→ Clauses - main and subordinate clauses - noun clauses - relative clauses - adverbial clauses - finite and non-finite clauses - analysis and conversion of sentences – Active to Passive and vice versa – Direct to Indirect and vice versa – Degrees of Comparison, one form to the other.

Module 4:

→ Written Composition – précis writing – outline story – Comprehension

COURSE MATERIAL

Modules 1 - 4 Core Reading: Concise English Grammar by Prof. V. K. Moothathu. Oxford University Press, 2012.

Further Reading:

1. Leech, Geoffrey et al. English Grammar for Today: A New Introduction.2nd Edition.Palgrave, 2008.
2. Carter, Ronald and Michael McCarthy. Cambridge Grammar of English.CUP, 2006.
3. Greenbaum, Sidney. Oxford English Grammar.Indian Edition.Oxford University Press, 2005.
4. Sinclair, John ed. Collins Cobuild English Grammar. Harper Collins Publishers, 2000.

5. Driscoll, Liz. Common Mistakes at Intermediate and How to Avoid Them.CUP, 2008.
6. Tayfoor, Susanne. Common Mistakes at Upper-intermediate and How to Avoid Them.CUP, 2008.
7. Powell, Debra. Common Mistakes at Advanced Level and How to Avoid Them.CUP, 2008.
8. Burt, Angela. Quick Solutions to Common Errors in English. Macmillan India Limited,2008.
9. Turton. ABC of Common Grammatical Errors. Macmillan India Limited, 2008.
10. Leech, Geoffrey, Jan Svartvik. A Communicative Grammar of English. Third Edition. New Delhi: Pearson Education, 2009.

Direction to Teachers: The items in the modules should be taught at application level with only necessary details of concepts. The emphasis should be on how grammar works rather than on what it is. The aim is the correct usage based on Standard English and not conceptual excellence.

Language Course V (Additional Language II)
15UML211.1: ഗദ്യസാഹിത്യം

No. of credits: 3
No. of instructional hours per week: 4

മൊഡ്യൂൾ ഒന്ന് (18 മണിക്കൂർ)

നോവൽ

മലയാള നോവൽ പ്രസ്ഥാനത്തിന്റെ ഉത്ഭവ - വികാസപരിണാമങ്ങളെപ്പറ്റി സാമാന്യമായി മനസ്സിലാക്കുക. ഒരുനോവൽ വിശദമായി പഠിക്കുക

1. എം.മുകുന്ദൻ - ഒരു ദളിത് യുവതിയുടെ കദനകഥ

മൊഡ്യൂൾ രണ്ട് (18 മണിക്കൂർ)

ചെറുകഥ

മലയാള ചെറുകഥയുടെ വികാസപരിണാമങ്ങളെപ്പറ്റിയുള്ള സാമാന്യജ്ഞാനം. ആഖ്യാന തന്ത്രങ്ങളുടെ വൈചിത്ര്യം. പ്രമേയത്തിലും രൂപശിൽപ്പത്തിലും സംഭവിച്ച മാറ്റങ്ങൾ

1. സി.വി. കുഞ്ഞിരാമൻ - ആത്മഹത്യ ചെയ്യാൻ എനിക്ക് മതിയായ കാരണമില്ലയോ?
2. കാരൂർ - പൊതിച്ചോറ്
3. ലളിതാംബിക അന്തർജ്ജനം - മനുഷ്യപുത്രി
4. കെ.സരസ്വതിയമ്മ - രമണി
5. എം.ടി - ബന്ധനം
6. സക്കറിയ - പത്രം
7. ടി.പത്മനാഭൻ - ദാസൻ
8. അഷ്ടമൂർത്തി - വീഡിയോ ചിത്രങ്ങൾ
9. സിതാര - അഗ്നി
10. ബി.മുരളി - ഐ.സി.യു

മൊഡ്യൂൾ മൂന്ന് (18 മണിക്കൂർ)

ഉപന്യാസം, പഠനം, അനുഭവം

സാഹിത്യവും സാഹിത്യേതരവുമായ 4 രചനകൾ പഠിക്കണം

1. എം.എൻ. വിജയൻ - മാമ്പഴം
2. സുകുമാർ അഴീക്കോട് - പ്രഭാഷണകല
3. കെ.പി.അപ്പൻ - മധുരം നിന്റെ ജീവിതം (ആദ്യഭാഗം)
4. സാറാജോസഫ് - അടുക്കളകൾ തിരിച്ച് പിടിക്കുക

റഫറൻസ് ഗ്രന്ഥങ്ങൾ

1. സമ്പൂർണ്ണ മലയാള സാഹിത്യ ചരിത്രം - എഡിറ്റർ പന്മന രാമചന്ദ്രൻ നായർ
2. കൈരളിയുടെ കഥ - എൻ. കൃഷ്ണപിള്ള
3. ആധുനിക സാഹിത്യ ചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ - ഡോ.കെ.എം. ജോർജ്ജ്
4. മലയാളനോവൽ സാഹിത്യ ചരിത്രം - ഡോ.കെ.എം.തരകൻ
5. മലയാള ചെറുകഥാ സാഹിത്യചരിത്രം - ഡോ.എം.എം.ബഷീർ
6. നോവൽ സാഹിത്യം - കെ.സുരേന്ദ്രൻ
7. നോവൽ സ്വരൂപം - കെ.സുരേന്ദ്രൻ
8. നോവൽ സിദ്ധിയും സാധനയും - പി.കെ.ബാലകൃഷ്ണൻ
9. നോവൽ സാഹിത്യപഠനങ്ങൾ - ഡോ. ഡി.ബഞ്ചമിൻ
10. ആധുനിക നോവൽ ദർശനങ്ങൾ - കെ.എം. തരകൻ
11. ചെറുകഥാ പ്രസ്ഥാനം - എം.പി. പോൾ
12. ചെറുകഥ ഇന്നലെ, ഇന്ന് - എം. അച്യുതൻ
13. ചെറുകഥ - വാക്കുംവഴിയും - കെ.എസ്.രവികുമാർ

14. നോവൽ പഠനങ്ങൾ - ഡോ.പന്മന രാമചന്ദ്രൻ നായർ
15. ചെറുകഥാ പഠനങ്ങൾ - ഡോ.പന്മന രാമചന്ദ്രൻ നായർ
16. കഥയും ഫാന്റസിയും - ഡോ.വത്സലൻ വാതുശ്ശേരി
17. കഥയിലെ ആത്മീയസഞ്ചാരങ്ങൾ - ഡോ.ഇ. രമാഭായി
18. കഥ അനുഭവവും ആഖ്യാനവും - ഡോ.കെ.പി.അപ്പൻ
19. കഥയും ഭാവുകത്വപരിണാമവും - ഡോ.കെ.എസ് രവികുമാർ
20. ഏകാന്തനഗരങ്ങൾ - ഡോ.പി.കെ രാജശേഖരൻ
21. ഭാരതപര്യടനം - കുട്ടികൃഷ്ണമാരാർ
22. മധുരം നിന്റെ ജീവിതം - കെ.പി.അപ്പൻ
23. ശീർഷാസനം - എം.എൻ.വിജയൻ
24. കവിതയും മനഃശാസ്ത്രവും - എം.എൻ.വിജയൻ
25. അടുക്കളകൾ തിരിച്ചു പിടിക്കുക - സാറാ ജോസഫ്

Language Course V (Additional Language II)
15UHN211.1: Fiction and Literary Analysis

No. of credits: 3

No. of instructional hours per week: 4

Aims of the Course / Objectives

The aim of the course is to guide the students to the world of Hindi Fiction (Novel & Short Story). To develop enthusiasm in Literary and aesthetic approaches.To understand various aspects and dimensions of literature.

Module 1

Short story (Prescribe a short story collection)

Module 2

Novel (Prescribe a novel of post eighties)

Module 3

Literary Analysis

The meaning and definitions of literature – Types of literature – Literature

and film – Literature and Mass Communication Media – Print media – Electronic media etc.

Literary criticism

Models of Literary Criticism – Short story – Poetry – Novel – Drama – Film etc.

Prescribed Textbooks

1. Short story collection (Non-Detailed) — Kahani Sankalan
   Edited by Dr. Sushama Dubey & Dr. Rajkumar
   Published by Vani Prakashan
   21 – A, Dariagang, New Delhi-2

Stories to be studied

1. Gunda - Jayasankar Prasad
2. Kafan - Premchand
3. Raja Nirbansiya - Kamaleswar
4. Sikka Badal Gaya - Krishna Sobti
2. Novel (Non Detailed) - ABCD
   by Ravindra Kaliya
   Published by Vani Prakasan
   New Delhi-2
3. Literary Analysis - Sahithya Vivechan
   by Jayanthi Prasad Nautiyal
   published by Kitab Ghar Prakasan
   Dariya Ganj, Delhi

(Chapters 3, 4, 5, 6 and 9 should be omitted)

Language Course V (Additional Language II)

15UFR211.1: Translation and communication in French

No. of credits: 3

No. of instructional hours per week: 4

AIMS:

The aim of the course is to facilitate the use of translation for more communication.

OBJECTIVES:

1. To ameliorate the level of language proficiency
2. To analyse the translated texts.
3. To enhance the ability to translate to the target language.

SYLLABUS:

NAME OF TEXT: **CONNEXIONS** – Niveau 1 By Régine Mérieux and Yves Loiseau

Publisher : Didier

Module 2 : Echanger

Unit 4 : Enquête

Unit 5: Invitations

Unit 6: A table !

Reference books:

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet

Cours de langue et de civilisation française Vol I (Mauger Bleu)

Foundation Course II
15UPY221: METHODOLOGY IN PHYSICS

No. of credits: 2

No. of instructional hours per week: 4

Unit 1 Physics and its methods (7 Hrs)

Physics, and its relation to other branches of Science. Hypotheses; theories and laws in science- Verification (proving), corroboration and falsification (disproving), Revision of scientific theories and laws. Significance of Peer Review.Publications and patents.

Research in India-Contributions by S. N. Bose, M. N. Saha, C. V. Raman and S.Chandrasekhar.VikramSarabhaBhai, H.J. Bhabha.

Unit 2 Measuring Instruments and Error Analysis (9 hrs)

Measurement of time –digital clocks –atomic clocks.
Length measurement – rulers – standard metre – micrometers – screw gauges - travelling microscope – laser range finder- sonar – GPS.
Angle measurement – spectrometer verniers - scale and telescope - measurement of stellar parallaxes. .
Electrical measurement - Working principle of galvanometer, voltmeter, ammeter- Familiarizing digital multimeter
Basic ideas of error measurement, uncertainties of measurement, importance of estimating errors, Dominant errors, random errors, systematic errors, rejection of spurious measurements, Estimating and reporting errors, errors with reading scales, number of significant digits, absolute error, relative error and percentage error, standard deviation, error bars and graphical representation.Propagation of errors - sum and differences, products and quotients, multiplying by constants, powers.

Unit 3 Mathematical Methods in Physics (10 Hrs)

Vector Analysis: – Vector Operations - Vector Algebra – Component form – How vectors transform, Applications of vectors in Physics.
Differential calculus: - the operator ∇ - Gradient, Divergence, Curl – Physical interpretation – Product rules of ∇ - Second derivatives.
Integral Calculus: – Line integral, surface integral and volume integral - Fundamental theorem of Gradients – Gauss's Divergence

Theorem (Statement only)– The fundamental theorem of curl – Stoke's theorem(Statement only). Divergenceless and curlless fields.
Curvilinear co-ordinates: – Spherical polar coordinates – cylindrical co-ordinates (Basic ideas-line , surface and volume elements).

Unit 4 Learning MS Office (6 Hrs)

(Teaching of this chapter should be based on Office 2010)

Word-Getting Started with word-Exploring the word window-moving around the screen-Editing text-moving and copying text-using undo and repeat-Selecting text attributes-formatting paragraphs-copying formatting-Adding headers and footers-working with columns and tables-Printing and publishing.
Excel-Creating a basic work sheet-working with formulas and functions-Sorting data-Generating Excel Charts.
PowerPoint-Creating a PowerPoint presentation-Editing the presentation-Formatting of a PowerPoint presentation.

Books for Study

1 Research methodology-methods and techniques, C.R. Kothari, New age international publishers

2 An Introduction to Error Analysis: The Study of Uncertainties in Physical Measurements, John R. Taylor - Univ. Science Books

3 Vignettes in Physics – G. Venkataraman, Universities Press - this series of books gives authentic accounts of contributions of Indian physicists (See 'Bose and his Statistics', 'Saha and his formula', 'Raman and his effect' and 'Chandrasekhar and his limit')

4 Introduction to Electrodynamics, David J. Griffiths, 3rd Edition, Prentice-Hall India

5 Picture Yourself Learning Microsoft 2010 - Diane Koers, Course technology Ptr

Reference

1 Cultural Boundaries of Science.,Gieryn, T.F. Univ. Chicago Press, 1999.

2 The Golem: What Everyone Should Know About Science., Collins H. and T. Pinch., Cambridge Univ Press, 1993.

3 Conceptual Integrated Science, Hewitt, Paul G, Suzanne Lyons, John

A. Suchocki& Jennifer Yeh, Addison-Wesley, 2007
4 The Truth of Science, Newton R.G. Havard University Press, 2nd edition
5 Methods for Teaching Science as Inquiry, Bass, Joel, E and et.al., Allyn& Bacon,2009
6 Instrumentation Devices & Systems - C. S. Rangan, G. R. Sarma, V. S. V. Mani McGraw-Hill

Internet Resources

http://www.upscale.utoronto.ca/PVB/Harrison/ErrorAnalysis/

http://phys.columbia.edu/~tutorial/index.html

Complementary Course III
15UMM231.1: Integration and Vectors

No. of credits: 3

No. of instructional hours per week: 4

Overview

The complementary course in the second semester continues the trend indicated in the first, namely, laying emphasis on applications of integral calculus and vectors to problems in Physics. Module 1 consists of various applications of integration techniques. It also covers multiple integrals. Modules 2 and 3 deal with vector calculus and its applications in detail.

Module 1: Applications of integration

- Integral curves, integration from the view point of differential equations, direction fields Exercise set 5.2; Questions 43, 44 and 51.
- Rectilinear motion: finding position and velocity by integration. Uniformly accelerated motion.The free-fall model.integrating rates of change. Displacement in rectilinear motion. Distance travelled in rectilinear motion. Analysing the velocity versus time curve.Average value of a continuous function. Average velocity revisited.

Exercise set 5.7; Questions 3, 4, 5, 6, 29, 39, 45 and 55.

- Use of definite integrals in finding area under curves, area between two curves, volume of revolution, arc length and surface area of a solid of revolution.
- The idea of approximating the volume under a bounded surface in 3-space by volumes of boxes, leading to the definition of double integrals of functions of two variables over bounded regions. Evaluation of double integrals by iterated integrals.Evaluation by changing to polar co-ordinates and by suitably changing order of integration in the iterated integral. Applications to finding the volume of solids under bounded surfaces.
- Triple integrals over bounded regions in three space. Evaluation by iterated integrals.Cylindrical coordinates and spherical coordinates and their relation to Cartesian coordinates.Use of cylindrical and spherical co-ordinates in evaluating triple integrals.Applications of triple integrals to finding volumes of solid objects.

Module 2: Vector Differentiation

- Vector function of a single variable and representation in terms of standard basis. Limit of a vector function and evaluation of limit in Cartesian representation. Continuous vector functions and the idea that such functions represent oriented space curves.Examples.
- Derivative of a vector function and its geometric significance. Derivative in terms of Cartesian components.Tangent vector to a curve, smooth and piecewise smooth curves.Applications to finding the length and curvature of space curves, velocity and acceleration of motion along a curve etc.
- Scalar field and level surfaces. The gradient vector of a scalar field (Cartesian form) at a point and its geometric significance.Gradient as an operator and its properties.Directional derivative of a scalar field and its significance.Use of gradient vector in computing directional derivative.
- Vector fields and their Cartesian representation. Sketching of simple vector fields in the plane. The curl and divergence of a vector field(Cartesian form) and their physical significance. The curl and divergence as operators, their properties. Irrotational and solenoidal vector fields.Various combinations of gradient, curl and divergence operators.

Module 3: Vector Integration

- The method of computing the work done by a force field in moving a particle along a curve leading to the definition of line integral of a vector field along a smooth curve. Scalar representation of line integral.Evaluation as a definite integral.Properties. Line integral over piecewise smooth curves. Green's theorem in the plane (without proof) for a region bounded by a simple closed piecewise smooth curve.
- Oriented surfaces. The idea of flux of a vetor field over a surface in 3-space.The surface integral of a vector field over a bounded oriented surface.Evaluation by reducing to a double integral.Use of cylindrical and spherical co-ordinates in computing surface integral over cylindrical and spherical surfaces.
- Stokes' theorem (without proof) for an open surface with boundary a piecwise smooth closed curve. Gauss' divergence theorem (without proof).Verification of the theorems in simple cases and their use in computing line integrals or surface integrals which are difficult to evaluate directly. Physical intrepretation of divergence and curl in terms of the velocity field of a fluid flow.
- Conservative fields and potential functions. Relation of conservative vector fields to their irrotational nature and the path- independence of line integrals in the field (without proof). Significance of these results in the case of conservative force fields such as gravitational, magnetic and electric fields.Method of finding the potential function of a conservative field.

Text : Howard Anton, et al, Calculus, Seventh Edition, John Wiley

Complementary Course IV
15UCH231.1: PRINCIPLES OF CHEMISTRY II

No. of credits: 2

No. of instructional hours per week: 4

Module – I: Radio Activity (9 Hrs)

Radioactive equilibrium (qualitative only) detection of radio activity by Wilson's cloud chamber and Geiger Muller Scintillation counter – units of radio activity – curie and rutherford – Radio Carbon dating , Rock dating, Neutron activation analysis. Applications in agriculture and medicine. A brief study of the biological effects of radiation such as pathological and genetic damage, Dosimetry – Units – rad, gray and roentgen. Fricke dosimeter and ceric sulphate dosimeter. Nuclear Chemistry – stability of Nucleus – n/p ratio, artificial transmutation and radio activity, mass defect, binding energy, atomic fission and fusion.

Module II Spectroscopy (9 Hrs)

Regions of electromagnetic spectrum – different units to represent energy such as erg, joule, calorie, cm– 1, Hz and eV, their inter conversions – interaction of radiation with matter, different types of energy levels of molecules – rotation, vibration and electronic levels. Rotation spectroscopy Microwave spectrum of diatomic molecules – expressions for rotational energy, selection rule – frequency separation and determination of bond length – vibrational spectrum – harmonic oscillator, equation for frequency of vibration, expression for vibrational energy, selection rule, frequency separation, calculations of force constant, Electronic spectroscopy –types of transition and regions where they absorb. Raman spectroscopy – stokes and anti stokes lines, quantum theory of Raman spectrum – advantages and disadvantages of Raman spectrum, rotational Raman spectrum, selection rules and frequency separation. Vibrational Raman spectrum –Complementary with IR spectrum, mutual exclusion principle, NMR spectroscopy, principle of NMR spectroscopy, nuclear spin, interaction with external magnet, energy spacing, transition between nuclear energy levels in hydrogen nucleus, low resolution

spectrum, chemical shift, spin – spin coupling – fine structure spectrum, application to simple molecule

Module III Electro Chemistry (9 Hrs)

Transport number – definition, determination by Hittorfs method and moving boundary method, application of conductance measurements. Conductometric titrations involving strong acid – strong base, strong acid – weak base, weak acid – strong base and weak acid – weak base. EMF – Galvanic cells, measurement of emf, cell and electrode potential, IUPAC sign convention, Reference electrodes, SHE and calomel electrode, standard electrode potential, Nernst equation, anion and cation reversible electrodes, redox electrode with examples, quinhydrone electrode, glass electrode concentration cell without transference, potentiometric titration, over voltage and passivity, corrosion of metals – prevention of corrosion, Fuel cells – H2 – O2 and hydrocarbon – O2 type.

Module IV Analytical Method (9 Hrs)

Analytical method in Chemistry – principles of volumetric analysis, primary standard, standard solution, normality and molarity, theory of acid - base titration, permanganometric and dichrometric titration, theory of acid – base and redox indicators. Evaluation of analytical data – accuracy and precision, classification of errors. Detection and correction of determinate errors, standard deviation, variance and coefficient of variation.

References

1. Atomic structure and chemical bonding with introduction to Molecular spectroscopy – Manas Chanda.
2. Concise Inorgantic Chemistry – J.D. Lee
3. Principles of Physical Chemistry Puri, Sharma, Pathania.
4. Physical Chemistry - N. M. Kapoor.

SEMESTER III

Language Course VI
15UEN311.1: WRITING AND PRESENTATION SKILLS

No. of credits: 4

No. of instructional hours per week: 5 (Total 90 hrs)

AIMS

1. To familiarize students with different modes of general and academic writing.
2. To help them master writing techniques to meet academic and professional needs.
3. To introduce them to the basics of academic presentation
4. To sharpen their accuracy in writing.

OBJECTIVES

On completion of the course, the students should be able to

1. understand the mechanism of general and academic writing.
2. recognize the different modes of writing.
3. improve their reference skills, take notes, refer and document data and materials.
4. prepare and present seminar papers and project reports effectively.

COURSE OUTLINE

Module 1

Writing as a skill – its importance – mechanism of writing – words and sentences - paragraph as a unit of structuring a whole text – combining different sources – functional use of writing – personal, academic and business writing – creative use of writing.

Module 2

Writing process - planning a text – finding materials - drafting – revising – editing - finalizing the draft .

Module 3

Writing models – essay - expansion of ideas/proverbs – dialogue - letter writing – personal letters - formal letters - CV – surveys – questionnaire - e-mail – job application - report writing. Academic writing - writing examinations - evaluating a text - note-making- paraphrasing – summary writing - planning a text – organizing paragraphs – introduction – body – conclusion – rereading and rewriting - accuracy.

Module 4

Presentation as a skill - elements of presentation strategies – audience – objectives – medium – key ideas - structuring the material - organizing content - audio-visual aids – handouts - use of power point - clarity of presentation - non-verbal communication - seminar paper presentation and discussion.

COURSE MATERIAL

Modules 1 – 4 Core reading:

Write Rightly. Cambridge University Press,India Pvt Ltd, 2012

Further reading:

1. Robert, Barraas. Students Must Write. London: Routledge, 2006.
2. Bailey, Stephen. Academic Writing.Routledge, 2006.
3. Hamp-Lyons, Liz, Ben Heasley. Study Writing.2nd Edition.Cambridge Uty Press, 2008.
4. Ilona, Leki. Academic Writing.CUP, 1998.
5. McCarter, Sam, Norman Whitby. Writing Skills.Macmillan India, 2009.
6. Jay. Effective Presentation. New Delhi: Pearson, 2009.

Reference:

Mayor, Michael, et al, Ed. Longman Dictionary of Contemporary English. 5th Edition. London: Pearson Longman Ltd, 2009.

Language Course VII (Additional Language III)

15UML311.1: ദൃശ്യകലാസാഹിത്യം

No. of credits: 4

No. of instructional hours per week: 5

പഠനോദ്ദേശ്യം : ദൃശ്യകലാ സംസ്കാരത്തിന്റെ സമ്പന്നതയെക്കുറിച്ചുള്ള അറിവ് വിദ്യാർത്ഥികൾ നേടേണ്ടതുണ്ട്. കഥകളി, തുള്ളൽ, നാടകം, സിനിമ എന്നീ ദൃശ്യകലകളെയും അവയ്ക്ക് ആധാരമായ സാഹിത്യപാഠങ്ങളെയും വിദ്യാർത്ഥികൾക്ക് പരിചയപ്പെടുത്തുകയാണ് ലക്ഷ്യം.

മൊഡ്യൂൾ ഒന്ന് (36 മണിക്കൂർ)

ആട്ടക്കഥ, തുള്ളൽ സാഹിത്യം

കഥകളിയുടെ ഉത്ഭവവികാസ പരിണാമങ്ങൾ, പ്രധാന ആട്ടക്കഥാകൃത്തുക്കൾ

തുള്ളൽ പ്രസ്ഥാനം - സാമാന്യ പരിചയം

1. ഉണ്ണായിവാര്യർ - നളചരിതം ആത്മക്കഥ (നാലാംദിവസം) (രണ്ടാം സ്വയം വരത്തിനെത്തിയ നളനെ ദമയന്തി കാണുന്നഭാഗം വരെ)
2. കുഞ്ചൻ നമ്പ്യാർ - കല്യാണസൗഗന്ധികം തുള്ളൽ (ഹനുമാൻ - ഭീമ സംവാദം)

മൊഡ്യൂൾ രണ്ട് (36 മണിക്കൂർ)

നാടക സാഹിത്യം

മലയാള നാടക പ്രസ്ഥാനം - സാമാന്യവലോകനം

1. മലയാള ശാകുന്തളം (നാലാം അങ്കം) - എ.ആർ.രാജരാജവർമ്മ
2. തോപ്പിൽ ഭാസി - അളിയൻ വന്നത് നന്നായി

മൊഡ്യൂൾ മൂന്ന് (18 മണിക്കൂർ)

തിരക്കഥാപഠനം

ചലച്ചിത്രനിർമ്മിതിയിൽ തിരക്കഥയ്ക്കുള്ള പ്രാധാന്യത്തെക്കുറിച്ച് സാമാന്യജ്ഞാനം.

എം.ടി. വാസുദേവൻ നായർ - ഒരു വടക്കൻ വീരഗാഥ

റഫറൻസ് ഗ്രന്ഥങ്ങൾ

1. കേരള സാഹിത്യ ചരിത്രം - ഉള്ളൂർ
2. സാഹിത്യ ചരിത്രം പ്രസ്ഥാനങ്ങളിലൂടെ - ഡോ.കെ.എം.ജോർജ്ജ്

3. കൈരളിയുടെ കഥ - എൻ.കൃഷ്ണപിളള
4. കുഞ്ചൻ നമ്പ്യാർ വാക്കും സമൂഹവും - കെ.എൻ.ഗണേഷ്
5. നാട്യശാസ്ത്രം - ഭരതമുനി
6. കഥകളി - ജി.കൃഷ്ണപിളള
7. കഥകളിരംഗം - കെ.പി.എസ്. മേനോൻ
8. കഥകളിയും സാഹിത്യവും - മാടശ്ശേരി
9. കഥകളി വിജ്ഞാന കോശം - അയ്മനം കൃഷ്ണകൈമൾ
10. നളചരിതം വ്യാഖ്യാനം - എം.എച്ച്. ശാസ്ത്രികൾ
11. കഥകളി മഞ്ജരി - ഡോ.എസ്.കെ നായർ
12. ആത്മകഥ - പി.കൃഷ്ണൻ നായർ
13. ദി ആർട്ട് & ലിറ്ററേച്ചർ ഓഫ് കഥകളി - ഡോ.എസ്.കെ. നായർ
14. സിനിമയുടെ ലോകം - അടൂർ ഗോപാലകൃഷ്ണൻ
15. ആധുനിക മലയാള സിനിമ - കെ.പി. രാമൻ കുട്ടി
16. സിനിമയുടെ വഴിയിൽ - ഐ.ഷമുഖദാസ്
17. സഞ്ചാരിയുടെ വീട് - ഐ.ഷമുഖദാസ്
18. കഥയും തിരക്കഥയും - എ.ജി. രാജ്കുമാർ
19. സിനിമയും മലയാളസാഹിത്യവും - മധു ഇറവങ്കര
20. മലയാള സിനിമ - സിനിക്
21. ചലച്ചിത്രത്തിന്റെ പൊരുൾ - വിജയകൃഷ്ണൻ
22. ചലച്ചിത്ര സമീക്ഷ - വിജയകൃഷ്ണൻ
23. സിനിമയുടെ രാഷ്ട്രീയം - രവീന്ദ്രൻ
24. കാഴ്ചയുടെ അശാന്തി - രവീന്ദ്രൻ
25. സിനിമയെ കണ്ടെത്തൽ - എം.എഫ്.തോമസ്
26. മലയാള സിനിമ അരനൂറ്റാണ്ട് - (എഡി) കെ.ജയകുമാർ
27. എം.ടി, കല, കാലം, വ്യക്തി - (എഡി) കെ.ജയകുമാർ
28. എം.ടി. കഥയും പൊരുളും - (എഡി) എം.എം. ബഷീർ
29. എം.ടി.യുടെ സർഗ്ഗപ്രപഞ്ചം - കേരളഭാഷാഇൻസ്റ്റിറ്റ്യൂട്ട്
30. നാടകദർപ്പണം - എൻ.എൻ. പിളള
31. നാടകം ഒരു പഠനം - സി.ജെ.തോമസ്
32. ഉയരു യവനിക - സി.ജെ.തോമസ്
33. നാടക പഠനങ്ങൾ - എഡിറ്റർ പന്മന രാമചന്ദ്രൻ നായർ
34. എം.ടി.കല,കാലം,സ്വത്വം - ഡോ.എ.എസ്. പ്രതീഷ്

Language Course VII (Additional Language III)
15UHN311.1: Drama, One Act Plays and Technical Terminology

No. of credits: 4

No. of instructional hours per week: 5

Aim of the Course / Objectives

The aim of the course is to appreciate the literary and stylistic elements of Hindi Drama and One Act plays. To understand the distinct features of Hindi Drama.To understand Hindi as the National and official language of India.To overcome multilingual problems and its implications. To familiarize the technical terms used in offices.

Module 1

Drama – Prescribe a Drama (Post Sixties)

Module 2

One Act plays (Prescribe a collection of one act play)

Module 3

Technical Terminology (Prescribe a text book)

Translation of Technical terms – official terms
(English to Hindi and Hindi to English)

Prescribed Textbooks

1.	Drama (Detailed)	- Ek aur Dronacharya By Shankar Shesh Published by Parameswari Prakashan, Preeth Vihar, Delhi
2.	One Act Plays (Detailed)	- Panch Rang Edited by Dr. Jagathpal Sharma Published by Navodaya Sales, New Delhi

Lessons to be studied

1. Lekshmi ka Swagath - Upendranath Ashk
2. Reed ki Haddi - Jagadeesh Chandra Mathur
3. Bahut Bada Saval - Mohan Rakesh

4. Technical Terminology - 'Paribhashik Sabdavali'
   Edited by Dr. Satheesh kumar G.
   Chairman (BOS)

Language Course VII (Additional Language III)
15UFR311.1: Literature in French

No. of credits: 4

No. of instructional hours per week: 5

AIMS:

The aim of the course is to acquaint students with French literature with consistent emphasis on grammar and vocabulary.

OBJECTIVES:

1. To enhance literary sensibility
2. To introduce students to the world of French literature.

SYLLABUS:

NAME OF TEXT: **CONNEXIONS** – Niveau 1 By Régine Mérieux and Yves Loiseau

Publisher : Didier

Module 3 : Agir dans l'espace

Unit 7 : Rallye

Unit 8 : chez moi

Unit 9 : Les vacances

The following poems to be studied:

1. Le Pont Mirabeau - Guillaume Apollinaire

2. Déjeuner du Matin - Jacques Prévert
3. Le Pélican - Robert Desnos
4. Noel - Théophile Gautier
5. Chanson d'Automne - Paul Verlaine
6. Pour faire le portrait d'un oiseau – Jacques Prévert

Reference books :

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet
3. Cours de langue et de civilisation française Vol I (Mauger Bleu)

A bouquet of French poems (Polyglot house) by Prof. T.P Thamby

Core Course II
15UPY341: THERMODYNAMICS AND STATISTICAL PHYSICS

No. of credits: 3

No. of instructional hours per week: 5

Unit 1.Transference of heat (8 hrs)

Thermal conductivity-determination by Lee's Disc method for bad conductor-radial flow of heat-cylindrical flow-thermal conductivity of rubber-Wiedmann-Franz law-Radiation of heat-Stefan's law-determination of Stefan's constant-solar constant-determination of solar temperature

Unit 2 Thermodynamics (18 hrs)

Zeroth Law & First law of Thermodynamics-differential form-Thermodynamic processes-Expression for work done in isothermal and adiabatic processes-Application of first law to specific heat and latent heat-Reversible and irreversible processes-Second law of thermodynamics-Clausius and Kelvin statements-Carnot engine-Principle of refrigerator-working and efficiency-Otto engine and Diesel engine-working and efficiency

Unit 3 Entropy (12 hrs)

Definition of entropy-change of entropy in reversible and irreversible cycle-Clausius inequality and second law of thermodynamics-entropy and available energy-Entropy, probability and disorder-Nernst theorem and third law of thermodynamics-Phase transition-phase diagram-first order phase transition-Clausius-Clepeyron equation-higher order phase transition (qualitative study)-Liquid Helium-Gibb's function-Helmholtz's function-Maxwell's equations.

Unit 4 Statistical Physics (16 hrs)

Statistical probability-Macro& Microstates-Phase space-Statistical ensemble-Postulate of equal a priori probability-Maxwell-Boltzmann distribution-Velocity distribution-Indistinguishability of identical particles-Bose-Einstein and Fermi-Dirac distribution functions-comparison of three statistics-Application of BE & FD statistics-Bose-Einstein condensation

Books for study

1 Thermal and Statistical Mechanics- S.K. Roy (NewAge International)

2 Heat and Thermodynamics –D. S. Mathur (S. Chand &Co)

3 Heat and Thermodynamics- Brijlal&Subrahmanyam (S. Chand &Co)

4 Concepts of Modern Physics – Arthur Beiser (TMH)

5 Thermal Physics : Kinetic theory, Thermodynamics and Statistical Mechanics – S.C Garg, R.M. Bansal and C.K. Ghosh (Second Edition – McGraw Hill Education)

Books for reference

1 Elements of Statistical Mechanics- Kamal Singh& S. P. Singh (S. Chand& Co)

2 Thermal Physics, Statistical Physics and Solid state Physics – C. J. Babu(Calicut University Press)

3 Statistical mechanics – Sinha (TMH)

4 Heat and Thermodynamics- Zemansky, McGraw-Hill

Complementary Course V

15UMM331.1: Differential Equations, Theory of Equations and Theory of Matrices

No. of credits: 4

No. of instructional hours per week: 5

Module 1: Differential equations

- Review of basic concepts about differential equations and their solutions. Method of solving special types of first order ODEs such as variable separable, exact, homogeneous, and linear.Finding the family of curves orthogonal to a given family.
- Second order linear differential equations. Nature of the general solution of homogeneous and non-homogeneous linear ODEs.Extension to higher order ODE.
- Second order linear homogeneous ODEs with constant coefficients. The characteristic equation and its use in finding the general solution Extension of the results to higher order ODEs.
- Second order linear non-homogeneous ODEs with constant coefficients. General solution as the sum of complementary function and particular integral. Second order linear differential operator and its properties. The inverse operator and its properties.Operator method for finding the particular integral of simple functions.Extension of the results to higher order equations.Cauchy and Legendre equations and their solutions by reducing to equations with constant coefficients by suitable change of variable.

Module 2: Linear Algebra

- The rows and columns of a matrix as elements of R^n for suitable n. Rank of a matrix as the maximum number of linearly independent rows/columns. Elementary row operations.Invariance of rank under elementary row operations.The echelon form and its uniqueness. Finding the rank of a matrix by reducing to echelon form.
- Homogeneous and non-homogeneous system of linear equations. Results about the existence and nature of solution of a system of

equations in terms of the ranks of the matrices involved.

- The eigen value problem. Method of finding the eigen values and eigen vectors of a matrix. Basic properties of eigen values and eigen vectors. Eigen values and eigenvectors of a symmetric matrix.
- Diagonalisable matrices. Advantages of diagonalisable matrices in computing matrix powers and solving system of equations. The result(without proof) that a square matrix of order n is diagonalisabe (i) if and only if it has n linearly independent eigen vectors (ii) if it has n distinct eigen values. Method of diagonalising a matrix.Diagonalisationof real symmetric matrices.Similar matrices.

Module 3: Theory of Equations

- Fundamental theorem of Algebra (without proof), relations between roots and coefficients of a polynomial, finding nature of roots of polynomials without solving-Des Cartes'rule of signs, finding approximate roots via bisection method, Newton-Raphson method

  Text for Module 1: Kreyzig, Advanced Engineering Mathematics, 8th edition, John Wiley.

  Text for Module 2:Peter V. O' Neil, Advanced Engineering Mathematics, Thompson Publications, 2007

  Text for Module 3: Barnard and Child, Higher Algebra, Macmillan

  Advanced Engineering Mathematics, K A Stroud, 4th Edition, Palgrave, 2003

Complementary Course VI
15UCH331.1: PHYSICAL AND INORGANIC CHEMISTRY I

No. of credits: 3

No. of instructional hours per week: 5

Module 1: Gaseous State (9 Hrs)

Maxwell's distribution of molecular velocities (No derivation) average, most probable and rms velocities, collision number and collision frequency, mean free path, deviation of gases from ideal behaviour – Boyle temperature, derivation of vander waals constants and critical constants –

Law of corresponding states – reduced equation of state, Joule Thomson effect, liquefaction of gases – Linde's and claude's processes

Module II – Crystalline State (9 Hrs)

Isotropy and anisotropy – symmetry elements in crystals – the seven crystal systems. Miller indices, Bravais lattices, primitive, bcc and hcc lattices of cubic crystals. Bragg equation, diffraction of X-rays by crystals – single crystal and powder method. Detailed study of structures of NaCl and KCl crystals. Liquid crystals – mesomorphic state, types of liquid crystals applications and examples.

Module III –Chemical Equilibrium (9 Hrs)

Reversible reactions – KP, KC, and KX and their inter relationships – Free energy change and chemical equilibrium – Van't Hoff reaction, isotherm and isochore - influence of pressure and temperature on the following reactions.

(i) $N_2 + 3H_2 \rightleftharpoons 2NH_3$ (ii) $PCl_5 \rightleftharpoons PCl_3 + Cl_2$

(iii) $2SO_2 + O_2 \rightleftharpoons 2SO_3$

Le Chatelier's principle and the discussion of the above reactions on its basis.

Module IV – Ionic Equilibrium (9 Hrs)

Concepts of Acids and Bases, ionization of weak electrolytes. pH and its determination of potentiometric method. Buffer solutions and calculations of their pH. Henderson equation. Hydrolysis of salt – degree of hydrolysis and hydrolytic constant, derivation of relation between Kw and Kh for salts of strong acid – weak base, weak acid – strong base and weal acid – weak base.

Module V - Environmental Chemistry (9 Hrs)

Nature of environmental threats and role of chemistry. Green house effect, ozone layer and its depletion. Water pollution: Various factors affecting purity of water, sewage water, industrial waste, agricultural pollution such as pesticides, fertilizers, detergents, treatment of industrial waste water using activated charcoal, synthetic resins, reverse osmosis, electrodialysis.-Dissolved oxygen-BOD,COD

Module VI : Chemistry of Nano Materials (9 Hrs)

Evolution of Nano science – Historical aspects – preparations containing nano gold in traditional medicine, Lycurgus cup – Faraday's divided metal etc. Nanosystems in nature.

Preparation of Nano particles – Top – down approach and bottom – top approach, sol – gel synthesis, colloidal precipitations, Co- precipitation, combustion technique. Properties of nano particles: optical, magnetic and mechanical properties. Tools for measuring nano structure – XRD, Atomic force Microscopy (AFM), Scanning Tunneling Microscopy (STM), and Scanning Electron Microscopy (SEM) Transmission Electron Microscopy (TEM) . Applications of nano materials in electronics, robotics, computers, sensors, mobile electronic devices, Vehiles Medical applications (use Au, Ag, ZnO and ZnO2 as examples.

References

1. Concise Inorganic Chemistry – J. D. Lee.
2. Physical Chemistry – Rakshit.
3. Principles of Physical Chemistry – Puri, Sharma, Pathania.
4. Nano – 'The Essentials'. T. Pradeep Mc. Graw Hill
5. Modern Inorganic Chemistry – R.D. Madan.
6. Physical Chemistry – N. M. Kapoor.
7. Environmental Chemistry A. K. De

SEMESTER IV

Language Course VIII

15UEN411.1: READINGS IN LITERATURE

No. of credits: 4

No. of instructional hours per week: 5 (Total 90 hrs)

AIMS

1. To sensitize students to the aesthetic, cultural and social aspects of literature.
2. To help them analyze and appreciate literary texts.

OBJECTIVES

On completion of the course, the students should be able to:

1. Understand and appreciate literary discourse.
2. Look at the best pieces of literary writing critically.
3. Analyze literature as a cultural and interactive phenomenon.

Module 1

What is literature – literature and context – genres – literature and human values – creative use of language – inculcation of aesthetic sense. Poetry – what is poetry – different types of poetry – poetic diction – figurative language – themes – stanza – rhyme.

Module 2

Drama.Scope and definition – different types – one act plays - structure – dialogue – characters – action.

Module 3

Prose What is prose – different types – personal – impersonal – technical.

Module 4: Fiction.

What is fiction – different types – plot – characters – setting – point of view – short story – its characteristics.

COURSE MATERIAL

Module 1

Core reading: Readings in Literature. Department of Publications, University of Kerala. Poems prescribed:

1. William Shakespeare: To Be or Not to Be (Hamlet, Act III, Scene 1)
2. William Blake: The Tiger
3. William Wordsworth: Lucy Gray
4. Alfred Lord Tennyson: Tithonus
5. Milton: On His Blindness
6. Rabindranath Tagore: Leave This Chanting (Poem 11 from Gitanjali)
7. John Keats: Ode to Autumn
8. Ted Hughes: Full Moon and Little Frieda.

Module 2

Core reading: Vincent Godefroy - Fail not our Feast [from Dramatic Moments: A Book of One Act Plays. Orient Black Swan, 2013]

Module 3

Core reading: Readings in Literature. Department of Publications, University of Kerala.

Essays prescribed:

1. Robert Lynd: The Pleasures of Ignorance
2. Martin Luther King: I Have a Dream
3. Stephen Leacock: The Man in Asbestos
4. Isaac Asimov: The Machine That Won the War.
5. E.R. Braithwaite: To Sir, with Love [extract]

Module 4

Core reading: Stories for Life, Indian Open University.

Stories prescribed:

(i) Catherine Mansfield: A Cup of Tea.

(ii) O Henry: The Last Leaf.

(iii) Rabindranth Tagore: The Postmaster.

(iv) Oscar Wilde: The Happy Prince.

(v) Ernest Hemingway: A Day's Wait

(vi) Further reading

1. A Concise Companion to Literary Forms. Emerald, 2013.

2. Abrams, M. H. A Glossary of Literary Terms.

3. Klarer, Mario. An Introduction to Literary Studies.Second edition. Routledge, 2009.

Direction to Teachers

The introduction to various genres is intended for providing basic information and no conceptual analysis is intended.

Language Course IX (Additional Language IV)

15UML411.1: വിനിമയം, സർഗ്ഗാത്മക രചന, ഭാഷാവബോധം

No. of credits: 4
No. of instructional hours per week: 5

പഠനോദ്ദേശ്യം : (i) ആശയവിനിമയത്തിന്റെ വിവിധ ഘടകങ്ങളും പ്രക്രിയകളും വിദ്യാർത്ഥികൾക്ക് പരിചയപ്പെടുത്തുക. ആശയവിനിമയ സിദ്ധാന്തങ്ങളെക്കുറിച്ചും ആശയവിനിമയ മാതൃകകളെക്കുറിച്ചും അവബോധമുണ്ടാക്കുക.

(ii) ഭരണകാര്യങ്ങൾ മാതൃഭാഷയിലൂടെ നിർവഹിക്കപ്പെടണം എന്ന കാര്യം ഇന്ന് പൊതുവേ അംഗീകരിക്കപ്പെട്ടിട്ടുണ്ട്. മലയാളം ഭരണഭാഷയാകുമ്പോൾ ഉണ്ടാകുന്ന പ്രശ്നങ്ങളെക്കുറിച്ച് വിദ്യാർത്ഥികളെ ബോധവൽക്കരിക്കുക.

(iii) എഴുത്തുകാരുടെ രചനാനുഭവങ്ങൾ വിദ്യാർത്ഥികൾക്ക് പരിചയപ്പെടുത്തുക. സർഗ്ഗാത്മകരചനയ്ക്ക് വിദ്യാർത്ഥികളെ പ്രാപ്തരാക്കുക.

(iv) പദം, വാക്യം, ചിഹ്നം എന്നിവ തെറ്റുകൂടാതെ പ്രയോഗിക്കുന്നതിലൂടെ ഭാഷാശുദ്ധി നിലനിർത്തുക. വിവർത്തനത്തിൽ പ്രായോഗിക പരിശീലനം നൽകുക.

പാഠ്യപദ്ധതി

മൊഡ്യൂൾ ഒന്ന് (18 മണിക്കൂർ)

വിനിമയവും മാധ്യമങ്ങളും

വിനിമയം - നിർവ്വചനം - ആശയവിനിമയ പ്രക്രീയ - വ്യവസ്ഥാപനം, നിർവ്യവസ്ഥാ

പനം, ആശയവിനിമയ പ്രക്രീയയുടെ ഘടകങ്ങൾ, ആശയ വിനിമയ മാതൃകകൾ - വിവിധതരം ആശയവിനിമയങ്ങൾ - വിവിധതരം മാധ്യമങ്ങൾ - അച്ചടി, റേഡിയോ, ടെലിവിഷൻ, സിനിമ, ഇന്റർനെറ്റ് തുടങ്ങിയ നവമാധ്യമങ്ങൾ - ഇവയുടെ സവിശേഷതകൾ - മാധ്യമങ്ങളും സമൂഹവും

വിശദപഠനത്തിന്

മാദ്ധ്യമം : മൗലികതയും നിരാകരണവും - ഡോ.എ.ശ്രീധരൻ, നാഷണൽ ബുക്ക് സ്റ്റാൾ (താഴെപ്പറയുന്ന രണ്ടു ലേഖനങ്ങൾ മാത്രം)

1. മാനവ ആശയവിനിമയം - തത്ത്വവും പ്രയോഗവും
2. ആശയ വിനിമയം - സിദ്ധാന്തവും പ്രയോഗവും

മൊഡ്യൂൾ രണ്ട് (18 മണിക്കൂർ)

ഭരണഭാഷ മലയാളം

ഭരണഭാഷ - നിർവ്വചനം - ഭരണനിർവ്വഹണം മാതൃഭാഷയിലൂടെ ആകേണ്ടതിന്റെ ആവശ്യകത - മലയാളം ഭരണഭാഷയാകുമ്പോൾ സ്വീകരിക്കേണ്ട മുന്നൊരുക്കങ്ങൾ ഭരണഭാഷയ്ക്കുണ്ടായിരിക്കേണ്ട ഗുണങ്ങൾ - നിയതാർഥ ബോധകം, ആർജ്ജവം, സുതാര്യത സരളം, ലഘുവാക്യങ്ങൾ, ആശയത്തെക്കുറിച്ചുള്ള അസന്ദിഗ്ദ്ധത മുതലായവ - വിവിധ സർക്കാർ വകുപ്പുകളുടെ സാങ്കേതിക പദാവലികൾ.

പഠനപ്രവർത്തനം

ഇംഗ്ലീഷിലുള്ള സർക്കാർ ഉത്തരവുകളും നടപടിക്രമങ്ങളും മലയാളത്തിലേക്കു മാറ്റാനുള്ള പരിശീലനം.

മൊഡ്യൂൾ മൂന്ന് (18 മണിക്കൂർ)

സർഗ്ഗാത്മകരചന

സർഗ്ഗാത്മകത - നിർവചനം - സർഗാത്മകതയുടെ ഉറവിടം - വിവിധ കാഴ്ചപ്പാടുകൾ - കാവ്യപ്രചോദനത്തെക്കുറിച്ചുള്ള ഭാരതീയ സങ്കല്പം - പ്രതിഭയെക്കുറിച്ചുള്ള രാജശേഖരന്റെ അഭിപ്രായം - ഭാവയിത്രി, കാരയിത്രി - ഭാവനയെപ്പറ്റി കോളറിഡ്ജ് - പ്രഥമഭാവനയും ദ്വിതീയ ഭാവനയും - ഫാന്റസിയും ഇമാജിനേഷനും തമ്മിലുള്ള വ്യത്യാസം - വേർഡ്സ്വർത്തിന്റെ കാവ്യനിർവചനം - സർഗ്ഗാത്മകരചനയിലേക്കു നയിക്കു സാഹചര്യങ്ങൾ - ജന്മവാസനയും അനുഭവവും - രചനയുടെ വിവിധ ഘട്ടങ്ങൾ.

പ്രായോഗിക പരിശീലനം

കവിത, കഥ, ലഘുനാടകം ഹ്രസ്വചിത്രങ്ങൾക്കുള്ള തിരക്കഥ, ഫീച്ചർ തുടങ്ങിയവയുടെ രചനാപരിശീലനം വിദ്യാർത്ഥികൾക്ക് നൽകേണ്ടതാണ്. ആവശ്യമെങ്കിൽ വിദ്യാർത്ഥികളെ ഗ്രൂപ്പുകളായി തിരിക്കാവുന്നതാണ്.

വിദേശപഠനത്തിന്

1. സർഗ്ഗാത്മകത - ഡോ.കെ.എം. കോശി
   (സാഹിത്യവിജ്ഞാന പ്രവേശിക)
2. വാക്കുകളുടെ ശില്പം - എം.കെ. സാനു
   (കാവ്യതത്ത്വപ്രവേശിക)
3. എന്റെ കവിതയെപ്പറ്റി - സുഗതകുമാരി
   (ഇരുൾച്ചിറകുകളുടെ ആമുഖം)
4. കാഥികന്റെ പണിപ്പുര - എം.ടി.വാസുദേവൻ നായർ
   (ഒരുകഥ ജനിക്കുന്നു എന്ന അനുഭവക്കുറിപ്പ് മാത്രം)

മൊഡ്യൂൾ നാല് (18 മണിക്കൂർ)

ഭാഷാവബോധം

തെറ്റായ രൂപത്തിൽ എഴുതപ്പെടുന്ന വാക്കുകളും അവയുടെ ശരിയായ രൂപങ്ങളും - വാക്യരചനയിൽ സാധാരണ വരുന്ന പിഴവുകളും അവ തിരുത്തുന്നതിനുള്ള മാർഗ്ഗനിർദ്ദേശങ്ങളും - പ്രധാനപ്പെട്ട ചിഹ്നങ്ങളും അവയുടെ പ്രയോഗ സാഹചര്യങ്ങളും.

പ്രായോഗിക പരിശീലനം

ഇംഗ്ലീഷിൽ നിന്ന് മലയാളത്തിലേക്കും മലയാളത്തിൽ നിന്ന് ഇംഗ്ലീഷിലേക്കുമുള്ള വിവർത്തനം - ഗദ്യം, പദ്യം, ശൈലികൾ, പഴഞ്ചൊല്ലുകൾ, സാങ്കേതിക പദങ്ങൾ മുതലായവയുടെ വിവർത്തനം.

സഹായകഗ്രന്ഥങ്ങൾ

1. മാധ്യമം : മൗലികതയും നിരാകരണവും - ഡോ.എം.എൻ. ശ്രീധരൻ,
   നാഷണൽ ബുക്ക് സ്റ്റാൾ
2. മാധ്യമങ്ങളും മലയാളസാഹിത്യവും - എം.വി.തോമസ്,
   കേരള സാംസ്കാരിക പ്രസിദ്ധീകരണ വകുപ്പ്
3. മാധ്യമങ്ങളും മലയാളസാഹിത്യവും - പലർ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്
4. മാധ്യമവിചിന്തനം - ഡോ.കെ.വി.തോമസ്,
   ഡോ.മാത്യു ജെ.മുട്ടത്ത്,
   ലിപി പബ്ലിക്കേഷൻസ്
5. മലയാളവും ഇന്റർനെറ്റും - സുനീത ടി.വി,
   ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്
6. സൈബർ മലയാളം - (എഡി) സുനീത ടി.വി,
   കറന്റ് ബുക്സ്, തൃശൂർ
7. ഭാഷയും ഭരണഭാഷയും - ഡോ. എഴുമാറ്റൂർ രാജരാജവർമ്മ,
   ഇൻഫർമേഷൻ ആന്റ്
   പബ്ലിക്കേഷൻ വകുപ്പ്,

കേരള സർക്കാർ

8. ഭരണ ശബ്ദാവലി - കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്

9. വ്യത്താന്തപത്രപ്രവർത്തനം - സ്വദേശാഭിമാനി രാമകൃഷ്ണപിള്ള, മാളുബെൻ പബ്ലിക്കേഷൻസ്

10. ലിറിക്കൽ ബാലഡ്സിന്റെ ആമുഖം - വില്യം വേർഡ്സ്വർത്ത്, വിവ: ഡോ.തോന്നയ്ക്കൽ വാസുദേവൻ, എം.എൻ.വിജയൻ സാസ്ക്കാരിക വേദി

11. സാഹിത്യവിദ്യ - കുട്ടികൃഷ്ണമാരാര്, മാരാർ സാഹിത്യ പ്രകാശം, കോഴിക്കോട്.

12. കാഥികന്റെ പണിപ്പുര - എം.ടി.വാസുദേവൻ നായർ, ഡി.സി.ബുക്സ്

13. ഉയരു യവനിക - സി.ജെ.തോമസ്, മാളുബൻ പബ്ലിക്കേഷൻസ്, തിരുവനന്തപുരം

14. കാവ്യസ്വരൂപം - എസ്.ഗുപ്തൻനായർ, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്

15. കഥയുടെ ന്യൂക്ലിയസ്സ് - ഡോ.വത്സലൻ വാതുശ്ശേരി, ഒലിവ് പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്

16. ഇരുൾചിറകുകൾ - സുഗതകുമാരി

17. ഗദ്യശില്പം - സി.വി.വാസുദേവഭട്ടതിരി, കേരളഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്

18. തെറ്റും ശരിയും - പ്രൊഫ.പന്മന രാമചന്ദ്രൻ നായർ, കറന്റ് ബുക്സ്, കോട്ടയം

19. തെറ്റില്ലാത്ത മലയാളം - പ്രൊഫ.പന്മന രാമചന്ദ്രൻ നായർ, കറന്റ ബുക്സ്, കോട്ടയം

20. ഭാഷാശുദ്ധി സംശയപരിഹാരങ്ങൾ - പ്രൊഫ.പന്മനരാമചന്ദ്രൻ നായർ

21. ഭാഷാശുദ്ധിയും ഭരണഭാഷയും - ഡോ.വിളക്കുടിരാജേന്ദ്രൻ, പ്രിയദർശിനി പബ്ലിക്കേഷൻസ്

22. മലയാളശൈലി - കുട്ടികൃഷ്ണമാരാര്, മാരാർ സാഹിത്യ പ്രകാശം, കോഴിക്കോട്

23. തായ്മൊഴി - എം.എൻ.കാരശ്ശേരി

24. ഭരണഭാഷാപ്രശ്നങ്ങൾ - എം.വി.തോമസ്,

കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്

25. വിവർത്തനവിചാരം - ഡോ.എൻ.ഇ.വിശ്വനാഥഅയ്യർ, കേരള ഭാഷാ ഇൻസ്റ്റിറ്റ്യൂട്ട്

26. തർജുമയുടെ താക്കോൽ - സി.വി. വാസുദേവഭട്ടതിരി, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്

27. നല്ല മലയാളം - സി.വി.വാസുദേവഭട്ടതിരി, ലിപി പബ്ലിക്കേഷൻസ്, കോഴിക്കോട്

28. http://en.wikipedia.org/wiki/media_influence

29. http://en.wikipedia.org/wiki/creative_writing

30. http://www.du.ae.in/du/course creative-writing.pdf.

Language Course IX (Additional Language IV)
15UHN411.1: Poetry, Translation and Communicative Hindi

No. of credits: 4

No. of instructional hours per week: 5

Aim of the Course / Objectives

The aim of the course is to introduce the student to the world of Hindi Poetry Ancient and Modern. To sensitize the student to the aesthetic aspects of literary appreciation and analysis.

Systematic study of the theory, description and application of translation.To develop students skill in communicative Hindi.

Module 1

Poetry – Prescribe a poetry collection (Ancient and Modern)

Module 2

Translation (Prescribe a text book)

Translation definition – Importance of Translation – Field of Translation – Types of Translation – Literary, Non Literary Translation – Translation of English passage to Hindi.

Module 3

Communicative Hindi (Prescribe a textbook)

Procedure for the development of communicative skills of students. Use of Hindi language in different situations – in Home, in College, in Banks, in Hospitals, in Railway Stations in Book Shops etc.Names of Animals, Birds, Trees, Plants, diseases, vegetables, professions, kitchen utensils, etc.

Prescribed Textbooks

1. Poetry Collection (Detailed) - Hindi Kavya Sopan
   Edited by Sathyaprakash Misra
   Published by Lokbharathi, New Delhi

Poems to be studied

1. Kabeer – Sakhi – 1 to 8
2. Soordas – Pad – 1to 3
3. Bihari – Doha – 1to 4
4. Nadi ke Dweep – Agyey
5. Desh Gaan – Sarveswar Dayal Saksena
6. Proud Shiksha – Dhoomil

2. Translation (Detailed) - Anuvad
   Edited by Dr. M.S. Vinayachandran
   Published by Lokbharathi Prakasan,
   New Delhi

(Chapter 2, 3 and 6 should be omitted. From chapter 4 Anuvad ke Prakar, Portions upto karyalayeen anuvad should be studied, Chapter -7 Translation. First 5 passages should be studied)

3. Communicative Hindi - Bolchaal ki Hindi
   By Dr. Suseela Gupt,
   Lokbharati Prakashan, Elahabad-1

(Conversations in Home, College, Bank, Hospital, Railway Station and Book shop should be studied. Names of Animals, Birds, Trees, Plants, Diseases, Professions, Vegetables, Kitchen utensils, Spices and Eatables should be studied.

Language Course IX (Additional Language IV)
15UFR411.1: Culture and Civilization

No. of credits: 4

No. of instructional hours per week: 5

AIMS:

This course is intended to familiarize the students with French culture and civilization with specific reference to Kerala culture.

OBJECTIVES:

1. To acquaint the students with French culture and civilization.
2. To comprehend, compare and understand better the civilization of one's native place.

SYLLABUS:

NAME OF TEXT: **CONNEXIONS** – Niveau 1 By Régine Mérieux and Yves Loiseau

Publisher : Didier

Module 4 : Se situer dans le temps

Unit 10 : Au jour le jour

Unit 11 : Roman

Unit 12 : Je te retrouverai

Articles on Kerala culture with special emphasis on festivals, tourist centres and cuisine.

Reference books :

1. Le Nouveau Sans Frontières Vol I by Philippe Dominique
2. Panorama Vol I by Jacky Girardet

Cours de langue et de civilisation française Vol I (Mauger Bleu)

Core Course III
15UPY441: ELECTRODYNAMICS

No. of credits: 3

No. of instructional hours per week: 3

Unit 1-Electrostatic Field (10hrs)

Introduction*, Coulomb's Law*, Electric field*, continuous charge distribution*Divergence and curl of electrostatic fields; Field lines, flux and Gauss' law, the divergence of E,applications of gauss's law, the Curl of E- Electric potential: Introduction to potential, Comments on potential, Poisson's and Laplace's equations, Potential of a localized charge distribution, electrostatic boundary.

Work and energy in Electrostatics: The work done to move a charge, the energy of a point charge distribution, The energy of a continuous charge distribution.

Unit 2-Electrostatic fields in matter (10 hrs)

Polarization: Dielectrics, induced dipoles, Polarization, The field of a polarized object: Bound charges, Physical interpretation of bound charges, and the field inside a dielectric, Electric displacement: Gauss's law in the presence of dielectrics, Boundary conditions

Unit 3-Magnetostatics (8hrs)

Introduction*, The Biot-Savart law*, Ampere's force law*, Magnetic torque,Magnetic flux and gauss's law for magnetic fields, Magnetic vector potential, Magnetic intensity and Ampere's circuital law, Magnetic materials.

Unit 4-Electromagnetic Induction (8hrs)

Electromotive force: Ohm's law; Electromagnetic induction: Faraday's law, the induced electric field; Maxwell's Equations:Electrodynamics before Maxwell, How Maxwell fixed Ampere's law, Maxwell's equations, Magnetic charge, Maxwell's equations in matter, Boundary conditions.

Unit 5-Electromagnetic waves (6hrs)

Waves in one dimension: The wave equation, Electromagnetic waves in

vacuum: The wave equationfor E and B, Monochromatic plane waves, Energy and momentum in electromagnetic waves.

Unit 6-Transient currents(4hrs)

Growth and decay of current in LR and CR circuits-Measurement of high resistance by leakage. Charging and discharging of a capacitor through LCR circuit.

Unit 7-Alternating current (4 hrs)

AC through series LCR (acceptor circuit) and parallel LCR circuit (rejecter circuit)- Q- factor, Power inAC-power factor - AC bridges Maxwell's L/C bridge and Owens's bridge.

Unit 8-Circuit Theory (4 hrs)

Ideal voltage and current sources- Thevenin's and Norton's theorems, Maximum power transfer theorem

* Revision topics

Books for study

1. Electrodynamics - David J Griffith (PHI 3rd edition)
2. Electricity and Magnetism-Murugesan (S.Chand& Co.)
3. Electricity and Magnetism -_K.K.Tiwari (S.Chand& Co.)

Reference Books

1. Electromagnetic theory fundamentals- Bhag Guru and Huseyin-Hizirogulu (Cambridge University Press 2nd edition)
2. Electricity and Magnetism – E.M. Purcell, Berkley Physics course, Vol.2 (MGH)
3. Electricity and Magnetism – J.H. Fewkes& John Yarwood (University t u t o r i a l press
4. Electricity and Magnetism- D.C.Tayal (Himalaya Publishing Co)
5. Electricity and Magnetism_ - Muneer H. Nayfeh& Norton K. Bressel (John Wiley & Sons)
6. Classical Electrodynamics- Walter Greiner (Springer International Edition)
7. Electromagnetic waves and radiating systems-Jordan &Balmain (PHI)
8. Electromagnetics, B.B.Laud (Wiley Eastern Ltd.2nd edition)

9. Introduction to electrodynamics-Reitz &Milford (Addison Wesley)

Topics for discussion in Tutorial session/Assignments (sample)

1. Comment on how electrostatic energy is stored in a field
2. Discuss the electrostatic properties of conductors
3. What is meant by electrostatic shielding? In what way it help us?
4. Discuss the peculiarities of electric displacement D and electric field E. How they are incorporated in Maxwell's Equations
5. Discuss the properties of linear dielectrics. What differentiates a dielectric to be linear or not
6. Discuss applications of Ampere's circuital law
7. Compare electrostatics and magnetostatics
8. Why magnetic forces cannot do work
9. Discuss about cyclotron motion & cycloid motion
10. Discuss whether there existed any stand-off between ohm's law and Newton's second law
11. A battery has an emf. Can this emf. is a 'force' ? How will you interpret electromotive force?
12. Discuss the role of motional emf in power generation
13. Discuss the orthogonality of E, B and propagation vector k
14. A wave function can have a sinusoidal representation. Solve the wave equation for this function and discuss the various terms related to a wave such as amplitude, frequency, phase, wave number, frequency etc.
15. Complex representation of wave function has good advantage. Why? Discuss the linearity of wave function. (use complex notation)
16. Discuss AC through LC, LR and CR circuits
17. Show that sharpness of resonance is equal to Q- factor
18. What is a choke coil? Discuss the advantage of using a choke coil instead of a resistor

Core Course IV

15UPY442: MECHANICS, PROPERTIES OF MATTER, HEAT AND ACOUSTICS

No. of credits: 3

No. of instructional hours per week: 2

1 Simple pendulum - Study of variation of period with length, mass and amplitude.
2 Spring mass system - spring constant
3 Fly Wheel - Moment of Inertia
4 Compound Bar Pendulum – Symmetric
5 Compound Bar Pendulum – Asymmetric
6 Uniform Bending - Y-Pin and Microscope
7 Uniform bendin - Y-optic lever method
8 Non-uniform bending - Y-Optic lever& telescope
9 Rigidity modulus –Static torsion
10 Torsion pendulum - Rigidity modulus
11 Kater's pendulum - Acceleration due to gravity
12 Melde's string - Frequency of fork
13 Phase transition - Determination of M.P of wax.
14 Determination of thermal conductivity of rubber
15 Lee's disc-determination of thermal conductivity of a bad conductor
16 Viscosity of a liquid - Stoke's method
17 Viscosity - Continuous flow method using constant pressure head.
18 Viscosity - Variable pressure head arrangement
19 Surface tension - Capillary rise
20 Sonometer - Frequency of A.C
21 Kundt's tube - Determination of velocity of sound.
22 Comparison of least counts of measuring instruments.
23 Evaluation of errors in simple experiments.

References

1 Yarwood and Wittle; Experimental Physics for Students, Chapman &Hall Publishers.

2 An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.

3 A text book of practical physics, S.Viswanathan& Co., Chennai.

4 Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

Complementary Course VII
15UMM431.1: Complex Analysis, Fourier Series and Fourier Transforms

No. of credits: 4

No. of instructional hours per week: 5

Module 1: Complex Analysis

- Representation of complex numbers, operations involving them, conjugates, polar form of complex numbers, De-Moivre's formula, complex number sets and functions, their limit, continuity, derivatives. Analytic functions, Cauchy-Riemann equations and Laplace equation, harmonic functions, proof that an analytic function with constant modulus is constant, exponential, trigonometric, hyperbolic, logarithmic functions in C
- Complex integration: Line integral (definition only, proof on existence not required), section on bounds on line integrals may be omitted, Cauchy's integral theorem and formula, and problems involving them, connected, multiply connected domains, Cauchy's inequality, Liouville's theorem, Morera's theorem (all without proof), problems using the theorems
- Complex sequences, series, their convergence tests, problems using the tests, power series and their convergence, radius of convergence of power series, addition, multiplication of power series, power series representation of analytic functions, Taylor, MacLaurin's series approximations, problems to find the series representations of important

functions

- Laurent series of functions, its singularities, poles, and zeros, Cauchy's residue integration method, finding residues, residue theorem (without proof), problems and applications using it

Module 2: Fourier series and transforms

- Periodic functions, trigonometric series, Fourier series, evaluation of Fourier coefficients for functions defined in $(-\infty, +\infty)$, Fourier series for odd and even functions, half range series, Fourier series for odd and even functions, Fourier series of functions defined in $(-L, +L)$.
- Fourier integrals and Fourier transforms.

Text:Kreyzig, Advanced Engineering Mathematics, 8th edition, John Wiley.

References

1. Thomas and Finney, Calculus and Analytic Geometry, Ninth Edition, Addison-Wesley.
2. Michael D. Greenberg, Advanced Engineering Mathematics, Pearson Education, 2002.
3. James Stewart, Essential Calculus, Thompson Publications, 2007.
4. David C. Lay, Linear Algebra, Thompson Publications, 2007.
5. George F Simmons, Differential equations with applications and historical notes, Tata McGraw Hill, 2003
6. T. Gamelin, Complex Analysis, Springer-verlag, 2006
7. Brown and Churchil, Complex Variables and Applications, McGraw-Hill Higher Education; 8 edition, 2008
8. S L Loney, The elements of coordinate geometry
9. SAGE Math official website http://www.sagemath.org/
10. Gnuplot official website containing documentation and lot of examples http://www.gnuplot.info/
11. More help and examples on gnuplothttp://people.duke.edu/hpgavin/gnuplot.html
12. Maxima documentations http://maxima.sourceforge.net/documentation.html

Complementary Course VIII
15UCH431.1: Physical and Inorganic Chemistry II

No. of credits: 3

No. of instructional hours per week: 3

Module – 1: Chemical Kinetics (9 Hrs)

Rates of reaction, various factors influencing rates of reactions – order and molecularity – Zero, first, second and third order reaction, derivation of integrated rate equation, fractional life time, units of rate constants, influence of temperature on reaction rates. Arrhenius equation, calculation of Arrhenius parameters – collision theory of reaction rates.

Module II – Catalysis and Photo Chemistry (9 Hrs)

General Characteristics of catalytic reactions. Different types of catalysis – examples – theories of catalysis (Outline of intermediate compound formation theory and adsorption theory). Photo Chemistry: - Laws of Photo Chemistry, Grothus – Drapter law, Beer Lambert's law, Einstein's laws, quantum yield, H2 – Cl2 reaction, H2 – Br2 reaction photo sensitization, chemiluminescence.

Module III – Phase Equilibria (9 Hrs)

Phase rule - Explanation of terms, the relationship F = C – P+2, application of phase rule to one component systems. Phase diagram of water and sulphur. General discussion of simple eutectic, lead – silver systems, Pattinson's process. Construction of phase diagram by cooling curve method, salt – water systems and freezing mixture (KI – water, FeCl3 -, H2O only).

Module IV – Binary Liquid systems (9 Hrs)

Completely miscible liquid pairs vapour pressure composition and temperature – composition curves of ideal and non ideal systems, azeotropes, fractional distillation. Partially miscible systems, critical solution temperature, phenol – water system. Immiscible liquid pairs, steam distillation, determination of molecular mass. Distribution law: Explanation, principle of solvent extraction.

Module V = Coordination Chemistry (9 Hrs)

Types of ligands, Werner's coordination theory, Valence bond theory of bonding in octahedral and tetrahedral complexes, Drawbacks of valence bond theory crystal field theory of octahedral and tetrahedral complexes, examples – high and low spin complexes, magnetic properties ,application in qualitative and quantitative analysis.

Module VI- Colloidal State (9 Hrs)

Kinetic, optical and electrical properties of colloids – ultra microscope – determination of avogandro number by Brownian movement – Electrical double layer and zeta potential. Gels – inhibition and syneresis. Miscelles, critical miscelle concentration, sedimentation and streaming potentials, Application of colloids Cottrell precipitator – purification of water, coagulation, reverse osmosis, electro dialysis.

References

1. Concise Inorganic Chemistry – J. D. Lee.
2. Physical Chemistry – Rakshit.
3. Principles of Physical Chemistry – Puri, Sharma, Pathania.
4. Nano – 'The Essentials'. T. Pradeep Mc. Graw Hill
5. Modern Inorganic Chemistry – R.D. Madan.
6. Co – ordination chemistry – Basolo and Johnson.
7. Physical Chemistry – N. M. Kapoor.

Complementary Course IX
15UCH432.1: Practical

No. of credits: 4

No. of instructional hours per week: 2

Reactions and identification of cations : Hg^{+}, Pb^{2+}, Ag^{+}, Hg^{2+}, Bi^{3+}, Cd^{2+}, As^{3+},Sb^{3+}, Sn^{2+}, Sn^{4+}, Fe^{3+}, Al^{3+}, Cr^{3+}, Mn^{2+}, Zn^{2+}, Ni^{2+}, Cd^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, Mg^{2+} and NH^{4+} .

The cations must be provided in solutions. A student must analyse at least ten mixtures containing two cations each.

Volumetric analysis

A. Acidimetry and Alkalimetry

a. Preparation and standardization of decinormal HCl using sodium carbonate as primary standard

b. Estimation of sodium hydroxide using (i)Std. oxalic acid and (ii) Std. Hcl

c. Determination of sodium hydroxide, and sodium hydroxide and sodium carbonate in a mixture (indicator method)

B. Permanganometry

a. Standardisation of KMnO4 by oxalic acid sodium oxalate and Mohr's salt

b. Estimation of oxalic acid / sodium oxalate

c. Estimation of Mohr's Salt.

d. Estimation of calcium.

C. Dichrometry

e. Preparation of Std. K2Cr2O7 and estimation of ferrous iron by external and internal indicators.

f. Estimation of ferric iron by reduction with stannous chloride (internal indicator).

D. Iodometry and Iodimetry

g. Standardization of sodium thiosulphate using std. potassium dichromate.

h. Estimation of copper in a solution

i. Estimation of iodine

E. Complexometric titrations

j. Standardisation of EDTA using std Mg2+ or Zn2+ ion solution

k. Estimation of any one metallic ion from Ca2+, Mg2+, Zn2+ or Ni2+

A student has to carry out at least twelve experiments in this class.

Gravimetric Analysis

1. Estimation of water of hydration in barium chloride crystals.

2. Estimation of barium chloride solution.

This laboratory based course reinforces the qualitative and quantitative chemical analysis that the student has learned in the 1st, 2nd, 3rd and 4th semesters.

SEMESTER V

Core Course V
15UPY541: Classical & Relativistic Mechanics

No. of credits: 4

No. of instructional hours per week: 4

Unit 1 - Particle Dynamics (7 hrs)

Newton's laws of motion – mechanics of a particle – equation of motion of a particle –Motion of a charged particle in electromagnetic field – mechanics of a system of particles.

Unit 2-Conservation laws and properties of space and time (6 hrs)
Linear uniformities of space and conservation of linear momentum – rotational invariance of space and law of conservation of angular momentum – homogeneity off low of time and conservation of energy.

Unit 3- Motion in central force field (10 hrs)
Equivalent one body problem – motion in central force field – general features of motion –motion in an inverse square law force field – equation of the orbit – Kepler's laws of planetary motion and their deduction.

Unit 4 - Collisions (8 hrs)
Conservation laws – laboratory and centre of mass systems – kinetic energies in the lab and CM systems – Cross-section of elastic scattering.

Unit 5 - Lagrangian Dynamics (9 hrs)
Constraints – generalized coordinates – principle of virtual work – D'Alembert's principle, Lagrange's equation from D' Alembert's principle, –applications of Lagrange's equation in simple pendulum, Atwood's machine and compoundpendulum (comparison of Lagrangian approach with Newtonian approach).

Unit 5 - Hamiltonian dynamics (7 hrs)
Generalized momentum and cyclic coordinates -Hamiltonian function H – conservation of energy – Hamilton's equations –examples of Hamiltonian dynamics – one dimensional harmonic oscillator-two dimensional harmonic oscillator using Cartesian coordinates(comparison of Newtonian,

Lagrangian and Hamiltonian approach)

Unit 6 – Frames of reference and Galilean transformation (5 hrs)
Inertial frames of reference-Galilean transformation-non-inertial frames - reference frame with translational acceleration-uniformly rotating frame-fictitious forces-centrifugal forces and coriolis forces.

Unit 7 - Special theory of relativity (20 hrs)
Origin and significance of special theory of relativity – search for universal frame of reference – Michelson-Morley experiment – postulates of special theory of relativity –consequences – Lorentz transformation equations – kinematical consequences of LorentzTransformation – length contraction – time dilation – twin paradox - transformation of velocity – causality and maximum signal velocity – relativistic optical shifts – space like and time like intervals – variation of mass with velocity – mass–energy equivalence –transformation of relativistic momentum and energy – tachyons –four vector and their transformation – experimental evidence for special theory of relativity.

Books for study :

1. Mechanics – H.S.Hans and S.P.Puri (Tata-McGraw Hill).
2. Introduction to classical mechanics – R.G.Thakwale and P.S.Puranik (Tata-McGraw Hill).
3. Classical Mechanics – J C Upadhyaya (Himalaya Publishing House)
4. Classical Mechanics-G Aruldas, PHI Pvt. Ltd

Books for reference:

1. Classical Mechanics – Goldstein.
2. Classical Mechanics- Vimal Kumar Jain (Ane Books Pvt Ltd)
3. Modern Physics – (Schaum's outlines)
4. Classical Mechanics - Systems of Particles & Hamiltonian Dynamics – Walter Greiner.
5. Concepts of Modern physics-ArtherBieser (Tata-McGraw Hill).
6. Classical Mechanics – N.C Rana and P.S.Joag

Core Course VI
15UPY542: Quantum Mechanics

No. of credits: 4

No. of instructional hours per week: 4

Unit 1 : The Emergence of Quantum Mechanics (12 Hrs)

Blackbody radiation –Wien's energy density distribution & its limitation (derivation not needed) – Rayleigh-Jeans formula and its limitation – Planck's hypothesis and radiation formula – Photoelectric effect – Einstein's photoelectric equation – The Compton effect – Stability of an atom – Rutherford and Bohr atom models and their limitations.

Unit 2 : Wave properties of matter (14 Hrs)

Wave-particle duality – de Broglie hypothesis – Experimental Confirmation of de Broglie's hypothesis – Davisson-Germer experiment – Thomson's experiment– Phase and group velocities – wave packet – Physical interpretation and conditions on wave function - Conservation of probability- Normalized and orthogonal wave functions – Operators associated with different observables–Expectation values of dynamical quantities – Ehrenfest's theorem

Unit 3 : General formalism of wave mechanics (16 Hrs)

General formalism – fundamental postulates of wave mechanics – Adjoint of an operator and self-adjointness – eigenvalues and eigen functions of self adjoint operators – Dirac delta function – completeness and normalization of eigen functions - closure – Generalized uncertainty principle –commuting observables – constants of motion

Unit 4 : Schrodinger's wave equation (20 Hrs)

One dimensional time dependent wave equation – one dimensional time independent wave equation – Particle in one dimensional box – Particle in rectangular three dimensional box – Simple harmonic oscillator – Transmission across a potential barrier: the tunnel effect – the finite square well potential

Unit 5 : The hydrogen atom (10 Hrs)

Wave equation for the hydrogen atom – solution of the azimuthal wave equation – solution of the polar wave equation –solution of the radial wave equation

Books for Study

1. Modern Physics – R. Murugeshan – S.Chand (15th Edition)
2. Concepts of modern physics – Arthur Beiser – Tata McGraw-Hill Edition (6th Edition)
3. A text book of quantum mechanics – PM Mathews & K Venkatesan – McGrawHill (2nd Edition)
4. Elements of quantum mechanics – Kamal Singh & SR Singh – S. Chand
5. Quantum Mechanics : Concepts and Applications – NouredineZettili – Wiley (2nd Edition)
6. Quantum Mechanics – Sathyaprakash& Swati Saluja – Kedarnath-Ramnath
7. Quantum Mechanics : 500 problems with solutions – G Aruldhas – PHI

Core Course VII
15UPY543: Electronics

No. of credits: 4

No. of instructional hours per week: 4

Unit 1. Diode Circuits: (12 hours)

[Ref. 1: Chapter. 2, Ref. 2: Chapter 17, Ref. 3: Chapter 9]

Extrinsic semiconductor – n-type and p-type semiconductors - PN junction - PN junction under forward and reverse biased conditions – r m s value and peak inverse voltage – diode characteristics - ac and dc resistances - half wave and full wave rectifiers (average dc value of current, ripple factor and efficiency) - different types of filters (shunt capacitor, LC and CLC) - breakdown mechanism in diodes – Zener diode voltage regulator- LED (theory and application)-solar cell-photodiode-Tunnel diode-theory, characteristics and working

Unit 2. Transistor: (12 hours); *[Ref. 1: Chapter 4, Ref. 2: Chapter18]*
Theory of BJT operation - CB, CE and CC characteristics - alpha and beta and gamma relation between transistor currents - biasing circuits (CE configuration) – stability factors - selection of operating point - ac and dc load lines -Q point- collector feedback; base resistor and potential divider methods

Unit 3. Transistor Amplifiers: *(14 hours);[Ref. 2: Chapter. 22]*
Small signal BJT amplifiers - input and output resistances - graphical analysis of the small signal CE amplifier (frequency response, bandwidth and gain in dB) - small signal CC amplifier (emitter follower) - h parameter- h parameter equivalent circuit - effect of Q point on AC operation. Power Amplifiers (qualitative idea only)-Different Classes- class A , Class B, Class AB and class C-operation and efficiency- push pull amplifier -distortion in amplifiers.

Unit 4. Feedback & Oscillator circuits: (8 hours);
[Ref. 1: Chapter. 6, Ref. 2: Chapter. 25]
Feedback principles – negative feedback – emitter follower – advantages of negative feedback - positive feedback - principle of sinusoidal feedback oscillation-Barkhausen criterion for oscillations - RC phase shift, Wien bridge, Hartley, Colpitt's, and Crystal oscillators (derivations not required)

Unit 5. Modulation: (6 hours); *[Ref. 1: Chapter. 14]*
Fundamentals of modulation - AM, FM and PM -Analysis of AM- frequency spectrum of AM - power in AM - modulated class C amplifier - linear demodulation of AM signal-frequency spectrum for FM - super heterodyne AM receivers.

Unit 6. Field Effect Transistor: (8 hours);
[Ref. 2: Chapters. 15 & 16, Ref. 3, Ref. 4: Chapter. 4]
JFET- Basic construction - Theory of operation - Static characteristics – Drain characteristics- advantages - MOSFET – Depletion enhancement MOSFET –Construction – Static characteristics-Uni-junction Transistor - Construction- operation –Silicon Controlled rectifier – Construction - biasing - operation- applications.

Unit 7. Operational amplifiers (IC741): (12 hours);
[Ref. 1: Chapter. 7, Ref. 4: Chapter. 16]
Introduction – Schematic symbol and pin configuration - circuit configuration and block diagram representation – ideal OP amp. - equivalent

circuit – CMRR – dual input, balanced output differential amplifier - voltage gain, input and output resistances– differential mode and common mode – virtual ground principle – parameters of OP amp. - inverting amplifier - non inverting amplifier - differential amplifier – summing and subtractor amplifiers.

Books for study:

1. Basic electronics- SantiramKal
2. Basic electronics- B. L. Theraja
3.Principles of electronics- V. K. Mehta
4. A first course in Electronics- Anwar A. Khan, Kanchan K. Dey Books for references:
5. Electronic Devices and Circuits- Theodore F.Bogart,Jr. – Universal book stall
6. Electronic devices and Circuit theory- Robert Boylestad& Louis Nashelski- Vth edition PHI
7. Electronic f u n d a m e n t a l s & applications- John D Ryder-Prentice Hall of India Pvt. Ltd.
8. Electronic Communications - Dennis Roddy, John Coolen, Fourth edition.

Topics for assignments/discussion in the tutorial session (sample)

1. Electronic projects using flip flops
2. Electronic projects using logic gates
3. Electronic projects using IC 741 OP amp.
4. Electronic projects using timer 555
5. Electronic projects using IC 311
6. Constant voltage power supplies
7. Constant current sources
8. Oscillators of different frequencies
9. Low range frequency generators
10. High range frequency generators
11. Voltage regulated dc power supplies with variable output
12. Voltage regulated dual power supplies with variable output
13. Instrument for the measurement of capacitance
14.Instrument for the measurement of dielectric constant of a liquid/ solid
15. Effect of temperature on electronic components

Core Course VIII
15UPY544: Atomic and Molecular Physics

No. of credits: 4

No. of instructional hours per week: 4

Unit 1- Vector Atom Model: (10hrs)

Bohr's theory, correspondence principle. Somerfield's atom model and explanation of fine structure of H line in Balmer series of hydrogen atom. Limitation of Somerfield atom model. Vector atom model- Various quantum numbers associated with vector atom model-, L.S and j.j couplings –application of spatial quantization- Pauli's exclusion principle – periodic classification of elements –some examples of electronic configuration with modern symbolic representations - magnetic dipole moment of electron due to orbital and spin motion - Stern and Gerlach experiment - Spin-Orbit coupling.

Unit 2- Atomic Spectra (14hrs)

Optical spectra-Spectral terms and notations - selection rules - intensity rule and interval rule fine structure of sodium D lines – hyperfine structure-alkali spectra - Zeeman effect - Larmor's theorem – quantum mechanical explanation of normal Zeeman effect. Anomalous Zeeman Effect –Paschen-Back effect-Stark effect.

Unit 3- X-ray Spectra (8 hrs)

Introduction-production of X-ray-properties of X-rays-continuous and characteristics X- ray spectrum-Origin of X-rays-Moseley's law-absorption of X-rays-hydrogen like character of X-ray spectrum-X-ray absorption spectrum.

Unit 4- Molecular spectra (2 8 hrs)

Molecular orbital-hydrogen molecule ion-hydrogen molecule-hybridization-electromagnetic spectra-molecular energies-classification of molecules-rotational spectra of diatomic molecules-rotational energy levels-selection rules-rotational spectrum-isotope effect- bond length and atomic mass.Diatomic vibrational spectra-vibrational energy levels-selection rule - vibrational transitions-Rotation-Vibration transitions-I.R spectrometer-electronic spectra-sequences and progressions-Frank-

Condon principle - Raman scattering-quantum theory of Raman scattering - classical description of Raman scattering- vibrational Raman spectra-diatomic molecules - polyatomic molecules- rotational Raman spectra- Raman spectrometer.

Unit 5- Resonance Spectroscopy (12 hrs)

NMR principle-Resonance condition-NMR spectrometer-chemical shift-indirect spin- spin interaction applications of NMR spectroscopy. ESR principle- Resonance condition – ESR spectrometer-hyperfine interaction-applications of ESR spectroscopy-Moss Bauer spectroscopy principle -isomer shift.

Books for Reference:

1. Modern Physics- G.Aruldas and P.Rajagopal, PHI, New Delhi, 2005.
2. Modern Physics by R.Murugesan, S.Chand& Co., Reprint, 2008.
3. Atomic and Nuclear Physics- N.Subramaniam&Brijlal, S.Chand& Co.
4. Atomic Physics - J.B.Rajam, S.Chand&Co.edition.
5. Concepts of Modern Physics by A. Beiser, Tata McGraw-Hill, New Delhi, 6th edition
6. Fundamentals of Molecular Spectroscopy - Banwell (TMH)
7. Spectroscopy- Walker & Straw, Chapman & Hill.
8. Molecular Spectroscopy- G.Aruldas.

Topics for assignments/discussion in the tutorial session (sample)

1. History of atom model
2. Rutherford experiment leading to atom model
3. Bohr model of atom and correspondence principle.
4. Molecular bond and electron sharing.
5. Width of spectral lines.
6. Spectroscopic techniques.
7. X-ray diffraction for identification of samples

Open Course
15UPY551.1: BIO PHYSICS

No. of credits: 2
No. of instructional hours per week: 3

Unit 1 (18 hrs)
Bio mechanics-biophysics and fluid flow-Gas transport-physics of audition Physics of vision (chapter 1 to 5 of Reference 3)

Unit 2 Cellular-Molecular biophysics (18 hrs)
Cell-components-proteins-nucleic acids-physics of bio-membranes-Thermodynamics of bio systems (Chapter 6 to 9 of reference 3)

Unit 3 Radiation biophysics (18 hrs) (chapter 18 of reference 1)
Bio-electronics and Bio Instrumentation (chapter 17 of reference 1) Bio-informatics (chapter 6 of reference 1)-Demonstration of biophysics experiments (reference 3)

Reference books

1. Essentials of Biophysics, P.Narayanan, 2nd edn. New Age publishers
2. A text book of biophysics, R.N.Roy, New central book agency Kolkata.
3. Elementary bio physics,P.K.Srivastava,Narosa publishing house ,New Delhi
4. Introduction to Biophysics ,Pranabkumarbanerjee,S.Chand& co ,New Delhi
5. Biological science ,Green,Stout,&Taylor, Cambridge university press

Open Course
15UPY551.2: ASTRONOMY AND ASTROPHYSICS

No. of credits: 2
No. of instructional hours per week: 3

Unit 1-Introduction 4 hrs (Book 2, Chapter 1, P 1 – 6)
Astronomy and Astrophysics-Importance of Astronomy-Methods of Astronomy and Astrophysics-The Scientific Methods-Scope of Astronomy
Unit 2 - Astronomy 15 hrs (Book 1, Chapter 4, 5, P 65-70, 78-101)
Birth of the Universe-Ancient astronomy-Medieval Astronomy-Renaissance Astronomy-Modern Astronomy

Unit 3-The Objects in the Sky 15 hrs ((Book 1, Chapter 6, P 102 -127)
The Microwave background radiation-The Sun-The Stars-Neutron Stars and Black holes-Supernovae-Galaxies

Unit 4 -The Solar System15 hrs (Book 1, Chapter 7, P 128-154)
Sun and Planets-Formation of the Planets-Comets-Planets and Satellites-Asteroids-Meteorites

Unit 5 -Earth in Space 5hrs (Book 1, Chapter 8 , P 155 -162)
Motion of the Earth-The Calendar-The Seasons

Books for Study

1. Planet Earth, CesareEmiliani , (Cambridge University Press, 1995)
2. Astrophysics - K. D. Abhayankar (University Press,2001)

Books for reference

1. Fundamentals of Geophysics William Lowrie(Cambridge University Press,1997)
2. Modern Physics- R. Murugeshan, KiruthikaSivaprasath (2007), S.Chand&Company Ltd.
3. Introduction to Astrophysics – BaidyanadhBasu
4. Modern Trends in Physics VolI , C. J. Babu
5. Space Science –Louise K. Harra& Keith O.Mason(Imperial College Press,London, 2004)

Open Course
15UPY551.3: APPLIED PHYSICS

No. of credits: 2

No. of instructional hours per week: 3

Unit-1. Electric and Electronic Equipments (12 hrs)

Electric motor-principles of working-Microwave oven-principle-technical specifications-applications- advantages-Public address system-Block diagram representation-function of each unit-CD player and drives-DVD player and drives-Telephonic communication (Cable and cellular)-Principles (qualitative using block diagrams)-Cell phone-SIM card-technical specifications-Radio-History of radio revolution- different types of radios-Television-working (qualitative)-Touch screens & ATM (Automatic Telling machine)

Unit 2. Scientific Instruments (12 hrs)

Tunneling Electron Microscope (TEM)-What is it?-working principle-schematic representation- applications-technical specifications-Scanning Electron Microscope (SEM)-What is it?-working principle- schematic representation-applications-technical specifications-Atomic Force Microscope (AFM)-What is it?-working principle-schematic representation-applications-technical specifications XRD-Principle and applications-Spectrophotometer-working and applications-Scanning Tunneling Microscope

Unit 3. Medical Instruments (10 hrs)

CT Scan-basic principle-applications & advantages-MRI Scan-principle and applications & advantages-X ray-applications & advantages-Echo Cardio Gram (ECG)-Ultra sound scan

Unit 4. Optical Instruments (10 hrs)

Microscope-Electron microscope-Camera-History of evolution of camera-Digital camera-Holography- Optical communication network-building blocks-Over head Projector (OHP)-LCD Projector-OMR reader- radar

Unit 5. Common Mechanical devices (10 hrs)

Pumps-what is it?-working-different types of pumps-Refrigerator-working principle-technical specifications-Heat engines-Automobile engines-working (Qualitative description only)-Different types- Brakes-Different types of brakes

References

1. Audio and video Systems. R.G.Gupta, Technical Education Series.
2. Mobile Satellite Communication Network (Ch 1 & 2), Ray E Sherrif&Y. Funttu,Wiley India Edn.
3. Television Engineering & Video System, R.G.Gupta, TMH.
4. Electrical Technology (Vol I & II), B.L.Theraja.
5. A Text book of elements of Mech. Engg (page 105-114), S.TrynbakaMoorthy,I.K International Publishing house.
6. Physical principles of electron microscopy- An introduction to TEM, SEM, AFM, Springer, 2005.

Open Course
15UPY551.4: ENVIRONMENTAL PHYSICS

No. of credits: 2

No. of instructional hours per week: 3

Unit 1 Essentials of Environmental physics (18 hrs)

Structure and thermodynamics of the atmosphere-composition of air-Green house effect-Transport of matter-energy and momentum in nature-Stratification and stability of the atmosphere-Laws of motion- Hydrostatic equilibrium-General circulation of the tropics-Elements of weather and climate in India

Unit 2 Environmental pollution and Degradation (18 hrs)

Factors governing air-water and noise pollution-Air and water quality standards-Waste disposal-Heat island effect-Land and sea breeze-Puffs

and Plumes-Gaseous and particulate matter-Wet and dry deposition-Dispersal mechanism of air and water pollutants-Mixing height and turbulence-Gaussian plume models-Dispersion models-Environmental degradation-Thermal and radioactive pollution-Nuclear radiation-Health hazards and safety

Unit 3 Environmental Changes and remote sensing (18 hrs)
Energy sources and combustion processes-Renewable sources of energy-Solar energy-Wind energy-Bio energy-hydro power-fuel cells-nuclear energy-Forestry and bio-energy-Deforestation-Degradation of soils-Agriculture and land use changes-Changing composition of local and global environment-Remote sensing techniques

Books for Study

1 The Physics of Monsoon:R.N. Kesavamoorthy and N SankarRao (Allied Pbl)

2 The Physics of Atmosphere :J.T.Houghton(Cambridge Uty)

3 Renewal Energy Resources:J.Twidell and J Weir (ELBS 1988

4 Numerical Weather Prediction:G.J.Haltiner and R.T.Williams (John Wiley)

Open Course
15UPY551.5: ENERGY PHYSICS

No. of credits: 2

No. of instructional hours per week: 3

Unit I (7 hrs)
Various forms of energy-renewable and conventional energy systems-comparison-coal, oil and natural gas-availability-applications-merits and demerits

Unit 2 (10 hrs)
Solar energy-Solar radiation measurements-solar energy collector-principle of the conversion of solar radiation in to heat-Solar energy storage-solar heaters, space cooling-solar ponds-solar cookers-solar

distillation-solar furnaces-solar green houses-photovoltaic generation basics-merits and demerits of solar energy

Unit 3 (9 hrs)

Wind energy-Basic principle of wind energy conversion-basic components of wind energy conversion system-wind energy collectors-Energy storage-application of wind energy

Unit 4 (9 hrs)

Biomass energy-classification-photosynthesis-biomass conversion process-gobar gas plants-wood gasification-ethanol from wood-merits and demerits of biomass as energy source

Unit 5 (9 hrs)

Energy from Oceans and Chemical energy resources-Ocean thermal energy conversion-energy from waves and tides-basic ideas-nature-applications-merits and demerits

Unit 6 (10 hrs)

Patterns of energy consumption in domestic-industrial-transportation and agricultural sectors-energy crisis and possible solutions-energy options for the developing countries-energy storage and hydrogen as a fuel (basics)-impact due to non-conventional energy sources-global warming

Text books

1. Non – Conventional Energy Resources by G. D. Rai, Khanna Publishers,2008.
2. Solar energy by G.D. Rai, 5th edition, 1995.
3. Solar Energy Fundamentals and application by H.P. Garg and J. Prakash, Tata McGraw - Hill Publishing company ltd, 1997.
4. Solar energy by S. P. Sukhatme, Tata McGraw- Hill Publishing company ltd,1997.

References

1. Energy Technology by S. Rao and Dr. B.B. Parulekar, 1997, 2nd edition
2. Power Plant Technology by A. K. Wahil. 1993.

SEMESTER VI

Core Course IX
15UPY641: SOLID STATE PHYSICS

No. of credits: 4
No. of instructional hours per week: 4

Unit I- Crystal Structures and interatomic forces (18 hrs)
Introduction-crystalline state-basic definitions-Fourteen Bravais lattices and seven crystal systems elements of symmetry-nomenclature of crystal directions and crystal planes-Miller indices examples of simple crystal structures-amorphous solids and liquids-interatomic forces-types of bonding.

Unit 2 – X-ray, Neutron and Electron diffraction (12 hrs)
Introduction-generation and absorption of X-rays-Bragg's law- reciprocal lattice and X-ray diffraction-diffraction condition and Bragg's law-experimental techniques-neutron diffraction-electron diffraction.

Unit 3 – Conduction in metals – Free electron model (12 hrs)
Introduction-conduction electrons-free electron gas-electrical conductivity-electrical resistivity versus temperature-heat capacity of conduction electrons -Fermi surface-electrical conductivity-effects of the Fermi surface-thermal conductivity in metals - Hall effect and magneto resistance -A.C conductivity and optical properties-failure of free electron model.

Unit 4- Band Theory (5 hrs)
Bloch theorem-The Kronig -Penney model-construction of Brillouin zones- conductors, semiconductors and insulators.

Unit 5- Magnetic Properties of materials (8 hrs)
Introduction-review and basic formulae-magnetic susceptibility-classification of materials-Langevin diamagnetism-Para magnetism-magnetism in metals- ferromagnetism in insulators - antiferromagnetism and ferromagnetism - ferromagnetism in metals - ferromagnetic domains.

Unit 6- Dielectric and Optical properties of materials (9hrs)
Introduction-dielectric constant and polarizability-local field-sources of polarisability-Electronic polarizability- dipolar polarizability-ionic

polarisability-piezoelectricity-ferroelectricity. Absorption processes-photoconductivity-photovoltaic effect- photoluminescence-colour centres.

Unit 7-Superconductivity (8 hrs)

Introduction-Zero resistance-perfect diamagnetism or The Meissner effect-The critical field-electrodynamics of superconductors-Theory of superconductivity- tunneling and the Josephson effect-miscellaneous topics (intermediate state, Type I & II superconductors).

Books for Study:

1. Solid State Physics – H.C. Gupta, 2nd edition, Vikas Publishing House Pvt Ltd
2. Solid State Physics – Structure and Properties of Materials, M.A.Wahab, 2nd edition, Narossa Publishing House.
3. Solid State Physics – S.O. Pillai, 6th edition, New Age International Publishers
4. Introduction to Solid State Physics, Kittel, Wiley & Sons, 7th edition
5. Solid State Physics – AJ Dekker, Macmillan Publishers India Ltd
6. Solid State Physics – Puri&Babbar, S.Chand

Books for Reference :

1. Concepts of Modern Physics by Beiser, Tata McGraw Hill, 5th Edition, 1997.
2. Fundamentals of Solid State Physics, Saxena-Gupta-Saxena, 9th edition (2004-05), PragathiPrakasan, Meerut.
3. Fundamentals of Physics, 6th Edition, by D.Halliday, R.Resnick and J.Walker, Wiley. NY, 2001.
4. Physic s, 4th Edition, Vols I, II & II Extended by D.Halliday, R.Resnick and K.S.Krane, Wiley, NY. 1994.
5. The Feynman Lectures on Physics, Vols. I, II, and III, by R. P. Feynman, RB Leighton and M Sands, Narosa, New Delhi, 1998.
6. Introductory Solid State Physics by H.P.Myers, Viva books, New Delhi, 1998
7. Elementary Solid State Physics – Principles and Applications, M.A.Omar

Core Course X
15UPY642: NUCLEAR AND PARTICLE PHYSICS

No. of credits: 4

No. of instructional hours per week: 4

Unit 1 - Introduction to the nucleus (14 hrs)

Constituents of nuclei- nuclear charge -binding energy-angular momentum of the nucleus-magnetic moment-nuclear quadrupole moment-nuclear stability-models of nuclear structure-The liquid drop model-shell model-collective model.

Unit 2 - Radioactivity (10 hrs)

Alpha, beta and gamma rays - rate of decay-half life and mean life-units of radioactivity - conservation laws in radioactive series-decay series-radioactive equilibrium-secular and transient equilibrium -radioactive dating-range of alpha particles-Geiger-Nuttal law- alpha decay-Gamow's theory-alpha particle disintegration energy-beta ray spectra-magnetic spectrograph - origin of line and continuous spectrum -neutrino-energy of beta decay-gamma decay-radio isotopes-applications.

Unit 3 - Nuclear forces (8 hrs)

Two-nucleon system, deuteron problem-nucleon-nucleon potential-spin and magnetic moment results of proton-proton and proton-neutron scattering experiments-meson theory of nuclearforces.

Unit 4 - Nuclear radiation detectors and particle accelerators (8 hrs)

G.M Counter-scintillation counter-Van de Graf generator-cyclotron-synchrocyclotron-betatron.

Unit 5 – Nuclear reactions (10 hrs)

The Q value equation for a nuclear reaction-threshold energy-nuclear reactions -conservation laws-energy balance in nuclear reaction and Q value-threshold energy of an endoergic reaction-scattering cross section-determination of cross section-reaction mechanism-compound nucleus.

Unit 6 – Nuclear fission and fusion (12 hrs)

Nuclear fission-energy released in fission-Bohr and Wheeler's theory-chain reaction multiplication factor-critical size-atom bomb-nuclear reactors-breeder reactors-uses of nuclear reactors. Nuclear fusion-sources of stellar energy-thermonuclear reactions-hydrogen bomb-controlled thermo-nuclear reactions-magnetic bottle-Tokamak- inertial confinement - nuclear power in India.

Unit 7 - Cosmic rays and elementary Particles (10 hrs)

Discovery of cosmic rays -latitude effect-altitude effect- primary cosmic rays - secondary cosmic rays-cosmic showers-origin of cosmic rays. Fundamental interactions in nature-classification of elementary particles-conservation law's-lepton conservation-baryon conservation-strangeness-isospin-hyper charge-resonance particles-The quark model-Bremstrahling effect-Cerenkov radiations.

Books for Study

1. Modern Physics by R. Murugesan, S. Chand & Co., Reprint,2008
2. Modern Physics- G. Aruldas and P. Rajagopal, PHI, New Delhi, 2005
3. Nuclear Physics – D. C. Tayal, Himalaya Publishing House, 4th edition.
4. Concepts of Modern Physics – Arthur Beiser, TMH, Sixth Edition
5. Introductory Nuclear Physics – Kenneth S Krane, Wiley India

References

1. Atomic and Nuclear Physics – N .Subramaniam and Brijlal, S.Chand& Co.
2. Nuclear Physics – S.N.Ghoshal, S.Chand& Co.
3. "Nuclear Physics"- Kaplan (Narosa)
4. Atomic Physics – J.B.Rajam, S.Chand& Co.

Topics for assignments/discussion in the tutorial session (sample)

1. Fusion reactors.
2. History of the Universe (elementary particle).
3. Linear accelerator.
4. Ionization chamber and Wilson cloud chamber.
5. Solid state detectors and proportional counter.

Core Course XI
15UPY643: CLASSICAL AND MODERN OPTICS

No. of credits: 4

No. of instructional hours per week: 4

Unit 1. Interference of light (12 hrs)

The principle of superposition - coherent sources – Spatial and temporal coherence - Double slit interference (theory of interference fringes and band width) - Interference by division of wave front and amplitude – Fresnel's biprism - interference in thin films – fringes of equal inclination- fringes of equal thickness - wedge shaped films- testing of optical flatness - Newton's rings (reflected system)- refractive index of a liquid - Michelson interferometer – determination of wavelength

Unit 2. Diffraction (12 hrs)

Fresnel diffraction: - Half-period zones - explanation of rectilinear propagation of light–diffraction at a straight edge-zone plate. Fraunhofer diffraction: - Diffraction at a single slit, double slits – plane transmission grating - Rayleigh's criterion for resolution - resolving power of diffraction grating.

Unit 3.Polarisation (12 hrs)

Plane polarized light - polarization by reflection – Brewster's law - pile of plates -Malus law - Double refraction - Huygens explanation for double refraction in uniaxial crystals - Nicol prism - Nicol prism as a polarizer and analyzer – Theory of production and analysis of plane, circularly and elliptically polarized light - quarter and half wave plates.

Unit 4. Dispersion (6 hrs)

Normal dispersion - Elementary theory of dispersion - Cauchy's and Hartmann dispersion formula - anomalous dispersion

Unit 5. Fiber Optics (8 hrs)

Introduction, optical fiber, the numerical aperture, coherent bundle, pulse dispersion in step index fiber, graded index fiber, single mode fiber, multimode fiber, Fibre optic sensors (qualitative), fiber optic communication (qualitative), Advantages of fiber optic communication system.

Unit 6. Holography: (8 hrs)

Principle of holography, recording of holograms, reconstruction of images (Theory not needed), application of holography, different types of holograms, transmission and reflection types.

Unit 7. Laser: (14 hrs)

Basic principle of laser operation-Einstein coefficient, light propagation through medium and condition for light amplification-population inversion by pumping and cavity threshold condition, line shape function- optical resonators (qualitative)-Q factor-various laser systems –Ruby laser He-Ne laser, Dye laser, semiconductor laser, (working principle only) Three level and Four level lasers (Fundamental ideas only) Application of lasers in industry and medicine.

Books of Study

1.Text Book of Optics.Subramaniam&Brijlal, M.N.Avadhanulu, 23rd edition (2006)

2.Optics and spectroscopy -R.Murugesan.

3. Optics - AjoyGhatak

4. Lasers: Principles, Types and applications – K.R.Nambiar

References

1.Optics P.Vivekanandan

2. Fundamentals of Optics - Jenkins and White

3.Modern Classical Optics – Geoffrey Brooker.

4. Principles of Optics - B. K. Mathur

5. Fundamentals of Optics - Khanna and Gulati

6.Lasers &Non-Linear Optics - B. B. Laud

7. Electronic Communications- Dennis Roddy& John Coolen

Topics for assignments/discussion in the tutorial session (sample)

1. Michelson's interferometer-Standardization of metre.
2. Diffraction at a rectangular aperture and circular aperture
3. Optical activity-Fresnel's theory of optical rotation.
4. Resolving power of prism and telescope

5. Constant deviation spectrometer.
6. Laurent's half shade polarimeter.
8. Harmonic generation.
9. Laser applications.
10. Study of Fraunhofer lines using spectrometer.
11. Study of absorption spectra of KMnO4.
12. Determination of refractive index of liquid by Newton's rings method.
13. Comparison of radii of curvature by Newton's rings method.

Core Course XII

15UPY644: DIGITAL ELECTRONICS AND COMPUTER SCIENCE

No. of credits: 3

No. of instructional hours per week: 4

Unit-1 (20 hours)

Number systems :-Decimal number system-binary number system-conversion of binary number to decimal and decimal number to binary-binary addition and subtraction- 1'scomplement- 2's complement-binary subtraction using 2's complement- signed arithmetic operation-conversion of real numbers-conversion of decimal fraction to binary fraction-binary coded decimal- hexa decimal number system- conversion of hexa- decimal number to decimal, decimal to hexadecimal, binary to hexa- decimal and hexa-decimal to binary-ASCII code.(Textbook1)

Boolean algebra and logic gates: - Logic gates AND, OR, NOT, NAND,NOR, and Ex-OR gate-realization of other logic functions using NAND / NOR gates-tri state logic gateBoolean laws- Demorgan's theorem-Simplification of Boolean equations using Boolean laws. Karnaugh map (Textbook1)

Arithmetic circuits:-Half adder-full adder-controlled inverter-binary adder- subtractor. (Textbook2)

Sequential circuits:- Flip-Flop, S-R Flip Flop, J-K Flip-flop, Master slave JK Flip- Flop (Textbook1)

Unit-2 (10hours)

Basics of computers:-Hardware- input and output units- memory unit-ALU-control unit–basic
operational concepts-Software – operating systems (Textbook3 and 4)

The memory systems:- Basic concepts-semiconductor RAM- internal organization memory chips-static memories-asynchronous and synchronous DRAMs-structure of large memories–ROM,PROM,EPROM, EEPROM–flash memory-speed, size and cost-Basic concepts of cache memory and virtual memories. Secondary storage-magnetic hard disks-optical disks-magnetic tape systems.(Textbook3)

Unit-3 (24hours)

Programming in C:- Importance of C-basic structure of C program-C constants and variables-data types-declaration of variables-assigning values to variables-defining symbolic constants-operators and expressions-input and output functions-reading and writing a character-formatted input-formatted output-control statements-simple IF statement-IFELSE statement-nested IFELSE-SWITCH statement-GOTO statement-loop control structures-WHILE loop-DO loop-FOR loop-jumps in loops- arrays and subscripted variables-functions in C-user defined functions-the form of C function - calling a function-category of functions-recursion-standard library functions-basics of structures and pointers (introduction only)-sequential file management-defining and opening a sequential file-input and output operations on files-closing a file. Simple C programs for solving problems in physics. (Textbook5)

Unit-4(18hours)

Computer oriented numerical methods) (Including algorithms):- :-Iterative methods-method of successive bisection to find the roots of an equation-Newton– Raphson iterative method-polynomial equation–interpolation-Lagrange interpolation-least square approximation of functions - linear regression-regression coefficients-algorithm for linear regression-polynomial regression-fitting exponential functions-numerical differentiation and integration-Simpson's rule-Trapezoidal rule-algorithms for integrating tabulated function and known function–numerical solution of differential equations-Euler's method-Runge-Kutta method(second order method only) (Text book6)

Text books:-

1. Fundamentals of microprocessors and micro-computers by B. Ram, DhanpatRai Publications (p) Ltd, NewDelhi (sixth edition)
2. Digital principles and applications by Albert.P. MalvinoandP. Leach,TMH,New Delhi (Fourthedition)
3. Computer organization by Carl Hamcher,ZvonkoVranesicandSafwa tZaky(Fifth International edition Indian print)McGraw-Hill
4. Fundamentals of computers by V. Rajaraman, PHI, New Delhi(Fourth edition)
5. Programming in ANSIC by E. Balagurusamy, TMH Publishing company Ltd, NewDelhi (Fourthedition).
6. Computer oriented numerical methods by V. Rajaraman, PHI, New Delhi(Third edition)

Books for reference:-

1. Introduction to digital electronics-NIIT-PHI.
2. A first course in Computers- Sanjay Saxena-Vikas publishing house PvtLtd
3. Theory and problems of programming with C-Schaumseries-Byron S Gottfried.
4. Graphics under C-YashavantKanetkar- BPB Publications-NewDelhi
5. Beginning Linux programming-Neil Mathew and Richard Stones-Wiley India Pvt Ltd.
6. Computational Physics-V K Mittal, RC Vermaand SC Gupta-Ane Books India
7. Numerical methods with Computer programs in C++-PallabGhosh-PHI

Core Course XIII
15UPY645: OPTICS, ELECTRICITY AND MAGNETISM

No. of credits: 3

No. of instructional hours per week: 2

1. Spectrometer-A, D and n of a solid prism.
2. Spectrometer –Dispersive power and Cauchy's constants
3. Spectrometer Grating—Normal incidence- N & wavelength
4. Spectrometer-i-d curve
5. Spectrometer- Hollow prism
6. Liquid lens-refractive index of liquid and lens
7. Newton's Rings—Reflected system
8. Air wedge-diameter of a wire
9. Potentiometer-Resistivity.
10. Potentiometer-Calibration of ammeter
11. Potentiometer –Reduction factor of T.G
12. Potentiometer –Calibration of low range voltmeter
13. Potentiometer – Calibration of high range voltmeter
14. Thermoemf - Measurement of emf using digital multimeter.
15. Carey Foster's bridge-Resistivity
16. Carey Foster's bridge-Temperature coefficient of resistance.
17. Mirror galvanometer - Figure of merit.
18. BG- Absolute capacity of a condenser
19. Conversion of galvanometer into ammeter and calibration using digital Multimeter
20. Conversion of galvanometer into voltmeter and calibration using digital Voltmeter.
21. Circular coil - Calibration of ammeter.
22. Study of network theorems - Thevenin's& Norton's theorems and maximum power transfer theorem.

23. Circular coil - Study of earth's magnetic field using compass box.
24. Absolute determination of m and Bh using box type and Searle's type vibration magnetometers.
25. Searle's vibration magnetometer-comparison of magnetic moments.

References

1. Yarwood and Wittle; Experimental Physics for Students, Chapman & Hall Publishers.
2. An advanced course in practical physics, Chathopadhyaya, Rakshit and Saha, New central agency, Kolkata.
3. A text book of practical physics, S.Viswanathan& Co., Chennai.
4. Advanced Practical Physics, B.L.Worsnop and H.T.Flint, Khosla Publishers, Delhi.

Core Course XIV
15UPY646: ELECTRNICS AND COMPUTER SCIENCE

No. of credits: 3

No. of instructional hours per week: 2

ELECTRONICS

1. PN junction Diode (Ge& Si) characteristics - To draw the characteristic curves of a PN junction diode and to determine its ac and dc forward resistances.
2. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to calculate the ripple factor with and without shunt filter (10 readings for RL 100 Ω to 5000Ω).
3. Full wave (centre tapped) rectifier-To construct a full wave rectifier using junction diode and to study effect of L,C, and LC filters on the ripple factor (for different RL).
4. Bridge rectifier-To construct a bridge rectifier using junction diodes and to calculate the ripple factor with and without shunt filter (10 readings for RL 100 Ω to 5000Ω).

5. Bridge rectifier- Dual power supply-To construct a dual power supply using bridge rectifier and measure the output voltages for different pair of identical load resistors.
6. Zener diode characteristics-To draw the I-V characteristic of a Zener diode and to find the break down voltage and the dynamic resistance of the diode.
7. Zener diode as a voltage regulator-To construct a voltage regulator using Zener diode and to study the output voltage variation (i) for different RL and (ii) for different input voltage with same RL.
8. Transistor characteristics-CE-To draw the characteristic curves of a transistor in the CE configuration and determine the current gain, input impedance and output impedance.
9. Transistor characteristics-CB-To draw the characteristic curves of a transistor in the CB configuration and determine the current gain, input impedance and output impedance.
10. Single stage CE amplifier-To construct a single stage CE transistor amplifier and study its frequency response.
11. OP amp. IC741- Inverting amplifier-To construct an inverting amplifier using IC741 and determine its voltage gain.
12. OP amp. IC741- Non inverting amplifier - To construct a non inverting amplifier using IC741 and determine its voltage gain.
13. OP amp. IC741- Differentiator-To construct an OP amp. Differentiator, determine its voltage gain and study the output response to pulse and square wave.
14. OP amp. IC741- Integrator-To construct an OP amp. Integrator, determine its voltage gain and study the output response to pulse and square wave.
15. Phase shift oscillator-To construct a phase shift oscillator using transistor and measure the frequency of the output waveform.
16. Logic gates- OR and AND-To verify the truth tables of OR and AND gates using diodes.
17. Logic gate- NOT-To verify the truth tables of NOT gate using a transistor.
18. Network theorems (Superposition, Thevenin's& Norton's theorems) - To verify the (i) Superposition, (ii) Thevenin's& (iii) Norton's theorems

19. RC-Filter circuits (Low pass) - To construct an RC –low pass filter circuit and to find the upper cut off frequency.
20. RC-Filter circuits (High pass)-To construct an RC –high pass filter circuit and to find the lower cut off frequency.

COMPUTER SCIENCE (C- Programs)

1. Program to find the roots of a quadratic equation (both real and imaginary root)
2. Program to sort a given list containing the name of students and their total marks and print the rank list.
3. Programs to plot the functions Sin x, Tan x and ex
4. Program to find the product of two n×n matrices.
5. Program to find the dot product and cross product of vectors
6. Program to simulate the trajectory of the projectile thrown (a) horizontally and (b) at an angle.
7. Program to study the motion of a spherical body in a viscous fluid.
8. Program to study the motion of a body under a central force field.
9. Program to fit a straight line through the given set of data points using least square fitting algorithm.
10. Program to integrate a given function using Simpson's rule.
11. Program to integrate a given function using Trapezoidal rule.
12. Program to find the solution of differential equation by RK2 method.

References:

1. Basic electronics and linear circuits; N.N. Bhargava, D.C. Kulshreshtha, S.C.Gupta
2. OP- Amps and linear integrated circuits; Ramakant A. Gayakwad
3. Basic electronics; SantiramKal
4. Basic electronics; B. L. Theraja
5. Principles of electronics; V. K. Mehta
6. A first course in Electronic s; Anwar A. Khan, Kanchan K. Dey

Elective Course
15UCH661.1: ELECTRONIC INSTRUMENTATION (Elective)

No. of credits: 2
No. of instructional hours per week: 3

Unit 1 (10 hrs)*(Ref: 1, Ch.1 & 3; Ref 2, Ch. 1; Ref 3, Ch. 13.1 to 13.4)*
Basic Concept of Measurement- measurement errors- standards of measurement-functional elements of an instrument- standard in quality management.

Unit 2 (10 hrs) *(Ref: 4, Ch.3, 4, & 5)*
Instruments for measuring basic parameters-ammeter-voltmeters-multimeter-digital voltmeter-accuracy and resolution of DVM.

Unit 3 – Oscilloscopes (10 hrs) *(Ref: 1, Ch.7; Ref 4, Ch. 7)*
Cathode ray tubes-CRT circuits-vertical deflection system-delay line-horizontal deflection system-multiple trace-oscilloscope probes and transducer-storage oscilloscopes.

Unit 4 – Transducers (10 hrs) *(Ref: 4, Ch.13; Ref 5)*
Basic principles-classification of transducers-strain gauges-temperature measurements- thermistors-photosensitive devices-radiation detectors-basic idea of instrumentation amplifier.

Unit 5 – Signal Generation and Analysis (14 hrs)
(Ref: 1, Ch.8 & 9.1 to 9.4.1; Ref 3, Ch.8.1 to 8.4.2)
Sine wave generator-frequency synthesizer-sweep generator-astable multivibrator-laboratory pulse generator-function generator-wave analyzers-harmonic distortion analyzer-wave meter- spectrum analyzer (qualitative idea only)

References

1. Modern Electronic Instrumentation and Measurement Techniques, Albert D.Helfrick& William D.Cooper, PHI Ltd.

2. Instrumentation-Devices and Systems, C.S.Rangan, G.R.Sarma, V.S.V.Mani, TMH Publishers.
3. Electronic Instruments and Instrumentation Technology, M.M.S.Anand, PHI Ltd.
4. Electronic Instrumentation, 2nd edition, Kalsi H.S, TMH Publishers.
5. Sensors and Transducers, D.Patranabis, Wheeler Publishing Co. Ltd.
6. Industrial Electronics and Control, S.K.Bhattacharya&S. Chatterjee,TMH Publishers.
7. Electronic measurement and Instrumentation, K.B.Klaassen,Cambridge University Press.
8. Measurement Systems-Applications and Design, 5th edition, Ernest O.Doebelin&DhaneshN.Manik, TMH Publishers. Principles of Measurement systems, John P.Bentley, 3rd edition,(Longman), Pearson Education Publishers.

Elective Course
15UCH661.2: SPACE SCIENCE (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Universe (12 hrs)

Large Scale Structure of the Universe-Astronomy and Cosmology-Our Galaxy-Galaxy types- Radio sources-Quasars-Structures on the largest scale-Coordinates and catalogues of astronomical objects-Expansion of the Universe

Ref; Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press,Art. 1.1 to 1.8 (Pages 1 to 26)

The evolution of Stars (9hrs)

Introduction-Classification of Stars-The Harvard classification-Hertzsprung–Russel diagram- Stellar evolution-White dwarfs-Electrons

in a white dwarf star-Chandrasekhar limit-Neutron stars-Black holes-Supernova explosion-Photon diffusion time-Gravitational potential energy of a star-Internal temperature of a star-Internal pressure of a star.
Ref; Modern Physics-R. Murugeshan, KiruthikaSivaprasath, S.Chand& Company
Ltd. (2007), Art. 78.1 to 78.15(Pages 963 to 976)

The active Sun (10 hrs)
Introduction, Sunspots and Solar storms-Sunspots and Solar activity-Cosmic rays of Solar origin- The Solar wind-Solar corona and the origin of the solar wind-Disturbed Solar wind.
Ref; Earth's Proximal Space- ChanchalUberoi (2000), Universities Press (India) Limited, Art 3.1 to 3.6 (Pages 36 to 55)

The earth's Atmosphere (15 hrs)
Introduction-Nomenclature and temperature profile-Temperature distribution in the troposphere-
Temperature of stratosphere-temperature of mesosphere and thermosphere-Temperature variability-The pressure profile-Scale height-Density variation-The Ionosphere-Effect on scale height-Ionospheric electric fields-Ionization profile-Layer of charge-Ionospheric hydrogen and Helium.
Ref; Introduction to Space Science- Robert C. Haymes (1971) John Wiley & Sons
Art. 3.1 to 3.9 and 3.12 to 3.17 (Pages 54 to 65 and 69 to 78)

Magnetosphere (8 hrs)
Introduction-The magnetic field of Earth-Earth's variable magnetic field-Solar activity and Earth's magnetic weather-solar wind interaction-The Chapman-Ferraro closed magnetosphere- Dungey's open magnetosphere-Structure of the magnetosphere-Magneto tail and Plasma sheet-Plasma sphere-Earth's radiation belts.
Ref; Earth's Proximal Space- ChanchalUberoi (2000), Universities Press (India)
Limited, Art. 4.1 to 4.6 and 4.8 to 4.8.3 (Pages 56 to 67 and 71 to 74

Books for Study

1. Introduction to Space Science – Robert C Hymes (1971), John Wiley & Sons Inc.
2. Earth's Proximal Space- ChanchalUberoi (2000), Universities Press (India)
3. Introduction to Cosmology- J. V. Narlikar (1993), Cambridge University Press
4. Modern Physics- R. Murugeshan, KiruthikaSivaprasath (2007), S.Chand& Company Ltd.

Books for reference

1. Space Physics and Space Astronomy – Michael D Pappagiannis (1972), Gordon and Breach
2. Science Publishers Ltd.
3. Introductory Course on Space Science and Earth's environment- Degaonkar (Gujarat University,1978)
4. Introduction to Ionosphere and magnetosphere- Ratcliffe (CUP, 1972)
5. The Physics of Atmospheres-Houghton (Cambridge University Press)
6. Introduction to Ionospheric Physics-Henry Rishbeth&Owen K. Garriot (Academic Press, 1969)
7. Space Science –Louise K. Harra& Keith O. Mason(Imperial College Press,London, 2004)
8. Introduction to Space Physics- Kivelson and Russel
9. Introduction to Astrophysics – BaidyanadhBasu

Astrophysics - K. D. Abhayankar (University Press)

Elective Course
15UCH661.3: PHOTONICS (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Unit 1: (7 hrs)

Photons in semiconductors-semiconductors-energy band and charge carriers-semi conducting
materials-electron and hole concentrations-generation-recombination and injection-junctions-hetero junctions-quantum wells and super lattices

Unit 2: (6 hrs)

Semiconductor photon sources-light emitting diodes-injection-electro-luminescence-LED
characteristics-internal photon flux-output photon flux and efficiency-responsivity-spectral
distribution-materials-response time-device structures

Unit 3: (8 hrs)

Semiconductor laser amplifiers-gain-amplifier band width-optical pumping-electrical current
pumping-hetero structures-semiconductor injection lasers-amplification-feedback and oscillators-resonator losses-gain condition-internal photon flux-output photon flux and efficiency-spectral distribution-spatial distribution-single frequency operation quantum well lasers (qualitative)

Unit 4: (8 hrs)

Semiconductor photon detectors-The external photo effect-photo electron emission-The internal photo effect-semiconductor photo detection-quantum efficiency-responsivity devices with gain-response time-photoconductors-photo diodes-PIN photo diodes-hetero structure photo diode- Schotky barrier photodiodes-array detectors-avalanche photodiodes-gain and responsivity- response time.

Unit 5: (8 hrs)

Electro optic-Pockels and Kerr effects-electro optic modulators and switches-scanners directional couplers-spatial light modulators-electro

optics of liquid crystals-wave retarders and modulators-spatial light modulators.

Unit 6: (7 hrs)

Nonlinear optics-second order and third order optical non linearity-intensity dependent refractive index-optical Kerr effect-self focusing.

Unit 7: (10 hrs)

Photonic switching and computing-opto mechanical-electro optic, acousto-optic and magneto optic switches-all optical switches-bistable systems-principle of optical bistability-bistable optical devices-optical inter connectors-optical computing-digital optical computing-analog optical processing.

Book of Study

1. Fundamentals of Photonics: BFA Saleh and M.C.Teich, John Wiley &Sons, Inc.

Reference books

1. Semiconductor optoelectronic devices: Pallab Bhattacharya, Printice Hall of India.
2. Optics and Photonics- An introduction: F. Graham Smith and Terry A.King, John Wiley &Sons,Inc.

   Lasers and Nonlinear Optics: B.B.Laud, New Age International Pvt Ltd.

Elective Course

15UCH661.4: NANOSCIENCE AND TECHNOLOGY (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Unit 1 Introduction to Nanoscience and Nanotechnology (10 Hours)

Nanoscience and nanotechnology-Definition-Historical development, scope and applications [Book 1, Chapter 1].Comparison of bulk and nanomaterials-classification of nanostructured materials-one, two and three dimensional confinement, size and dimensionality effects-size effects-conduction electrons and dimensionality-Fermi gas and density of states-Potential wells- Partial confinement-Properties dependent on density of states-excitons. [Book 2 Chapter 9.1, 9.3, 9.4]

Unit 2 Properties of nanomaterials and scaling laws (6 Hours)

Introduction-size dependent properties-Properties of nanomaterials-chemical reactivity- solubility-melting points-electronic energy levels-electrical conductivity-Super-paramagnetism- Electron confinement-Integrated optics-Optical properties-Mechanical properties- Thermodynamic properties-scaling laws. [Book 1 Chapter 3.1 to 3.4]

Unit 3 Synthesis and characterization (16 Hours)

Synthesis of nanoscale materials and structures-Zero Dimensional materials-Inert gas condensation-Inert gas expansion-Sonochemical processing-Sol-gel deposition-Molecular self assembly-1D and 2D-Foil beating-Electro-deposition-PVD-CVD-3D Rapid solidification- Equiangle extrusion-Milling and Mechanical alloying-Micromachining-Consolidation of nanoclusters and milled powders-Methods for nanoprofiling[Book 3 chapter 8.1]-Electron microscopy-Scanning probe microscopy-Optical microscopy-XRD [Book 4, Chapter 2.1 to 2.4, 2.6]-IR and Raman Spectroscopy-Photoemission and X-ray spectroscopy [Book 2 Chapter 3.4]

Unit 4 Carbon nanostructures (10 Hours)

Carbon nanostructures-carbon molecules, carbon clusters-Fullerene-structure of C-60 and its

crystal-larger and smaller fullerenes-other bucky balls-Carbon nanotubes-fabrication-structure-electrical properties-vibrational properties-mechanical properties-Applications of carbon nano tubes-Field Emission and shielding-computers-fuel cells-chemical sensors-catalysis-mechanical reinforcement. [Book 2, Chapter 5]

Unit 5 Nanomachines and nanodevices (12 Hours)

Resonant Tunneling diode, quantum cascade lasers, single electron transistors-operating principles and applications. [Book 5, Chapter 9.1 to 9.4]

Books for study

1. Nanotechnology, An Introduction to synthesis, Properties and Applications of Nanomaterials,Thomas Varghese and KM Balakrishna, Atlantic Publishers and Distributors (P) Ltd, New Delhi
2. Introduction to Nanotechnology, Charles P. Poole Jr and Frank J Ovens, Wiley Interscience,USA
3. Nanomaterials, Nanotechnologies and design, Michael F Ashby, Paulo J Ferreira and Daniel L Schodek, Elsevier Publishers, UK
4. Nano, The Essentials, T. Pradeep, Tata McGraw Hill, New Delhi
5. Nanotechnology and Nanoelectronics, W.R. Fahrner, Springer, Newyork.

References

1. Encyclopedia of Nanoscience and Nanotechnology, H.S.Nalwa (Ed), American Scientific Publishers, Los Angels
2. Nanotubes and Nanowires, C.N.R. Rao and Govindraj, RSC Publishing
3. Nanotehnology, An Introduction, Jeremy J Ramsden, Elsevier Publishers, UK
4. Nanotechnology, Mick Wilson, KamaliKannagara, Geoff Smith, Michelle Simmons and BurkhardRaguse, Overseas Press, New Delhi

Elective Course

15UCH661.5: COMPUTER HARDWARE & NETWORKING (Elective)

No. of credits: 2

No. of instructional hours per week: 3

Unit 1 - 3 hrs

P.C. Architecture-Functional block diagram of a computer-Processors-Introduction to Microprocessor-CISC-RISC processors-Type of Processors and their specification.(Intel: Celeron-Pentium family-PII, PIII, PIV, dual core, core 2duo - AMD-K5,K6 series)

Unit 2 -10 hrs

Motherboards-Motherboard components-Types-Form factor-Different components of Motherboard (BIOS, CMOS,BICMOS, RAM, CMOS Battery, I/O slots, I/O connectors)-Riser architecture-Main Memory (SIMM, DIMM, RIMM)-extended/expanded/cache memories- Chipsets (Intel & AMD)-ROM, DRAM, SDRAM, CDRAM, RDRAM, WRAM. Bus standards-Types of Buses (PC, ISA,MCA, AGP, PCI, USB, IEEE FireWire)-Add on Cards-Different latest Add on Cards (TV Tuner Card,DVR card, Video Capture,Internal Modem, Sound Card)

Unit 3 -9 hrs

Drivers:

(1) Floppy Disk Drive- Floppy Drive Components(overview only)

(2) Hard Disk Drive (HDD)

Types, Capacity-Hard Disk Components (Media, Read/Write Head, Spindle Motor Head Actuator)-Connector-Jumper setting-trouble shooting in HDD-Hard Disk Controller (HDC)–Block diagram-Working-Interfacing (IDE,SCSI, ATA and SATA series) Configuration of HDD-Installation-Formatting-File Format (FAT, NTFS)-Pen drive- i-pods

(3) Optical Disk Drive

Types (ROM, R/W, DVD ROM, DVD R/W)-Capacity-Difference between CD &DVD (capacity,format)-trouble shooting.

Unit 4 -5 hrs

Peripherals-Keyboard and Mouse-operation-Types of VDU (CRT, LCD, and TFT)-Resolution- and Dot pitch-Printers-Types (dot matrix, inkjet, laser) Scanner-operation-Power conditioning device-SMPS-Block diagram operation-UPS-Types (online, off line, Hybrid)-trouble shooting in all these devices.

Unit 5- 4 hrs

Viruses & Vaccines-Virus-Introduction-infection methods-Types of viruses-Different symptoms of virus attack-precautions-Vaccine-Method of vaccine-Different types of Antivirus used in PC,Firewalls

Unit 6- 7 hrs

NETWORKING ESSENTIALS

Introduction-Need for networking-Network Topology-OSI Model-Types of networks (LAN, WAN, MAN) Protocols-LAN Protocols-Classification-Examples-Ethernet networking-WAN Protocols-PPP, X.25, PPTP, L2TP, ISDN

Unit 7-- 8 hrs

LAN Connectivity Devices-NIC-Repeater-Hub-Switch-Bridge-Internet Connectivity-Device-Routers-Gateways-CSU/DSU-TCP/IP Protocol Suite-What is TCP/IP-Importance-OSI vs TCP/IP

Unit 8- 6 hrs

IP Addressing-Overview-Address classes-Network ID-Host ID and Subnet Mask-Addressing
guidelines-Reserved IP Address-Subnetting and Supernetting (overview)

Unit 9 -2 hrs

Emerging Technologies-Wireless Technology-Bluetooth-WAP-Mobile Technology-GSM- CDMA-GPRS

Books for Study:

1. D. Balasubramanian, “Computer Installation & Servicing”, Tata McGraw Hill.
2. Rom Gilster, Black book, “PC Upgrading and Repairing”, Dream tech,

New Delhi.
3. Street Smart, James Pyler, “PC Upgrading and Repairing”, Wiley Publishing, Inc.
4. Stephen.J.Bigelow,”Bigelow’s Troubleshooting, Maintenance & Repairing PCs”,Tata McGraw Hill
5. Craig Zacker, “The Complete Reference- Networking”, Tata McGraw Hill
6. Douglowe, “Networking All in One Desk Reference”-3Edn, Wiley India Pvt Ltd

References:

1. Mark Minasi, “The Complete PC Upgrade & Maintenance Guide” BPB Publication
2. C.A. Schmidt, “The Complete Computer Upgrade & Repair Book”, Dreamtech
3. Craig Zacker, John Rourke, “The Complete Reference- PC Hardware”Tata McGraw Hill
4. Scott Mueller, “Upgrading & Repairing PC’s”, Pearson Education
5. Vishnu Priya Sing &Meenakshi Singh, “Computer Hardware Course”, Computech
6. ManaharLotia, Pradeep Nair, PayalLotia, “Modern Computer Hardware Course”,BPB Publication.
7. Richard Mc Mohan, “Introduction to Networking”, Tata McGraw Hill.

Internet Resources:

1. www.edugrid.ac.in/webfolder/courses/cn/cn_resourses.htm
2. www.howstuffwork.com
3. www.e-tutes.com
4. www.learnthat.com
5. www.intel.com
6. www.amd.com
7. http://en.wikipedia.org