GUJARAT UNIVERSITY

SYLLABUS OF

FIRST YEAR
BACHELOR OF SCIENCE
EXAMINATION

(T.Y. B.Sc.)
THIRD & FINAL B.Sc. EXAMINATION

G. Sc.—8:

No student will be admitted to the Third B.Sc. Examination unless he has after having passed the Second B.Sc. Examination of this University or any other examination considered equivalent thereto kept two terms in a college affiliated to this University for the purpose of this examination, provided that a candidate who is allowed to keep terms for the Third B.Sc. Examination of this University will be eligible for admission to this examination after keeping two terms in a college affiliated to this University.

G. Sc. 8-A:

A candidate who has passed the B.Sc. Examination in any group of subjects in old course will be permitted on the submission of a new application and the payment of a fresh fee to appear in the subjects he offered as subsidiary in the old course as his special subject in the new course, provided he keeps two fresh terms in this subject for the Third or Final B.Sc. Examination.

Such a candidate shall, at his option be allowed to claim exemption in Compulsory English at the Third B.Sc. Examination, but he will be required to pass either previously or in the same examination season, the fifth paper in that subject at the Second B.Sc. Examination for which purpose he shall be required to apply for admission to the examination separately and pay necessary fees separately, provided that the result of the B.Sc. Degree Examination with a new principal subject shall not be declared until he passes in the paper or papers concerned at the S.Y.B.Sc. Examination, and provided further that the result of the B.Sc. Degree Examination, so held in abeyance shall be forfeited, if he fails to pass in that paper at the
S.Y.B.Sc. Examination within two years of the declaration of the result so have abeyance.

In case he desires to offer at Third Year or Final B.Sc. Examination, a sp subject which he has not studied and passed at the subsidiary level in the Old Coup, he will have to keep fresh four terms, two for the S.Y.B.Sc. Examination and for the T.Y.B.Sc. Examination and will be permitted to appear at the end of S.Y.M.Sc. and T.Y.B.Sc. under the relevant regulations in force on submission of a f, by application and on payment of the examination fees.

O. Sc. 9 :

Students must forward their applications for examinations to the Regis. 14 : or before the prescribed date with attendance of the first term. Certificates The st attendance during the second term shall be forwarded by the Principals Exami colleges within a week of the close of the second term.

R. Sc. 11 :

A student who has passed in all subjects EXCEPT one at the Second l Examination will be allowed to keep terms for the Third Year B.Sc. Examinat 1. but he shall not be declared to have passed the Second B.Sc. Examination, unless passes in the previous or the same examination season in the subject in which he l failed and result for the Third, i.e., Final B.Sc. Examination shall not be decla till he passes the Second Year B.Sc. Examination, provided that no student shall allowed to keep terms for the Special Degree Course, if he has failed to pass in 1 Special subject at the Second B.Sc. Examination but he will be allowed to keep terms for the General Degree Course in the Third, i.e., Final B.Sc. Examination.

R. Sc.—12 :

A student for the B.Sc. General Degree Course shall offer English and three other Science subject as mentioned in O. Sc.—5.

A student for the B.Sc. Special Degree Course shall offer English and one Science subject as a special subject as mentioned in O. Sc.—5.
Note.—A student after passing the T.Y.B.Sc. Examination of the University will have the option to claim exemption from English when he appears again at the said examination with a different subject or subjects as the case may be.

R. Sc.—13 :

A student who has passed the Third B.Sc. Examination with the General Degree course will be eligible to enter upon the Special Degree Course for any of these three subjects if he offers the remaining papers (VI to X) and corresponding practicals (if any) including papers and practicals prescribed for that subject for the B.Sc. General Degree Course.

R. Sc. 14 :

The following are the subjects of study prescribed for two terms at the Third B.Sc. Examination for the General Degree Course and the Special Degree Course, provided that a student will offer only one course at a time:

General Degree Course

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. English—One Paper</td>
<td>70</td>
<td>30</td>
<td></td>
<td>Three hours</td>
</tr>
</tbody>
</table>

2. Three Science subjects, subject to restrictions stated in O. Sc.—5 from the following, viz, (1) Physics, (2) Chemistry, (3) Botany, (4) Zoology, (5) Geography, (6) Geology, (7) Microbiology, (8) Mathematics and (9) Statistics and (10) Biochemistry in the following manner:

Four papers including practicals covering 600 marks in all as under:

One paper and one practicals (if any) covering 100 marks for Theory (70 marks for External evaluation and 30 marks for Internal evaluation) and 50 marks for practicals (if any) (35 marks for the University examination and 15 marks for internal evaluation), in that subject, which the student had offered as a Second Subject in Second B.Sc. Examination and three papers including practicals (if any) covering 50 marks in the Third Science subject in the manner as that prescribed for a Special subject in the Second B.Sc. Examination. A student will not be required to do any more papers in the subject in which he has done three papers including practicals if any) covering 450 marks at the Second B.Sc. Examination.
### A Subject as a Second Subject

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Subject</th>
<th>Theory Paper III of Second B.Sc.</th>
<th>Practicals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>External</td>
<td>Internal</td>
</tr>
<tr>
<td>1.</td>
<td>Physics</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>2.</td>
<td>Chemistry</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>3.</td>
<td>Botany</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>4.</td>
<td>Zoology</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>5.</td>
<td>Geography</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>6.</td>
<td>Geology</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>7.</td>
<td>Microbiology</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>8.</td>
<td>Mathematics</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>9.</td>
<td>Statistics</td>
<td>70</td>
<td>30</td>
</tr>
<tr>
<td>10.</td>
<td>Biochemistry</td>
<td>70</td>
<td>30</td>
</tr>
</tbody>
</table>

### The Special Degree Course

#### Marks

<table>
<thead>
<tr>
<th>No.</th>
<th>Subject</th>
<th>Paper</th>
<th>External Evaluation</th>
<th>Internal Evaluation</th>
<th>Duration of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>English</td>
<td>One</td>
<td>70</td>
<td>30</td>
<td>Three hours</td>
</tr>
<tr>
<td>2</td>
<td>The Special subject(s) elected in S.Y.B.Sc. in papers comprising 500 marks</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Physics—VI to X</td>
<td>Five (each of 70 marks)</td>
<td>70 each 150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180 for 4 70</td>
<td>Three &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>practicals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Chemistry—VI to X</td>
<td>Five each (of 70 marks)</td>
<td>70 each 150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>180 for 6 70</td>
<td>Three &quot;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>experiments</td>
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<td></td>
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<td>---</td>
</tr>
<tr>
<td>3.</td>
<td>Botany—VI to X</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 4 practicals</td>
<td>70</td>
<td>Five hours each</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Zoology—VI to X</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 4 practicals</td>
<td>70</td>
<td>At least five hours</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Geography—VI to X</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 4 practicals</td>
<td>70</td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Geology—VI to X</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 4 practicals</td>
<td>70</td>
<td>Four hours each</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Microbiology—VI to X</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 3 practicals</td>
<td>70</td>
<td>Six hours each</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Mathematics—VI to X</td>
<td>100 each</td>
<td>250</td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Statistics—IV to VIII</td>
<td>70 each</td>
<td>90</td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Theory Papers IV, V and VI</td>
<td>100 each</td>
<td>100</td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Theory Papers VII &amp; VIII (Mathematics)</td>
<td></td>
<td></td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Practicals—I &amp; II &amp; III</td>
<td>30 each</td>
<td>60</td>
<td>Three hours each</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Biochemistry</td>
<td>70 each</td>
<td>150</td>
<td>Two hours each</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 for 3 practicals</td>
<td>70</td>
<td>Six hours each</td>
<td></td>
</tr>
</tbody>
</table>

For Internal evaluation test see common Regulation.
The following is the syllabus in the subject of Third B.Sc. Examination:

(1) Compulsory English (Third B.A./B.Sc.)
( New Course Inforce from June 1980)

(a) Objectives:

The course in Compulsory English at Third B.A./B.Sc. shall aim at developing further the students' ability to read and write English language in such a way as to achieve the general objectives laid down at the beginning of First Year B.A./B.Sc. syllabus

(b) Contents:

The contents of the course alongwith the distribution of marks shall be as follows:

1. Text-book study (including a question on text-based composition of 10 marks) 25 Marks
2. Vocabulary 6 Marks
3. Grammar 9 Marks
4. Comprehension (unseen) 20 Marks
5. Composition 10 Marks

(c) Description:

1. Text-book study: The prescribed text-book shall be an anthology of modern English prose or a twentieth century novel. It shall be for detailed study though no question on explanation with reference to the context shall be asked.

2. Vocabulary: A vocabulary of 1000 words selected from the CIEFL list of lexical items shall be prescribed. The selection shall be as far as possible based on the words actually used in the prescribed text. These words shall be for productive use only (Vocabulary as per Appendix).

3. Grammar: This shall include the following items:
   (a) Reported speech
   (b) Adjectives & adverbs
   (c) Common errors (errors in tenses, concord, Prepositions) etc.

4. Comprehension: A non-textual piece of prose of about 400 words incorporating, as far as possible, words and structures used in the text-book shall be set for comprehension.

5. Composition: The students shall be required to write a short essay of approximately 300 words on a given topic.
Vocabulary prescribed for T.Y.B.A. in Compulsory English

1. All the words mentioned in the list are to be learnt for productive use.

2. The bracket alongside some of the words indicate specific grammatical class for which only the respective words are to be learnt.

3. Words mentioned in the list are to be learnt for their more common use.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>abolish</td>
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<td>abound</td>
<td>back yard</td>
</tr>
<tr>
<td>absentmindedness</td>
<td>beam</td>
</tr>
<tr>
<td>accommodate</td>
<td>beat</td>
</tr>
<tr>
<td>accomodation</td>
<td>bee</td>
</tr>
<tr>
<td>accompany</td>
<td>behalf</td>
</tr>
<tr>
<td>according (to)</td>
<td>being</td>
</tr>
<tr>
<td>accurate</td>
<td>beware</td>
</tr>
<tr>
<td>accuse</td>
<td>bid (n.,v.)</td>
</tr>
<tr>
<td>accused (adj)</td>
<td>biography</td>
</tr>
<tr>
<td>acknowledge</td>
<td>biscuit</td>
</tr>
<tr>
<td>acquaint</td>
<td>blanket</td>
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<td>acquaintance</td>
<td>blast</td>
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<td>acquire</td>
<td>bloom</td>
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<tr>
<td>acute</td>
<td>blunt</td>
</tr>
<tr>
<td>adupt</td>
<td>boast (v.)</td>
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<tr>
<td>adjust</td>
<td>bonus</td>
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<tr>
<td>adjustment</td>
<td>book (v.)</td>
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<tr>
<td>administration</td>
<td>bottle</td>
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<td>admire</td>
<td>bow (n.,v.)</td>
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<td>adopt</td>
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<td>advance</td>
<td>brand</td>
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<td>adventure</td>
<td>brass</td>
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<tr>
<td>against</td>
<td>breathe</td>
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<tr>
<td>aggression</td>
<td>bread (v,)</td>
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<tr>
<td>ahead</td>
<td>breeze</td>
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<tr>
<td>alarm (n.)</td>
<td>brick</td>
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<tr>
<td>alike</td>
<td>brilliant</td>
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<tr>
<td>along</td>
<td>broadcast (n.,v,)</td>
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<tr>
<td>aloud</td>
<td>broaden</td>
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<td>already</td>
<td>bronze</td>
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<td>alternative</td>
<td>carbon</td>
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<tr>
<td>altogether</td>
<td>carbondioxide</td>
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<tr>
<td>amuse</td>
<td>cabbage</td>
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<tr>
<td>amusement</td>
<td>cake</td>
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<td>ancestor</td>
<td>calculate</td>
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<td>avoid</td>
<td>calf</td>
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<td>carnal</td>
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carboard
cargo
carriage
cassette
cast
cattle
caution
cafe
cease
ceiling
celebrate
centimetre
centigrade
chain
chalk
channel
chaos
characteristic
charity
chatter (n.v.)
cheek
chest
chicken
childhood
chimney
chin
chocolate
church
cigarette
circuit
circular
circulation
circumference
circus
circumstance
civilization
civilize
clap (v.)
clarify
classic
classmate
clay
clean
clumsy
coarse
coconut
colleague
colony
column
comfort
command
commerce
commission
commitment
commodity
community
compel
competition
compose
comprehension
compress
compulsion
computer
concentration
concept
concern (n.v.)
conclusion
condemn
condense
confidence
confirm
conflict
conscience
conscious
consent (n.v.)
consider
consist
constant
constitution
construction
construct
construction
contended (adj.)
contest (n.v.)
context
contradict
contrary
contrast (n.v.)
convenience
conceive
copper
corporation
correspond
correspondence
corrupt
consequence
contribution
cotton
conversion
council
counsel (v.)
courteous
counter
crack
cradle
crane
crash
create
creation
creature
crippling
crip
crib
cries
crockery
crooked
crush
cuckoo
cultivate
culture
cunning
curiosity
curious
curl
currency
curse
cushion
customer
cyclone
cylinder
D
decoit
damp
dawn
day-to-day
deal
deceive
decimal
declare
decorate
defect
deliberate
delicate
delicious
deliver
depression
descent
descent
deserve
despair
desire
destiny
destructive
detect
detector
determination
determine
diamond
dictate
differ
dimension
dine
dip
directory
disaster
discount
discuss
discrimination
disguise
disguise
dissipate
dispensible
disperse
dispute
distinguished
distribute
distribution
divine
document
domestic
dove
draft
drag
industrial
infectious
information
inhabit
inherent
injection
injury
innocent
inquire
insist
inspiration
inspire
instance
instinct
instrument
intellect
intend
intense
interfere
international
intimate
introduce
invest
investigate
involve
iodine
irrigate
irritate
island
isolate
issue

J
jar
jaw
jerk
jewel
journalist
junior
justify

K
key
killer
kneel

L
landlord
lane
latter
laugh (n.v.)
lavatory
lawn
leaf
league
lean
leap
least
leather
legal
legislature
liver
lizard
loaf
loyal
lunch (v.)
lung
lustre

M
mail
maintain
majesty
manhood
manage
mania
manufacture
manure
marvellous
mask
mature
meet
medieval
memorable
menu
mercy
messenger
methodical
micro
midst
might
mighty
migrate
millimetre
million
mineral
minor
mission
mobile
mode
moderate
modest
modify
moreover
mortal
mosque
mosquito
motion
motive
mourn
moustache
multiply

N
namely
native
naughty
neat
needle
neglect
nerve
net (n., adj.)
nightingale
nourish
nut
nutrition

O
obey
obedience
objective
oblige
observe
occupy
occupation
operate
opportunity
organise
organisation
original
ornament
orphan
orthodox
ounce
outcome
output
owe
owl
oxygen

P
pale
paradise
parallel
pardon
park (n.v.)
parrot
particle
particular
partition
path
pattern
pavement
peak
pepper
perfection
perform
performance
perfume
permanent
pursue
pet
physical
pickle
pilgrim
pioneer
piston
pit
stable (adj.)
starve
steamer
stenographer
stir (n.v.)
stomach
strainer
stranger
straw
stress (n.)
strip (n.)
structure
submit
subordinate
subsidy
sufficient
suitable
superb
supper
suppression
superintendent
superior
surface
surround
survey (n.v.)
suspend
suspidion
suspen
c.swallow
swan
swear
sweep
symmetry
synthesis
T
 tame
talkative
tank
tap (n.)
task
taste
technician
telescope
temperature
temple
temporary
tent
terror
textile
thigh
thorough
throne
thumb
thunder
tide
tight
title
tobacco
toe
toffee
tolerance
tomb
ton
tortoise
torture
toss
trace (n.)
track
tradition
traffic
translate
translation
transport (n.v.)
trap
traveller
tray
treasure
tribe
troop
trunk
trustworthy
tuberculosis
tumour
tunnel
twin
typhoid
U
Unanimous
unique
universal
universe
uplift
upset
upward
urban
V
vaccine
vacuum
vague
vain
vegetarian
verandah
verify
violent
virgin
visual
vital
volcano
W
wax (n.)
wealthy
weapon
weave
wedding
welfare
well-to-do
while
whisper
willingness
wine
wolf
worship
wrap
Y
yarn
yawn
younger
Z
zebra
zenith
2. PHYSICS

(In force from June-1980)

Physics (Special)

*Paper VI* Classical and Quantum mechanics

*Paper VII* Nuclear Physics

*Paper VIII* Solid State Physics and Statistical Mechanics

*Paper IX* Electricity and Magnetism

*Paper X* Electronics

Practicals

*Paper VI* Classical and Quantum Mechanics


**Variational Principle : Lagrange's and Hamilton's equations :**


Chapt. (8) and Chapt. (11)

The Schrodinger Equation and Stationary States:

(2.1) A free particle in one dimension, (2.2) Generalization to three dimension, (2.3) The operator correspondence and the schrodinger equation for a particle subject to forces, (2.4) Normalization and probability interpretation, (2.5) Nonnormalizable wave functions and box normalization, (2.6) Conservation of probability, (2.7) Expectation values; Ehrenfest's theorem, (2.8) Admissibility conditions on the wave function, (2.9) Stationary states: The time independent Schrodinger equation, (2.10) A particle in a square well potential, (2.11) Bound states in a square well; (E 20) (2.12) The square well: Non localized states (E 70), (2.13) The square potential Barrier.

General Formalism of Wave mechanics:

(3.1) The Schrodinger Equation and the probability interpretation for an N-particle system (3.2) The fundamental postulates of wave mechanics, (3.3) The adjoint of an operator and self adjointness (3.4) The eigenvalue problem; degeneracy (3.5) Eigenvalues and eigen functions of self-Adjoint operators (3.6) The Dirac Delta function (3.7) observables: Completeness and normalization of eigen functions (3.8) Closure (3.9) Physical interpretation of eigen value, eigen functions and expansion coefficients, (3.10) Momentum eigen functions in momentum space, (3.11) The uncertainty principle (3.12) States with minimum value for uncertainty product (3.13) Commuting observables observables; Removal of degeneracy (3.14). Evolution of system with time; constants of motion (4.1) One dimensional Harmonic oscillator.


Ref: A text-book of Quantum Particle Dynamics by P. G. Puranic, S. Chand, New Delhi. Chapters 3, 4, 5, 6 (Art. 1 only) 2-8.

Paper VII: Nuclear Physics

Rutherford's theory of the scattering of particles, The experimental test of the Rutherford's theory, some characteristics of the atomic nucleus.

Ref. Art. 3.2, 3.3 and 3.4 of Kaplan.

The Constitution of the Nucleus:

(8.1) Proton-electron hypothesis, (8.2) The angular momentum of the nucleus failure of the proton-electron hypothesis, (8.3) Nuclear transmutation and the discovery
of the neutron (8.4) The proton–neutron hypothesis (8.5) Magnetic and electric properties of the nucleus (8.6) Additional properties of atomic nuclei.


Radioactivity: (10.1) Bases of the theory of radioactive disintegration, (10.2) Disintegration constant, half life, mean life, (10.3) Successive radioactive transformations, (10.4) Radioactive equilibrium.

Alpha-Decay: (13.1) The velocity and energy of particles, (13.2) The absorption of α particles: range, ionization and stopping power, (13.3) Range-energy curves (13.4) α particle spectra. Long range particles and fine structure, (13.5) Nuclear energy levels (13.6).

The theory α of decay


Gamma Rays and Gamma Decay:

(15.1) The absorption of γ rays by matter: experimental data (15.2), The interaction of γ rays with matter, (15.3) Photo electric absorption, (15.4) Compton scattering, (15.5) Electron–Positron pair formation, (15.6) The absorption of Gamma-rays by matter. Comparison of experimental and theoretical results, (15.7) The measurement of Gamma rays energies (15.8) Gamma decay, internal conversion, (15.9) Gamma decay and nuclear energy levels: Theory, (15.10) Gamma-decay and nuclear energy levels: Experimental results and nuclear isomerism.

Nuclear Forces and Nuclear Structure:

(17.1) Nuclear binding energies and saturation of nuclear forces, (17.2) Nuclear stability and the forces between nucleons, (17.3) Energy levels of light nuclei
and the hypothenus of the charge independence of nuclear forces, (17.4) The nuclear radius, (17.5) The interaction between two nucleons, (17.6) The status of the problem of nuclear forces, (17.7) Nuclear models, (17.8) The liquid drop model and the semiempirical binding energy formula (17.9).

**Cosmic rays:**

- Discovery of Cosmic rays.
- Instruments used for the study of Cosmic rays
  (Names be mentioned only).
- Important phenomena observed in the study of Cosmic rays—Latitude effect, East-West asymmetry, Altitude effect.
- Hard and soft components.
- Primary cosmic rays. Meson—its discovery mass and decay (Elementary Particles and their classification: Text: 1. Nuclear Physics by Kaplan.
  2. Basic Nuclear Physics—P.N. C. Divastava.

**Paper VIII: Solid State Physics and Statistical Mechanics**

**Solid State Physics: X-ray diffraction:**

- Lame derivation of amplitude of scattered waves. Diffraction conditions, Reciprocal lattice, Fourier analysis of periodic distribution, Ewald construction, Brillouin zones, structure factor of the basis, atomic scattering factor or form factor, temperature dependence of the reflection lines.

**Crystal Binding:** Crystals of inert gases van der Waals London interaction, Repulsive interaction, Equilibrium lattice constants, cohesive energy, compressibility and bulk modulus. Ionic crystals: Electrostatic or Madelung energy, Evaluation of the Madelung constant, Bulk modulus. Covalent crystals: Metal crystals: Hydrogen bonded crystals, Atomic radii, Tetrahedral covalent radii, ionic crystal radii.

**Elastic constants and Elastic waves:**

- Analysis of elastic strains, dilation, stress components Elastic compliance and stiffness constants, elastic energy density, elastic stiffness constants of cubic crystals, bulk modulus and compressibility. Elastic waves in cubic crystals, waves in the (100)
Wave propagation in (110) direction. Experimental determination of elastic constants.

Lattice heat capacity, Einstein model, Debye model of the Lattice heat capacity. Dabre's T^3 Law.


**Statistical Mechanics**

Chapter I:

1.1 Introduction: Basic Concepts.
1.2 Scope of Statistical mechanics.
1.3 Classical and Quantum assemblies.
1.4 Meaning of an 'Ensemble'
1.5-A Probability: Definition & Elementary Laws.
1.5-B Elementary Laws of Probability.
1.6-A Concept of Generalised Co-ordinate.
1.6-B Phase Space.
1.7 Elements of Phase Space.
1.8 One dimensional Harmonic Oscillator.
1.9 Macrostates and microstates.
1.10 Aprion Probability.
1.11 Thermodynamic Probability.
1.12 Illustration of Thermodynamic Probability.

Chapter II:

2.1 Classical Statistics of Maxwell-Boltzmann.
2.2 Domain of Classical Statistics.
2.3 Classical distribution function of Maxwell-Boltzmann.
2.4 The most Probable distribution.)
2.5 Evaluation of the Constant B.
2.6 Evaluation of the Constant exp. $a = A$
2.7 Distribution of NE.

Chapter III:
3.1 Maxwell's distribution law of Velocities for an ideal gas.
3.2 Values of $V_p, V, V_{rms}$.
3.3 Partition Function.
3.4 Entropy and Probability.
3.5 Evaluation of the Constant from Thermodynamic considerations.
3.6 Velocity distribution for the molecules of a perfect gas in terms of the three velocity Components.
3.7 Calculation of Pressure in a perfect gas.
3.8 Principle of equipartition of Energy.
3.9 Partition sanctions and some important relations.
3.10 Other applications of classical Statistics.

Chapter IV:
4.1 Failures and Limitations of Maxwell-Boltzmann Statistics.
4.2 Two types of Quantum Statistics.
4.3 The B.E. Statistics.
4.4 Quantum Statistics of gas (Bose-Einstein gas)
4.5 The Einstein Condensation.
4.6 Planck's radiation Formula from B-E distribution.

Chapter V:
5.1 Introduction to Fermi-Dirac Statistics.
5.2 Fermi-Dirac distribution Formula.
5.3 Calculation of Constants.
5.4 Comparison of the three Statistics.
5.5 The Fermi Function.
5.6 Calculation of Fermi-Energy at absolute Zero.
5.7 Mean energy of an electron
5.8 Effect of rise in Temperature on F (E) and N (E)
5.9 Small effect of the electron gas on heat capacity of metals.
5.10 Thermionic Emission (Dushman-Richardson equation).

Text-book: Elementary statistical Mechanics, University Leadership Project, Physics Department, Nagpur University.
Paper IX : Electricity and Magnetism

(MKS system of units should be followed)

(7.2) A conducting rod moves through a uniform magnetic field, (7.3) A loop moves through a non-uniform magnetic field. (7.4) A stationary loop with the field source moving (7.5) A Universal law of induction (7.6) Mutual inductance (7.7) A Reciprocity theorem (7.8) Self inductance (7.10) Energy stored in the magnetic field (7.11) Something is missing (7.12) The displacement current (7.13) Maxwell's equations.

(9.1) Dielectrics (9.2) The moments of a charge distribution (9.3) The potential and field of a dipole, (9.4) The torque and the force on a dipole in an electric field (9.5) Atomic and molecular Dipoles; induced dipole moments (9.6) The polarizability Tensor (9.7) Permanent Dipole moments (9.8) The Electric field caused by Polarized Matter (9.9) The capacitor filled with Dielectric, (9.10) The field of a polarized sphere, (9.11) A dielectric sphere in a uniform field (9.12) The field of a charge in a dielectric medium and Gauss's law (9.13) The connection between electric susceptibility and atomic polarizability (9.14) Energy changes in polarization (9.15) Dielectrics made of polar molecules (9.16) Polarization in changing fields (9.17) The Bound charge current Magnetic fields in Matter ... ... ... ... ... ... ...

(10.1) How various substances respond to a magnetic field (10.2) The absence of Magnetic "charge" (10.3) The field of a current loop, (10.4) The force on a dipole in an external field (10.5) Electric currents in atoms (10.6) Electron spin and magnetic moment (10.7) Magnetic susceptibility, (10.8) The magnetic field caused by magnetized matter, (10.9) The field of a permanent magnet (10.10) Free currents and the field H, (10.11) Ferro-magnetism.

Instrumentation:
The scope is as follows:

(1) Michelson Interferometer

principles of optics by B. K. Mathur, Gopal printing press, Kanpur.
Chapter 10 Art 10.6 Michelson interferometer
10.6A Adjustment
10.6B Form of fringes
10.6C White light fringes
10.6D Applications: (a) measurement of wavelength (b) Ratio and difference between the wavelengths of sodium D lines (c) Determination of refractive index.
(2) Fabry-perot Interferometer and Etalon

Principles of Optics by B. K. Mathur
Chapter 17 Art 17.4A Fabry-Perot Int. and Etalon
17.4B Theory
17.4C Shape of fringes
17.4D Effect of phase change of reflection from silver films
17.4E Adjustment
17.4F Determination of Wavelength with variable gap Int.
17.4G Determination of Difference of two close wavelengths.
17.4J Mountings for Fabry Perot Etalon

(3) Babinet's Compensator

Principles of Optics by B. K. Mathur
Chapter 20; Art 30.25 Complete.

(4) G. M. Counter

Atomic Physics by J. B. Rajam, S. Chand and Company.

(5) Scintillation counter

Atomic physics by J. B. Rajam, S. Chand & Co.
Page 900 Components of the scintillation counter; some important uses of the scintillation counter.

(6) Vacuum Tube Voltmeter

Electronic Instrumentation and Measurement techniques by William David Cooper
Prentice Hall of India Pvt. Ltd., New-Delhi 1976
Chapter 10; Art 10.4 Balanced bridge Voltmeter (V.T.V.M.)

(7) Cathode-Ray Oscilloscope

Chapter 7; Art 7.17 Cathode Ray Oscilloscope
7.18 Waveform tracing in Electrostatic C.R.O.
7.19 Uses
(8) Electron microscope

Atomic Physics by J. B. Rajam
S. Chand and Company,

Page 213 Electron microscope, principle, Electrostatic focussing, Magnetic focussing, Description, Uses.

Text: Electricity & Magnetism Berkeley Physics Course Vol. 2 by E. M. Purcell.

Paper: X Electronics

Circuit Analysis:

(B-II 1.6) Passive and Active elements of an electronic Circuit T and TT Net Networks.

(B-I 3.3, & 3.4) Series and Parallel Resonance.

(B-I 3.5) Band width and Selectivity Q of a Circuit.

Rectifiers:

(G. 9.7 & 9.8) Expression for ripple factor in case of full-wave rectifier with

(i) Single L-Section filter and

(ii) multiple L-Section filter-Section filter.

Amplifiers:

(G. 11.8) Classification of Amplifiers.

(G. 11.18) Distortion in amplifiers: (S. 3.3) Decible.

(G. 12.8) R–C Coupled Amplifier using pentode

(G. 12.9) Gain-Baud width product of R. C. coupled amplifier.

(G. 12.10) Effect of Gain coding on the Band width.

(G. 14.2) Theory of Feed Back.

(G. 14.3) Significance of Feed-Back equation.

Oscillators:

(G. 18.2) Principle of Oscillators (G. 18.3) Requirements of an Oscillator

(G. 18-4) Condition for self excitation.

(Barkhansen Criteria for Oscillations)

(G. 18.9) Juced Plate Oscillator with Analysis.

(G. 18.13) Hartley oscillator with analysis.

(G. 18.14) Colpitts Oscillator with Analysis.

(G. 18.17) R. C. Phase shift Oscillator.
Transistor Electronics:


(R. 3.1, 3.2, 3.3, 3.4, 3.5)

Active Networks:


(R. 4.1, 4.2, 4.3, 4.4, 4.5, 4.6, 4.7, 4.8)

Bias for Transistor amplifiers (R. 6.1, 6.2, 6.3, 6.4)

(G. 27.7) R-C Coupled Common emitter multiplier.

(G. 28.3) Tuned Collector Oscillator.

Modulation and Detection:


Amplitude demodulation (Detection)

(G. 21.1)—Introduction

(G. 21.2)—Square Law Diode detection.

(G. 21.3)—Anode Band detection.

Books:


(3) Electronic & Radio Engineering by M. L. Gupta (5th edition)


(7) Electricity and Electronics by Bhandari and others. Pub: Ramesh Book Depot, Jaipur.
PRACTICALS

Physics (Special) Degree Course
(Inforce from June 1980)

Unit 1. Gen. Physics & Heat 1-9
Unit 2. Optics 1-9
Unit 3. Magnetism & Electricity 1-12
Unit 4. Electronics & Nuclear Physics 1-15

Unit 1:

(1) Kater’s Pendulum
(2) “Y” by Koenig method.
(3) Viscosity by Decrement
(4) S. T. by Rayleigh’s method of Ripples.
(5) Platinum Resistance Thermometer.
(6) Thermal Conductivity of Rubber.
(7) Determination of Stefan’s Constant
(8) To Study the losses of temperature of the body when allowed to Cool.
(9) Thermocouple.

Unit 2:

(1) Adjustment of spectrometer with Gauss–Egepiece and determination of Wave-length using Cawchoy’s formula.
(2) Resolving power of a Telescope.
(3) Refractive index by total internal reflection using guass Eye-piece.
(4) Fabrg-Purrot Etalon (determination of thickness of air film and wavelength of light) using spectrometer.
(5) Cardinal points by Searie’s Coniometer.
(6) Use of Edser-Butler plate.
(7) Babinet’s Compensator
(8) Rydeberg Constant.
(9) Michelson inter-ferometer.

   (a) determination of wave length.
   (b) determination of thickness.
Unit 3:

2. Hysteresis—anchor ring method using CRO
3. Constants of a Ballistic galvanometer.
4. Comparison of capacities—mixture method
5. Determination of capacity by Schersing's bridge.
7. Mutual inductance by ballistic Galvanometer.
8. Measurement of frequency and phase by CRO
11. Determination of ionic mobility of negative Cr₄O₇ radicte ion from K₂Cr₂O₇ solution.
12. To study the decay of potential difference across the Cadenser when allowed to discharge through resistance.

Unit 4:

1. Triode as oscillator (Hartley)
3. Parellal resonance & Q-Calculation.
4. Study of a Common emitter amplifier with variation of gain (Load) at a fixed frequency.
5. Study of a Common emitter amplifier with variation of frequency at a fixed load.
6. Study of a low voltage electronic power supply.
7. Construction and Study of field effect transistor (EFT) Voltmeter.
8. To determine the activation enegres of a Semi Conduotor.
9. To Study the Characteristics of an unregulated power supply.
10. Negative feed-back amplifier.
11. "e/m" Thomson's method
12. "e" by Millikan's oil drop experiment.
15. Comparison of relative intensities of different Sources using G.M. Tube.
Ref : 1. Advance Practical Physics—by Worthrop & Print.
3. Practical Physics by Prof. P. D. Pathak and N. M. Pandya, University Book Publication Board
4. Experiments in Nuclear Physics, University Leadership Project, Physics Deptt. Nagpur University, Nagpur.

(3) CHEMISTRY

Paper VI

SECTION-I

42-Marks
3-Questions

1. Symmetry :

Symmetry elements and symmetry operations.

Symmetry point groups C₁, Cᵥ, C₂, C₃, C₄, C₅, C₆, C₇, C₈, C₉, D₁, Dᵥ, D₂, D₃, D₄, D₅, O₃, Cᵥ, Dᵥ (Group theory and basic properties Multiplication table for Cᵥ, C₂ᵥ and C₃ᵥ.

Ref: (1) Physical chemistry by Daniels and Albery IV ed. pages. 434 to 454.
(2) Chemical applications of Group Theory by F. Cotton (14–61)
(4) Introduction Quantum Chemistry by A. K. Chandra (201–218)

2. Electronic Spectra : d¹ and d⁹. Electronic configuration of atom and Term symbol.

Ref: (1) Concise Inorganic Chemistry by J. D. Lee Pages. 463–480.
(2) Physical methods in Inorganic Chemistry by Drago.
Pages 21 28; 161–164.

3. 1. R. Applications to Inorganic systems and structure determination of metacarbonyls

4. Mössbauer Spectroscopy:

Introduction Experimental Techniques, Theory and Applications.

Ref: (1) Basic Principles of Spectroscopy by R. Change pages 90—103.
(3) Inorganic Chemistry by J. E. Huhuy, Pages 171—173.

SECTION II

28 marks
2 Questions

1. UV Spectra: Solvents for UV espectral study, UV spectra of polymers and polyenes, UV spectra of polynuclear hydrocarbons and of Cis trans isomers.

2. IR Spectra: Techniques of IR spectra. Group frequencies; spectra structural corelation with respect C—H stretching and C=O stretching frequencies. IR Spectra and H—Bunding IR spectra of tautomers and Cis—Trans isomers.

3. PMR Spectra: Equivalent and Non-equivalent protons; chemical shifts factors affecting chemical shifts; Relative intenstiy of signale. Spin-spin couplin and coupling constant. pmr of Cis trans isomers.

4. Problems based upon application of spectroscopy and combined spectroscopy.


Paper VII INORGANIC CHEMISTRY

4 Questions from topics 1 to 6
1 Question from topic 7


Reference Books

1. Theoretical Inorganic Chemistry by Day & Selbin, 2nd Edition
   Pages: 34 to 54 & 168-170.

   pages 72-99.
(Indian Institute of Science, Bangalore)

page 26–40. (Department of Chemistry, Vallabhbhidyanagar)

2. Valence Bond theory and molecular orbital theory, L. C. A. O. : method,  
explanation of H₂ and H₃ according to V. B. and M.O. theory, Comparison of V. B.  
and M.O. treatment for H₃ and H₂ M.O. treatment for simple homo/hetero nuclear  
diatomic system like N₁, O₂, F₂, C₀, N₀.

M. O. treatment for complexes, metallic bonding from M. O. point of view.

Reference Books

(i) Concise inorganic chemistry by J. D. Lee (Pages 61–85).
(ii) Inorganic Chemistry by Dey & Selbin (pages 134–157; 249–294.)
(iii) Advanced Inorganic Chemistry by Cotton & Wilkinson. pages 82–93 and  
702–706.
(iv) Atomic Structure and Chemical Bond by Manas, Chandra, Indian Inst. of  
(v) Valency and Molecular structure by E. Cartmell and C. W. A. Fowler.

3. Reactions of Co-ordination compounds:

The trans effect, mechanism of trans effect, Lability, stability and instability,  
Ligand field effect, Substitution in Octahedral complexes, mechanism of redox reactions.

Reference Books

As per (1) James E. Huhuay–Pages 423–440. Basolo and Pearsonal

4. Metal Carbonyls–mononuclear and polynuclear carbonyls, Carbonyls anions,  
carbonyl hydrides, metal nitrosyls, carbonyl nitrosyls (structural approach).

Reference Books

1. Inorganic Chemistry by James E. Hunoay pages 453–464
702–706; 713–715.
3. Introduction to Advanced Inorganic Chemistry by P. J. Durrant and B. Durrant
5. Hydrides of B, Si, S and F (Structural approach).

Reference Books

2. Emelius and Anderson.

Non aqueous solvents : SO₂, NH₃ and HF.

Industrial

7. (i) Chemicals from sea (Gopal Rao pages 195–205.)
(ii) Ceramic Industry (Gopal Rao page No. 138–143).
(iii) Fuels–liquid–power alcohol, synthetic petrol, Gaseous–Gobar gas and  
Bio–gas.
References
1. Industrial Chemistry by Dryden Ravised by Gopal Rao pages 308 to 313.
2. Industrial Chemistry by Shreeve (Pages 81 to 93)
3. Industrial Chemistry by Rogers
4. IndustrMial Chemistry by Reigel.

Paper VIII Organic Chemistry

4 Questions from 1 to 8
1 question from 9

1. Stereochemistry:

2. Nucleophilic Substitutions at Saturated Carbon Atoms:
   Mechanism and scope of reaction available mechanism Kinetic characteristics scope of reaction, Stereochemistry of SN1 and SN2 reactions, Relative reactivity in substitution-solvent-effect-variation at carbon site Relative leaving group activity. SN1 mechanism, Neighbouring group participation and cyclization. Competitwe reactions. Elimination reactions E-1, E-2 and E1,2 mechanisms. Carbonium ion rearrangement.
   Ref: Cram-Hendrikson Hammond: 10.1-10.5.

3. Nucleophilic Aromatic Substitution:
   Structure, physical properties, Nucleophilic aromatic substitution bimolecular displacement, its mechanism, reactivity, orientation electron withdrawal by resonance, evidence of two step mechanism, Elimination-addition mechanism,
   Ref: M. B. III Ed. 817-841.

4. Electrophilic and nucleophilic Addition Reactions:
   Addition to carbon carbon double bond: The functional group, reactions, Geat of hydrogenation and stability, of alkenes, Addition of halogens, NMarkownikov's rule, Peroxide effect, Addition of sulfuric acid, hydration, Electrophilic addition: orientation and reactivity, rearrangement, mechanism of addition of halogens, halohydrin formation, dimerisation, alkylation, Free radical addition-Mechanism of peroxide initiated addition of HBr, other free radical additions, polymerisation, Clycol formation, allylic halogenation, orientation and reactivity in substitution, Resonance theory, resonance structure of a llyl radical, its stability, orbital picture, Hyperconjugation,
   Ref: N. B. III Ed. Pages 177-221.

   Stereoselective and stereospecific reactions syn-and anti-addition (7.11), Mechanism of addition of haloen (7.12), Electrophilic addition to conjugated dienes, 1,4 addition
Isoprenoids:

Methylene Compounds:
Finar p-245 to 262. (Including ketoenol tautomerism).

Carbohydrates:
Configuration of Glucose–The Fischer proof, Configuration of aldoses, Optical milies D and L, Absolute configuration, Formation of glucosides, Configuration at C-1, Methylation, determination of ring size, Conformation.
Ref: N. B. IIIrd Ed. p. 1080 to 1106.
Disaccharides: Maltose, Cellobiose, Lactose, Sucrose. (p. 1112 to 1118).

Oxidation reduction:
Use of specific reagents. Pref. mechanism and applications of following reagents: isopropanol, Lithium Al-hydrde, Sod. Borohydride, Wolff-Kishner reduction, Albutoxide, Selenium dioxide, Osmium tetroxide, Lead tetraacetate, Periode acid.

Petroleum based industries:
A brief outline of sources of organic chemicals. Outline of some typical formulations in common usage.
(a) Synthetic Dyes: Dyes and fabrics, anionic and cationic dyes, mordant and vat dyes. Reactive and disperse dyes. Methods of preparation of alizarin, malachite green, optical brightness.
(b) Synthetic drugs: Chemotherapy, general classification: mebans of preparation of sulphathiazole, sulphadiazine, Testing of sulpha drugs, Analgesics, Tranquilizers.
(c) Detergents: General, action in cleaning, Anionative and Cation active, biodegradability. Preparation (general)
(d) Pesticides: General, methods of preparation of DDT, Gammexene, Aldrin, malathion.

PAPER IX

4 Questions from 1 to 9
1 Questions from 10

Thermodynamics:
Free energy and work function: conditions of spontaneous charge and equilibrium.
Phases in equilibrium, Clapeyron-Clausius equation, Gibbs Heimholts equation; Application of Clapeyron-Clausius equation, elevation in boiling point and depression of freezing point, Boiling point relationships. Van't Hoff isotherm, Van't Hoff equation (isochore). Thermodynamic derivation of law of mass action. Criteria for spontaneous reaction, standard free energy of reaction; determination of free energy.

Entropy and free energy. third law, determination of entropy from thermal measurements.

Partial molal volume and free energy (chemical potential).

2. E.M.F.:

Reversible cells and reversible electrodes; Reactions in reversible cells,

Reversible electrode potentials; Double layer and electrode potential *electrode
reversible w.r.t. positive ions, negative ions, metal-insoluble salt electrodes, oxidation-reduction electrodes.

Reference electrodes hydrogen, calomel, quinhydrone, glass electrodes.

Determination of e.m.f. of simple cells, Poggendorff's method. Weston cell.
Standard oxidation potentials and E.M.F. series.

Concentration cells: electrode concentration cells, solution concentration cells.

Cells with transference and without transference. Liquid Junction potential.

Free energy and e.m.f. Gibbs Helmholtz equation and e.m.f.

Applications of e.m.f. measurements

Over voltage, Tafel equation.

3. Equilibria in electrolytes:

Interionic attraction theory, D.H.O. equation (No. derivation), incomplete dissociation, significance of degree of dissociation.

Activity and activity coefficients of strong electrolytes, Debye-Huckel limiting law.

4. The Phase Rule:

Phase rule and phase diagrams.

Theoretical derivation of phase rule.

Water and sulfur systems,

Application of phase rule salt hydrates, freezing point and solubility curves.

Condesed phase rule, eutectic point.

Systems involving a salt and water, freezing mixtures.

Two components forming a solid compound congruent m.pt.

Mixtures of liquids.

* Expressions for single electrode potentials.
Ideal systems and Raoult’s law.
Nonideal mixtures of miscible liquids.
Composition of liquid and vapour
Distillation of liquid mixtures.
Partially miscible liquids.
Distillation of partially miscible liquids.
Completely immiscible liquids.
Steam distillation.

5. Chemical Kinetics

Theory of reaction rates: Effect of temperature on reaction rates, energy of activation, Collision theory Reaction coordinates Activated complex theory, prediction of reaction rates, ionic reaction of reaction rates, ionic reactions and salt effect.

Heterogeneous gas reactions: Kinetics of heterogeneous reactions, retardation of surface reactions.

6. Photochemistry:

Laws of photochemistry, Fluorescence and Phosphorescence sources of radiation, Actinometer, photoelectric cell, Einstein’s law of photochemical equipment, Quantum yield-high and low yields, Types of photochemical reactions, chemiluminescence, Flash photolysis and mas spectroscopic results.

7. The Solid State:

Study of crystals, space lattice, crystal systems, lattice planes, X-rays and crystal structure, Lattice dimensions:
Avogadro number.
Heat Capacities of Solids (elementary).

8. Molecular spectra:

Band spectra, Rotational spectra, Microwave spectra, vibration-rotation spectra, Raman spectra, Electronic spectra, Force constants and characteristic frequencies of bands, ortho-and para-hydrogen.

9. Isotopes and Nuclear Chemistry:

Positive ray analysis, isotopes: radioactive and nonradioactive isotopes; Aston’s mass spectrograph, Dempster and Bainbridge mass spectrographs, Chemical atomic weights, Separation of isotopes (radioactive, non-radioactive), Artificial nuclear reactions: Interaction of nuclei, acceleration of charged particles, charge particle reactions, neutral particle reactions, artificial or induced radioactivity
Energy changes in nuclear reactions, rates of nuclear reactions; cross section for release of nuclear energy, fission, Thermonuclear fusion reactions, Fission chain reactions.

10. Industrial Electrochemistry:

Reference Books for 1 to 9
(i) Elements of Physical Chemistry—Glasstone & Lewis
(ii) Physical Chemistry—Moore
(iii) Physical Chemistry—Barrow
(iv) Principles of Physical Chemistry—Maron & Prutton.

Reference books for 10
(i) Electrochemistry—Potter
(ii) Modern Electrochemistry—Bockris and Reddy

PAPER X ANALYTICAL CHEMISTRY

Treatment of Analytical data:
Significant Figures, Accuracy, Precision, Errors—Types, Ways of expressing accuracy and precision, Rejection of a result, Tests of significance correlation coefficient

Types of Analytical Methods (General):
Advantages and Limitations of instrumental and chemical methods, Literature of Analytical Chemistry.

Theory of precipitation:
Formation of precipitates, particle size of precipitates, impurities in an on precipitates, purification of precipitates, precipitation from homogeneous solution, precipitation titrimetry—The Mohr method, Fajans Method, Volhard Method, Construction of option titration curve, Factors influencing the sharpness of end points.

Acid–Base Titrations:
Construction of titration curves, Feasibility of titration, titration of polyprotic acid and mixtures of acids, titration of Salts, Differential titration of alkalies, Buffers-Level, range and capacity of buffers.
Separation of precipitation:
As oxides, as sulfides, separation of metals with r-hydroxyquinoline, cupferron, Dimethylglyoxime benzoin oxime, Dithizone

Redox titrations:
Calculation of potentials at various points on the titration curve, Redox indicators, potential requirements of oxidation-reduction titrations, multicomponent titrations, Iodometry, Iodimetry Metal reductors,

Complexometric EDTA Titrations:
Types, indicators, Masking and demasking, construction of the titration curve.

Potentiometry:
The scope of potentiometric titrations, precipitations and neutralization titrations, Reference half cells used in potentiometric titrations, Graphical methods including Grams Plot for selection of End point, Differential titrations, Dead stop titrations, Ion-selectrods (elementary) principle of pH meter.

Polarography:
Principle, electrodes, Types of currents, half wave potential, Ilkovic equation, Methods of determining concentration,

Colorimetry and Spectrophotometry:
Laws of Absorbance, Visual colorimetric methods, spectrophotometric instrumentation—Light sources, optical system, The wavelength selectors, Light sensitive devices, accuracy and error of spectrophotometry, analysis of mixtures,

Flame Photometry, Atomic Absorption, Spectrometry—principles.

Chromatography and Ion exchange:

Solvent extraction:
Distribution coefficient, Distribution ratio, solvent extraction of metals, the extraction process, separation efficiency.

Detection and Determination of Functional Groups:
Carboxylic & sulfuric acid groups, Amine groups, Ester groups, carbonyl, Azo, NO₂—OCH₃ and—OC₂H₅, N—acetyl, O—acetyl, —OH (alcoholic & phenolic).
Reference Books


Third B.Sc. Chemistry Practical

(The syllabus in force from June 1980)

Practicals of four periods a day for four days a week.

All types of practicals given in the syllabus are to be performed during the year.

(a) Inorganic Quantitative Analysis:

Analysis of mixtures of powders containing six radicals only by Semi-micro Method.

(b) Volumetric Analysis:

(i) Hardness of water (Ca^{2+}+Mg^{2+}) by EDTA (Artificial mixtures)

(ii) Fe^{3+}+Cr^{3+} in a mixture by EDTA.

(iii) Back titration of Ni^{2+} with Mg^{2+} using EDTA (Erio T indicator).

(iv) % age purity of H_{2}O_{2} solution by iodometric method.

(v) Chloride by Silver Nitrate (Mohr's method)

(c) Gravimetric determinations of the radicals after removal of the interfering radical:

(i) CuCl_{2}, NiCl_{2}, HCl

(ii) BaCl_{2}, FeCl_{3}, HCl

(iii) CuCl_{2}, MnCl_{2}, HCl

(iv) CuSO_{4}, FeSO_{4}(NH_{4})_{2}SO_{4}, H_{2}SO_{4}

(v) CuSO_{4}, Al_{2}(SO_{4})_{3}, H_{2}SO_{4}

(vi) Analysis of Brass

(vii) Analysis of German Silver.

(d) Chromatographic Separation:

Metallic cations to be separated by paper chromatography. (i) Ag^{+}, Pb^{2+}, Hg^{2+} (ii) Cu^{2+}, Bi^{3+}, Cd^{2+}, Hg^{2+} (iii) Fe^{3+}, Cr^{3+}, Al^{3+} (iv) Ca^{2+}, Sr^{2+}, Ba^{2+} R_{f} values to be determined.
Organic Practicals:

(a) Separation of two components from the mixture of organic compounds using macro or semi-macro method.

Identification of the components by sodium fusion test, physical and chemical tests, M.P./B.P. and derivatives.

(b) Estimation of functional groups:

Acid, Ester, Amide, Phenol, Aromatic amine.

Glucose by iodometric method.

(c) Saponification value of oils.

(d) Preparation of substances by single stage method.

(i) p-bromoacetanilide (ii) Aspirin, (iii) Acetaminilide (iv) Picric acid (v) p-nitroacetaminilide (vi) m-dinitrobenzene from nitrobenzene.

(e) Chromatographic separation: Paper chromatographic method to be used to separate.

(1) A mixture of indicators like, Fuschin, Rhodamine, Malachite green.

(2) A mixture of direct dyes like Supra direct Blue 2B Supra direct metanil yellow, Supra direct green, Direct fast red A.

(3) A mixture of amino acids like Glycine, DL-Aspartic acid, Lysine, and Tyrosine.

*Rf* values to be determined.

Physical Practicals:

(i) To determine the heat of solution.

(ii) To determine the solubility of Mg$_2$C$_2$O$_4$, SrCrO$_4$ and PbSO$_4$ by conductivity method,

(iii) To check pH meter, by known buffer solution; To determine the degree of ionisation at different concentration of HCl and NaOH solutions.

(iv) To titrate potentiometrically

(i) HCl........NaOH (ii) Fe$^{+2}$........K$_2$Cr$_2$O$_7$

(v) To titrate conductometrically

(i) Weak acid—strong base
(ii) weak acid $\frac{1}{2}$ strong acid—strong base.

(vi) To determine % age of sugar by polarimeter.
(vii) To determine surface tension of liquids and to calculate parachor.

(viii) To study bimolecular reactions.

(i) $HBrO_3 + HI$

(ii) $H_2O_3 + HI$

(iii) $H_2SO_4 + KI$.

(ix) Energy of activation by hydrolysis of methyl acetate (calculation method).

(x) To determine refractive index by Refractometer.

Practicals

(Three days—Six hours in one day)

1. (a) Physical 30 marks
   (b) Qualitative test 25 marks

2. (a) Gravimetric 30 marks
   (b) Volumetric 25 marks

3. (a) Organic separation 30 marks
   (b) Organic Estimation 25 marks
   (c) Chromatography 15 marks

Total ... 180 marks

(4) BOTANY

(In force from June, 1980)

THEORY

I. Third B.Sc. Botany Special

(A) The course consists of Five theory papers and Four Practical. The course is to be completed by assigning Three periods per each theory paper per week, 4 periods per each practical per week and and three tutorial periods per week. (The practical periods are inclusive of field study for ecology and angiosperm taxonomy)

(B) General Details of theory Papers:
   Paper VI Biology of lower plants and plant pathology.
   Paper IX Physiology, Ecology and Plant Geography.
   Paper X Anatomy, Cytology, Genetics and Evolution.
Paper VI—Biology of lower plants (Virus, Bacteria, Algae, Fungi & Lichen.

Plant pathology:

1. Virus and Bacteria:
   
   (a) Ultra structure of TMV (Tobacco Mosaic Virus);
       Bacteriophage—(Virus and Bacteria).
   
   (b) General account of Actinomycetes,

2. Algae*:

   General account, classification (Smith’s), structure, reproduction and life history of the following:
   
   (a) Chlorophyta—Ulva, Caulerpa, Hydrodictyon, Coleochaete.
   
   (b) Desmids and Diatoms—(General account).
   
   (c) Phaeophyta—Sargassum, Dictyota.
   
   (d) Rhodophyta—Polysiphonia.

   *(Change from June, 1981—Algae—Ulva, Dictyota Deleted)

3. Fungi*:

   (a) General account of slime molds and life history of Stemonitis.
   
   (b) General account, classification (Smith’s), structure, reproduction and life—history of the following:

   1. Archimycetes—Synchytrium
   2. Phycymycetes—Peronospora and Saprolegnia
   3. Ascomycetes—Penicillium and Peziza

   *(Change from June, 1981:—

   (1) Life history of stemonites peronospora and penicillium—to be deleted
   (2) General account of Fungi Imperfecti—Deuteromycetes—to be added)

4. Lichens:

   General account and classification.

5. Plant Pathology:

   General account of the following plant diseases, disease cycle and their control.
   
   (a) Citrus canker
   
   (b) Green—ear disease of Bajra (Sclerospora).
Paper VII—Bryophyta, Pteridophyta, Gymnosperms and Fossil-Botany

1. Bryophyta:
   (a) General account, classification (Smith's), Structure, reproduction, life-history and comparative account of Pellia, Anthoceros and Sphagnum.
   (b) Origin and evolution of Bryophytes.
      *(and comparative account word to be deleted—change from June 1981)*

2. Pteridophyta:
   (a) General account, classification (Smith's), structure, reproduction, life-history and comparative account of Psilotum, Lycododium, Isoetes, Ophioglossum, Osmunda, Adiantum and Azolla.
      *(and comparative account words to be detailed—change from June 1981)*

3. Gymnosperms:
   General account, classification, structure, reproduction and life history of Ginkgo, Ephedra and Gentum.

4. Fossil-Botany:
   (a) Pteridophytes—
       Geological history (rise and fall), Evolution of stele and origin of heterosporangia and seed habit.
   (b) A general account of the following fossil groups:
      (i) Psilophytales—Rhynia
      (ii) Lepidodendrales—Lepidodendron, Stigmaria, Lepidostrobus and Lepidocarpon.
      (iii) Sphenophyllales—Sphenophyllum, Sphenophylloostachys.
      (iv) Calamitales—Calamites and Calamosaccys.
      (v) Cycadofilicales—Lygenodendron (including fructification), and Lagenostoma.
      (vi) Bennettitales—Cycadoidea (including fructification)
      (vii) Caytoniales—Caytonia (including fructifications)
      (viii) Cordaitales—Cordaites, Cordianthus and cordiocarpus.

Paper VIII: Angiosperms, Economic Botany and Embryology

(a) Principles of Taxonomy based on evolutionary complexity of structure as illustrated by systems of classification of Bentham and Hooker; Engler and Prantle Bassey, Hutchinson and Takhtajan.
(b) General account of the following families including economic importance of plants wherever possible:

1. Dicotyledons: Annonaceae, Menispermaceae, Capparidaceae, Caryophyllaceae, Sterculiaceae; Zygophyllaceae; Meliaceae; Anacardiaceae; Vitaceae; Sapindaceae; Lythraceae; Combretaceae; Passifloraceae; Ficoidae, Umbelliferae, Sapotaceae, Convolvulaceae; Solanaceae; Boraginaceae, Bignoniaceae: Scrophulariaceae; Verbenaceae; Chanopodiaceae; Polygonaceae; Urticaceae; Loranthaceae.

2. Monocotyledons: Orchidaceae; Cannaceae; Commelinaceae; Palmae; Pandanaceae; Cyperaceae; Gramineae.

1. Angiosperms*

*[(a) Principles of Taxonomy and their merits and demerits of Systems of classification only of Bentham and Hooker, Engler and Prantle, and Hutchinson—to be retained, other to be deleted (i.e. line "based on evolutionary complexity of structure as illustrated by") to be deleted]

(b) The following families are to be omitted Menispermaceae, Caryophyllaceae, Zygophyllaceae, Vitaceae, Ficoidae Solanaceae, Chanopodiaceae, Loranthaceae and Gramineae.

The following family to be added.
Rhamnaceae

2. Economic Botany:

The botanical name of the plant, family, useful part or parts, important chemical constituents and uses with reference to the study of the following: Beverages (Tea and Coffee), oil (ground-nut and coconut), spices (clove, Nutmeg and Cinnamon), Fibres (Jute and Cotton), Drugs (Vasaka, Cinchona and Ruwolfa); Tobacco.

3. Angiosperm Embryology:

(a) Megasporogenesis, Gametogenesis, fertilization, endosperm types and development; general account of embryo types and development.

(b) Nutrition of embryo—(Embryo sac haustoria and endosperm haustoria).

Paper IX: Physiology, Ecology and Plant Geography

1. Physiology*

(a) Nitrogen Metabolism: Nitrogen assimilation, Nitrogen Fixation, mechanism of amination and deamination, amino acid metabolism and protein synthesis.

(b) Photosynthesis: Photosynthetic apparatus, Photosynthetic pigments, Composition of PS I & PS II, Mechanism of light and dark reactions, Calvin cycle (C3 cycle, C4 cycle,) Crassulacean acid metabolism, Factors affecting Photosynthesis.
(c) Lipid Metabolism: Fatty acid oxidation and synthesis of fats.

(d) Heterophoric Nutrition

(e) Respiration: Glycolysis, Krebs cycle and oxidative phosphorylation. Factors affecting respiration. Alternative pathway linking respiration and photosynthesis (Pentose phosphate Pathway and Glyoxalate cycle); Anaerobic respiration and fermentation.

(f) Transpiration: Mechanism of stomatal opening and closing in regulation for the rate of transpiration. Law of perimeter.

(g) Growth and Development: Concept of phasic development; role of Light and Temperature in growth and development (Photo-periodism, Phototropism and Vernalization) and

Growth regulators: Auxins, Gibberellins, Cytokininns, Ethylene, Abscissic acid.

(h) General account of dormancy in seeds and buds.

*[Change from June, 1981—
Photosynthesis: Word 'Photosynthesis apparatus' to be omitted.
Respiration: Glycolysis, krebs cycle and oxidative phosphorylation to be deleted
Respiratory—to be added
Growth and Development: Concept of phasic development of Lysenko to be added.]

2. Ecology*

(a) Abiotic factors (Light, Temperature, Soil and Water) and Biotic components (including heterotrophs) of Ecosystem.

(b) Structure of Plant Community; Plant succession (Hydrosere and Xerosers).

(c) A detailed study of typical aquatic ecosystem. Analysis of its biotic and abiotic components.

(d) Concept of productivity (Primary) Biomass; Foodweb, Ecological pyramids, fruits and seed dispersal.

*[Change from June, 1981—
Ecology: Law of Limiting factors; Liebig's Law of minimum and shelford's Law of Tolerance.—to be added.

(a)—A detailed study of typical aquatic ecosystem, analysis of its biotic and abiotic components—deleted.
3. Plant geography:

(a) Vegetation Zones of India
(b) Flora of Gujarat.
* [Change from June, 1981]

reference books

(a) For Vegetation zones of India: Ecology of Ambasit or Misra or Varshenyy
(b) Flora of Gujarat (Angiosperm only to be added)—G. L. Shah]

Paper X: Anatomy, Cytology, Genetics and Evolution.*

1. Anatomy:

(a) The dermal tissue system—including Periderm
(b) The mechanical tissue system
(c) The absorbing system
(d) The conducting tissue system
(e) Root—stem transition
(f) Secretory tissue system (Excluding Laticefors)
(g) Ontogeny of xylem and phloem
(h) Leaf fall
(i) Primary anomalous structures
(j) Anomalous secondary growth in stems and fleshy roots.

2. Cytology:

(a) General account of microscopy (including that of electron microscope in particular).
(b) Ultra—structure of chloroplasts and mitochondria (correlating their structure and functions)
(c) Role of sphaerosomes, Peroxymes, Glyoxysomes in cell Biology;

3. Genetics:

(a) Sex Determination
(b) Cytoplasmic Inheritance
(c) Gene regulation—(Genetic dodes & Operon's Concept)
(d) Polyploidy and Mutations.

4. Evolution:

(a) Origin of species (Variations, Isolations, Adaptation and Speciation)
(b) Experimental methods of studying evolution—(Hybridization and Evolution)
(c) Plant breeding techniques and their importance in evolutionary process.
* [Change from June 1981—
Anatomy: Evolution of stele in (d) to be added.
Genetics: (c) Gene regulation and (d) Polyploidy and mutation to be deleted.
Genemutation to be added]
Practical Syllabus for T.Y.B.Sc. Botany Special

Practical on Paper VI

1. Study of Types as per theory syllabus through fresh/preserved material and permanent slides.
2. Pathogens studied under types are also included as pathogens also.
3. Students are expected to submit their collection on this paper.

Practical on Paper VII

1. Study of Types as per theory syllabus through fresh/preserved material and permanent slides.
2. The following fossils specimens and/or slides should be studied:
   (i) Rhynia—stem T.S. and sporangium section
   (ii) Lepidodendron—Cast, impression, T.S.
   (iii) Stigmaria—cast, T.S.
   (iv) Lepidocarpon—V, S. slide
   (v) Sphenophyllum—stem T.S., root T.S. and impression
   (vi) Calamites—Stem cast, stem T.S.
   (vii) Lyginodendron—Stem T.S.
   (viii) Cycadoides—Stem T.S.
   (ix) Cordaites—Stem T.S. and Leaf impression.
3. Submission—Students are expected to submit their collection on this paper.

Practical on paper VIII

1. Study of families as prescribed in the theory syllabus including floral formulae and floral diagrams.
2. Embryology—Exposition and mounting of:
   (a) endosperm haustoria—Cucurbita, Guar
   (b) Developing embryo from Mustard (crucifer type)
   (c) Study of embryological topics as prescribed in theory syllabus through permanent slides.
3. Economic Botany—Study of various specimens as prescribed in theory excluding their chemical constituents.
4. Submission—Students are expected to submit 10 (ten) herbarium sheets of angiosperm plants.
5. Students are expected to go on Botanical study tour and due records be entered in journals.
Practical on Paper IX and X

(A) Physiology—to be performed by the student

1. Determine and compare the rate of transpiration under different wind conditions.
2. Perform the experiment to study the rate of photosynthesis under different wave lengths of light
3. Perform the experiment to study the rate of photosynthesis under different concentration of CO₂.
4. Determine R.Q. of the given plant material.
5. Determine the rate of the activity of Enzyme Catacase.
6. Separate the plant pigments by paper chromatography.
7. Separate a colloid from a crysralloid in a given mixture by dialysis.
8. Demonstrate the presence of P.K, Mg, Ca and Fe in the plant ash.
9. Determine the number of stomata per unit area (1 sqr. M.M.) of the given leavesurfaces (upper & lower).

Demonstration experiments on the following topics in addition to the experiments mentioned above should be shown.

1. Kundts’ tube expt. on anaerobic respiration
2. Anaerobic respiration (Test tube experiment)
3. C₃, C₄ cycle demonstration by anatomical features
4. Arc Indicator experiment
5. Auxonometer-experiment
6. Phototropism experiment
7. Hydrotropism experiment
8. Geotropism experiment
9. Klinostate experiments
10. Experiment to demonstrate experiment on law of perimeter
11. Experiment to demonstrate hydrotropism is greater than geotropism
12. Physical demonstration experiment on law of Perimeter.

R. ECOLOGY:

(a) Experiments:

(1) Determination of the requisite size of a Quadrat by species area curve method.
(2) Determination of Frequency/Density/Abundance.
(3) Determination of Carbonate, Nitrate and base deficiency in the scale of 0-5 in soil samples.
(4) Determination of Chloride content in a water sample.
(5) Determination of carbonate and bicarbonate content in a water sample.
(6) Determination of Calcium content in a water sample.
(7) Determination of total hardness of a water sample.

(B) List of the Ecological Instruments
1. Soil thermometer
2. Maximum and Minimum Thermometer
3. Dry and wet bulb thermometer
4. Sling psychrometer
5. Mambor's paper strip hygrometer
6. Anemometer

(C) Anatomy:
1. Delmal Tissue System
   (a) Types of epidermis:
   (b) Epidermal outgrowths:
       Hairs: Gossypium leaf: (star shaped)
              Abutilon leaf: (Star shaped)
              Abicoinia leaf: ('T' shaped)
              Teoctona leaf: (Branched) Withania leaf
              Ulitica leaf: (Stinging)
              Martina: (Glandular)
              Jatropa: (Glandular)
              Dresena leaf: (P. Slide).
   (c) Foliar peltate glands:
       Dionaea leaf T.S. (P. Slide)
       Pinguicula leaf T.S. (Do)
       Nepenthes leaf T.S. (Do)
       Acanthes leaf T.S. (Salt gland)
       Abicoinia leaf T.S. (Salt gland)
   (d) Stomatal types:
       Anomocytic type:
       Anisocytic type:
       Panacytic type:
       Diacytic type:
       Glaminaceous type:
2. Absorbing Tissue System:
   (a) Root hairs
   (b) Orchid root T. S.
   (c) Cuscus-ta-haustoria in section.

3. Secretory Tissue System:
   (a) Oil glands: Orange Rind
   : Lemon leaf
   : Eucalyptus leaf

4. Mechanical tissue system to be taught through the study of permanent slides.


6. Study of Leaf-fall through permanent slides.

7.* Study of anomalous primary structures in T.S. of the following:
   (a) Nyctarthus stem, (b) Puncia stem, (c) Capsicum stem.
   (d) Calotropics stem, (e) Mirabilis stem and (f) Casuarina stem.

8. Study of anomalous secondary growth in T.S. of the following:
   Stems of:
   (a) Tinospora, (b) Bignonia, (c) Salvadoria, (d) Achyranthes, (e) Boerrhavia, (f) Dracaena.

   Students are expected to prepare the double stained permanent preparations of the above materials mentioned under 7 and 8 above.

9.* Study of anomalous secondary growth in T.S. of the fleshy roots of:
   (a) Beet, (b) Radish, (c) Carrot, (d) Boerrhavia.

   *[Change from June 1981—
   Study of Anomalous primary structures of T.S. of the following to be deleted:
   (7) Punica stem, capsicum and (9)(d) Boerrhavia fleshy root.]

ZOOCOLOGY
(In force from June 1980)

Note.—The following syllabus is in addition to that prescribed for the Second B.Sc. Course.

Paper—VI: Biochemistry and Animal Physiology:

   Elementary knowledge for Carbohydrates, Proteins, liquids, enzymes, nucleic acids and intermediary metabolism.

   Physiology of respiration, movement, osmoregulation, reproduction, co-ordination and endocrines.
Paper VII: Cell Biology, Genetics and Evolution:

**Cell Biology:**

Ultra structure and function of Mitochondria, chloroplast, chromosome, cell-cycle, Mitotic apparatus—Cytoplasmic interaction Nuclear.

**Genetics:**


**Evolution:**


**Paper VIII**: Non-Chordates:

Bionomics, distribution and systematics of non-chordates, Organ system and functions with reference to the following types in addition to those of Paper III. Monocystis, Leuccosolenia Obelia, Planaria Ascaris, Grasshoper, Sepia. Star fish comparative aspects on body symmetry, body wall, coelon, Segmentation. Cephalisation.

**Paper IX**: Chordates:

Bionomics, distribution and systematics of chordates. Organs system and their functions with reference to the following types in addition to those of Paper IV:

Balangiossussus, Tunicate, Ophiocephalus. Caletes, Rat. Comparative anatomy of vertebrate systems: With reference to osteology (only limbs and girdles) and integument.

**Paper X**: Biology and Mankind:

Human population and control:

1. Population growth in India and countries.
2. Reasons of population growth.
4. Population growth and natural resources.
5. Population growth and industrial development, urbanization.
6. Introduction of family planning.
7. Methods of family planning.

Pollution and control:
1. Removal of non-degradable pollution from air, water, sewage, food, fodder etc.
2. Biological control
   (a) Treatment of peegrable wastes.
   (b) Biological control of pest for removal of pesticides pollution.

Parasitology:
Study of following microbial, fungal, protozoan, helminthes. Parasi-
sites with reference to Pathogenicity in mankind.

Microbial: 1. Nussesia gonorrheae.

Fungal: 1. Trichophyton

Protozoan: Trypanosoma gambiense Leishmains donovani, Balantidium coil.

Helminthes: Platyhelminthes, Schistosomes.

Nematodes: Dracunculus medinensis, Trichenilla spiralis.

Space Biology:
Elementary knowledge of problems of space travel and its solution (mechanical
Chemical and Biological approaches).

Radiation and Man:
(1) Type of Radiations and causes
(2) Effects of radiations
(3) Uses of radiations.

Cancer and Man:
(1) General nature of cancer and its types
(2) Theories of Cancer
(3) Cancer Morphology
(4) Biochemical changes in Cancerous cells
(5) Various cancer Therapies
(6) Immunology and Cancer  
(7) Researches in Cancer.

Entomology:
(1) Introduction—Insect life processes  
(2) Useful insects—Honey bee and lac insects  
(3) Harmful insects—Insect pest on Crop Vegetable and fruit plants  
Insects pests on cattle and wild life  
(4) Insect control—nature and application of insecticides  
(5) Insecticides and Toxicity.

T.Y.B.Sc. (Zoology) Practical

Appendix 'A'

Paper VI: Biochemistry and Animal Physiology
1. Detection of unknown solutions:
   (a) Carbohydrates—Glucose, fructose, lactose Maltose Sucrose, Starch Glycogen.  
   (b) Proteins—Albumin, Globulin, Pepton, Casein.  
   (c) Fats and Oils—Castor Oil, Groundnut Oil and Saponification value of above Oils.
2. Paper Chromatography and thin layer chromatography of Amino acids—Glycine, Cystine.  
3. Effect of Ptyline (man) and Amylase (cockroach salivary gland) on suitable substrate.  
5. Movement—1. Simple muscles twitch  
   2. Effect of cold and warm ringer solns.  
   3. Effect of Adrenalin/Ringer soln. on Heart beat.  
6. Osmoregulation (1) to determine pH of a soln. by pH paper method universal pH indicator bottle method.  
7. Endocrines and reproductive physiology—Effect of FSH on female frog

Appendix 'B'

Paper VII: Cell Biology, Genetics and Evolution

Cell Biology:
1. Localization of DNA, RNA, Salivary gland chromosomes, Cell division stages—Mitosis and Meiosis etc.  
4. To study the different types of W.B.C. of Man/Rat/Frog.
5. Determination of Blood groups (A, B, AB, O & Rh.)

Genetics:
6. Demonstration/charts to show:
   1. Monohybrid and Dihybrid ratios.
   2. Interaction of genes, (a) Lethal genes in yellow rate, (b) Segregation for yellow body colour when two yellow mice are crossed, (c) Two genes affecting same character (Comb shapes in fowl), (d) Linkage and crossing over, (e) Sex-linked Human diseases, (f) Coiling of shells in Limnea.

Evolution:
7. Examples showing mimicry (Natural selection):
   (a) Stick insect
   (b) Leaf insect
   (c) Kalima butterfly.
8. Adaptations: Feeding adaptations:
   (a) Mouth parts of 1. Mosquito
       2. Honey bee
       3. House fly.
   (b) Desert adaptations—(1) Horn toad.
   (c) Fossorial and subterranean adaptations.
       1. Snakes, Caecilian (Ichniothophis)
       2. Hedge hog.
   (d) Climbing adaptations:
       1. Chameleon
       2. Squirrel
       3. Wood pecker.
   (e) Volant adaptations:
       1. Any bird
       2. Draco
       3. Flying mammals (Bat)
       4. Nlying fish (Exocoetns)
       5. Flying frog (Hyla).
   (f) Aquatic adaptations:
       1. Any fish, crocodile, turtle
       2. Dolfin.
(a) Parasitic adaptions:
1. Liverfluke
2. Plasmodium.
3. Tapeworm.

(b) Physiological adaptions:
1. Teredo of shipwood (Shipworm).

9. Models/Charts in relation to evolution and future of Man:

Appendix C

Paper—VIII: Non-Chordates:

1. Dissections:

<table>
<thead>
<tr>
<th>Animal</th>
<th>System</th>
<th>Mountings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Ascaris</td>
<td>Reproductive</td>
<td>—</td>
</tr>
<tr>
<td>2. Grass hopper</td>
<td>Digestive, Nervous, Reproductive</td>
<td>—</td>
</tr>
<tr>
<td>3. Sepia</td>
<td>Digestive, Circulatory, Nervous, Reproductive</td>
<td>Jaws, Ink gland, statocyst, Spermatophore</td>
</tr>
<tr>
<td>4. Starfish</td>
<td>Digestive &amp; Water Vascular Systems</td>
<td>Pedicillaria, Tube feet</td>
</tr>
<tr>
<td>5. Pila</td>
<td>Digestive, Circulatory, Nervous &amp; reproductive systems</td>
<td></td>
</tr>
</tbody>
</table>

2. Permanent Slides:

1. W. M. Monosystis.
2. L. S./T. S. Leucosolenia.
3. W. M. Obelia colony (Polypo stage).
4. W. M. Medusa obelia (Medusa)
5. W. M. Planaria.
6. T. S. Ascaris
7. W. M. Larva Starfish.
8. V. S. Eye of Grasshopper.

3. Taxonomy of non-chordates.
Appendix D

Paper IX Chordates:
1. Dissections:

<table>
<thead>
<tr>
<th>Animal</th>
<th>System</th>
<th>Mountings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chork</td>
<td>Cranial nerves</td>
<td>Internal Ear</td>
</tr>
<tr>
<td>Ophiocephalus</td>
<td>Digestive, Arterial</td>
<td>Air bladder</td>
</tr>
<tr>
<td></td>
<td>Brain, Urinogenital,</td>
<td>Ctenoid scales.</td>
</tr>
<tr>
<td>Calotes</td>
<td>Digestive, Circulatory</td>
<td>Pecton</td>
</tr>
<tr>
<td></td>
<td>Urinogenital Brain</td>
<td>Hyoid Apparatus</td>
</tr>
<tr>
<td></td>
<td>Cranial nerves Sympathetic</td>
<td></td>
</tr>
<tr>
<td>Rat</td>
<td>Digestive Circulatory</td>
<td>Ear ossicle Salivary gland</td>
</tr>
<tr>
<td></td>
<td>Reproductive Brain</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sympathetic</td>
<td></td>
</tr>
</tbody>
</table>

2. Eye muscles of Frog/Scoliodon
3. Osteology: Pectoral, Pelvic girdles and limbs of Fish, Frog, Varanus, Pigion, Rabbit (Comparative account)
4. V. S. Skin of Frog and Rat
5. Taxonomy of chordates.

Appendix E

Paper X Biology and Mankind:

Human Population & Control: Human population and control, pollution & Control Patashiology, Space Biology, Radiation and Man, Cancer and Man, Entomology.

I. Human Population & Control:

Population growth Graphs showing growth rates.
1. Natality and mortality
2. Detection of ovulation graph
3. Human Population......structure graph
4. Appliances of family Planning.

II. Pollution and Control:

(i) Detection of pollutions by thin layer chromatography method. (e.g. organochlorine such as DDT, BHC),
(ii) Chart of high chimney
(iii) Chart of showing pollution of water by industrial waste.
III. Parasitology:
   1. Effect of fungicide on fungus
   2. Identification of parasites as per syllabus

IV. Space Biology:
   1. Chart showing Bio-regenerating system
   2. Chart showing Chemo regenerating system.

V. Radiation:
   1. Identification of appliances
   2. Picture showing irradiation by cobalt bomb.

VI. Cancer:
   1. Permanent slide of cancerous tissue and cell
   2. Picture showing cancerous tissue

VII. Entomology:
   1. Identification of various pests as per syllabus
   2. Useful Insects
   3. Demonstration of Appliances for spraying and dusting pesticides through pictures.
   4. Demonstration of toxicites and effect of insecticide on insects and other useful organisms.

(6) GEOLOGY

Note. — A student offering B.Sc. General Degree Course will offer Paper V as Practical III of Second B.Sc. if he has offered Geology as a Second Subject, and will offer Papers III, IV and V and Practicals I, II & II of Second B.Sc., if he is offering Geology as a Third Subject.

Paper VI:
General stratigraphy, Indian Geology and Invertebrate Palaeontology.

Principles of general stratigraphy, stratification, chronological order, correlatio and homotaxis of strata imperfection of the geological records—their causes and importance. Palaeogeography. Geological eras and their sub-divisions.

Study of the important rock formations of peninsular India and their mineral wealth Phyla-Brechopoda and Mollusca (Lamelipranchia, Gastropoda and Cephalopoda) their general study.

Paper VII:
Mineralogy, Crystallography, Optical mineralogy and Petrology, Systematic study of mineral families.
Study of (11) eleven types of symmetries of crystals. Twinning in crystals.

Twinkling—Extinction—Twinning—Polarisation colours. Introduction to the interference figures of Uniaxial & Biaxial minerals.

Detailed study of igneous, sedimentary and metamorphic rocks.

Paper VIII:

Economic Geology and Invertebrate Palaeontology.


Evaporation deposits—Gypsum—Sodium Chloride—Potash.

Residual deposits—mechanical concentration—placers—beach—placers with Indian examples. Oxidation and Secondary enrichment with all the chemical reactions involved. Metamorphic deposits. Asbestos—Graphite—Talc—Kyanite—Sillimanite—Indian example.

Study of chief classes of invertebrate phyla.

Paper IX:

General Stratigraphy and Indian Geology.

Statigraphical eras and systems—their study.

Geology of India and Pakistan. Detailed study of the "Fundamental Complex"

Geology of extra-peninsular region.

Paper X:

Speculative and Applied Geology.

Present is key to the past. Glaciation—Isostasy—Vulcanicity—Mountain building. Joints—Folds—Faults—their detailed structural characteristics. Effect of faults on the outcrops. Physical criteria to find out faults in the fields.

Weathering of rocks and formation of soils, Definition of soil—its composition—texture and fertility. Classification of soils as to their origin. Chief types of soils—Erosion of soils—measures to check soil erosion.

Properties of rocks—their utilisation for building purposes.

Surface water-foundations-dam-sites. Toposheets-geological maps and scale of maps.

Practicals

Practical I : Structural Geology and Filedwork:

Section and inscription of Geological maps with structural features as unconformity, overlap, folding, faulting etc., outcrop problems with one series strata with inlier, outlier and faulting.


Practical II—Crystallography and Mineralogy:

Study of 35 crystal models representing all the systems with diagrams.

Twining of spinol, Rutile, Aragonite, starpolite, Gypsum, Orthoclase (Manebench, Daverno and Carlsbad) Abgite, Plagioclase with diagrams.

Megascope study of metallic and non-metallic minerals representing important mineral families.

Practical III— Petrology:


Megascope and microscopic study of important representative rock specimens of igneous, sedimentary, metamorphic types.

Practical IV—Paleontology and Blow-pipe analysis:

Study of fossil specimens with diagrams representing important phyla belonging to different geological eras.

Blow-pipe analysis of 20 mineral powers—Carbonates, Sulphides, Sulphates and Oxides of Ca, Ba, Sr, Zn, Pb, Mg, Fe, Cu, Mn, Cr, Sb, Hg.

Field-work and keeping of systematic journals are compulsory.
(5) MICROBIOLOGY
(In force from June 1980)

Theory:

Paper VI—Microbial Physiology and Genetics

Paper VII—Immunology

Paper VIII—Medical Microbiology

Paper IX—Agriculture Microbiology and Virology

Paper X—Industrial Microbiology

Paper VI—Microbial Physiology and Genetics

1. Chemotherapy:
   Principles, Sulfonamides, Antibiotics, Drug resistance.

   Enzymes:

3. Bioenergetics:

4. Metabolism:
   Carbohydrate degradation—glyoxylate by pass, Gluconeogenesis.
   Protein synthesis.
   Nucleic acid synthesis.

5. Microbial Genetics:
   (i) DNA as a genetic material, genetic code
   (ii) Early concept of bacterial variation.
   Evidence for occurrence of mutation in bacteria
   Types of microbial mutants, their induction and isolation.
   Mutagenesis and mutagenic agents.

6. Genetic Recombination:
   Gene transfer—different methods. Boisomes.
7. Genetic aspects of enzyme regulation:

Paper VII—Immunology

1. Blood:
   Components and their functions.

2. Immunity:
   Artificial and passive immunization, Humoral and cellular immunity
   Preparation and standardisation of antisera, antitoxins and vaccines.

3. Molecular aspects of immunogens and immunogenicity:
   Hapten, Forssman antigen, Isoantigens, Antigenic Characteristics
   Salmonella.

4. Immunoglobulins:
   Classification, nomenclature and functions.
   Structure and amino acid composition of IgG Cellular bases of antibody
   formation.
   Primary and secondary response to immunogens.

5. Antigen-antibody interactions:
   Mechanisms and their applications.

6. Hypersensitivity and allergy

7. Autoimmunity and disorders of immune system

Paper VIII—Medical Microbiology

1. Host-parasite relationships:
   Factors influencing infective process.
   Pathogenic attributes of microorganisms.
   Constitutive and inducible host resistance.

2. Principles of epidemiology.

3. Diagnostic microbiology:
   Normal flora of human body.
   Bacterial, fungal, protozoal and viral diseases of humans—
   Symptomatology, Principles of diagnosis, treatment, prevention and control.
   Diagnostic skin tests.

4. Food poisoning, Microbial toxins:
   Bacterial and fungal toxins Characteristics Mode of action and their effects.
aper IX Agriculture Microbiology and Virology

a) Agriculture Microbiology.

1. Soil Microbiology:
   Enumeraton of soil microflora and methods of study
   Breakdown of cellulosic and proteinous materials.
   Formation of humus. Carbon and nitrogen cycles.

1. Plant pathology:
   Etiology, Symptoms, Survival, Spread and Control of Plant diseases.

b) Virology:
   1. Nature of viruses, their origin.
   2. Structure of viruses:
      Organization, Chemical composition of viral components.

3. Methods of Study;
   Cultivation, purification, erulemention, serology, Characterization of a virus particle.

4. Classification of viruses:
   Characteristics of major groups of animal viruses. Characteristics of insect viruses and plant viruses.

5. Bacteriophage;
   Morphology, lytic cycle, lysogeny

Paper X Industrial Microbiology

1. Concept of fermentation

2. Fermentation media—raw materials.

3. Screening, development and Preservation of cultures.

4. Fermentation process:

5. Fermentative production of ethyl alcohol, citric acid, penicillin, lysine, amylase and the mechanisms of their accumulation.
7. Microbiology of sewage:
   Composition, Sewage disposal methods—activated sludge and role of micro-organisms.
   Biochemical oxygen demand.
8. Food and dairy microbiology:
   Food spoilage, Food Preservation Milk Products.
Practicals:
   Exercises at the Practical examination with the exception of spot test and viva-voce will be set from the items 1 to 9, only.
Items:
1. Items—Isolation, Cultivation and identification of the following from the pathological:
2. Isolation and identification of the following nitrogen fixers:
   Azotobacter, Rhizobium
3. Isolation and Identification of Xanthomonas citri.
4. Isolation, Cultivation and identification of the following:
   Yeasts Fusarium, Helminthosporium, Alternaria, Cunninghamella, Curvularia.
5. (a) Susceptibility of micro-organisms towards antibiotics.
   (b) Bioassay of penicillin.
6. Serology:
   A. Agglutination tests:
      (i) Slide agglutination technique.
      (ii) Dreye's technique.
      (iii) Bordet-Durham technique.
      (iv) Double dilution technique.
   B. Precipitation tests:
      (i) Kahn Tests
      (ii) V.D.R.L. test
7. Examination of blood:
   (i) Blood grouping-ABO and Rh Systems.
   (ii) Differential count.
(iii) Total Count.
(iv) Hemoglobin percentage.
(v) E. S. R.
(vi) Blood Sugar.
(vii) Blood Urea.
(viii) Blood bilirubin.


10. Studies on **Mycobacterium tuberculosis**, **Mycobacterium**, **Smegmatis**, **Actinomycetes**.

11. Enrichment culture of the following:
   Cellulose decomposing organisms; Desulphovibrio from mud; **Nitrosomonas**, **Nitrobacter** and **Thiobacillus** from soil.

12. Identification of the following plant diseases; Canker, Leaf-spot, Downy mildew, Powdery mildew, Smut, Rust, Mosaic.

13. Isolation of bacteriophage from Sewage.

14. Physical, Chemical and Microscopic examination of Urine.

15. Fermentative production of alcohol.

16. Sterility testing of pharmaceutical products.

17. Isolation of Mutants by replica plating technique, gradient plate technique.

18. Permanent Slides:
   Insect Vectors, Pneumococci, Gonococci, **Leishmania**, **Plasmodium**, **Wuchericha**.

   Visits to Public Health or Drug Laboratories and Institutions using micropoiological techques should be undertaken during the year.

   The candidate is required to bring for inspection at his/her practical examination his/her own practical journal duly signed and certified by the Head of the Department.

   The oral examination will be illustrative of the theoretical portion of the syllabus.
The following exercises will be set at the external practical examination and the marks will be distributed as under:

**Practical—I**

1. Isolation and identification of bacteria. \[30\]
2. Identification of fungi cultures. \[15\]
3. Viva-Voce (Papers—VI to X) \[15\]

**Practical—II**

4. Bioassy of penicillin. \[25\]
5. Spotting. \[20\]
6. Viva-Voce (Papers—VI to X) \[15\]

**Practical—III**

7. Serology. \[25\]
8. Blood examination. \[20\]
9. Estimation of Sugar or amylase. \[15\]

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**Books recommended**

(In addition to Second B.Sc. Books)

<table>
<thead>
<tr>
<th>Title of the Book (Year of Publication)</th>
<th>Authors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Chemical Microbiology (1976)</td>
<td>A. H. Rose</td>
</tr>
<tr>
<td>2. General Virology (1976)</td>
<td>Luria and Darnell</td>
</tr>
<tr>
<td>3. Industrial Applications of Microbiology (1975)</td>
<td>J. Riviere</td>
</tr>
<tr>
<td>5. Medical Microbiology (1976)</td>
<td>N. C. Dey</td>
</tr>
<tr>
<td>7. Plant Pathology</td>
<td>R. S. Singh</td>
</tr>
<tr>
<td>8. Text-book of Microbiology.</td>
<td>W. Burrows</td>
</tr>
</tbody>
</table>

**(8) Mathematics**

(In force from June 1980)

- Paper VI: Abstract Algebra.
- Paper VII: Analysis—I
- Paper VIII: Analysis—II
- Paper IX: Principles of Mechanics
- Paper X: Topology
Paper VI—Abstract Algebra:

Pre-requisites—Set theoretic notions: Union, intersection, complementation, product of sets.

Mapping: Onto, one-to-one correspondence, composition of mapping Inverses.


Relations: Equivalence relations. Partition of a set into disjoint equivalence classes.

Properties of Integers: Order in integers, well ordering principle and induction in natural numbers; Division Algorithm, divisibility, prime integers, g.c.d. and l.c.m. of integers relatively prime integers; and division; existence of g.c.d. and l.c.m. prime integers. Unique Factorization Theorem, relation of congruence modulo, n Zn; Addition and Multiplication on Zn and their properties.

Group: Group, abelian, non-abelian, Elementary properties group. Cancellation law. The existence of the solution of ax = b and ya = b.

Definition of $a^n$, order of an element, order of a group, finite and infinite group. cycle, groups and idea of generators permutation groups.

Homomorphism and their fundamental properties. Fundamental theorem of homomorphism properties of cyclic groups.

Ring, Integral Domain Field:

Ring—commutative ring, ring with unity, zero divisors, cancellation laws integral domain. Field, Elementary properties of ring. Ideals in ring, Principal ideals in a commutative ring with unity, Sub-fields and extensions.

Polynomials over an integral and field. Divisibility of polynomials, unit Associates Irreducible polynomial g.c.d. of two polynomials and its existence. Division algorithm, Remainder theorem and factor theorem. The unique factorization theorem zeros and roots. Euclidian ring and unique factorization domain (Gaussian domain as an example).

The scope of the syllabus is roughly indicated by—


(2) Father Valles: ‘Arup Bijganit’ (Gujarati), Bharat Prakashan, Ahmedabad. (119, 120, 121, 124).

Books for reference

1. I. N. Herstein : ‘Topics in Algebra’
2. Johnson : ‘A First Course in Abstract Algebra’
Paper VII: Analysis I (Inforce from June 1980)

(a) Number systems:

The real field to be developed by ordered-set approach. Equivalence of this approach and Dedikinds approach, extended real number system. The complex number system Euclidean spaces.

(b) Basic Topology:


(c) Sequences and Series:

Convergent sequences, sub sequences. Cauchy sequences, upper and lower limits, Special sequences series. Series of non-negative terms. The number Root and ratio tests. Power series with real (complex) terms, interval (Circle) of convergence and radius of convergence of a power series. Summation by parts Absolute convergence, addition and multiplication of series, Rearrangements.

(d) Limits and continuity:

Limits and continuity for functions from a metric space into another metric space. Continuity of a composite function structural properties of Continuous functions from a metric space into $\mathbb{R}^{n}$ continuity and compactness. Continuity and connectedness. Discontinuities Monotonic functions Discontinuities of a monotonic function Infinite limits and limits at infinity.

(E) Differentiation:

Derivatives of a real function, continuity and differentiability, structural properties of the class of differentiable functions Mean value theorems. Continuity of derivatives L Hospital's rule. Derivatives of higher order. Taylor's theorem Differentiation of a Vector valued function on $(a, b)$

The course is roughly indicated by walter Rudin: "Principles of Mathematical Analysis". Third edition (International student edition MC Graw-Hill kogakusha Ltd. chapters 1 (including the appendix), 2, 3, 4 and 5.
Third B.Sc.

Paper VIII Analysis II (Inforce from June 1980)

(a) Riemann–Stieltje's Integral


(b) Sequences and Series of functions:


(c) Some Special functions:


(d) Functions of several Variables:


(E) Complex valued functions on subsets of a Complex plane:


The Course is roughly indicated by—


Chapters 6, 7 (Omit §§ 7.28 to 7.33)

8 (Omit §§ 8.8 to 8.22)

9 (Omit §§ 9.9 and 6.24 to 9.38)

and

(ii) R. Churchill: Complex variable and applications Chapters 2, 8.

Books of reference for Papers VII & VIII

(i) T. M. Apostol: ['Principles of Mathematical Analysis'].

(ii) G. H. Hardy: (Pure Mathematics)
(iii) E. C. Titchmarsh: 'Theory of Functions'

(iv) Olmstead: 'Function of Real-Variables'

(v) H. K. Nickerson: 'Advanced Calculus'
D. C. Spencer & (East-west) 1868
N. E. Steenrod

(vi) Jack Indritz "Methods in Analysis".

Paper IX—Principles of Mechanics

Method of Plans Statistics:
Equilibrium of a Practical, Equilibrium of a system of particles, work and potential Energy.

Application of Plane Statics:
Mass centres of gravity—Flexible Cables.

Plane Kinematics:
Kinematics of Particles. Motion of a Rigid Body parallel to fixed plane.

Methods of plane Dynamics of—
Motion of particles—Motion of a system.
Motion of a Particle.
Projectile without resistance
Oscillators, General Motion under a central force, planetary orbits.
Motion of a Rigid Body and of a system.

Moment of inertia, Kinetic Energy and Angular momentum. Rigid Body rotation about a fixed axis; General motion of a rigid body parallel to a fixed plane Stability of Equilibrium.

Plane Impulsive Motion

General Theory of Impulsive Motion—Collisions

The scope of the course is indicated by—
Principles of Mechanics—Synge and Griffita
Chaps. I, II (except 2.5)
Chap. III (except 3.3, 3.5) Chap. IV, Chap. V (except 5.3)
Chap. VI (except 6.2), Chap. VII (except 7.4)
Chap. VIII.
Paper I X Topology

1. Introduction:
   What is topology? Revision of notion of sets, complements, set union and intersection, index sets, union and intersection of indexed collections.

2. Topologies and Topological spaces:

3. Functions, Mappings and Homeomorphisms:
   Cartesian product; Functions and mappings; continuity; Homeomorphisms.

4. Connected Spaces:
   Connected spaces; Relative topology; connected sub-spaces.

5. Compact Spaces:
   Hausdorff spaces; compact spaces; Properties of compact spaces.

6. A Hierarchy of topological spaces:
   $T_1$-Spaces; Regular spaces $T_2$-Spaces; Normal spaces; $T_4$-spaces completely regular space; Tychonoff spaces.

7. Metric Spaces:
   Metrics and metric topology; Properties of metric spaces; some properties of metric spaces; sequences; complete metric spaces.

The course is roughly covered by Introduction to topology Maynard Mansfield (D. Van Nostrand Co.) (Omit Articles 7.6, 7.7)

Reference books

1. 'Introduction to Topology', Mendelson (Blackie & Son Ltd.)
2. 'Introduction to Topology and Modern Analysis', George F. Simmons (McGraw Hill book Ltd.)

(9) STATISTICS (New Course)
   (In force from June 1980)

Paper IV Mathematical Statistics

Ischebyscheff's inequality and its uses; Law of the large numbers with known variance. Characteristic function and its elementary properties, inversion theorem with proof: First limit theorem (statement only) and its application: Central Limit theorem (Lindeberg-Levy form only) and examples.
General definition of multivariate distributions, definition of independent variates, marginal and conditional distributions for bivariate cases only and examples.

Some special distributions and their properties:

Geometric distribution, Negative binomial distribution; Pearsonian system of curves: differential equation, finding of constants, study of main types—type I & type VI, detail study of types III, Bivariate normal distribution.

Correlation and Regression: Multiple and partial correlation for the variates only, correlation ratio, sampling distribution of sample correlation coefficient when (population correlation coefficient is zero); Relations among regression coefficients and partial (multiple) correlation coefficients; use of Z—transformation.

Sampling distributions: Joint distribution of the mean and variance based on a sample drawn from the normal population; Chisquare, student’s, Snedecor’s F and Fishe’s Z distributions and their properties; Asymptotic properties of these distributions.

The course is indicated by the following books:

   (Princeton University Press)
   Chapter 10: Article, 10.1, 10.2, 10.3, 10.4, 10.5
   Chapter 15: Articles 15.7, 17.3, 17.4.
   (Omit proof of Liapounoff’s theorem)
   Chapter 18: Articles 18.1, 18.2, 18.3, 18.4
   Chapter 20: Articles 20.2 only
   Chapter 22: Articles 22.1 and 22.2.

2. Weatherburn C. E.: ‘A first course in Mathematical Statistics’
   (Cambridge University Press)
   Articles 109–119.


   Chapter 2: Articles 2.1–2.4
   Chapter 3: Articles 3.1–3.5
   Chapter 4: Articles 4.1–4.4, 4.7–4.9
   Chapter 5: Articles 5.3–5.4.
   (Charles Griffith).
   Chapter 6: Articles 6.1-6.7, 6.9.

Recommended books

1. Marek Fisz : 'Probability and Mathematical Statistics' (Wiley)
3. Wani J. K. : 'Probability and Statistical Inference'
   Century-Crofts Meredith Corporation, New York).

Paper V: Statistical Inference and Design of Experiments

(A) Statistical Inference:

(i) Estimation: Point of estimation, properties of estimates—consistency, unbiasedness, sufficiency and efficiency, Cramer–Rao inequality, and its use to obtain minimum variance unbiased estimates (MVUE); Standard errors for sample moments; Internal Estimation.

(ii) Methods of estimation. method of maximum likelihood; statement of the properties of maximum likelihood estimates with a proof for consistency only. Solving of maximum likelihood equation by the interactive procedure; Method of moments and method of least squares.

(iii) Testing of hypothesis: Hypothesis; two kinds of error; Critical region, level of significance; Power of the test; Neyman-Person theory of testing of simple hypotheses only. Elementary idea of likelihood ratio test.

(B) Analysis of variance & Design of Experiments:

(i) Analysis of variance—one-way and two-way classifications with fixed effect models; Expected values of the mean squares and heuristic justification of the F-test. Transformation of variates when the assumptions are not fulfilled; Test of normality.

(ii) Principles of design of experiments; Completely randomised, randomised, block and latin square designs with their relative efficiencies; Missing plot technique upto two missing observations only.
(iii) Factorial experiments, construction of factorial designs involving four factors at two levels only; Yates methods of analysis; simple ideas of confounding partial and total.

The course is indicated by the following books:

1. Hogg and Craig : 'Introduction to Mathematical Statistics'
   Chapter 6 : Articles 6.1–6.4
   Chapter 7 : Articles 7.1–7.2
   Chapter 8 : Articles 8.1–8.2

2. Mood and Graybill : 'Introduction to the theory of Statistics'
   Chapter 8 : Articles 8.1–8.7, 8.9–8.12
   Chapter 10 : Articles 10.7, 10.9
   Chapter 11 : Articles 11.1–11.5, 11.7
   Chapter 12 : Articles 12.1–12.2, 12.6
   Chapter 13 : Articles 13.1–13.5

   (Princeton University Press)
   Chapter 27 : Articles 27.1–27.5
   Chapter 32 : Articles 33.1–32.6
   Chapter 33 : Articles 33.1–33.3

   (Van Nostrand)
   Chapter 9 : Articles 9.1–9.7, 9.16

   (Asia Publishing House)
   Chapter : 1–3
   Chapter 4 : Articles 4.11–4.15a, 4.21–4.27a, 4.31–4.37
   Chapter 5 : Articles 5.11–5.14, 5.21–5.24
   Chapter 6 : Articles 6.11–6.14, 6.21

   Chapters I, II, III, IV, V, VI, VII (Articles 1–4 only)
Recommended Books


Paper VI : Applied Statistics II—Sampling Techniques, Statistical Quality Control and Linear Programming

1. Sampling Techniques : Drawing of random sample from distributions; Stratified random sampling; Systematic sampling; Two-stage sampling; Non-sampling errors.

5. Statistical Quality Control (S.Q.C.)

(i) Objectives of S. Q. C. and its importance in industry Process control and lot control; principles and construction of control charts; Theory of runs; Use of three-sigma limits in control charts; Control charts for variables—simple X, R and S charts and their applications; OC functions of these charts; Selection of rational subgroups, action based on control charts: Specification limits and modified control limits, Group control and difference control charts; Control charts for attributes—p, np and c charts and their applications.

(ii) Acceptance sampling plans : Sampling plans for attributes concepts of OC, AOQ and AOQL, ASN and AOI for sampling plans; Single sampling plans for attributes.

3. Linear Programming : Introduction to linear programming problems with illustrations; Formulation of the problem, convex set, Feasible solution; Optimum solution by graphical method with illustrations.
Course is covered by the following books:

   Chapter 5 : Articles 5.1–5.12
   Chapter 5-A : Articles 5A. 1-5A. 3, 5A. 6-5A. 14
   Chapter 8 : Articles 8.1–8.4
   Chapter 10 : Articles 10.1–10.7
   Chapter 13 : Articles 23.1–13.6

   (Omit articles 264–266)

3. Gass S. I. : 'Linear Programming Methods and Applications'
   Chapters I & II

   Williamson E.

Recommend books

1. Murthy M. N. : 'Sampling Theory and Methods'
   (Statistical Publishing Society, Calcutta)


3. Sukhatme & Sukhatme : 'Sampling Theory of Surveys with Applications'
   (Asia Publishing House, 1970)

4. Duncon C. J. : 'Industrial Statistics and Quality Control'

   Chapters 3, 12, 13

6. Hadley G. : Linear Programming (Addison Wilesley)

Paper VII—Analysis I

(a) Number Systems:
   
The real field to be developed by, ordered-set approach. Equivalent of
   this approach and Dedikind's approach, extended real number system. The
   complex number system Euclidean spaces,

(b) Basic Topology:
   
   Finite countable and uncountable sets. Metric spaces. Neighbourhoods in
   metric spaces limit points of a set. Open, closed bounded compact perfect
   connected or convex subsets of metric spaces.
(c) Sequences and Series:

(d) Limits and Continuity:

(e) Differentiation:
Derivatives of a real function, continuity and differentiability, structural properties of the class of differentiable functions. Mean value theorems. Continuity of derivatives. L'Hopital's rule. Derivatives of higher order. Taylor's theorem. Differentiation of a vector valued function on (a, b).


Paper VIII Analysis II

(a) Riemann—Stieltjes Integral

(b) Sequences and Series of Functions:

(c) Some Special Function:
(d) Functions of Several Variables:


(e) Complex Valued Functions on Subsets of a Complex plane:


The Course is roughly indicated by--


Chapters 6, 7 (Omit §§ 7.28 to 7.33)
8, (Omit §§ 8.8 to 8.22)
9, (Omit §§ 9.9, and 9.24 to 9.38)

and

(ii) R. Churchill: Complex variable and applications Chapters 2, 8.

Books of reference for Papers VII & VIII

(i) T. M. Apostol : “Principles of Mathematical Analysis”.

(ii) G. H. Hardy : ‘Pure Mathematics’

(iii) E. C. Titshmarsh : ‘Theory of Functions’

(iv) Olmstead : ‘Function of Real Variables’

(v) H. K. Nickerson : ‘Advanced Calculus’

D. C. Spencer (East–west) 1968 &

N E. Steenrod

(vi) Jack Indritz “Methods in Analysis”.

Practical Papers

There shall be three practicals each of three hours duration based on the theory papers. The broad guidelines are given below which are by no means exhaustive:

Practical Paper I (Based on Theory IV and V)

Fitting of distributions (i) geometric. (ii) negative binomial. (iii) normal; Testing of goodness of fit.

Determination of the types of the Pearson curves; Fitting of Pearson type III curve.

Computation of \(R_{i\setminus jk}, r_{i\setminus jk}, i \neq j \neq k, i, j, k = 1, 2, 3\) and regression planes. Testing of \(R_{i\setminus jk} = 0\) and \(r_{i\setminus jk} = 0\). Testing of regression coefficients \(\beta_{ik,j} = 0\) for \(i \neq j \neq k = 1, 2, 3\); Test for homogeneity of correlation coefficients by Z-transformation.
Estimation of Parameters with their standard errors by the methods of moments and maximum likelihood in case of following distributions:

(i) Binomial and poisson truncated at zero (ii) exponential distribution (for grouped and ungrouped data).

Practical Paper II (Based on Theory Paper V)
To determine critical region by Neyman-Pearson lemma to test a statistical hypothesis. Calculation of power and drawing of power curves in case of binomial poisson & normal distributions.

Analysis of variance in case of one-way and two-way classifications, testing of homogeneity of variances.

Analysis of standard designs such as completely randomised block, latin squares and their relative efficiencies, Missing plot techniques; Analysis of factorial desings.

Practical Paper III (Based on Theory Paper VI):

1. (i) Stratification of given data, drawing of random samples; estimation of the mean and variance; determination of sample size under proportional and Neyman allocation and with given cost function; comparison of stratified random sampling with simple random sampling under proportional Neyman and arbitrary allocations.

(ii) Estimation of population mean and variance in case of systematic sampling; comparison of systematic sampling with simple random and stratified random sampling when \( N = nk \) and \( N \neq nk \).

(iii) To estimate mean and variance in case of two-stage sampling with equal first stage units, Allocation of sample to the two-stages, comparison of two-stage sampling with one-stage sampling.

2. (i) Drawing of X, R & p, np and C charts; finding of revised limits and associated problems,

(ii) Drawing of OC, ASN, AOI and AOQ curves for single sampling Plans.

3. Linear programming problems by graphical method.

4) BIO-CHEMISTRY (New Course)
(In force from June 1980)

Paper VI Bio-Chemistry

Metabolism

Carbohydrate Metabolism:
Glycolysis, Glycogenesis, Glycogenolysis, Citric acid cycle, Tricarboxylic, acid cycle, hexosemonophosphate shunt glucobio–genesis. Regulation of carbohydrate metabolism energy storage.
Metabolism of Lipid:

Metabolism of lipid (fat). Oxidation of fatty acids (β-Oxidation of fatty acids and energy storage. Formation and metabolism of the ketone bodies, ketosis. Biosynthesis of triglycerides and phosphatides. Cholesterol metabolism, coronary heart diseases and atherosclerosis.

Metabolism of Protein:

Amino acids of blood: Tissues, and urine. Breakdown and storage deamination, transamination and amination, decarboxylation reaction of amino acids. Urea formation, the Krebs–Henseleit cycle. Biosynthesis of creatine and creatinine.

Nucleic acid:

Biosynthesis and catabolism of purines and pyrimidines. Detoxification.

Ref.—(i) Text book of Biochemistry by West and Toold.
(ii) A review of Physiological enemistry by Harper
(iii)

Paper VII Bio-Chemistry

Food and Nutrition

Fuel used by body carbohydrate, fats and proteins, energy metabolison, water and minerals vitamins.

Use of food tables, Chemical composition of cereals and millets, legumes, oil seeds and nuts. Fats and sugars vegetables and fruits. Foods of animal’s origin Food microbiology, Food preservation. Food standards.

Ref.—(i) Applied Nutrition by R. Rajlaxmi
(ii) Human Nutrition and Dietetics by Davidson and Passmore.

Paper VIII Bio-Chemistry

Clinical Nutrition

Primary Nutritional Diseases:

Starvation, obesity Rickets & Ostomalacia, Sourvy Beri-beri, Nutritional Mercropathy Pellagra, Xerophthalmia, Keratomalacia and blindness. Used Nutritional disorders.

Conditioned Nutritional Diseases:

Inborn errors of metabolism diabetes mellitus Gout.

Diseases of the liver, biliary tract and pancreas,

Diet and allergy.
Disease of the cardiovascular System.

Diet and Physiological stress:

Pregnancy, lactation, Childhood, adolescence, Nutrition and the care of the aged.


Paper IX : Bio-Chemistry

Microbiology

History of Microbiology.

Contribution of Pasteur, Koch, Ehrlich, Elemen, Waterman etc.

Introduction to bacteria, Viruses, Richettsia, fungi and their comparative study.

Classification and nomenclature.

Study of bacteria.

Microorgans and its environment.

Physical and Chemical factors affecting microorganism.

Elements of microbial genetics.

Antigen—antibody, their reactions,

Infection, disease, pathogen, virulence, invasiveness.

Industrial use of micro-organisms.

Microbiology of water milk, food, sewage, air etc.

Ref : Fundamentals of Microbiology by Frobisher et al Biochemistry.

Paper X : Bio-Chemistry

Biochemical Techniques

pH meter, Colorimeter and Spec-trophotometer, Chromatography (TLC, Electrophoresis, Paper.) Isotopes—its use in biological research, centrifuge, Basal metabolism and energy requirement, purification of enzyme methods for the determination of enzyme, Basic Kinetics

Ref.—(1) Instrumentation Method of Analysis by Willard.

(2) The Enzymes by Dixo & Webb.

(3) The Text Book of Biochemistry by West & Todd.
1. Study of Enzymes
   (a) Amylase
   (b) Protease
   (c) Phosphatase
   (d) Arginase
      (i) Find out optimum Enzyme concentration
      (ii) To find out optimum substrate concentration
      (iii) To find out optimum pH.

2. Estimation of following by colorimetric analysis
   (i) Sugar in blood by Foline-Wa method.
   (ii) Sugar in blood by Orenomdybdate method.
   (iii) Urea in Blood by diacetylmonoxime method
   (iv) Cholesterol from serum and other biological sources
   (v) Phosphorous from biological material
   (vi) Calcium in blood
   (vii) Uric acid estimation
   (viii) Creatine in blood
   (ix) Creatinine in blood

3. (a) Estimation of serum protein
      (b) Extration and estimation of protein from different tissues.

4. To find out A/C ratio by chemical method.

5. To find out A/C ratio by electrophoretic method.

6. Liver Function Test
   (a) Determination of SGPT
   (b) Determination of SGOT
   (c) Bilurubine direct
   (d) Bilurubine indirect.
   (e) Thymol Turbidity
   (f) Zinc Turbidity.
7. Determination of Total nitrogen by Kjeldahl method.

8. Chromatographic Technique
   (a) Separation of amino acids by paper chromatography
   (b) To find out Rf-value
   (c) Separation of sugars by paper chromatography
   (d) Separation method by T.L.C.
        Determination of Iodine No. and saponification value of Oil or fat.

9. Microbiology
   (i) Monochrome staining
   (ii) Grams staining
   (iii) Staining of capsule, Sporl, Granule
   (iv) Acid fast staining,
   (v) Motility
   (vi) Isolation
   (vii) Enzymatic reactions of bacteria
        (a) Amylase.
        (b) Gelatinase
        (c) Casease
        (d) Lipase...
   (viii) Study of permanent slides
   (ix) Qualitative & Quantitative examination of water, milk
   (x) Antibiotic essay by Zone method.

Standard of Passing—Third B.Sc. Examination

R. Sc. 15(A):

To pass the examination, a student must obtain at least 36 per cent of the marks obtainable separately in papers and practicals in each subject at the University examination and separately in internal evaluation of both-papers and practicals in each subject.

(1) Those at the successful candidates who obtain at least 60 per cent of the total marks obtainable in aggregate, i.e. (i) the marks worked out as a percentage at their First and Second Year Examination on the basis given in paragraph 2 below, and (ii) the actual marks obtained by them in their Third Year Examination including English will be placed in First
Class, provided they obtain at least 60 per cent of the total marks obtainable in the papers and practicals at the Third Year Examination in the examination actually held by the University as distinguished from internal evaluation and those obtainable 48 per cent or more but less than 60 per cent of the total marks obtainable in aggregate. i.e. (i) the marks worked out as a percentage at their First and Second Year Examinations on the basis given in the paragraph 2 below, and (ii) the actual marks obtained by them in their Third Year Examination including English will be placed in Second Class provided they obtain at least 48 per cent of the total marks obtainable in the papers and practicals at the Third Year Examination in the examination actually held by the University as distinguished from internal evaluation.

(2) For the purpose of determining the class at the Degree Examination, the percentage of marks obtained by a candidate in each of his F.Y. and S.Y. Examinations shall be given weightage so as to constitute it as an integral part of the total, it being understood that the total of 800 marks shall be counted as per the following formula:

1. Marks obtained in the optional paper and Compulsory 600 marks English of Third Year Examination, i.e. of

2. Percentage of marks obtained in optional paper (i.e. ...100 marks papers other than English and General Education of First Year Examination.

3. Percentage of marks obtained in optional papers (i.e. ...100 marks in papers other than English and General Education) of Second Year Examination.

Total ...800 marks

(3) The marks assigned as the internal evaluation in which he passes, will be carried forward for the student appearing more than once at his examination as an ex-student.

(4) Notwithstanding anything contained above, it is hereby provided that—

1. A student who joins the Three-year Degree Course in the Second Year after passing Intermediate Examination of this University or an examination recognised as equivalent thereto, the percentage of the aggregate marks obtained by him thereat shall be counted in place of the percentage of marks at the F.Y. Examination as contemplated above.