NORTH-EASTERN HILL UNIVERSITY
Mawkynroh :::::::Umshing
Shillong

No.AC:65-2/Conf/2001-240 Dated Shillong,the 24th May, 2001

To

All members of the
Academic Council,
North-Eastern Hill University.

Subject: Agenda for the 65th meeting of the Academic Council.

Sir/Madam,

I am to forward herewith a copy of the agenda for the 65th meeting of the Academic Council to be held on 7th and 8th June, 2001 at 10:00 A.M. in the Seminar Hall, Mayurbhabj Complex, NEHU, Shillong for favour of your perusal.

Yours faithfully,

JMS Khongwir
Deputy Registrar

AGENDA ITEMS FOR THE 65TH MEETING OF THE ACADEMIC COUNCIL MEETING SCHEDULED ON 7TH AND 8TH JUNE, 2001

1. Item No. 1 : CONFIRMATION OF THE MINUTES:

| | |
|---|---|
| i) Confirmation of the Minutes of the 64th meeting of the Academic Council held on 1st and 2nd December, 2000. | 1:1(1-2) |

4. DEFERRED ITEMS :

| | |
|---|---|
| i) Golden Jubilee Chair in Modern Indian History. | 4:1(1-4) |

5. ACADEMIC MATTERS:

5:1 - STATUTES, ORDINANCES, REGULATIONS & RULES

| | |
|---|---|
| i) Draft revised ordinances on USIC. | 5:1:1(1-4) |

5:2 - SYLLABUS

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|---|---|
| i) Revised M.Sc(Chemistry) syllabus | 5:2:1(1-42) |
| ii) Syllabus for BA/B.Sc(General) in clinical Nutrition and Dietetics Course. | 5:2:2(1-17) |
| iii) Syllabus for P.G.Diploma Course in Applied Statistics and Computer applications. | 5:2:3(1-19) |

5:3 - RESEARCH

| | |
|---|---|
| i) Starting of Ph.D programme in the Centre of Environmental Studies. | 5:3:1(1-2) |

5:8 - OTHERS

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|---|---|
| i) Nomination of three members to the Boards of Under-Graduate studies. | 5:8:1(1) |
| ii) Nomination of three members to the BUGS. | 5:8:2(1) |
| iii) Ph.D Registration of Md Mushahidun-nabi. | 5:8:3(1-5) |
| iv) Implementation of Five Day Week in the University. | 5:8:4(1-3) |

ITEM NO.6 - ADMINISTRATIVE MATTERS:

6:1 - SELECTION COMMITTEE

| | |
|---|---|
| i) Change of effective date in respect of teachers placed in the Senior Scale/Selection Grade/Reader under C.A.S. after 1.1.96. | 6:1:1(1-4) |

6:2 - APPOINTMENT/CREATION OF POSTS/TERMINATION OF SERVICE ETC.

| | |
|---|---|
| i) Re-employment of teachers | 6:2:1(1-3) |

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Item No:1 - Confirmation of the Minutes

i) Confirmation of the minutes of the 64th meeting of the Academic Council held on 1st and 2nd December'2001.

With regard to confirmation of the minutes of the 64th meeting of the Academic Council, the Comments as received from the Director, College Development Council on the above minutes is placed as Annexure-'A'.

The matter is placed before the Council for consideration.

NORTH-EASTERN HILL UNIVERSITY ANNEXURE-'A'
SHILLONG

1:1(2)

No:CDC/A.56/99-2000/1295 February 2, 2001

To

The Chairman,
Academic Council,
NEHU,Permanent Campus,
Umshing, Shillong - 22

Subject :- Corrections of Minutes of AC Resolution:AC: 64:2000:5:7:(iii)(b)&(a).

Sir,

The records of the AC Minutes on the above subject on permanent affiliation is not correctly recorded. The item was placed by the Meghalaya College Principals' Council to amend the Clause No:2 of the Resolugion No.AC:57:98:5:7(iii) as follows :-

" A College may be eligible for Permanent affiliation on completion of ten years after its first affiliation to the University as a Degree College provided there has been uninterrupted affiliation for a period of ten years"

Therefore, the word "Unconditional" after the word "Uninterrupted" should be deleted from the record as the amendment suggested by the Meghalaya College Principals' Council was accepted by the Academic Council.

Item No:5:7(iii)(a): should be recorded as follows -

The Council considered the syllabii on information Technology for the First Semester and desired that the syllabii should be more exhaustive and resolved that the same should be re-examine by the Committee constituted for the purpose by the Vice-Chancellor, NEHU. It was further resolved that Prof.S K Mishra will be co-opted as one of the members in the Committee.

I request you to kindly do the needful for the corrections.

Yours faithfully,
Sd/-
( B K Dev Sarma )
Director
College Development Council.

Item No.4-Deferred Items.

4:1(1)

1)Golden Jubilee Chair in Modern Indian History.

The draft Ordinance on the Golden Jubilee chair for study of Modern Indian History submitted by the committee constituted as per Resolution No.AC:57:98:5:6(iii) adopted at the 57the meeting of the Academic Council was placed in the 64th meeting of the Academic Council wherein, the Council considered the institution of the Golden Jubilee Chair etc. and resolved to defer the matter.

The recommendation is placed as Annexure -'A'.

The matter is placed before the Council for consideration

4:1(2).

Annexure-'A'

NORTH-EASTERN HILL UNIVERSITY
MIZORAM CAMPUS : AIZAWL-796007

Prof R Lalthantluanga
Pro-Vice-Chancellor

Grams : NEHU
Office: 341259
Res:341275/340404
Fax:340313

No:A.19011/19(b)/90/MC(PVC)
Dated 10th November,2000

The Vice-Chancellor
and Chairman,
Academic Council,
NEHU, Shillong.

Sub:- Golden Jubilee Chair in Modern Indian History.

Sir,

I would like to inform you that the 57th meeting of the Academic Council constituted a Committee to frame ordinance on the Chair mentioned above. The meeting of the Committee was held on 5th September,1998 and the draft ordinance prepared by the Committee is submitted herewith for consideration of the Academic Council.

Since Rs.30,00,000/- given for the chair by the Government of India through the Mizoram Government is not sufficient for operation of the chair, the Committee requested the chairman of the Committee to explore the possibility of getting more funds for the purpose. The submission of the draft ordinance was delayed because of this. After contacting the concerned Ministry, Government of India and the State Government of Mizoram, it is unlikely that we will get additional fund for the chair. Hence the draft ordinance is submitted now for the consideration of the Academic Council.

Yours faithfully,

Sd/-

( R Lalthantluanga )
Chair of the Committee.

4.1(3)

~~4:1(2)~~

ON THE GOLDEN JUBILEE CHAIR FOR STUDIES IN MODERN INDIAN HISTORY
(Under-Section 5(23)read with Section 26(1)(q)of NEHU Act 1973).

Short Title 1. The Fund shall be called "The Golden Jubilee Chair for Studies in Modern Indian History"and shall be administered by the North Eastern Hill University (hereinafter to be referred to as the University).

Objective 2. The object of the Chair shall be to carry out research in Modern Indian History with special reference to the culture, society, economy of the East Indian Frontier and mariitime areas (including Mizoram Bangladesh and Andaman & Nicobar Islands)the result of which shall be published by the University in the appropriate form to be devised by the Deans'Committee of the University and the Copyright of which shall vest with the University.

Operation of the Fund 3.(i) A distinguished Professor equivalent to a National Professor in the discipline of Modern Indian History shall be appointed for a period of two years to the Chair which may be extended by one year.

(ii)The Professor so appointed to the Chair shall be designated as 'The Golden Jubilee Professor'

(iii)The Professor so appointed as such shall formulate and complete the Research Project and submit the manuscript of the Research done to the University within the period of 2(two)years from the date of his joining.

(iv)The incumbent shall submit a comprehensive Annual Report on the progress of the Research Project to the Chairman of the Dean's Committee

Fund 4.(i)The Fund of Rs. 30 lakhs(Rupees thirty lakhs) shall be invested in a long term interest yielding securities of the State Bank of India. The balance of interest in a year after meeting the expenses shall be added to the corpus of the Fund.

(ii) The expenditure in connection with the salary and allowance of the incumbent to the Chair shall be met from the interest accrued to the Fund in a particular year.

(iii) The Chair shall carry a contingency grant of Rs.2.0 lakhs (Rupees two lakhs)Only per annum to enable the incumbent to meet the requirement of Research assistant, travel etc as may arise in the course of his work. This grant also shall be met from the interest accrued to the Fund in a particular year.

Emoluments and perquisites of the Professor/ incumbent. 5 (i) The Golden Jubilee Professor shall be paid a salary of Rs.22000-500-24500(Rupees twenty two thousand to Rupees twenty four thousand five hundred per mensom plus the usual allowances as admissible.

( ii) During his stay in the University he shall be entiled to free residential accommodation and local conveyance and the expenses so incurred shall be met out of the General Maintenance Fund of the University.

Contd...P...2/-

Academic Thrust

6. The thrust of the Research Project shall be on Modern Indian History' with special reference to culture, society, economy of the East Indian Frontier and maritime areas (including Mizoram, Bangladesh and Andaman & Nicobar Islands)

Mode of Selection

7(i)The Golden Jublilee Professor shall be selected in the manner as provided in Statute 21 of the NEHU Act,1973.

Maintenance of the Fund

8(i)The Finance Officer of the University shall be responsible for proper maintenance of accounts of the Fund. The accounts of the fund shall be audited every year. The audit fees or any other related expenditure shall be charged to the University.

Item No:5

5:1 - STATUTES, ORDINANCES, REGULATIONS & RULES

i) Draft revised Ordinances on USIC

The Draft Ordinances of USIC was placed in the 64th meeting of the Council, wherein the Council vide its Resolution No:AC:64:2000:5:1(ii) resolved to refer back the same to the Committee for re-drafting it in line with the other Ordinances of the University and deleting Clause 2(iii) and (vii).

The Committee has now submitted the said redrafted Ordinance for the Centre which is placed as Annexure-'A'.

The matter is placed before the Council for consideration.

Annexure-'A'

5:1:1(2)

Dr. Y. S. Jain
Convener
Committee for Ordinances on USIC

May 5, 2001

The Vice Chancellor,
Chairman,
Academic Council,
NEHU, Shillong - 793 022.

Sub.: Draft revised ordinances on USIC.

Sir,

I am enclosing herewith a copy of the draft revised ordinances as desired by the Academic Council. Hoping that these draft ordinances are in order for the consideration of the Academic Council, I request you kindly to place them in its forthcoming meeting for its approval.

Thanking you.

Faithfully yours,

(Y. S. Jain)
Convener.

Encl: as stated.

Copy to: 1. Prof. S.K.Mishra(Department of Economics)-Member.
2. Dr.R.Sharma(Department of Bio-chemistry).Member.
3. Dr.B.K.Tiwari(Centre for Environmental Studies) - Member.

(Y. S. Jain).

OA-14

ON THE UNIVERSITY SCIENCE INSTRUMENTATION CENTRE
Under Section 26(1)(k) of NEHU ACT 1973

Short Title

1. This ordinance may be called University Science Instrumentation Centre(hereinafter referred USIC) Ordinance 2001.

Objectives

2. The objectives of the USIC shall be to strengthen the University in its technological infrastructure through collaborative efforts of its academic community, provide service to University departments/centres/offices and affiliated colleges in repair and maintenance of their instruments, provide and assist analytical services on specialised instruments available in the University.

Status

3. USIC shall be a non-vacational academic department and shall have the requisite functional autonomy for its day-to-day functioning towards achievements of its objectives.

Levels and Functions

4. The levels and functions of USIC shall be according to guidelines of the UGC.

Staff

5. USIC shall have teaching, technical and administrative staff as per the guidelines of UGC.

Head of USIC

6. USIC shall have its Head not below the rank of a Reader with an adequate experience in instrumentation. He will be responsible directly to the Vice-Chancellor and shall report to him. He shall be treated at par with the other Head of the departments. The Head of USIC shall have the following duties:

i. prepare an annual work-plan of the USIC and report it to the advisory committee, and assign work as per the plan to his staff and assess their performance.

ii. organise training and awareness programmes in collaboration with the staff of other departments/centres and maintain proper records as stipulated in the UGC guidelines on USIC and submit annual reports of work done by USIC to the advisory committee and to the UGC.

iii. shall monitor the activities of the technical staff of USIC through their work diaries to be maintained by them.

Streering Committee

7.a). USIC shall have a streering committee with Head of USIC as its chairman. It shall have the following members.

i. All members of USIC in the rank of Professor or its equivalent position

ii. one member in the rank of reader or its equivalent

...2...

iii. one member in the rank of lecturer or its equivalent

iv. one teacher nominated by each Deans of School of Physical Sciences, Life Sciences, and Human and Environmental Sciences, and

v. three external experts preferably from other USICs.

b). Term of the members of the streering committee shall be three years.

c). One third of the total members shall form the quorum in the meetings of the committee.

d). The functions of the streering committee shall be to:

i. formulate and approve the programmes of USIC within the policy frame approved by the advisory committee

ii. review quarterly the progress of work done in USIC, identify difficulties, if any, and make suggestions for their removal,and

iii. discharge any such other functions as may be assigned by the advisory committee

Advisory Committee

8. a). There shall be an advisory committee consisting of Head or his/her nominee from each user department/centre with the Head of the USIC as Convener and the Vice-Chancellor as its Chairman.

b). Where the number of the departments is more than ten, the Vice-Chancellor may nominate members from among the user departments to represent various areas. The committee shall meet twice a year.

c). Term of the members of the advisory committee shall be three years.

d). One third of the total members shall form the quorum in the meetings of the committee.

The advisory committee shall have the following functions:

i. frame policies for providing services in general and advise the Head of USIC on all matters related to its services.

ii. monitor and evaluate the performance of USIC and its staff and suggest follow-up measures.

iii. submit an annual report on the implementation of USIC programmes to the University and the UGC, and

iv. prepare annual budget of USIC and submit to the University body for its approval.

Removal of Difficulties

9. Any difficulty, arising in giving affect to or in interpretation of any or all Provisions of this ordinance, shall be referred to the Vice-Chancellor whose decision thereon shall be final.

5:2- Syllabus

i) Revised M Sc(Chemistry) Syllabus.

The Dean, School of Physical Sciences, NEHU, Shillong vide his letter No:997 of 28th April'2001 has submitted the Revised M Sc (Chemistry) Syllabus duly approved by the School Board of Physical Sciences in its 37th meeting held on 26.4.01.

The syllabus is placed as Annexure-'A'

The matter is placed before the Council for consideration.

# M.Sc. Chemistry
# Revised Syllabus

## DEPARTMENT OF CHEMISTRY

### M.Sc. CHEMISTRY

# COURSE STRUCTURE

| Semester | Course Number | Course Name | Marks |
|---|---|---|---|
| I | CHEM – 411 | Inorganic Chemistry – I | 100 |
| | CHEM – 412 | Organic Chemistry – I | 100 |
| | CHEM – 413 | Physical Chemistry – I | 100 |
| | CHEM – 414 | Quantum Chemistry – I | 60 |
| | CHEM – 415 | Laboratory Course – I (Physical Chemistry) | 100 |
| II | CHEM – 421 | Inorganic Chemistry – II | 100 |
| | CHEM – 422 | Organic Chemistry – II | 100 |
| | CHEM – 423 | Physical Chemistry – II | 100 |
| | CHEM – 424 | Molecular Spectroscopy | 60 |
| | CHEM – 425 | Laboratory Course – II (Organic Chemistry) | 100 |
| III | CHEM – 531 | Inorganic Chemistry – III | 100 |
| | CHEM – 532 | Organic Chemistry – III | 100 |
| | CHEM – 533 | Physical Chemistry – III | 100 |
| | CHEM – 534 | Applications of Spectroscopy | 60 |
| | CHEM – 535 | Laboratory Course – III (Inorganic Chemistry) | 100 |
| IV | CHEM – 541 | Computer Programming in Chemistry | 80 |
| | CHEM – 542 | Environmental Chemistry | 60 |
| | *CHEM – 543(a) | Organometallic Chemistry | 80 |
| | *CHEM – 543(b) | Bioinorganic Chemistry | 80 |
| | *CHEM – 543(c) | Natural Products Chemistry | 80 |
| | *CHEM - 543(d) | Theoretical Organic Chemistry | 80 |
| | *CHEM – 543(e) | Chemical Dynamics | 80 |
| | *CHEM – 543(f) | Liquid state Chemistry | 80 |
| | *CHEM – 543(g) | Solid State Chemistry | 80 |
| | *CHEM - 543(h) | Advanced Spectroscopy in Chemistry | 80 |
| | CHEM – 544(I) | Project Work in Inorganic Chemistry | 120 |
| | CHEM – 544(O) | Project Work in Organic Chemistry | 120 |
| | CHEM – 544(P) | Project Work in Physical Chemistry | 120 |

*Students will choose any two of the Electives Courses offered during the semester, out of which one elective course shall be from the branch of specialisation assigned for the project work.

Courses having 100 marks each will have 45 lectures, 80 marks courses will have 36 lectures and 60 marks courses will have 27 lectures (i.e., each unit in all courses will have 9 lectures)

5:2:1 (4)



## CHEM - 411

## INORGANIC CHEMISTRY - I

Unit - 1 **Symmetry and Structure-** Symmetry elements and operations, equivalent symmetry elements and equivalent atoms, symmetry point groups with examples from inorganic compounds, groups of very high symmetry, molecular disymmetry and optical activity, systematic procedure for symmetry classification of molecules and illustrative examples, molecular symmetry for compounds having co-ordination numbers 2 to 9.

Unit - 2 **Stereochemistry and Bonding-** LCAO - MO theory for diatomic molecules, orbital symmetry and overlap, delocalisation and aromaticity, electronegativity (calculations using Pauling, Mulliken and Allred Rochow methods), group electronegativity and polarity of bonds. Review of VSEPR model and the use of outer d-orbitals.

**Metal ligand equillibria in solution -** Stepwise and overall formation constants, trends in stepwise formation constants, determination of binary formation constant using spectrophotometry, factors affecting the stability of metal complexes and chelate effect.

Unit - 3 **Kinetics and Mechanism of Inorganic reactions -** Labile and inert complexes, mechanisms of ligand-replacement reactions, ligand displacement reactions in octahedral and square planar complexes, the trans-effect, isomerisation and racemisation of tris-chelate complexes, electron transfer reactions, stereochemical nonrigidity and fluxional molecules.

Unit - 4 **Selected Topics** -Synthesis, properties and structures of boranes, carboranes, borazines, silicates and S,N compounds, non-stoichiometric oxides, zeolites and clay, polymorphism of carbon, phosphorus and sulphur and thermal methods of analysis (TGA, DTA and DSC).

Unit - 5 **Bioinorganic chemistry-** Essential and trace elements in biological systems, structure and functions of biological membranes, mechanism of ion transport across membranes, ionophores, valinomycin and crown ether complexes of $Na^+$ and $K^+$, ATP and ADP, Photosynthesis: chlorophyll a, PSI and PSII and biological calcification.

**Text Books**


1. F.A. Cotton, Chemical Applications of Group Theory, Wiley Eastern, 1972.
2. J.E. Huheey, E.A. Keiter and R.L. Keiter, Principles of Structure and Reactivity, 4th Edn., Harper Collins College Publishers, 1993.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern Ltd., 1976.


**Reference Books**


1. D.F. Shrive, P.W. Atkins and C.H. Langford, Inorganic Chemistry, ELBS, 2nd Edn., 1994.
2. R.P. Hanzlik, Inorganic Aspects of Biological and Organic Chemistry, Academic Press, 1976.
3. N.N. Greenwood and A. Earnshw, Chemistry of the Elements, Pergamon Press, 1984.
4. T. Moeller, Inorganic Chemistry, A Modern Approach, John Wiley, 1982.
5. F. Baslo and R.G. Pearson, Mechanism of Inorganic Reactions, Wiley Eastern, 1967.
6. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley, 6th Edition, 1999.

## CHEM - 412

## ORGANIC CHEMISTRY -I

Unit - 1 **Structure and Bonding** - Types of bonds, bonding in organic compounds , bond length and bond angles , inductive and field effects, hydrogen bonding; application of acid base concept, HSAB theory, aromaticity and antiaromaticity, homoaromaticity - Huckel's Rule.

**Organic Reactions** : Reaction rates, transition state theory and parameters influencing reaction rates, nucleophillic substitution at saturated carbon - reaction mechanism, stereochemistry, relative reactivity, synthetic application of nucleophillic substitution involving alcohols, thiols, amines and hydrides, C-C and C-O bond formation. Phase transfer catalysts and crown ethers.

Unit - 2 **Stereochemistry** : Stereo-isomerism in carbon compounds - enantiomerism, nomenclature and structure of stereo-chemical isomers; conformational analysis of acyclic, cyclic, heterocyclic compounds and steroidal systems conformation and reactivity - stereo-specific and stereo-selective reactions; diastereo selective reactions and chiral synthesis.

Unit - 3 **Carbonyl and related group (Part A)** Reactivity of carbonyl group, nucleophillic addition of hetero atoms (N,O,S,Y) ; as hydride donors, as nucleophiles, carbanion additions, as organometallic reagents, addition - elimination, vinylogous or conjugate additions.

Unit- 4 **Carbonyl and related group (Part B):** Substitution by hydrides and organometallic carbanions, 1,4-addition or conjugate addition reactions, acylation of carbonyl carbon, carbonyl cyclization reactions and cleavage of carbonyl compounds. Carboxylic acid derivatives and decarboxylation reactions; other aromatic nucleophillic substitutions, nucleophillic addition and substitution in synthesis; summary of carbonyl reactions.

Unit - 5 **Elimination Reactions:** Introduction to elimination reactions (concept in terms of Frontier Orbital Interactions) : formation of alkenes by elimination with proton loss and by other elimination reactions; formation of other double bonds (C=N, C=O) and triple bonds by elimination reactions.

Electrophillic addition to multiple bonds : direction and stereochemistry of addition, alkyl halides from addition, hydration of alcohols and related compounds. Other *trans* addition, *cis* additions and addition-elimination reactions in organic synthesis; synthesis of aromatic compounds.

**Text Books**

1. S.H. Pine, Organic Chemistry, 5th Edn., Mc Graw Hill Book Co.,1987.
2. J. March, Organic Chemistry, Structure, Reactions and Mechanisms, 4th Edn., John Wiley, 1992.
3. P.S. Kalsi, Stereochemistry, Conformation and Mechanism, 3rd Edn., John Wiley, 1995.

**Reference Books**

1. F.A. Carey and R.J. Sandburg, Advanced Organic Chemistry, Part A and B, 3rd Edn, 1990.
2. Wamser and Harris, Fundamentals of Organic Reaction Mechanism, John Wiley, 1990.

5;2:1(6)



## CHEM - 413

## PHYSICAL CHEMISTRY-I

**Unit -1 Chemical Thermodynamics**

Brief resume of : concepts of laws of thermodynamics, free energy, chemical potential and entropies; Gibbs - Helmholtz equation; Real gas - definition of fugacity, standard state of real gases, the relation between fugacity and pressure; Solutions - partial molar quantities, partial molar volume and its determination, thermodynamics of mixing, chemical potentials of liquids, liquid mixtures: Activities - solvent activity, solute activity, determination of activity and activity coefficients.

**Unit -2 Non -equilibrium Thermodynamics**

Entropy of irreversible processes - Clausius inequality, entropy production and entropy flow: Entropy production due to - heat flow, chemical reactions, electrochemical reactions; Entropy production in open system; Rate of entropy production - Generalized forces and fluxes, transformation of the generalized forces and fluxes; Phenomenological equations , Onsager's reciprocity relation ; Electro kinetic phenomena; Stationary non -equilibrium states - states of minimum entropy production.

**Unit - 3 Surface Phenomena**

Surface tension and surface free energy, bubbles and drops, Laplace equation and Kelvin equation; adsorption on solids -Gibbs adsorption isotherm, derivation of BET equation, estimation of surface area of adsorbent: catalytic activity at surfaces.

**Unit - 4 Micelles**

Surface active agents; classification of surface active agents; micellization - hydrophobic interactions; critical micellar concentration (CMC), factors affecting the CMC of surfactants; thermodynamics of micelle formation - phase separation and mass action models; solubilization; reverse micelles; Emulsion - formation of emulsions, factors determining emulsion stability; microemulsion.

**Unit - 5 Electromagnetic radiation and its interaction with matter**

Absorption and emission of radiation, Einstein coefficients, transition probability, selection rules, intensity of spectral lines, oscillator strength, natural line width and line broadening, Removal of line broadening.

**Text books**

1. P.W. Atkins, Physical Chemistry VI$^{th}$ Ed., Oxford Univ. Press, 1998.
2. G.K. Vemulapalli, Physical Chemistry, Prentice - Hall, India, 1993.
3 M.J. Rosen, Surfactants and Interfacial Phenomena, John Wiley, 1978.
3. J.M. Hollas, Modern Spectroscopy, John Wiley, 1990.
4. A. Katchalsky and P.F. Curban, Nonequilibrum Thermodynamics in Biophysics, Harvard Univ. Press. 1965.

**Reference Books**

1. I. Prigogine, Introduction to Thermodynamics of Irreversible Processes, Interscience Publishers, 1960.
2. R. Haase, Thermodynamics of Irreversible Processes, Addison-Wesley Pub., 1969.
3. Y. Moroi, Micelles : Theoretical and Applied Aspects, Plenum, 1992.

## CHEM - 414

## QUANTUM CHEMISTRY

**Unit - 1** **General Principle of Quantum Mechanics** - Concept of linear operators, commutations of operators, postulates of quantum mechanics (related theorems).

**Solutions of Schrödinger wave equation for system with constant potential energies and system without constant potential energies**: Applications of particle in a box model (one dimensional) to linear conjugated system., Potential energy barriers (one dimensional) and tunnel effect, one dimensional harmonic oscillator, spherical harmonics, Rigid rotator, Hydrogen atom.

**Unit - 2** **Approximate methods** - General perturbation theory for non-degenerate state ( time independent); Variation theorem , example of helium atom; SCF model, Hartree-Fock method for atoms.

**Theory of angular momentum** - Angular momentum vectors, commutation relations; shift operators; Eigen functions and eigen values of angular momentum; spin - orbit coupling; atomic term symbols.

**Unit - 3** **Theory of Chemical Bonding and Molecular structure** - Born Oppenheimer approximation, Valence bond (VB) and Molecular Orbital (MO) theories for diatomic molecules - Hydrogen molecule ion ($H_2^+$), Hydrogen molecule; resonance, symmetry and nature of bonding, excited states of $H_2$ - singlet and triplet; Non-crossing rule and correlation diagram (both homonuclear and heteronuclear diatomics), isoelectronic principle, comparison of MO and VB methods. Configuration interaction, principal types of s-p hybridisation.

### Text Books

1. A.K. Chandra , Introductory Quantum Chemistry, 4th Edition, Tata Mc Graw Hill, 1997.
2. D.A. McQuarrie , Quantum Chemistry, Oxford University Press,1983.
3. I. Levine, Quantum Chemisty, Tata Mc Graw Hill,1994.

### Reference Books

1. R. McWeeny, Coulson's Valence, ELBS, 1979.
2. J.N. Murrell, S.F.A. Kettle, J..M. Tedder, Valence Theory, ELBS, 1977.

## CHEM - 415

## LABORATORY COURSE IN PHYSICAL CHEMISTRY

1. Determination of the effect of change of (i) temperature (ii) concentration of reactants (iii) catalyst and (iv) ionic strength of the media on the velocity constant of hydrolysis of an ester.
2. Determination of the velocity constant of hydrolysis of an ester in micellar media.
3. To study the reaction between acetone and iodine in the presence of an acid.
4. Determination of the rate constant for the oxidation of iodide ions by hydrogen peroxide, studying the kinetics of iodine - clock reaction.
5. Oscillatory reaction (oxidation of malonic acid by acid bromate, catalysed by ceric ions).
6. Determination of equilibrium constant of the reaction

$$KI + I_2 \rightleftharpoons KI_3$$

7. To construct the phase diagram for a three component system (e.g., Chloroform-acetic acid-water).
8. Determination of partial molar volume of a solute in solution.
9. Determination of molecular weight and activity of a non-volatile non-electrolyte by cryoscopy.
10. Determination of glass transition temperature of a given salt (e.g., $Ca(NO_3)_2.4H_2O$), conductometrically.
11. Determination of the order of reaction, velocity constant and energy of activation for saponification of an ester by sodium hydroxide, conductometrically.
12. Determination of strength of strong and weak acids in a given mixture, conductometrically.
13. Determination of the degree of dissociation and equilibrium constant of weak electrolytes in different solvents and in their mixtures (e.g., DMSO, DMF, dioxane, acetone, water), conductometrically, and to test the validity of Debye-Huckel-Onsager's theory.
14. Determination of solubility and solubility product of sparingly soluble salts (e.g., $PbSO_4$, $BaSO_4$), conductometrically.
15. Determination of strengths of halides in a mixture, potentiometrically.
16. Determination of temperatue dependence of EMF of a cell (e.g., a galvanic cell) and hence calculation of $\Delta G$, $\Delta H$ and $\Delta S$ for the cell reaction.
17. Determination of the stoichiometry and formation constant of silver - ammonia complex, potentiometrically.
18. Determination of specific rotation of sucrose, and rate constant of its hydrolysis, using a polarimeter.
19. Determination of the $pK_a$ of an indicator (e.g., methyl red), spectrophotometrically.
20. Determination of the $pK_a$ of an indicator (e.g., methyl red) in (i) micellar and (ii) microemulsion media, spectrophotometrically.
21. Determination of stoichiometry , oscillator strength and stability constant of an inorganic (e.g., Ferric sulphate-Salicylic acid) and an organic (amine-iodine) complex.
22. Determination of oxidation, reduction and half-wave potentials by Voltammetry

**Text Books**

1. Findlay's Practical Physical Chemistry, 9th Ed., Revised by B.P. Levitt, Longman, 1973.
2. J.C. Ghosh, Experiments in Physical Chemistry, Bharati Bhavan, Patna , 1974.
3. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., New Delhi, 1980.

**Reference Books**

1. D.P. Shoemaker, C.W. Garland and J.W. Niber, Experiments in Physical Chemistry, Mc Graw Hill Interscience, 1996.

5:2:1(11)

CHEM - 421

## INORGANIC CHEMISTRY - II

**Unit -1** **Magnetic Properties and Electronic Structure of Transition Metal Complexes** - Brief review of different types of magnetic behaviours, spin-orbit coupling, quenching of orbital angular momenta, temperature independent paramagnetism, measurement of magnetic susceptibility using the Gouy and the Faraday methods. Term symbols for metal ions, Crystal field theory and its application to explain magnetic properties of coordination compounds, spin cross - over. Structural effects : ionic radii and Jahn -Teller effect; Thermodynamic effects : hydration and lattice enegry, octahedral vs. tetrahedral coordination.

**Unit - 2** **Electronic Structure of Transition Metal Complexes** - Electronic absorption spectra of octahedral and tetrahedral complexes, Orgel diagrams, Tanabe-Sugano diagrams, calculation of Dq, B and ß values, selection rules, band intensities and band widths, spectra of high-spin octahedral and tetrahedral complexes for $d^1$ to $d^9$ systems, Spectrochemical series.
Adjusted crystal field theory, Nephelauxetic series, molecular orbital theory of complexes (qualitative principles involved in complexes with no $\pi$-bonding and with $\pi$-bonding), M.O. diagrams for octahedral and tetrahedral complexes and charge-transfer spectra.

**Unit - 3** **Aspects of Transition Elements, Lanthanides and Actinides** - Elements of first transition series and their comparison with the second and third series, general periodic trends, chemistry of the various oxidation states of first row transition metals and their comparison based on electronic configuration.
The splitting of f-orbitals in octrahedral field; lanthanide contraction; lanthanide shift reagent; oxidation states, complexes, magnetic and optical properties of lanthanides and actinides.

**Unit - 4** **Transition Metal $\pi$-acid Complexes** Structure, bonding, synthesis and reactivity of complexes with CO,NO, $O_2$ and tertiary phosphine and arsine ligands; metal carbonyl hydrides and metal carbonyl clusters : LNCC and HNCC, Wade's rule and the capping rule.

**Unit - 5** **Aspects of Bioinorganic Chemistry :** Iron - Sulphur proteins : Rubredoxin and Ferredoxins; Metalloporphyrins; Heme proteins :Hemoglobin, Myoglobin and Cytochrome c; None-heme proteins : Hemerythrin, Ferritin and Hemocyanin; Nitrogen fixation and nitrogenases.

**Text Books**


1. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern Ltd. Third Edition, 1976.
2. J.E. Huheey, E.A. Keiter and R.L. Keiter, Principles of Structure and Reactivity, Harper Collins College Publishers, 4th Edition, 1993.
3. R.L. Dutta and A. Syamal, Elements of Magneto Chemistry, Affiliated East-West Press, 2nd Edition.

**Reference Books**

1. A. Earnshaw, Introduction of Magnetochemistry, Academic Press, New York, 1968.
2. T. Moeller, Inorganic Chemistry - A Modern Approach, John Wiley, 1982.
3. M.N. Hughes, The Inorganic Chemistry of Biological Processes, Wiley, 1981.
4. E.I. Ochiai, Bioinorganic Chemistry; - An Introduction, Allyn & Bacon Inc., 1977.
5. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley, 6th edition, 1999.

5:2:1(13)

## CHEM - 422

## ORGANIC CHEMISTRY - II

**Unit-1 Reductive Reactions**

(a) Catalytic hydrogenation- Scope and mechanisms for heterogeneous catalytic hydrogenation of olefins and other functional groups; reduction selectivity; catalyst poisoning and desulfurisation; homogeneous catalytic hydrogenation with Wilkinson's catalyst; olefin double-bond isomerisation.

(b) Dissolving metal reductions : Scope and basic mechanisms; liquid ammonia reduction with alkali metals; Birch reduction of arene systems; Clemmenson reduction of ketones; the acyloin condensation and related reactions.

(c) Metal hydride and related reductions : Scope, stereochemistry and mechanism of metal hydride reductions of carbonyl compounds; reduction of other functional groups; Meerwein-Pondorf-Verley reduction; hydroboration and synthetic utility of alkyl boranes; use of tributyl tin hydride with coupling reactions.

(d)Reduction with hydrazine and derivatives: The Wolff-Kishner reduction of ketones; reductions with tosylhydrazine, diimide, semicarbazide; use of hydrazine with other reducing agents.

**Unit -2 Oxidation Reactions**

(a) Oxidation with chromium and manganese compounds : Mechanisms and stoichiometry for oxidation of alcohols and aldehydes with Cr (VI) and Mn(VII) oxidants; oxidation of C=C double-bonds and carbon-hydrogen bonds; use of pyridinium chlorochromate (PCC).

(b) Oxidation with peracids and peroxides : Peracid epoxidation of C=C double bonds; use of metal/alkyl hydroperoxides; Sharpless assymmetric epoxidation; the Baeyer-Villiger oxidation.

(c) Oher methods of oxidation : Prevost and Woodward hydroxylation of alkenes; oxidative cleavage of C-C single and double bonds; use of $OsO_4$ periodate, $Pb(OAc)_4$, mercuric acetate, $SeO_2$ and singlet molecular oxygen for various organic oxidations.

**Unit- 3 Reactive Intermediates (Charged Species)**

(a) Carbocations : Generation, structure and stability of carbocations; structures of simple alkyl cations in gas and solvent phase; reactivity and fate of alkyl and acyl carbocations; classical and nonclassical carbocations; neighbouring group participation; carbocation rearrangements including Wagner-Meerwein, dienone-phenol, Fries rearrangement and Bradsher cyclodehydration (PPA cyclisation).

(b) Carbanions and organometallics : Generation, structure and stability of carbanions; carbon

acids; reactivity and fate of carbanions in the context of organometallic chemistry; use of organolithium, organocopper and organosilicon reagents for sysnthesis; Favorskii rearrangement, carbon nucleophiles.

**Unit-4 Reactive Intermediates (Neutral Species)**

(a) Arynes (Benzynes) - Generation, structure and stability of arynes; the benzyne mechanism; direction of aryne bond formation and of nucleophilic addition; Addition and rearrangement reactions of arynes; trapping of benzynes.

(b) Free radicals : Generation, structure, stability and fate of organic free radicals; radical coupling, abstraction and chain reactions; addition to multiple bonds; aromatic substitution by radicals; allylic C-H bond bromination by NBS; mechanisms of some well-known organic radical reactions.

(c) Carbenes : Generation, structure and stability of carbenes; singlet and triplet states; cyclopropanation; carbene insertion to C-H bonds; rearrangement to olefins; Wolff rearrangement of acyl carbenes and its synthetic applications.

(d) Nitrenes : Generation, structure and stability of nitrenes; C-H bond insertions and aziridine formation; rearrangement of acyl nitrenes (Hoffmann, Curtius and Schmidt rearrangements) with their applications in organic synthesis .

**Unit - 5 Photochemistry and Pericyclic Reactions**

(a) Organic Photochemistry : Physical and chemical processes in photochemically excited organic molecules; Jablonski diagram; uses of photosensitisation; photochemistry of olefins and carbonyl compounds; photooxygenation; Paterno-Buchi reaction; Barton's reaction; Di-π-methane rearrangement; Photocleavages.

(b) Pericyclic reactions : Main features of pericyclic reactions; orbital symmetry conservation and application of the Woodward-Hoffman rules; application of the correlation diagram method; [4+2] and [2+2] cycloadditions ($h\nu$ and $\Delta$); Electrocyclic reactions for 4n and [4n +2] π-electron systems ( under $h\nu$ and $\Delta$); stereochemical definitions; sigmatropic [*i,j*] bond shifts for C-H and C-C bonds; Fischer indole synthesis and examples of the Somelett - Hauser, the Claisen and the Cope rearrangements (degenerate cases and valence tautomerism)

**Text Books**

1. H.O. House, Modern Synthetic Reactions, W.A. Benjamin, 1972.

**Reference Books**

1. Jerry March, Advanced Organic Chemistry -Synthesis and Reactions, McGraw-Hill, 1984.
2. T.L.Gilchrist and C.W. Rees, Carbenes, Nitrenes and Arynes, Nelson, London, 1969.
3. C.Depuy and O.L. Chapman, Molecular Reactions and Photochemistry, Prentice -Hall of India, 1975.

5:2:1(15)



4. R.B. Woodward and R. Hoffmann, Conservation of Orbital Symmetry, Verlag-Chemie, Academic Press, 1970.
5. I. Fleming, Frontier Orbital Theory and Organic Chemical Reactions, John Wiley and Sons, 1976.

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CHEM - 423

# PHYSICAL CHEMISTRY II

**Unit -1 Electrochemistry - I**

(a) Ion-Ion Interactions - Debye Hückel Theory of ion-ion interactions, Poisson's equation, linearized Poisson-Boltzmann equation, ionic cloud and the chemical potential change arising from ion-ion interactions, activity coefficients and ion-ion interactions, mean ionic activity coefficients,expression for mean ionic activity coefficient in terms of ionic strength.

(b) Ion-Solvent interactions - free energy change arising from ion-solvent interactions, Born model - Born expression for the free energy of ion-solvent interactions, enthalpy and entropy of ion-solvent interactions, experimental evaluation of heats of interaction of salt and solvent.

**Unit - 2 Electrochemistry - II**

Electrodics : Processes at electrodes - The electrical double layer–Gouy-Chapman, Helmholtz and Stern models ; Rate of charge transfer ; Butler -Volmer equation; overpotential; polarization - concentration polarization; fuel cells ; corrosion - the rate of corrosion, corrosion current, inhibition of corrosion.

**Unit -3 Electrochemistry - III**

Voltammetry and Polarography - Ilkovic equation, diffusion limit of current, charging current, migration current, current maxima, half wave potential; cyclic voltammetry; ion-selective electrodes .

**Unit - 4 Solid State Chemistry-I**

a) Solid State reactions - General principles, experimental procedures, co-precipitation, kinetics of solid state reactions–Wagner reaction mechanism.

b) Crystal Defects - Perfect and imperfect crystals, Thermodynamics of defect formation, types of defects–point defects, line defects and plane defects; Schottky and Frenkel defects; thermodynamics of Schottky and Frenkel defect formation.

c) Solid solutions- requirements for solid solutions; substitution and interstitial solid solutions.

**Unit -5 Solid State Chemistry-II**

a) Metals, insulators and semiconductors; electronic structure of solids -band theory; band structure of metals, insulators and semiconductors; intrinsic and extrinsic semiconductors, p-n junction.

b) Superconductors-Meissner effect, BCS theory

c) Electrically conducting organic solids: Organic charge-transfer complexes, organic metals.

**Text books**

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electrochemistry, Vol. 1 and 2, Plenum, 1970.
2. P.W. Atkins, Physical Chemistry, VIth Ed., Oxford Univ. Press , 1998.
3. N.B. Hanney, Solid State Chemistry, -Prentice Hall, India , 1967.
4. A.R. West, Solid State Chemistry and its Applications, John Wiley ,1987.
5. T.V. Ramakrishnan and C.N.R. Rao, Superconductivity Today (An Elementary Introduction), Wiley Eastern, New Delhi, 1992.

**Reference Books**

1. A.J. Bard, Electrochemical Methods, John Wiley, 1980.

## CHEM- 424

## MOLECULAR SPECTROSCOPY

**Unit -1 Rotational and Vibrational Spectroscopy**

(a) Microwave Spectroscopy

Classification of molecules; rigid rotor model - rotational energy levels for diatomic molecules, effect of isotopic substitution on the transition frequencies, intensity of spectral lines, centrifugal distortion, Stark effect.

(b) Vibrational Spectroscopy

Review of : Linear harmonic oscillator, vibrational energies of diatomic molecules, zero point energy, force constant, anharmonicity; Morse potential energy diagram; vibrational - rotational spectroscopy, P,Q,R branches, normal modes of vibration, group frequencies, overtones, hot bands, combination of bands, Fermi resonance.

(c) Raman Spectroscopy

Theories of Raman scattering, Raman spectra - rotational, vibrational and vibrational-rotational spectra.

**Unit -2 Electronic Spectroscopy**

(a) Electronic Spectroscopy : Molecular spectroscopy - energy levels, vibronic transitions, spectral transitions, spectra of transition metal complexes; charge - transfer spectra.

(b) Photo electron spectroscopy : Basic principles ; photo electric effect, ionization processes, Koopman's theorem, photoelectron spectra of simple molecules, ESCA; Auger electron spectroscopy.

c) Lasers : Laser action - population inversion, properties of laser radiation, He-Ne laser; chemical lasers.

**Unit -3 Magnetic Resonance Spectroscopy**

( a) Nuclear Magnetic Resonance : Nuclear spin and nuclear spin resonance; relaxation; resonance, line shape and saturation; shielding and deshielding of magnetic nuclei, chemical shift; spin-spin interactions; ABX classification; NMR studies using $^{13}C$, $^{19}F$, $^{31}P$ FT NMR.

(b) Electron Spin Resonance: Basic principles, zero field spilitting, Karmer's degeneracy, factors affecting g values, isotropic and anisotropic hyperfine coupling constants, spin densities and McConnel relationship.

**Text Books**

1. J.M. Hollas, Modern Spectroscopy, John Wiley, 1996.
2. M. Chanda, Atomic Structure and Chemical Bond Including Molecular Spectroscopy, IIIrd Ed., Tata McGraw Hill, 1991.
3. A. Carrington and A.D. Maclachlan, Introduction to Magnetic Resonance, Harper and Row, 1969.
4. P.W. Atkins, Physical Chemistry, 6th Ed., Oxford Univ. Press, 1998.

**Reference Books**

1. R. Chang, Basic Principles of Spectroscopy, Mc Graw Hill, Kaga Kusha New Delhi, 1971.
2. G.M. Barrow, Molecular Spectroscopy, McGraw Hill, Tokyo, 1985.

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## CHEM -425

## LABORATORY COURSE II

## ( ORGANIC CHEMISTRY)

1. Separation techniques of organic compounds and their spectroscopic identifications.

2. Organic preparations : at least eight preparations (involving two or more than two steps) involving the following representative reactions:)

   a. Esterification and saponification
   b. Oxidation (peracid, chromic acid, Mn(VII))
   c. Hydride reduction of hydrogenation
   d. Nucleophilic substitution
   e. Cycloaddition reaction
   f. Grignard reaction
   g. Condensation reaction
   h. Preparation of dyes
   i. Aromatic electrophilic substitution
   J. Heterocyclic synthesis

3. Extraction of Natural products : any one (solasodine, caffeine, nicotine, piperine, rosine, carotenoids)

4. Experiment involving the separation and purificaiton of organic compounds from a mixture, using chromatographic techniques, steam distillation, fractional crystallization and sublimation.

**Text Books**

1. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley-Eastern Ltd.,3rd Edn., 1994.
2. R.G. Brewster and W.E. Mcwedn, Unitized Experimental Organic Chemistry, East-West Press, 4th Edn.,1977.
3. A.I. Vogel, Practical Organic Chemistry, Longman Group Ltd., 3rd Edn., 1973.

**Reference Books**

1. A.O. Fitton and R.K. Smallery, Practical Heterocyclic Chemistry.
2. R.L. Shriner, Reynold C. Fuson, Systematic Identification of Organic Compounds, John Wiley & Sons Inc., 5th Edn., 1964.

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## CHEM - 531

## INORGANIC CHEMISTRY - III

**Unit - 1** **Organometallic Chemistry** - Synthesis, structure, bonding and reactivity of transition metal complexes with olefins, cyclopentadienyl, cyclopentadienide, benzenoid, π-allyl and enyl systems.

**Unit - 2** **Homogeneous Catalysis** - Coordinative unsaturation, oxidative addition reactions, insertion reactions, reactions of cooordinated ligand and activation of small molecules by complexation, catalytic reactions of alkenes (isomerization, hydrogenation, hydroformylation, hydrosilylation and polymerization).

**Unit -3** **Photochemistry of Metal Complexes and Metal-Metal Multiple Bonds**- Excited states: ligand field states, charge-transfer states and Thexi states. Photochemical reactions : substitution and redox reactions of Cr(III), Ru(II) and Ru(III) complexes. Applications : synthesis and catalysis, chemical actinometry and photochromism. Metal-metal multiple bonds : major structural types, quadrupole bonds and one dimensional solids.

**Unit -4** **Applications of Group Theory** - Brief review of matrix representation of groups, reducible and irreducible representation, the "Great Orthogonality Theorem" and its consequences, and Character table. Applications : Transformation properties of atomic orbitals, hybridization schemes for σ- and π- bonding and hybrid orbitals as L.C.A.O.

**Unit -5** **Nuclear and Radiochemistry**

Brief review of different modes of radioactive decay, highlights of nuclear reactions : energetics, Q-value, cross-sections, types of nuclear reactions, nuclear fission and fusion; Radioactive techniques : Tracer techniques and Neutron Activation analysis.

**Text Books**


1. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, Third Edition, 1976.
2. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John-Wiley, Fifth Edition, 1988.
3. F.A. Cotton, Chemical Applications of Group Theory, Wiley Eastern 2nd Edition, 1972.
4. G. Friedlander, J.W. Kennedy and J.M. Miller, Nuclear and Radiochemistry, Wiley International, Second Edition, 1964.
5. H.J. Arnikar, Essentials of Nuclear Chemistry, Wiley Eastern, 4th Edition, 1995.


**Reference Books**


1. C.Cutal and A .W. Adamgon, Comprehensive Coordination Chemistry, Vol. 1 Editor In -Chief G. Wilkinson, 1985.
2. A. Yamamoto, Organo Transition Metal Chemistry, Wiley, 1986.
3. R.H. Crabtree, The Organometallic Chemistry of Transition Metals, John Wiley, Second Edition, 1994.
4. G. Friedlander, J.W. Fenndy, E.S. Macias and J.M. Miller, Nuclear and Radio Chemistry, John Wiley, Third Edition, 1981.

5:2:1(22)

CHEM-532

## ORGANIC CHEMISTRY - III

**Unit -1 Three and Four Membered Heterocycles**

(a) Three membered heterocycles - Ring strain and reactivity; synthetic methods for epoxides, aziridines and thiiranes; nucleophilic and electrophilic ring-openings; heteroatom extrusion and rearrangements.

(b) Four-membered heterocycles - Synthesis of oxetanes, azetidines, thietanes, ß-lactones and ß-lactams; ring openings (nucleophilic and electrophilic); total synthesis of ß-lactam antibiotics (penicillins).

**Unit -2 Five-Membered Heterocycles**

(a) Five membered heterocycles (1 heteroatom) - Synthetic methods for furans, pyrroles and thiophenes (general and specific); Effect of structure on reactivity; nucleophilic, radical and electrophilic substitutions; addition reactions; structure and function of some metalloporphyrins in nature.

(b) Five membered heterocycles (2 heteroatoms) - Synthesis of 1,2-azoles and 1,3-azoles; nucleophilic and electrophilic substitutions; structure and function of thiamine (Vitamin $B_1$)

**Unit-3 Condensed Five Membered Rings and Pyridines**

(a) Condensed five membered heterocycles - Synthesis of indoles with benzofuran and benzothiophenes, reactions analogous to unit 2(a) above; total synthesis of reserpine and lysergic acid diethylamide (LSD).

(b) Pyridine heterocycles - Hantzsch synthesis and variations; nucleophilic and electrophilic substitutions; synthesis and function of nicotine, pyridoxal and derivatives.

**Unit -4 Quinoline, Isoquinoline and Diazines**

(a) Quinoline and isoquinoline - Synthetic methods; nucleophilic and electrophilic substitutions; structure of quinoline, isoquinoline and hydrophenanthrene alkaloids

(b) Diazines - Synthesis of pyridazines, pyrimidines, pyrazines, s-triazine and their fused-ring analogues, electrophilic and nucleophilic substitutions.

**Unit 5 Nucleic Acids and Proteins**

(a) Nucleic acid chemistry - Structure of nucleic acid bases with nucleosides and nucleotides; structures and functions of DNA, mRNA, rRNA and tRNA; DNA replication, mutagenesis, structure and function of ATP, NADP and NADH.

(b) Chemistry of proteins - Structure and properties of essential amino acids; Merrifield

polypetide synthesis; Nomenclature and sequencing of polypeptides; helical and pleated structure of proteins; protein denaturation; brief account of protein biosynthesis; transcription and translation; codons, anticodons and the genetic code; the genetic dogma.

**Text Books**

1. L.A. Paquette, Modern Heterocyclic Chemistry, W.A. Benjamic Inc., 1968.
2. I.L. Finar, Organic Chemistry, Vol II, ELBS ,1986.
3. A.L.Lehninger, Biochemistry, Kalyani Publishers ,1983.

**Reference Books**

1. A.R. Katritzky and C.W. Rees, "Comprehensive Heterocyclic Chemistry, Vols.1-7, Pergamon Press, 1984.
2. T.L. Gilchrist, Heterocyclic Chemistry, Longman, 1989.

## CHEM-533
## PHYSICAL CHEMISTRY-III

**Unit 1** **Chemical Dynamics-I**

Methods of determining rate laws; collision theory of reaction rates; steric factor; activated complex theory; Arrhenius equation and activated complex theory; ionic reactions - kinetic salt effects; steady state kinetics; kinetic control of reactions.

**Unit-2** **Chemical Dynamics-II**

Dynamics of chain reactions (hydrogen-bromine reaction; pyrolysis of acetaldehyde, decomposition of ethane); photochemical reactions (hydrogen-bromine and hydrogen - chlorine reactions); oscillatory reactions (Belousov-Zhabotinsky reaction); homogeneous catalysis; kinetics of enzyme reactions; general features of fast reactions; study of fast reactions by flow methods, relaxation method, flash photolysis and the nuclear magnetic resonance method.

**Unit-3** **Statistical Thermodynamics I**

(a) Ensembles-Postulates of ensemble averaging; canonical ensemble; grand canonical ensemble; micro canonical ensemble and their thermodynamics.
(b) Partition Functions- General relations for independent, distinguishable and indistinguishable molecules (Boltzmann statistics); translational partition function using particle in a box model for ideal gases; rotational partition function using rigid-rotator model for ideal diatomic molecules; rotational partition function for linear and non-linear molecules.

**Unit-4** **Statistical Thermodynamics-II**

(a) Vibrational partition function for ideal diatomic gases using harmonic oscillator model; electronic partition function.

(b) Chemical equilibria in ideal gases-reference state of zero energy for calculation of partition function of a system; expression for equilibrium constant in terms of partition functions; applications to some chemical equilibria.

(c) Equation of state for ideal gases; heat capacity behaviour of crystals (Einstein's model); ideal lattice gas (Langmuir adsorption isotherm); theory of absolute reaction rates.

**Unit-5** **Statistical Thermodynamics-III**

(a) Fermi-Dirac statistics; ideal Fermi-Dirac gas (electrons in metals).

(b) Bose-Einstein statistics; ideal Bose-Einstein gas (helium)

(c) Statistical mechanics of imperfect gases-derivation of the virial equation of state of one component gas, significance of virial coefficients - evaluation of second virial coefficient.

5:2:1(25)

**Text Books**


1. P.W. Atkins, Physical Chemistry VI$^{th}$ Ed., Oxford Univ. Press,1998.
2. G.L. Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1998.
3. K.L. Kapoor, A Text book of Physical Chemistry, Vol. 1, Macmillan,1998.
4. T.L. Hill, An Introduction to Statistical Thermodynamics, Dover Publications, 1986.
5. M.C. Gupta, Statistical Thermodynamics, Wiley Eastern,1990.


**Reference Books**


1. J.Rajaram and J.C. Kuriacose, Kinetics and Mechanisms of Chemical Transformations, Macmillan, 1998.
2. L.K. Nash, Elements of Classical and Stastical Thermodynamics, Addison-Wesley, 1970.
3. A. Maczek, Statistiel thermodynamics, Oxford Univ. Press, 1998.

CHEM-534

## APPLICATIONS OF SPECTROSCOPY

**Part A Applications to Organic Chemistry**

**Unit -1 a) Ultraviolet and Visible Spectroscopy**

Ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Woodward rule for conjugated dienes and carbonyl compounds, aromatic heterocyclic compounds, steric effect in biphenyl.

**b) Infrared Spectroscopy**

Characteristic vibrational frequencies of alkanes, alkenes , alkynes, aromatic compounds, alcohols, ethers, phenols, amines; detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amide, acid anhydride, lactone, lactam, conjugated carbonyl compounds); effect of H-bonding and solvent effect on vibrational frequencies; extension of these studies to various organic molecules for structural assignments.

**Unit - 2 Nuclear Magnetic Resonance Spectroscopy**

General introduction and definition, chemical shift, spin-spin interaction, shielding mechanism, mechanism of measurement, chemical exchange, approx. chemical shift values and correlation to protons bonded to carbon (aliphatic, olefinic , aldehydic and aromatic); proton bonded to other nuclei (alcohols, phenols, enols, carboxylic acids, amines, amides, SH); chemical exchange, effect of deuteration; complex spin-spin interaction between two, three, four and five interacting nuclei (first order spectra); complex interaction, virtual coupling, stereochemistry, hindered rotation, Karplus curve, variation of coupling constant with dihedral angle, nuclear magnetic double resonance, simplification of complex spectra using shift reagents, spin tickling, fourier transform technique, nuclear overhauser effect (NOE); resonance of other nuclei.

**Unit - 3 a) Carbon-13 NMR Spectroscopy**

Chemical shift (aliphatic, olefinic, alkynes, aromatic, heteroaromatic, carbonyl carbon); $^{13}C$ coupling constants, two dimensional NMR spectroscopy, NOESY, DEPT, INEPT terminology.

**b) Mass spectrometry**

Mass spectral fragmentation of organic compounds, common functional groups; molecular ion peak, Mclafferty rearrangement, examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

**Text Books**

1. R.M. Silverstein, G.C.Bassler and T.C. Morill, Spectroscopic Identification of Organic Compounds, John Wiley.

**Reference Books**

1. D. Williams and I.Fleming, Spectroscopic Methods in Organic Chemistry, McGraw Hill.

**Part B - Applications to Inorganic and Coordination Compounds**

**Unit -1** **Infrared and Raman Spectroscopy** - Structural studies (involving IR and Raman spectroscopy) of coordination compounds containing the following molecules/ions and ligands: $NH_3$, $H_2O$, $OH^-$, $SO_4^{2-}$, $CN^-$, $SCN^-$, NO, $O_2$, $PR_3$ and halides.

**Mössbauer Spectroscopy** : Principle, Isomer shift, quadrupole effect, effect of magnetic field, applications to iron and tin compounds.

**Unit -2** **Magnetic Resonance Spectroscopy** -Electron spin resonance spectroscopy : ESR of $d^1$ and $d^9$ transition metal ions in cubic and tetragonal ligand fields, evaluation of g values and metal hyperfine coupling constants. Nuclear magnetic resonance spectroscopy : Applications of $^{31}P$ and $^{19}F$ NMR spectroscopy in the structural assesment of inorganic compounds.

**Text Books**

1. K. Nakamato, Infrared and Raman Spectra of Inorganic and Coordination Compounds, 4th Ed., John Wiley , 1986.
2. R.V. Parish, NMR, NQR,EPR and Mossbauer spectroscopy in Inorganic Chemistry, Ellis Horwood, New York, 1990.

**Reference Books**

1. R.S. Drago, Physical Methods in Chemistry, Saunders College Publishers, 1977.
2. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hills , New Delhi, 1975.

## CHEM - 535

## LABORATORY COURSE III
## (Inorganic Chemistry)

I **Quantitative estimation** involving volumetric (redox and complexometry), gravimetric and spectrophotometric methods of constituents in three component mixtures and alloys.

II **Preparation and characterisation of the following compounds** (at least 8 preparations are to be completed by turn):

1. Reinecke salt
2. Tris (oxalato) manganese (III)
3. Tetrapyridinesilver (II) peroxodisulphate
4. Tris (acetylacetonato) iron (III)
5. Tris(acetylacetonato) ruthenium (III)
6. Bis (N,N-diethyldithiocarbamato)nitrosyliron(II)
7. Optical isomers of tris (ethylenediamine) cobalt(III) chloride
8. Linkage isomers of dithiocyanato bis(triphenylarsine) palladium (II) or Nitro and nitritopentamminecobalt(III) chloride
9. Ferrocene or dibenzene chromium
10. Hydridochlorocarbonyl tris (triphenylphosphine) ruthenium(II)
11. Tetraphenyl porphyrin and its complex with Fe(II)
12. Beryllium acetate , $Be_4O(OCOCH_3)_6$
13. $[PNCl_2]_3$
14. Tris(2,2'-bipyridine)ruthenium(II)perchlorate
15. Dipyridineiodine (I)nitrate.
16. $[(p\text{-(cyamine)}RuCl_2]_2$

Characterization includes magnetic susceptibility and conductance measurements and infrared, UV-visible, NMR spectroscopy and cyclic voltammetry studies.

III **Nuclear Chemistry Experiments**

1. Determination of operating voltage plateau for the G.M. tube.
2. Studying counting statistics through measurement of radioactivity.
3. Determination of linear absorption coefficient and half-thickness of different materials.
4. Verification of the inverse square law.
5. Determination of half-life of $^{137}$Ba radionuclide.
6. Determination of radioactivity in the solid samples (soil, cement and ash).

**Text Books**

1. G. Marr and B.W. Rockett, Practical Inorganic Chemistry, Van Nostrand, 1972.
2. G. Pass and H. Sutcliffe, Practical Inorganic Chemistry, Chapman & Hill, 2nd Ed., 1974.

**Reference Books**

1. J. Basset, R.C. Danney, G.H. Jeffery and J. Mendham, Vogel's Text Boook of Quantitative Inorganic Analysis, ELBS, 4th Ed., 1978.
2. H.H. Willard, L.L. Merrit and J.A. Dean , Instrumental methods of Analysis, East-West Press, 4th Ed., 1974.
3. G.W. Parshall (Ed. in Chief), Inorganic Synthesis, Vol. 15, Mcgraw Hill, p. 48, 1974.
4. D.D. Sood, , S.B. Monahar and A.V.R. Reddy, Experiments in Radiochemistry Theory and Practice, IANCAS Publications, 1994.
5. R.A. Faires and G.G. J. Boswell, Radioisotopes laboratory techniques, Butterworths, London, 4th Edition, 1981.

## CHEM-541

## COMPUTER PROGRAMMING IN CHEMISTRY

**Unit - 1** Flow charts, Introduction to Basic language and programming,- constants, variables and expressions, input and output statements, control statements, FOR statement, subscripted variables, functions and subroutines.

**Unit - 2** Introduction to Fortran language and programming - constants, variables and expressions , input and output statements, control statements, DO statement, subscripted variables, Format specifications, functions and subroutines.

**Unit – 3** Solution of equations – Bisection, Regula falsi , Newton – Raphson and Iteration methods for solving non-linear equations. Linear simultaneous equations- Cramer's rule, Gauss elimination method and Gauss-Seidel method.

**Unit – 4** Eigenvalues and matrix diagonalization – Jacobi, Givens and Householder methods; Numerical integration –Gauss's quadrature formula, Simpson's rule, Romberg's integration method.

**Text Books**

1. V.K. Jain, Basic Programming with Applications, Tata mc Graw Hill, 1995.
2. R. Rajaraman, Computer Programming in Fortran 90 and 95, Prentice Hall (India), 1997.
3. R.Rajaraman, Computer Programming in FORTRAN 77, Prentice Hall (India), 1989.
4. S. Balachandra Rao and C.K. Shantha, Numerical Methods, Univ. Press(India) ,1992.
5. J.B. Scarborough, Numerical Mathematical Analysis, Oxford & IBH Pub., 1966.

**Reference Books**

1. W.E. Mayo and M.Chsakala, Programming with Fortran 77 : Shaum's outline series, Mc Graw Hill,1995.
2. A.C. Norris, Computational Chemistry John Wiley,1981.
3. C.-E. Frogberg, Numerical Analysis, McMillan,1988.
4. M.J. Moron, Numerical Analysis - A Practical Approach, John Wiley ,1982.

## CHEM - 542

## ENVIRONMENTAL CHEMISTRY

**Unit -1 Atmosphere and Air Pollution**

Atmospheric photochemistry; depletion of stratospheric ozone; industrial air pollution; (particulates, peroxydable organic compounds, greenhouse effect and acid rain); transport related air pollution, analysis and control of air pollution gases ($SO_x$, $NO_x$ and CO); brief description of Bhopal disaster.

**Unit -2 Hydrosphere and Water Pollution**

Criteria for water quality, organic pollutants (hydrocarbons, oil, pesticides, detergents); inorganic pollutants (Hg, Pb, As, Cd, phosphates); water quality-monitoring instruments; brief description of Minamata disease, abatement of water pollution.

**Unit -3 Pollution of soil**

Mineral resources, soil nutrients, organic polymers (degradable, non degradable, bio-degradable); Industrial and radioactive wastes and their disposal; Detoxification of wastes, reclamation, recycling and reuse; sampling techniques of air, water and soil.

**Text Books**

1. J.W. Moore and E.A. Moore, Environmental Chemistry, Academic Press, London , 1976.
2. A.K. De, Environmental Chemistry, 3rd edition, New Age International Limited, Publishers, New Delhi ,1994.
3. S.E. Manahan, Environmental Chemistry, Willard Grant Press, Boston , 1983.

**Reference Books**

1. A.R. Meetham, Atmospheric Pollution, Pergamon Press, U.K., 1981.
2. S.M. Khopkar, Environmental Pollution Analysis, Wiley Eastern, New Delhi ,1994.
3. S.S. Dara, A Text Book of Environmental Chemistry and Pollution Control, S. Chand and Co., New Delhi,1995.

## CHEM 543(a)

## ORGANOMETALLIC CHEMISTRY

**Unit-1 Main - Group Organometallics**

Synthesis and reactions of orgonolithium compounds; Synthesis and reactions of organomagnesium compounds; Organometallics of Zinc and Mercury : Preparation, structure and properties; Preparation, structure, bonding and reactions of aluminium organyls; Thallium(I) organyls (synthesis of ThCP); Organyls of sodium (synthesis of NaCp); Silicon organyls of coordination number 4.

**Unit-2 Transition Metal-Carbon bond**

(i) Transition metal-carbon σ-bond; Brief review of metal alkyl compounds; Transition-metal carbene compounds; Transition metal carbyne compounds; Transition metal vinylidene compounds; Transiton metal allenylidene compounds;

(ii) Transition Metal-Carbon π-bond; Cyclopropenyl cation ($C_3R_3^+$) as a ligand; $C_4R_4$as a ligand (R=H, Me,Ph)

**Unit -3 Syntheses of Cyclopentadienyl and Arene Metal analogues**

a) Synthesis and reactions of Cyclopentadienyl metal carbonyls, Cyclopentadidnyl Metal Hydrides, Cyclopentadienyl Metal Halides, Arene Metal Carbonyls.

**Unit -4 Applications to Organic Synthesis and Homogeneous catalysis**

(i) In Organic Synthesis

The hydrozirconation of alkenes and alkynes; Carbonylation of Colman's reagent; $\eta^4$ -Diene-Iron-Tricarbonyls in Organic Synthesis; $\eta^6$-Arene-Chromium Tricarbonyl in organic synthesis

(ii) In catalysis

Asymmetric hydrogenation; Synthesis of acetic acid and glycol (Monsanto acetic acid process); Arylation/Vinylation of olefins (Heck reaction); Wacker process (Olefin oxidation);Asymmetric Epoxidation

**Text Books**

1. Ch. Elschenbroich and A. Salzer, Organometallics- A Concise Introduction, VCH Publication, Second Ediiton, 1992.
2. Francois Mathey and Alain Sevin, Molecular Chemistry of the Transition Elements, John Wiley and Sons, 1996.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, John Wiley,V Edition, 1986.
4. R.C. Mehrotra and A. Singh, Organometallic Chemistry, A Unified Approach, New Age International, 2nd Edn., 2000.

**Reference Books**

1. Yamamoto, Organo Transiton Metal Chemistry, Wiley 1986.
2. R.H. Crabtree, The Organometallic Chemistry of the Transiton Metals, John Wiley and Sons, Second Edition, 1994.
3. A.J. Pearson, Metallo-Organic Chemistry, John Wiley and Sons, 1985.
4. Manfred Bochmann, Organometallics -1 Complexes with Transition Metal-Carbon σ-Bonds, Oxford Chemistry Primers, 1994.
5. Manfred Bochmann, Organometallics -2, Complexes with Transition Metal -Carbon π-bonds, Oxford Chemistry Primers, 1994.

## CHEM-543 (b)

## BIOINORGANIC CHEMISTRY

**Unit -1** Scope of bioinorganic chemistry: Inorganic elements in biological systems, cells, biologically important compounds (amino acids, proteins, nucleotides, carbohydrates and lipids), basic bioenergetics, enzymes and its classifications. Biochemistry: Distribution, biological roles, membrane structure; ionophores - Valinomycin, cyclic polyethers; active transport of cations across membrane - the sodium pump, biology of calcium carriers, role in muscle contraction, enzyme stabilization, blood clotting and biological calcification.

**Unit - 2** Metalloporphyrins: Structure and optical spectra, heme proteins : magnetic susceptibility, epr and electronic spectra, Hemoglobin and Myoglobin: molecular structures, thermodynamics and kinetics of oxygenation, electronic and spatial structures, synthetic oxygen carriers, model systems, peroxidases, catalases and cytochrome.

**Unit - 3** Iron metabolism in animals; iron storage and iron carriers : ferritin, transferrin; the electron carriers: rubredoxins, ferredoxins, HIPIP; oxygen carriers : hemerythrin and model studies, Hemocyanin, superoxide dismutase, cytochrome oxidase and ceruloplasmin, Vitamin $B_{12}$ and $B_{12}$ coenzymes.

**Unit - 4** Carbonic anhydrase, carboxy peptidase and interchangeability of zinc and cobalt in enzymes; pyruvate kinase and pyruvate carboxylase; Toxicity of mercury, cadmium, lead, beryllium, selenium and arsenic; Biological defence mechanisms, Nitrogenase and nitrogen fixation.

**Text Books**

1. Ei- Ichiro Ochiai, Bioinorganic Chemistry - An Introduction, Allyn and Bacon Inc., 1977.
2. G.L. Eichhorn, Inorganic Biochemistry, Elsevier, 1973.
3. M.N. Hughes, The Inorganic Chemistry of Biological Processes, Wiley,1981.
4. R.P. Hanzlik, Inorganic Aspects of Biological and Organic Chemistry, Academic Press, 1976.

**Reference Books**

1. J. M. Pratt, Inorganic Chemistry of Vitamin $B_{12}$, Academic Press, 1972.
2. A.W. Addison, W.R. Cullen, D. Dolphin and B.R. James edited "Biological Aspects of Inorganic Chemistry", John Wiley, 1977.
3. R.J.P. Williams and J.R.R.F. Dasilva edited, "New Trends in Bioinorganic Chemistry", Academic Press, 1978.
4. A.E. Martell edited "Inorganic Chemistry in Biology and Medicine", ACS Symposium series, Am. Chem. Soc., 1980.
5. S.J. Lippard edited "Progress in Inorganic Chemistry, Bioinorganic Chemistry" , Vol. 38, John Wiley, 1990.

## CHEM – 543(c)

## NATURAL PRODUCTS CHEMISTRY

**Unit -1** **Biosynthetic Pathways:** Studies on biosynthetic pathways of natural products using coenzymes and enzymes; synthesis of selected natural products based on genetic classification : fatty acids derivatives and related compounds including general biogenesis; Syntheis of *cis*-jasmone, methyl jasmonate, prostaglandins, exaltone and muscone.

**Unit -2** **Plant Products** Classification of general class of natural products, isolation and characterization, structure, synthesis and basic concepts in the biosynthesis of common plant products; phenolics (quercetin), terpenoids (pinene, camphor, hirsutene, abietic acid), alkaloids (reticuline reserpine, yohimbine and tylophorine).

**Unit - 3** **Mono- and Sesquiterpenes** General biosynthetic studies of mono- and sesquiterpenes and *trans*- chrysanthemic acid cyclopentano mono-terpene lactones, biosynthetic and synthetic studies of loganin and secologanin- synthesis of *cis* -Juvenile hormone; *trans* - annular cyclization of caryophyllene and synthesis of caryophyllene and isocaryophyllene, rearrangement of santonic acid and bisabolene type of sesquiterpene; Rearrangement of longifolene and the synthesis of longifolene and isolongifolene.

**Unit 4** **Steroids** Biosynthetic studies of diterpenes and higher terpenes and steroids, nomenclature of steroids and synthesis of squalene, lanosterol and carotenoids, synthesis of equelenins, estrogens and the total synthesis of non aromatic steroids (Progestrogens), corticosteroids; degradation diosgenin to progesterone and its synthesis, micellaneous transformations in steroid molecules.

**Text Books**

1. K. Nakanishi, Natural Products Chemistry, Vol. I and II, Academic Press Inc., New York & London.

**Reference Books**

1. T.L. Gilchrist, Heterocyclic Chemistry, Longman Scientific and Technical Publications, 2nd Edn., 1992.
2. R.K.l Bansal, Heterocyclic chemistry - Synthesis, Reactions and Mechanisms, Wiley Eastern, 1991.

## CHEM – 543(d)

## THEORETICAL ORGANIC CHEMISTRY

**Unit -1 Hückel Molecular Orbital Calculations**

(a) Simple π- electron approximation

Linear Combination of Atomic Orbitals (LCAO); Simple Hückel Molecular Orbital Theory (HMO); HMO calculations of - ethylene, allyl and butadiene systems; charge densities and bond order; diagrammatic methods for calculating energies of linear cyclic and acyclic polymers.

(b) Symmetry Simplification of Hückel Molecular Orbital theory

Wave function as basis function; projection operators; symmetry adapted Linear combination (SALC); symmetry factoring of secular determinant; symmetry simplification of HMO for heteroatomic compounds, e.g., Pyrrole.

**Unit -2 Methods beyond HMO**

(a) Advanced molecular orbital methods

Extended Hückel Molecular Orbital calculation (EHMO); ab initio methods - Self consistent (SCF) method (Roothan's equations); brief discussion on semiempirical methods and zero differential overlap (ZDO)

(b) Relativistic Quantum Chemistry

Dirac equation;Dirac quantum numbers; consequences of Dirac treatment -effect on Bohr radius (relativistic contraction), spin-orbit splitting, circulating current and the electron spin; shapes of orbitals; effects on chemical properties -effect on periodic system of elements, inert pair effect, effect on bond lengths, effect on catalysis and reaction pathways, effect on ionisation potential and electron affinity, valency rule for heavy transition elements, a case study of Ag and Au, a brief note on elements 112, 114, and 118.

**Unit -3 Fundamentals of Chemical Reactivity**

(a) Understanding Chemical Reactivity : Chemical reactivity from the viewpoint of the solitary reactant; the reactants apart at non-bonded distances; the transition state and the products; Thermodynamic and kinetic control of reactions; The Hammond postulate; application to some simple organic reactions.

(b) Molecular interactions - Full second - order perturbational expression for intermolecular interaction energy, covalent and electrostatic contributions; weak interactions (van der Waals forces and hydrogen bonds); Repulsive terms; truncated multiple expansion for electrostatic interactions, Frontier orbital approximation for overlap interactions, geometrical and steric aspects of molecular interactions with effects on stereochemical outcome and product distribution.

**Unit -4 Theoretical Treatment of Reactivity**

(a) Solitary reactants : Quantitative structure-activity relationships, topological considerations, linear free energy relationships (Hammett, Taft etc); Reactivity indices based on atomic charges and frontier orbital concepts of HOMO, LUMO and SOMO energy levels with AO coefficients. Hard-soft theory for acids and bases for electrophiles and nucleophiles, theoretical derivation of Woodward -Hoffman rules.

(b) Transition States : Transition state theory, potential energy hypersurfaces, stationary points (maxima, minima and saddle points) and their characterisation, reaction pathways; molecular dynamics; types of transition states; application to some simple organic reactions.

**Text Books**

1. E. Heibronner, H. Bock, The HMO Model and its Application Vol. I and Vol II, Wiley - Interscience, 1976 .
2. Orchin and Jaffe, Symmetry, Orbitals and Spectra, Wiley - Interscience , 1971.
3. I. N. Levine, Quantum Chemistry, 4th Edition, Prentice - Hall, New Delh, 1991.
4. Pople and Beveridge, Approximate Molecular Orbital Theory, Tata McGraw -Hill, 1976.
5. I. Fleming, Frontier Orbitals and Organic Chemical Reactions, Wiley -Interscience, 1976.

**Reference Books**

1. F.A., Cotton, Chemical Applications of Group Theory, Wiley Eastern , 1992.
2. A. Hans Bethe and Edwin E. Salpeter, Quantum Mechanics of One and Two - Electron Atoms, Plenum,1977.
3. Lionel Salem, Electrons in Chemical Reactions (First Principles ), Wiley -Interscience, 1982.

## CHEM-543(e)

## CHEMICAL DYNAMICS

**Unit-1** **Transition State** Potential energy surfaces; strategies involved in probing the transition state; dynamics of barrierless chemical reactions in solution.
Unimolecular Reactions : Lindeman, Hinshelwood and the Rice - Ramsperger-Kassel-Marcus (RRKM) theories of unimolecular reactions.

**Unit-2** **Femtochemistry** Concepts and perspectives; applications to studies of dynamics and control of chemical reactions.

**Unit-3** **Electron Transfer Reactions** Concepts and overview; time and distance scales; energy curves; application of transition state theory; solvent polarization effects; evaluation of rate constants; use of spectral measurements.

**Unit-4** **Linear Free - Energy Relationships** Hammett equation, Yukawa - Tsuno equation, Taft equation; interpretation of reaction mechanisms.

**Text Books**

1. N. Sathyamurty (Ed.,) : Reaction Dynamics - Recent Advances, Narosa Publishing House, New Delhi, 1998.
2. H. Eyring, S.H. Lin and S.M. Lin; Chemical Kinetics, John Wiley,1999.
3. H. Maskill; The Physical Basis of Organic Chemistry, Oxford ,1998.

## CHEM –543(f)

## LIQUID STATE CHEMISTRY

**Unit -1** a) **Properties of liquids** - liquids as dense gases, liquids as disordered solids, some thermodynamic relations - internal pressure and its significance in liquids, equations of state , critical constants; different types of intermolecular forces in liquids, different potential functions for liquids, additivity of pair potential approximation.

b) Classical partition function for liquids - Correspondence principle, configuration integral, configuration properties.

**Unit -2** **Theory of liquids** - Partition function method or model approach : simple cell models, communal energy and entropy; LJD model, significant structure model.

**Unit -3** **Theory of liquids** - Radial Distribution Function (RDF) Method - equation of state in terms of RDF; molecular distribution functions, pair distribution function; relationship between pair distribution function and pair potential function; The YBG equation, the HNC equation, the PY equation, cluster expansion.

**Unit -4** **Supercooled liquids and ionic liquids**- Theories of Transport properties : Non Arrhenius behaviour of transport properties; Cohen -Turnbull free volume model, configurational entropy model, Macedo-Litovitz hybrid model ; glass transition in supercooled liquids.

**Text Books**

1. P.A. Egelstaff, An Introduction to Liquid State, Academic Press, N.Y,1967.
2. T.L. Hill, Introduction to Statistical Thermodynamics, Addison Dover- Wiley,1986.
3. J.A. Pryde, The Liquid State, Hutchinson, London, 1966.
4. S. Petrucci, Ionic Interactions, Vol. 1, Academic Press,1971.

**Reference Books**

1. A.F.M. Barton, The Dynamic Liquid State, Longman, London ,1974.
2. H. Eyring and M.S. John, Significant Liquid Structures, John Wiley,1969.

## CHEM-543(g)

## SOLID STATE CHEMISTRY

**Unit -1** **Solid state chemical reactions**- preparative methods, characterization of solids - applications of various physical methods.
Stoichiometric and non-stoichiometric defects; phase transitions.

**Unit -2** **Solid electrolytes** - electrical properties - conductivity- electronic and ionic; Seebeck coefficient, Hall effect.

**Unit -3** **Band theory of solids**- magnetic and optical properties of solids.

**Unit -4** **Conducting organics** - preparation, mechanism of conduction in organic semiconductors, photo conductivity of polymers

**Text Books**

1. A.R. West, Solid State Chemistry and its Applications, John Wiley, 1987.
2. N.B. Hanney, Solid State Chemistry, Prentice - Hall of India, New Delhi , 1979.
3. F. Gutmann and L.E. Lyons, Organic Semiconductors, John Wiley, 1987.

**Reference Books**

1. D.K. Chakrabarty, Solid State Chemistry, New Age International, New Delhi, 1996.
2. L.I. Buguslavski and A.V. Vannilov, Organic semiconductors and Biopolymers, Plenum Press , 1988.

CHEM – 543(h)

## ADVANCED SPECTROSCOPY IN CHEMISTRY

**Unit -1** **Electron Paramagnetic Resonance**

Classical and quantum mechanical description of resonance. Features of e.s.r. spectra; line shapes and line widths, the 'g' value, the shifts in 'g' value, tensor properties of 'g' and 'A' parameters; biradical and triplet states.

Experimental technique. Illustration of e.s.r. spectra of isotropic spectra. e.g. $C_5H_5$, $C_6H_6$, $C_{11}H_{10}$, $Ag^+$ in KCl, $Co^{2+}$ in MgO; ESR spectra of single crystal; ESR spectra of triplet, biradical and transition metal complexes.
Double resonance technique in e.s.r. ENDOR technique.

**Unit -2** **Nuclear Magnetic Resonance**

(a) Theory of magnetic resonance
Expectation value of magnetisation, effect of alternating magnetic fields, Exponential operators, Quantum mechanical treatment of a rotating magnetic field, Bloch equations and solution for low value of alternating field ($H_1$); spin temperature.

(b) Pulse magnetic resonance
Time and frequency (fourier transform), Free induction decay (FID), spin echoes, the Carr-Purcell sequence, the phase alternation and Meiboom - Gill methods, Spin-flip narrowing, NOE

Terminology in pulse NMR:

WAHUHA, MREV, MLEV, DANTE, WALTZ, INEPT, DEPT, INADEQUATE, COSY, COSY - 45, COSY-90, E.COSY, NOESY.

**Unit -3** **(A) Photo-electron spectroscopy**

Core binding energies and chemical shifts

Valence electron spectra of small and large molecules, molecular orbital models, vibrational structure and lone pair, photo electron spectra of benzene, appplication of X-PES (or ESCA) in material sciences.

**(B) Laser Raman Spectroscopy**
Laser as a source: simple systematic diagram of a Raman spectrometer, NIR - FT Raman spectroscopy, some applications of lasers in chemistry,

**Unit -4 X-Ray diffraction**

Diffraction of light by an optical grating, diffraction of x-rays by a crystal, Laue equations, Bragg's law, unit cell and crystal patterns, structure of simple lattices, Miller indices, systematically absent reflections, multiplicities, intensities, structure factors and electron density map. Experimental technique : Laue method, Bragg's method, Powder method (Debye-Scherer and Guinier focussing methods), Single crystal methods.

**Text Books**

1. John E. Wertz and James R. Bolton, Electron Spin Resonance , Chapman and Hall, New York, 1986.
2. C.P. Slichter, Principles of Magnetic Resonance, Springer Verlag, New York, 1976.
3. J.M. Hollas John Willey, Mordern Spectroscopy , New York, 1996.
4. A. R. West, Solid State Chemistry and its Applications, John Wiley, 1987.
5. P.K. Ghosh, Introduction to Photo Electron Spectroscopy, Wiley Interscience, 1983.

**Reference Books**

1. R. Chang, Basic Principles of Spectroscopy , McGraw Hill ,1971.
2. Andrew E. Derome, Modern NMR techniques of Chemistry Research, Pergamon Press, Oxford 1988.
3. R.S. Drago, Physical Methods in Chemistry, Saunders College,1977.
4. C.N. Banwell and E.M. McCash, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, New Delhi , 1995.

ii) Syllabus for BA/B.Sc.(General) in Clinical Nutrition and Dietetics Course.

An Expert committee was constituted by the Vice-chancellor, NEHU, to examine the Under-Graduate Syllabus for Clinical Nutrition & Dietetics course vide Notification No.BUGS :5-43/Conf/2000-210 of 30th, April' 01 , which is placed as Annexure - 'A'.

The said Expert committee went through the draft syllabus & has furnished the final version of the same which is placed as Annexure - 'B'.

The committee while submitting the final version of the said syllabus has opined that it would be useful to offer the above course as Honours (Major).

The matter is placed before the council for consideration.

5:2:2(2) Annexure - 'A'

NORTH EASTERN HILL UNIVERSITY
SHILLONG

NO:BUGS:5-43/Conf/2000-210 Dated 30th April'01.

## N O T I F I C A T I O N

The Vice-chancellor, NEHU is pleased to Notify the constitution of an Expert Committee to examine the syllabus for "Clinical Nutrition and Dietetics Course" with the following members :-

1. Prof. A.N.Rai, - Chairman
   Department of Bio-Chemistry,
   NEHU, Shillong.

2. Prof. Ramesh Sharma, - Member
   Department of Bio-Chemistry,
   NEHU, Shillong.

3. Prof. (Mrs) Veena Tandon, - Member
   Department of Zoology,
   NEHU, Shillong.

4. Prof. S.B. Prasad, - Member
   Department of Zoology,
   NEHU, Shillong.

5. Dr. B.Myrboh, - Member
   Reader,
   Department of Chemistry,
   NEHU, Shillong.

The Committee is requested to submit its report by 19th May' 01.

Sd/-

P.K.D.Purkayastha,
Asstt.Registrar(Conf)

Copy to :-

1. Finance Officer, NEHU, Shillong.
2. Controller of Examination, NEHU, Shillong.
3. Director College Development Council, NEHU, Shillong.
4. P.S. to the Vice-chancellor, NEHU, Shillong.

Sd/-

Asstt.Registrar.

## Clinical Nutrition and Dietetics

(B.A. and B.Sc.)

General

TOTAL MARKS: 400

| | | | |
|---|---|---|---|
| FIRST YEAR | PAPER: I | Basic Nutrition, Human Physiology and Nutritional Biochemistry. | 70 |
| SECOND YEAR | PAPER: II | Food microbiology, Food Commodities, Meal Management & Personnel Management | 70 |
| | PAPER: III | Practical: (Group A and Group B) | 30+30 |
| | PAPER: IV | Dietetics | 70 |
| THIRD YEAR | PAPER: V | Clinical Nutrition & Community Nutrition | 70 |
| | PAPER: VI | Practical: (Group A and Group B) | 30+30 |

**PAPER: I**

UNIT: A BASIC NUTRITION (THEORY)

Introduction to nutrition – food as a source of nutrients, function of foods, definition and types of nutrition. Nutrients: adequate, optimum, good nutrition and malnutrition. 3

Inter-relationship between nutrition and health. visible symptoms of good health. Food guide- Basic food groups, how to use food guide. 2

Use of food in body: Digestion, absorption, transport, and utilization of nutrients 2

Electrolyte balance. 1

Nutrients- Classification, composition, sources, functions, Recommended Daily Allowance(RDA), and deficiencies of Carbohydrates, Proteins, Lipids, Vitamins (water soluble and fat soluble), and Minerals (micro- and macro minerals) 6

Energy – unit of energy, food as source of energy, energy value of food. The body's need for energy: Basal Metabolic Rate (BMR) and utilization of food for energy requirement. 3

UNIT: B HUMAN PHYSIOLOGY (THEORY)

Blood and Blood Circulation: 6
Blood composition, function, clotting; Blood groups, Blood vessels: Artery, vein, capillary; Structure of heart, cardiac cycle.
ECG and its significance, Blood pressure: Systolic, diastolic; Pulse
Basic idea of – Anaemia, Leukemia, Varicose veins, Atherosclerosis, Angina.

Respiratory System:
Organs of respiration- structure and functions 3
Mechanism of respiration – Chemical respiration, Tissue respiration.
Basic concept of common diseases like TB, Asthma, Pleurisy, Cough and Hiccups.

Digestive System: 4
Organs, structure and functions.
Role of digestive juices in digestion. Mechanism of digestion.
Vomiting, constipation and diarrhoea.
Abdominal pain, peptic and duodenal ulcers, piles.

Excretory System:
Organs, structure and functions of the kidney, Formation of urine, 5
comparison of Normal Urine with Abnormal Constitutents of urine and diseases associated with it.

Skin: 1
Disorders of the skin – Dandruff, dermatitis and burns.

Eye: 2
Basic idea of common diseases of the eye.
Conjunctivitis, trachoma, cataract.

Muscle contraction. 1

Nervous system: 5
Structure of a nerve cell. Nerve fibre. Classification of nervous system.
Brief account of – nerve impulse – Transmission of nerve impulse - reflex action – voluntary action.

Endocrine system: 4
Endocrine glands- their structure and functions, hormones and disorders of over and under secretions.

Reproductive system: 5
Structure and functions of reproductive organs; Brief idea of menstruation, puberty, and menopause; Fertilization , development of fertilized ovum; placenta and its function and parturition.

UNIT: C NUTRITIONAL BIOCHEMISTRY. (THEORY)

Transport: passive diffusion, facilitated diffusion, active transport, Coupled reactions. 2

Introduction to : Nucleic acids, DNA, RNA, Genetic repair mechanisms, Genetic code and protein biosynthesis . 6

Major Metabolic pathways of :

(a) Carbohydrate, Glucose transport. Glycolysis, metabolism of lactate and pyruvate, citric acid cycle, Gluconeogenesis, pentose phosphate pathway. 6

(b) Lipid: Transport and oxidation of fatty acids, biosynthesis of fatty acids, Mobilization of fat, ketogenesis, metabolism of phospholipids, glycolipids, and cholesterol. 9

(c ) Energy conservation, high energy phosphate bond, storage and release of high energy phosphate, synthesis of ATP (oxidative and substrate level phosphorylation). 4

Hormones: Modes of action 4
Prostaglandin
Control of homeostasis

**Suggested Books:**

Guthrie, H.A., "Introductory Nutrition". 6th Edition, St. Louis, Times Mirror/Mosby College, 1988.
Mudambi, S.R. and Rajgopal, M.V. "Fundamentals of Food and Nutrition". 2nd Edition, Wiley Eastern Ltd. 1990.
Swaminathan, S. "Advance Textbook on Food and Nutrition", Vol. I & II, 2nd Edition, 1985
Willson, EVAD "Principles of Nutrition". 4th Ed. N.Y. John Willey & Sons, 1997.

Keele, C.A. and Neil, E. 1978 " Samson Wright's Applied Physiology, Oxford University Press.
Tortora, G.J. and N.P. Anagnostakos 1984, " Principles of Anatomy and Physiology, Harper and Row , Publisher, New York.
Rao, K.R. " Text book of Biochemistry." 3rd Ed. 1986. Prentia Hall of India Ltd., New Delhi.
Murray, R.K. Grammer, P.A. Mayes, V.W. Rod well "Harper's Biochemistry." 1998. 24rth Ed. Prentice-Hall.

## PAPER: II

UNIT: A FOOD MICROBIOLOGY and FOOD COMMODITIES. (THEORY)

Introduction to microbiology and its relevance to every day life. 4
General characteristics of bacteria, fungi, virus, protozoa, algae.

Sources and types of food spoilage and contamination ; Effects on the following:
a. Cereals & Cereals Products. 10
b. Sugar and Sugar Products.
c. Vegetables and Fruits.
d. Canned Foods.

Environmental Microbiology - Water, Air, Soil and Sewage. 4

Microbial toxins and infections – Sources of contamination of foods, toxin production and physiological action. Sources of Infection of foods by pathogenic organisms – symptoms and method of control and relevance of microbiological standards for food safety. 3

Beneficial effect of microorganisms. 4

Cereals & Pulses 5
Cereals and millets, breakfast cereals, cereal products, fast foods – structure, processing, use in variety of preparations, selection, variety storage, nutritional aspects and cost.
Pulses – production (in brief) selection and variety, storage, processing, use in variety of preparations, nutritional aspects and cost.

Milk and milk products 6
Composition, classification, quality processing, storage, uses, cost, nutritional aspects of milk curds, butter milk, paneer, khoa, ice-cream, kulfi and various kinds of processed milk.

Eggs 3
Production, grade, quality, selection, storage, uses, cost and nutritional aspects.

Fish, Poultry and meat 3
Selection, purchase, storage uses, cot and nutritional aspects,

Vegetables & Fruits 3
Variety, selection, purchase, storage, availability, cost, use and nutritional aspects of raw and processed vegetables and fruits.

Different forms of sugar
(sugar, jaggery, honey syrup) manufacture, selection, storage & use preserves.

Fats & oils 3
Types and sources of fats and oils (animal and vegetable) processing, uses, storage, cost and nutritional aspects.

Raising agents 1
Types, constituents, gram flour (basin) cookery and bakery, preservation methods.

Food adjuncts 3
Spices, condiments, herbs, extracts, concentrates, essences & Food colours, uses, storage, procurement

Convenience Foods 2
Types, uses, cost and contribution to diet.

Salt Types, uses in the diet.

Beverages 3
Tea, coffee, chocolate and cocoa powder; Growth, Cultivation processing, cost and nutritional aspects.

UNIT: B MEAL MANAGEMENTand PERSONNEL MANAGEMENT (THEORY)

Introduction to meal management - balanced diet – Basic principles of meal planning – Objectives – steps in meal planning – Food cost. 4

Nutrition in Pregnancy – Physiological stages of pregnancy – Nutritional requirements – Food selection – Complication of pregnancy. 4

Nutrition during lactation – Physiology of lactation – Nutritional requirements. 3

Nutrition during Infancy – Growth & developments- nutritional requirements- Breast-feeding – infant formula – introduction of supplementary foods.4

Nutrition during early childhood (Toddler/pre-school) Growth & nutrient needs – Nutrition related problems – Feeding pattern. 3

Nutrition of school children – nutritional requirement – Importance of snacks – school lunch. 2

Nutrition during adolescence: growth & nutrient needs; Factors influencing food choices & eating habits. 3

Geriatric Nutrition – Factors affecting food intake & nutrient use - Nutrient needs – nutrition related problems. 3

Aims and objects of different food service outlets 6.
a. Hospitals,
b. Industrial Canteens,
c. Institutional Canteens
d. Flight kitchens etc.

Menu Planning: Indian and Asian. 4

Types of meals and styles of service: 2
a. Breakfast, b. Lunch, c. Dinner afternoon tea, d. Snacks, e. BF (1),
f. DH (Table d' Hote) (3), and g. Ala Carte (2)

Introduction to basic and specific Equipment – Indicate and list the equipment. Care and use of the equipment. Vessels, utensils, Cutlery (Silver, Glass etc.) 3

Classification of beverages. (Hot, Cold, Alcoholic and Non-alcoholic etc) 3

Planning and layout of Food Service Unit. 2

Material Used (Base material, Finishes, electrical insulation materials Etc) 2

Municipal Rules and Legislation. 1

Plant and equipment management: (maintenance, sanitation, safety, security garbage disposal, pest control) 3

Purchase and storage of Perishable and Non-perishable foods. 2

Account Keeping: 10
Introduction, objects, principles and advantages of:
Double Entry, Journal, Ledger, Subsidiary book, Cash Book, Petty Cash Book and Trial Balance

Personnel management- recruitment, selection and training of the personnel. 5

Functions and management of resources. (Time, money and energy) 5

Labour policies and legislation. 2

Sanitation. 1

Chemical food hazards (including antibiotic metals and hormones) 3

Carriers of contaminants: Water, Air, Soil and Sewage; 4
Humans, Domestic animals, Vermins, Birds.

Waste products handling : 6
Planning for waste disposal, solid and liquid wastes.
Rodent control. 1

Food sanitation, control and Inspection – 4
Planning and Implementation of training programme for health personnel.

**Suggested Books:**

Lavies, B. Food Commodities – London, Heinemann Ltd. 1988.
Huges O, Introductory Foods, Macmillan & Co., New York, 1988.
Pyke, M. Catering Service and Technology, London, John Murray Publ, 1974.
Dowell P and A. Bailey – The Book of Ingredients, Dorling Kindersley Ltd., London, 1980.
Frazier, W.C. " Food Microbiology." 4th ed., 1998. Mc Grow Hill, N.Y
Kawata K. " Environmental Sanitation in India" 1963. Lucknow Publ. House.
Mahmood. A. Khan, "Food Service Operations" Aviv. Publ.Co. 1987.
John Fuller, "Modern restaurant Service" Hutchinson, 1983.
Dorothy Tompkins, "Table Layout and Decoration." Ward Lock & Co.Ltd, 1969.
Bessie. B. West. Le Velle Wood. Revised by Harper V. Shugant M. S. June Payne Palacio.
" Food Service in Intuition " Macmillan Publishing Co. 1986.
D. R. Lillicrap " Food and Beverage Service" 2nd Ed. BLBS, Reprinted 1989.
Mass Catering WHO Publication.
Minor. L.J. And R.F. Cichy " Food Services Systems Management' Avi. Publ. Co. Connecticnt, 1984.
Mohini Sethi and Surjeet Malhan " Catering Management, An Integral Approach" Wiley Eartern Ltd., 1987.
Bora P.M. "Food Administration in India: A study of an Indian State. 1982.
Avery A.A. " Modern Guide to Food Service Equipment". C.B.I. Publishing Inc. 1980.
Anderson F. " Home Appliance Servicing " Taraporewals Sons & Co. 1976.
Ronald Kinton and Victor Caserani, "The Theory of Catering" 6th end. ELBS 1989.
Jules Wilkinson " The Complete book of cooking equipment " 2nd ed. A CBI Book, Publ. Reinhold Company.,1981
Designand layout of food Service Facilities John C. Birchfield endorsed by the Food Service Consultants Society International 1988 by Van Nortrand Reinhold, 1981.
Kazarian Edward, " Food Service Facilities Planning" 3rd end. 1989.
Walley J. " The Kitchen in Catering" B.A.S. Printers Ltd.,
Recommended dietary intake for Indians. ICMR., 1989.
Guthrie H.A. " Introductory Nutrition" 6th ed., Times Mirror/ Mosby college Publ., St. Louis. 1986.
Worthington Roberts, Bonnie S. & Others., " Nutrition in Pregnancy and Lactation." 3rd ed., Times Mirror/ Mosby College, ST. Louis, 1985.
Jacob, M. " Safe Food Handling " A Training guide for Manager. WHO Geneva Marriott, N.G. 1989.
Van Nostrand Reinhold " Principles of Food Sanitation" 2nd ed., AVI Book New York.
Hobbs B.C. & R.J. Gilbert " Food poisoning & Food hygiene" 4th 1978, The English Language Book Society and Edward Arnold ( Publishers) Ltd.,
Kawata, K. " Environmental Sanitation in India" Lucknow Publishing House. 1963.
Guthrie H.A. & others "Introductory Nutrition" 1986. 6th ed. Times Mirroe/Mosby College Pub. St. Louis.
Anderson L & others "Nutrition in Health & Disease" 1982 17th ed. J.B. Lippincottt Co. New York.
Whitney E.N. Hamilton E.N. & Roffes SR "Understanding Nutrition" 5th ed. West Pub. Co. New York.
Recommended Dietary Intakes for Indians I.C.M.R. 1989.

**PAPER: III**

PRACTICAL

GROUP: A. No. of classes: 2/ Week.

Dissection to observe the following:
Abdominal cavity of human ( Mannequin) observe & draw liver, kidney, appendix, spleen, pancreas, stomach, gall bladder, large and small intestine, urethra bladder, diaphragm.

Types of Cells.
Microscopic examination of prepared slides.

Epithelium – Stratified squamous, Ciliated Columnar.
Connective tissue – Adipose, Bone, Areola Connective Tissue.
Muscle – Smooth, Cardiac, Stratified.
Nerve – Medullae, Nerve Cell.
Cell Division – Resting Stage, Prophase, Metaphase, Anaphase, Telophase.
Blood
Microscopic examination of prepared slides.
i. Fresh Mount of Blood.
ii. Stained Blood Smear.
Testing of blood groups using typed sera.
Coagulation of blood – Blood collected from Slaughter house in –
i. Clean vessel
ii. Vessel with Ammonia Oxalate. ( Centrifuge Vessel No.ii)
Haemoglobin estimation using haemometer.
R.B.C. Count.

Anatomy of Sheep's Heart.
Observe – pericardium, auricles, ventricles, semi lunar, and mitral.
Valves, Chordae tendinae.
Blood vessels – aorta, venacava, pulmonary artery pulmonary veins.

Histology of Artery and Vein- Examine artery and Vein.
Histology of Lung section and Trachea.
Pulse & Respiration Rate – At rest & after exercise.

Digestion
Salivary digestion- Benedict's tests for sugars, Burette tests for Protein, Iodine test for Starch.
Gastric digestion – using pepsin. Tests for lipase and amylase.

Arterial Blood pressure: Determination using a sphygmomanometer.

Excretion- Examine sheep's kidney and identify and draw capsule, blood vessels, urethra.

Draw a sagittal section of the kidney and label Cortex, Medulla, Pyramid, Pelvis and Urethra.

Skin –
Histology- Microscopic Examination of the prepared slides.
Location of tough end organ.
Location of pain end organ
Location of hot and cold organs.
Measurement of body temperature – Mouth arm pit, rectum, diurnal rhythm.

Nerve System: Experiments on special senses.
Eye- Accommodation, muscular phenomenon blind spot
Ear – Equilibrium & Hearing.
Taste and Smell- Tongue & Nostril.

Reflexes of man: Pharyngeal reflex, Retinal reflexes, Pupillary reflex, Salivary reflex, Tendon reflex.

Muscle physiology: Using a frog
Simple muscle switch. Recording on the smoked drum.

Genesis of Tetanus.
Fatigue of Muscle by tetanus.

GROUP: B 2 Practical /week.

Planning, preparation and calculation of the nutritive values and the cost of the menu/ meal for:

Adult man (sedentary, moderate and heavy worker), Adult woman (sedentary, moderate and heavy worker),
Pregnant woman, Nursing mother, Infant Supplementary feeding – Preparation of weaning foods, Toddler and Pre-School Child, School going Child, Adolescents, Senior citizen (Geriatric nutrition) and Planning of the meals for middle income family.

Organizing, preparing and serving food for three different meals for 50 members or more.

Setting up the restaurant – laying of table cloth changing, setting up the silvers and other table appointments.

Folding of serviettes correct use of waiter's cloth. Preparing for customers.

Servicing and clearing practice, French and English service.

Service of beverages tea, coffee, juices and alcoholic beverages.
Laying for breakfast
Tray service.

Order taking, making out checks bills presentation of bills.

Upkeep and cleaning of cutlery, crockery other equipment.

Rice preparation:
Plain & fried rice, pulao, masala rice, tomato rice, vegetable biriyani, mogalai biriyani, mutton biriyani, chicken biriyani, ykhani pulao. (any four).

Wheat preparations:
Chapati, paratha plain, paratha stuffed, puries, bhaturas, nan.

Pulse preparations:
Punjabi dal, sambar, dal fry, sprouted pulses, Alu chhole, Masala ramjah, Dhanskak (any four)

Vegetable preparations:
Alu matar, alu palak, dum alu, fried veg, palak paneer, vegetable kofta, vegetable korma (any four).

Salads:
Tossed salad, Russian salad, Moulded salad, Decorative salad.

Meat preparations:
Kofta curry, roghan gosh, mutton chilli fry, mutton palak, vindaloo, murg masala, brain masala, tanduri chicken, chicken curry, prawns curry, fish curry. (any four)

Snacks:
Variety of sandwiches, vegetable puffs, fried snacks, fermented and steamed snacks.

Sweets:
Laddu, Bujiya burfi, Shrikhand, Gulab jamun, Puranpoli, Kheer, Halwas. (any four)

Western cookery:
Soups: Mixed veg., tomato cream soup, carrot cream soup, mulligatawny soup, minestrone soup, chicken soup and corn soup.

Sauces: White sauce, cheese sauce, mayonnaise sauce, curry sauce

Entrees: Vegetable pie, hollandaise, vegetable and meat loaf, chicken, casserole, hamburgers, vegetables burgers. (any four)

Vegetables: Vegetable augratin, baked cauliflower, savoury vegetables, baked stuffed capsicum.

Sweets: Bread pudding, soufflés, trifle, coffee mousse, gateaux.

Bakery Products:
Short crust pastries:
Different types of tarts, pies and turn over. Vegetables and mutton patties.
Cakes and cookies: Plain cake, fruitcake, banana bread, date and walnut cake and varieties of cookies.
Breads: Breads, different kinds of rolls, doughnuts.

Visits to food service institution to study layout and food service equipment.

Studying the food service equipment available in India. Type, feature and cost.

Planning physical layouts of a food service institution, commercial, non-commercial.

**PAPER: IV**

DIETETICS

UNIT: A. BASIC DIETETICS (THEORY)

| | |
|---|---|
| Introduction to dietetics. | 1 |
| Role of Dietician – The hospital and community. | 2 |
| Definition of nutritional care, interpersonal relationships with the patient, planning and implementing dietary care, team approach to nutritional care. | 3 |
| Basic Concepts – Purpose and principles of diet therapy, Therapeutic Adaptation, Normal Diet. | 1 |
| Routine Hospital Diets - Regular diet, Light diet, Soft diet, Full liquid diet and tube feedings,Pre and Post Operative diets. Oral feeding , Parenteral feeding and intravenous feeding. | 3 |
| Modifications of Diets- Febrile conditions, infections and surgical conditions | 5 |

Diet in surgical conditions, burns and cancer; Dietary treatment 4

Diets for – Fevers and infections (Influenza, T.B. Typhoid fever, recurrent Malaria), Gastro-intestinal disorders, renal diseases, liver diseases, obesity and Leanness, Cardiovascular diseases and diabetes mellitus. 6

Feeding infants and Children – Problems in feeding children in the hospital. 3

Feeding the Patient – Psychology of feeding the patient, assessment of patient's needs 3

Nutrition and Diet Counselling – Patients check up assessment, dietary counselling, and education of the patient and follow up. 4

UNIT: B. ADVANCED DIETETICS

(THEORY)

Diet in gastritis, peptic ulcer (gastric & duodenal) 5
Etiology, symptoms, clinical findings, treatment, dietary modification, adequate nutrition, intervals of feeding chemically and thermally irritating foods.
A four stage diet ( liquid,soft,convalescent, liberalized diet.)

Diet in disturbances of the small intestine and colon. Diarrhoea ( child & adult)
Classification, Modification of diet, fibre, residue, fluids, nutritional adequacy.
Constipation, flatulence – dietary considerations.
Ulcerative colitis (adult) symptoms, dietary treatment.
Sprue, Celiac disease and disaccharide intolerance, dietary treatment 7

Diet in disease of the liver, gall bladder and pancreas. 7
Etiology, symptoms and dietary treatment in jaundice, hepatitis, cirrhosis of liver and hepatic coma; Role of alcohol in liver diseases.

Dietary treatment in cholecystitis and cholelithasis and pancreatitis. 4

Diet in Diabetes Mellitus: 7

-Incidence and predisposing factors.
-Symptoms, types and tests for detection.
-Metabolism in diabetes.
-Dietary treatment and meal management.
-Hypoglycaemic agents, insulin and its types.
-Complications of diabetes.

Diet in renal diseases: 8

Basic renal function, symptoms and dietary treatment in acute and chronic glomerulonephritis, nephrosis, Renal failure and dialysis.
Urinary calculi- causes, treatment, acid and alkali producing and neutral foods and dietary treatment.

Diet in cardiovascular diseases: 5

Role of nutrition in cardiac efficiency. Incidence of Atherosclerosis, dietary principles.
Hyperlipidemia and dietary treatment and dietary management and

adult and chronic diseases of the heart.
Sodium restricted diet, level of sodium restriction,
source of sodium, and danger of sodium restriction.

Gout: Nature and occurrence of uric acid causes, symptoms and diet. 2

Diet in Allergy and Skin disturbances. 2

Definition, classification, manifestations, common food allergies,
tests and dietary management 2

Diet and drug interactions. 3

**Suggested Books:**

Anderson M.V.Dille. P.R. Turkki, H.S. Mitchell and Rynbergen : " Nutrition in health and disease" 17th ed J.R. Lippincett Co., Philadelphia, 1982.
Anita P. "Clinical Dietetics And Nutrition" 3rd ed., Oxford University Press, Delhi .
(Reprinted in 1975)1989.
Bennion M., "Clinical Nutrition" Harper and Row Publ. N.Y. 1979.
Frances, D.E.M., " Diets for Sick Children" Blackwell Scientific Publ, 1974.
Passmore. R and M.A. Eastwood "human Nutrition and Dietetics," 8th ed.,
ELBS Churchill Livingston 1986.
Robinson C.H. M.R. Lawleer W.L. Chenoweth and A.E. Garwick " Normal & Therapeutic Nutrition" 17th ed., Macmillan Publ. Co., 1986.
Patel K.C. And M>M. Prabhu " Diet in Health and Disease" 1st ed., United Arts, Mumbai. 1981.
Bhala S.M.L. Bhatic >N. Gopinath," Diet Manual for heart patients" CTC. AIMS. New Delhi. 1983.
Robinson C.H., and E.S. Winley., "Basic Nutrition & Deit Therapy" 5th ed.,
Macmillan Publ. Co., N.Y. 1984.

**PAPER: V**

UNIT: A CLINICAL NUTRITION (THEORY)

Carbohydrates: Review of digestion, absorption and metabolism of carbohydrates,
aerobic and anaerobic glycolysis, storage and utilization of carbohydrates
as energy sources for physical activity. 4

Lipids: Review of digestion, absorption and metabolism of fats and fatty acids,
Energy yield from dietary fats, storage, mobilization of fat stores during exercise,
Production of Ketone bodies, Ketogenic diets. 4

Energy Metabolism: BMR, Energy requirements for physical activity, relative body weight
And influence of physical exercise in changes in body fat and body composition,
Utilization of energy by muscle tissue, shifts in lipid and carbohydrate, utilization in relation to
Exercise type, intensity and duration. 5

Water and Electrolyte Balance: Water and Electrolyte losses and their replenishment,
Affect of dehydration. 2

Nutrient and Drug Interactions: Effect of drug therapy on intake, absorption and

Utilization of nutrients. 3

Diseases of the gastro–intestinal tract: Effect on digestion, absorption and nutritional status. 6
Implications for diet therapy: Diarrhoea & Constipation, Gastritis and Ulcers, Colitis and malabsorption syndromes.

Liver, Gallbladder and Pancreas: 7
Etiology, Symptom, Metabolic and Nutritional Implications.
Hepatitis, Cirrhoses, Hepatic coma, Pancreatic, Cholecystitis, Cholelithiasis

Renal System: 6
Etiology, symptoms, metabolic and nutritional implications.
Nephritis, Nephrotic Syndrome, Renal Failure, Renal Calculi.

Disorders of Metabolism: 6
Diabetes Mellitus, Inborn Errors of Metabolism, Gout.

Cardiovascular System: 6
Etiology, symptoms and role of specific nutrients
Hypertension and Atherosclerosis.

UNIT: B COMMUNITY NUTRITION (THEORY)

Nutrition and Health in National Development. 4
Nutritional problems confronting our country:
-The causes of malnutrition in India
Balance between food and population growth.

Methods of assessment of Nutritional Status: 8
-Sampling Techniques.
-Identification of risk groups.
-Direct assessment :-
Diet Surveys
Anthropometrical,
Clinical And Biochemical estimations.
- Indirect assessment:-
Food Balance Sheets and Agricultural Data,
Ecological Parameters,
Vital Statistics.
-Use of Growth Charts.

Nutrition intervention schemes in the community. Lecture and Method Demonstrations, Nutrition Exhibitions and Visual Aids. 6

Role of National and International agencies in promoting community nutrition: 6
ICDS, SNP, ANP, Mid-day Meal Programme, FAO, WHO, UNICEF, CARE, AID, ICMR, ICAR, CSIR, NIN, CFTRI, NIRD and ARISET

Breast feeding and its implications.
Hazards of bottle feeding. 2

Weaning foods: Planning, formulating and preparing. Importance of correct and timely Weaning; Nutrition and Infection (relationship) Immunization and its importance. 2

Recent advances in Community Nutrition Research.
Fortification and Enrichment of Foods. 2

**Suggested Books:**

Anita F.P. " Clinical Dietetics and Nutrition " 3rd 1989. Oxford University Press, New Delhi / Mumbai.
Passmore. R . Eastwood , M.A. "Human Nutrition & Dietetics" 8th ed 1989, ELBS Publ.
Robinson C.H. Wyley "Basic Nutrition and Diet Therapy" 6th ed., 1986,Macmillan Publ., N.Y.
Anderson L. And Others, "Nutrition in Health & Disease" 1982, 17th ed., J.B. Lippincott Co., Philadelphia.
MacLarea. D.S. " Nutrition in the Community" 1983, John Wiley and Sons.
JelliffeD.B. " The Assessment of Nutritional Status on the Community" 1966, WHO Monogrph Series- no. 53, Geneva.
Reh, Emma, " Manual on house hold Food Consumption Surveys. FAO. Nutritional Studies. No 18. Rome.
Shukla P.K. " Nutritional Problems of India" 1982 Prentice Hall of India Pvt. Ltd., New Delhi.
Shanti Ghosh " The Feeding and Care of Infants and young Children" Voluntary Health Association of India, 1977, New Delhi.
Ebrahim G.J. " Nutrition in Mother and Child Health" 1988, Macmillan, London.
Ritchey, S.J. and J. Taper " Maternal and Child Nutrition" Harper and Row., Publishers. 1983 New York.

**PAPER: VI**

PRACTICAL

GROUP: A No. of classes: 2/ Week.

Standardization of common food preparation.

Planning & preparation of full or normal diet.

Planning & preparation of liquid diet

Planning & preparation of soft diet

Planning & preparation of high & low calorie diet with modified fat & carbohydrates levels.

Planning & preparation of bland diet for the peptic ulcer.

Planning & preparation of diet for the viral hepatitis and cirrhosis of the liver.

Planning & preparation of diet for Diabetes Mellitus

Planning & preparation of diets for Hypertension and Atherosclerosis.

Planning & preparation of diets for nephritis and nephrotic syndrome.

Planning & preparation of low and medium cost diet for PEM, Anaemic & Vitamin A deficiency.

GROUP: B

Planning and preparation of diets with modified:
Consistency, Fibre and Residue

Diet for Diarrhoea and Constipation

Diet for Peptic Ulcer.

Diet for Liver Diseases.

Planning & preparation of diet in fevers and infections.

Planning & preparation of diets for –
Insulin Dependent Diabetes Mellitus Patient.
Planning snacks
Deserts and Beverages for Diabetic Patient.
Complications of Diabetes.
Meal Exchange List.

Planning & preparations of diet in cardiovascular diseases congestive cardiac failure.

Planning & preparations of diets in:
Kidney failure, Kidney Transplant, Renal Complications and Kidney Stones.

Planning & preparations of diets in:
Cancer, Trauma (Burns) and Surgery.

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iii) Syllabus for PG Diploma course in Applied statistics and computer applications.

The joint meeting of the Board of Under Graduate Studies in statistics & Computer Sciences which was held on 27.11.2000 approved the syllabus for P.G.Diploma course in Applied Statistics & Computer Applications after incorporating some Modifications as suggested by the said BUGS.

The syllabus and the Minutes of the BUGS are placed as annexure - 'A' & 'B'.

The matter is placed before the council for consideration.

# ST. ANTHONY'S COLLEGE, SHILLONG

## Department Of Statistics

## Proposal for introducing

## POST-GRADUATE DIPLOMA in APPLIED STATISTICS & COMPUTER APPLICATIONS

CONTENTS:

**Preamble:**

In today's world of Information Technology, statistics is playing an important role in every sphere of activities. Hardly any field of knowledge is left where there is no application of Statistics. The ability to analyse data / information & draw conclusions from the analysis is an essential skill for any professional in to-day's world.

This one year modular course (Post-Graduate Diploma) in **Applied Statistics and Computer Applications ( PGDASCA )** aims to give adequate expertise to a student to enable him/her to apply the subject matters in different sectors. Since computer is also a part of the course structure, students can develop statistical packages to solve different problems. After completion of first semester i.e., first module of the course, a certificate will be issued to those who do not wish to continue the second module. At the end of the second module i.e., after the completion of both the modules ( First and Second Modules ), the Post Graduate Diploma in Applied Statistics and Computer Applications will be offered. This modular system of the course is designed in view of the fact that, for most of the office goers and persons from Bio-sciences, first module of the course is enough for the purpose.

**Eligibility :**

This course is open to graduates of Arts, Science and Commerce streams. It does not presuppose that the applicant has had prior exposure to statistics or computer science. However, a good academic record with mathematics up to ( 10 + 2 ) level and an aptitude for this subject would be an essential requirement.

**Duration :**

The duration of the course is one academic year consisting of two semesters of five months each. Each semester has a minimum of 100 working days for the purpose of class room teaching and excludes the days of examination and other works.

**Examination :**

There will be theory as well as practical examinations along with the submission of project report in this PGDASCA. In the theory paper, the questions shall be designed to test the candidate's ability to answer both objective & descriptive questions, whereas in the practical, ones ability for the application of computer to solve different statistical problems will be examined. (Problems need not be restricted to those given in the syllabus. However they should be of similar standard)

**Requirements for Passing:**

For all papers the passing requirement shall be that the candidate secures minimum 40 percent in the Internal Assessment as well as in Semester Examinations. Only the candidates passing in the Internal Assessment may be allowed to appear for the Semester Examination.

The marks for internal assessment for each paper are to be given on the basis of

- tests given during the course ( 3 tests may given for each paper, and the best two marks may be considered for internal assessment )
- assignments submitted and/or seminars given
- practical record book in the papers applicable

A record of this may maintained in the College.

Practical Record Book: In the papers involving practical, a standard set of Experiments have been listed and are to be done as practical work and submitted by the student in a practical record book.

**Classification of Successful Candidates:**

A candidate who qualifies for the Diploma as per the regulations for the passing requirements and secure not less than 60% shall be declared to have passed in the First Division.

All other successful candidates shall be declared to have passed in the Second Division.

Candidates shall have to pass all the Examinations within a period of 3 years from the date of admission to the First Semester to qualify for the award of the Diploma.

## DASCA-1.1 : FUNDAMENTAL OF MATHEMATICS & COMPUTER

**Unit 1 : Mathematics:**

Law of indices, logarithms, A.P, G.P, & H.P, simultaneous equations, quadratic equations, permutations & combinations, binomial expansion, differential calculus ( functions, limits, derivatives: chain rule, parametric and implicit functions, maxima and minima, partial derivatives), integral calculus (method of substitution, integration by parts, definite integral), basic idea of matrices, rank of the matrices & matrix inversion. Finite differences & interpolation, numerical integration( only Simpson's one third rule ).

**Unit 2 : Computer :Windows OS, EXCEL, Use of SPSS package.**

This paper aims to make the graduate efficient at using computers for solving statistical problems.

**Windows OS:**

Navigating on the desktop, maximising, minimising, sizing, moving, opening multiple windows, closing windows selectively, restoring windows, activating window.
Dialogue boxes
Moving, Deleting, Renaming and Copying files and folders.
Use of mouse- mouse buttons, right/ left handed, double or single click.
My Computer- selecting files and folders, selecting drives, control panel .
Recycle Bin - sending files to recycle bin, recovering one or more files, bypassing, emptying.
Start menu options - Using Help, Explorer (exploring a folder, making shortcuts, deleting files and folders)

**Microsoft Excel :**

Elements of Excel screen, workbook, worksheet, row, column, cell.
**Creating** or opening workbooks, previewing workbooks, moving around in a sheet, moving around in a workbook, inserting and deleting sheets, renaming sheets, moving and copying sheets, opening, closing workbooks windows, saving workbooks.
**Selecting cells** and moving within a selection, selection of sheets, choosing, repeating and undoing commands, working in dialogue box, data entry, entering numbers, dates or times, text, filling adjacent cells and creating series
**Editing, copying and moving cells**; inserting, deleting and clearing cells, rows and columns, finding and replacing, changing column width and row height, formatting fonts, adding borders, patterns, applying number formats, copying formats quickly, applying formats automatically

**Charts** :Creating embedded **charts** and chart sheets, activating a chart to modify it, selecting items of chart with / without mouse, adding data labels, titles and other items to a chart, chart types and AutoFormats, changing the chart type, combining multiple chart types in a chart, adding and deleting chart data, changing the range of data plotted in a chart. Changing chart text, formatting the chart area and the plot area, formatting chart items (colours, patterns, text and numbers), formatting data markers, explode, sizing an embedded chart
**Printing** : selecting printer, setting up page, choosing what to print, print pre-view, controlling page breaks, page numbers, sizing and printing charts
**Sorting** : Sort rows in descending order based on the contents of one column, Sort rows based on the contents of two or more columns Sort columns based on the contents of rows, Sort months, weekdays, or custom lists, Filtering using AutoFilter and Advanced filter.

**Pivot table**: steps to create it, creating a chart from it, customising it, adding and removing data in it, changing the layout of it, changing view of the data using page fields, totals in a pivot table, formatting and editing it, grouping and sorting items in a pivot table
**Solving what-if problems**: Using Data Tables, Goal Seek and Scenario

Using formulae, moving and copying formulae and references, naming references, using AutoSum, using function wizard, working with arrays.

**Database Functions** : (DCOUNT, DCOUNTA, DMAX, DMIN, DSUM, DAVERAGE, DSTDEV, DSTDEVP, DVA, DVARP)
**Logical Functions** : (AND, OR, IF, TRUE, FALSE)
**Lookup and Reference Functions** : (HLOOKUP,VLOOKUP)
**Mathematical Functions** : (ABS, COUNTIF, INT, LN, LOG, MOD, PI, LOG10, RAND, RANDBETWEEN, ROUND, ROUNDUP, ROUNDOWN, SIGN, SQRT, SUM, SUMIF, SUMSQ, TRUNC)

**Statistical Functions** :

AVEDEV, AVERAGE, AVERAGEA, BETADIST, BETAINV, BINOMDIST, CHIDIST, CHIINV, CHITEST, CONFIDENCE, CORREL, COUNT, COUNTA, COVAR, CRITBINOM, DEVSQ, EXPONDIST, FDIST, FINV, FISHER, FISHERINV, FORECAST, FREQUENCY, FTEST, GAMMADIST, GAMMAINV, GAMMALN, GEOMEAN, GROWTH, HARMEAN, HYPGEOMDIST, INTERCEPT, KURT, LARGE, LINEST, LOGEST, LOGINV, LOGNORMDIST, MAX, MAXA, MEDIAN, MIN, MINA, MODE, NEGBINOMDIST, NORMDIST, NORMINV, NORMSDIST, NORMSINV, PEARSON, PERCENTILE, PERCENTRANK, PERMUT, POISSON, PROB, QUARTILE, RANK, RSQ, SKEW, SLOPE, SMALL, STANDARDIZE, STDEV, STDEVA, STDEVP, STDEVPA, STEYX, STDIST, TINV, TREND, TRIMMEAN, TTEST, VAR, VARA, VARP, VARPA, WEIBULL, ZTEST

**Problems for Practical:**

**A : Windows :**

The following practical must be done in WINDOWS 95 :

1. To create shortcuts on the desktop,
2. To rename a file/folder,
3. To create a new file/folder starting from MY COMPUTER,
4. To delete files/folders,
5. To format a floppy disk,
6. To copy or move files/folders,

**B: Excel :**

1. Create a workbook storing the marks for a given number of subjects of various students and calculate the total and average.
2. Create a workbook storing the payroll list of an establishment containing employee number, name, basic pay, allowances, deductions, net pay and gross pay.
3. Create a workbook containing the annual rainfall of a place, and hence find mean, median, standard deviation of annual rainfall using statistical functions and produce the output in a given format. Also plot a graph to show the pattern of the annual rainfall (various types of graphs should be plotted and embedded in the worksheet).
4. A worksheet similar to that of Problem 1, contains the marks and grades of students. Using COUNTIF function find the number of students in various grades and using SUMIF function find the average total mark for each grade. Also find the maximum and minimum total marks.
5. In the worksheet made in Problem 1, calculate the result (passed or failed) of each student.
6. A workbook contains the names, state of domicile, sex, marks obtained in various subjects and result of a given number of students. Using database functions, produce reports like state-wise pass percentage, list of those passed from a given state, percentage of pass among boys and girls. Draw charts to show the trend (wherever applicable) and add legends and titles as required. Also use comparative histogram to show the number passed from different states of boys versus girls.
7. A workbook contains the performance of various students in the pre-test and the final examination. Using array formula, calculate the average change. Also compute the maximum and minimum change using array formula.
8. A worksheet contains scores (1 to 10) of a large number of archers. Prepare a frequency distribution table using /without using array formula.
9. Create a database which has the pollution level of the metropolitan cities of India and compare them by various graphs.
10. A workbook contains date, branch, amount, account number, customer name and account type which is maintained by a bank. Create pivot tables to answer the following:
    a) What is the total deposit amount for each branch, broken down by account type?
    b) What is the Rupees distribution of the different account types?
    c) How is a particular branch doing compared to the other two (or more) branches?

    Create charts to picturize the various cases.
11. A workbook contains the names of various publishers and the profits earned by them for five years from a particular book stall. Using chart wizard, plot a chart to compare the revenues of all the publishers for five years. Add appropriate legends and title. Also display the data labels on the chart. Plot a pie chart to show the revenue percentage made by each publisher (explode the slice of a particular publisher).

**SPSS PACKAGE**

1. Introduction ( Running SPSS/PC+, Important DOS Concepts)
2. Statistical Guide : *Preparing data for analysis & data definition
   *Data transformation
   *Selecting, weighting & ordering cases
   *Restructuring files (Joint & Aggregate)
   *Tabulation of data ( Frequencies)
   *Descriptive statistics
   *Cross tabulation & measurement of association
   *Sub population (Mean)
   *t-test (Difference between two means )
   *F-test, Chi-square test
   *Plotting data
   *Correlation
   *ANOVA
   *Experimental Design
   *Non parametric
   *Regression
   *Reporting result procedure
   *Control charts (SQC)
   *Time series
   *Index Numbers
   *Probability Distribution
   *Generation of Random Numbers
   *Simulation Techniques.

**Distribution of Marks:**

| | | |
|---|---|---|
| Paper I ( Fundamentals of Mathematics & Computer) | : | Semester( 70 Marks) |
| Unit 1 (Mathematics) | : | 35 Marks |
| Unit 2(Computer) | : | 35 Marks |
| Internal Assessment | : | 30 Marks |

Instruction for paper setter (Semester Exam.):
There will be 7( seven) questions from each unit of which 5(five) from each unit have to be answered. Each question carries 7(seven) marks.

## DASCA 1.2. Basic Statistics

**Unit 1. Descriptive Statistics :**

**Descriptive Statistics** :Collection of data, classification, tabulation and diagrammatic representation of various types of statistical data. Frequency distribution. Measures of central tendency and dispersion. Moments. Measures of association and contingency. Method of least squares and curve fitting. Simple correlation, multiple correlation and regression. Flow charts: Measures of central tendency and dispersion.. Regression and correlation.

**Unit 2.Probability and probability distributions :**

**Probability and probability distributions**: Random variable, Definition of probability, addition and multiplication theorems of probability. Expectation. Probability distribution, Binomial, Poisson and Normal distributions.

**Stochastic Process**: Introduction, Transition probability matrix, Concept of Markov Chain.
**Sampling Distribution** : Definition and application of Chi-square, t and F distributions.

**Unit 3. Statistical Inference :**

(a) Theory of estimation, Unbiasedness, Consistency, Sufficiency and Efficiency. Method of estimation, BLUE
(b) Testing of hypothesis : Basic concept of testing of hypothesis, testing of mean for known and unknown parameters ( only Normal Distribution ). Measuring the power of a hypothesis test
(c) Non-parametric Statistics : Introduction, advantages and limitations. Sign test, Run test, Mann – Whitney U- test.

**Unit 4 . Sample Survey and Sampling Techniques:**

**Sample Survey and Sampling Techniques** : Primary and Secondary data, principal steps of sample survey, sampling and non-sampling errors. Simple random sampling, Stratified random sampling, Systematic sampling, Double sampling. Cluster sampling ( only definitions and theorems ; proof of the theorems are not required)

**Distribution of Marks:** **Semester(70 Marks)**

**Paper II:**

| | | |
|---|---|---|
| **Unit 1 (Descriptive Statistics)** | : | **35 Marks** |
| **Unit 2 (Probability & Probability Distributions)** | : | **35 Marks** |
| **Internal Assessment** | : | **30 Marks** |

**Paper III:** **Semester(70 Marks)**

| | | |
|---|---|---|
| **Unit 3 (Statistical Inference)** | : | **35 Marks** |
| **Unit 4 (Sample Survey & Sampling Technique)** | : | **35 Marks** |
| **Internal Assessment** | : | **30 Marks** |

**Instruction for paper setters :**

**DASCA 1.2 (Basic Statistics ) consists of two papers, paper II and paper III. Each paper will have two units. 7(seven) questions from each unit of which 5(five) have to be answered. Each question carries 7(seven) marks.**

**DASCA 1.2.1 : Practical – 1(Use of computer to solve the problems based on DASCA 1.1. and 1.2.)**

**Name of Experiments :**

**Experiment No.**

1. Solution of simultaneous equation of two variables.
2. Computation of matrix addition, subtraction, multiplication inversion(Gauss elimination method only) and rank of the matrix.
3. Computation of Newton's forward and backward interpolation formulae.
4. Computation of Lagrange's interpolation formula.
5. Computation of Simpson's one-third rule of numerical integration.
6. Graphical representation of statistical data.
7. Construction of frequency distribution table.
8. Computation of measures of central tendency and dispersion.
9. Computation of moments, skewness and kurtosis.
10. Fitting of linear and non-linear functions by method of least squares.
11. Computation of correlation and regression .
12. Fitting of binomial, Poisson and normal distributions.
13. Computation of Chi-square, t and F statistics.
14. Generation of Random Numbers and selection of Simple random sample ( with and without replacement).

**Distribution of Marks :**

| | |
|---|---|
| **Semester** | **: 70 (50 + 10 + 10)Marks** |
| **(i) Practical** | **: 50 Marks** |
| **(ii) Practical note book** | **: 10 Marks** |
| **(iii) Viva** | **: 10 Marks** |
| **Internal Assessment** | **: 30 Marks** |

**Instruction for Paper setter(Semester Exam.):**

**There will be 8(eight) questions for practical of which 5(five) have to be answered. Each question carries 10(ten) marks.**
**There will be 10(ten) marks for each practical note book and viva.**

## DASCA 1.3. APPLIED STATISTICS

**UNIT : 1** **Index Number** : Definition,Various types of Index Numbers and their Constructions. Cost of Living Index Number. Uses of Index Number, Computer Database Exercise, Flow Chart

**Time Series:** Introduction, Variations in Time Series, Trend Analysis, Cyclical Variation, Seasonal Variation, Time Analysis In Forecasting, Computer Database Exercise Flow Chart, Business Forecasting

**Statistical Application in Finance** : Statistical Application in Cost Volume, Profit Analysis, Project Evaluation, Inventory Control, Receivable Management, Demand Forecasting.

**Statistical Application in Investment Management** : Using probabilities to assess expected returns from Shares, Use of Standard Deviation for measurement of total risk from investing in shares, Use of Covariance to Partition total risk into Systematic & Unsystematic components Use of tests for drawing conclusion s regarding Share Price changes.

**Decision Theory** : The decision environment expected profit under uncertainty : Assigning Probability values, Using Continuous distributions: Marginal Analysis, Utility as a decision criterion, Helping decision makers, Supply the Right Probabilities, Decision -Tree Analysis.

**Costing:** Nature, Importance & Basic Principles, Marginal Costing : Nature, Scope & important, break-even analysis, Its uses & limitations, Construction of break-even chart, Practical applications & Marginal Costing, Standard Costing : Nature and scope, Computation & Analysis of Variances with reference to material Cost, labour Cost & Overhead Cost, Interpretation of the variances

**UNIT : 2** **Agricultural Statistics ( Analysis of Variance and Experimental Design )** :One, Two & Three ways Classifications, Analysis of two way classified data with k- observations per cell ) Terminology in Experimental Design, Size of the plot, Completely Randomised Design, Randomised Block Design, Latin Square Design, Factorial Experiments, Confounding in Factorial Experiments, Split Plot Design, Incomplete Block Design, Experiment in farmers' field, Application in Industry, Biological assays dose-response curve, types of bio-assays, Quantal response assays.

**UNIT : 3** **Techniques of Quality Control:** Statistical process Control, Control Charts for attributes & variables, CUSUM Control Charts, Concepts of ARL, Economic Design of Control Charts, Total Quality Management, Acceptance Sampling Plans ( Single Sampling Plan & Double Sampling Plan ), Computer Database exercise, Flow Chart : Quality & Quality Control, Concepts of Life Testing & Reliability, ISO 9001.

**UNIT : 4** **Managerial Statistics (Operations Research): Linear Programming Problem** : Graphical & Simplex method, Duality in L.P.P, Transportation Problem, Assignment problem, **Queuing Theory** (Characteristic of queuing system, Poisson process and exponential distribution. Properties of Poisson process, classification of queues, transient and steady state, Poisson queues model: M/M/1 : ( $\alpha$/FIFO )), **Inventory Management** (Inventory control, definition of costs, demand, lead time, stock replenishment, time horizon, techniques of

inventory control with known demand ).Replacement problem & System Reliability, Network Scheduling by PERT / CPM., Information Theory.

UNIT : 5 **Educational Statistics: ( Psychometric & Education):** Introduction, Scaling Individual Test Items in terms of difficulty ( σ-Scaling ), Scaling of Scores on a test, Percentile Scores, Scaling of ranking in terms of Normal Probability Curve, Reliability of Test Scores, Standard Error of measurement, Index of Reliability, Parallel Tests, Speed Vs. Power Tests, method of determining test Reliability, Effect of Test-length on the Reliability of the test, Validity of test scores, Validity of Test-length, The Relation of Validity to Reliability, Intelligence Quotient, Rank, Biserial & Tetrachoric correlations.

UNIT : 6 **Population Statistics** :Introduction, Uses of Population Statistics, Method of obtaining Vital Statistics, Measurement of Population Rates & Ratio of Vital events, Measurement of Mortality, Life Table, Abridged Life Table, Fertility, Measurement of Population Growth, Migration

UNIT : 7 **Econometrics:** Introduction, Econometric Model & Methods, Estimation Problems .Auto Correlation, Heteroscadasticity, Error in the independent variables, multi-collinearity, Identification & Simultaneous Estimation, Auto-Regression Model, Distributed Lags, Principal Components, Factor Analysis, Canonical Correlation, Spectral Analysis, Probit Analysis, Input-Output Models.

UNIT : 8 **Medical/Bio-statistics** : Introduction, application of statistics to biology, medical science & epidemeology. Model building. Bio-assays: structure, relative potency, similarity, dose response curves, types of bio-assays, quantal response assays.

**Distribution of Marks:**
(Paper V and paper VI)
Semester (For the four units) : 140 Marks
Internal Assessment(for the four units) : 60 Marks

Instruction for Paper setter ( Semester Exam.)
Each unit will carry 35 marks and there will be 7(seven) questions from each unit of which 5(five) to be answered. Each question carries 7(seven) marks.

N.B: Any two units comprise of one paper.

**DASCA 1.3.1. : Practical –2 ( Use of computer to solve the problems based on DASCA 1.3.)**

(Paper VII)

**Name of Experiments:**

Experiment No.:

1. Computation of Index Numbers.
2. Analysis of Time series data.
3. Computational work on statistical applications in finance, investment management and costing.
4. Analysis of variance
5. Analysis of design of experiments
6. Computational work on control charts and sampling plan.
7. Computational work on LPP, Inventory management.
8. Computational work on educational statistics
9. Computation of vital rates, life table.
10. Computational work on simple econometric models.
11. Computational work on bio-statistical problems.

| Distribution of Marks: | Semester ( 70 Marks) |
|---|---|
| (i) Practical | : 50 Marks |
| (ii) Practical note book | : 10 Marks |
| (iii) Viva | : 10 Marks |
| Internal Assessment | : 30 Marks |

Instruction for Paper Setter ( Semester Exam.):

There will be 8(eight) questions for practical of which 5(five) have to be answered. Each question carries 10(ten) marks. Two questions to be set from each unit.

There will be 10(Ten) marks for each practical note book and viva.

## DASCA 2.1: PROJECT

**Guidelines for DASCA 2.1 : Project( Paper VIII)**

**Project Work:**

The project work is an integral part of the PGDASCA Program. The objective of the project work is to enable the candidates to have an opportunity to apply the theoretical concepts that they have learnt. This gives an opportunity to have an interface with the industry/organisation. The candidate should have necessary depth in the subject/topic which they have selected for project work so that full benefit can be derived. In order to ensure that the objective is achieved, the detailed guidelines relating to the project work are given below.

The candidates are required to comply with the following guidelines.:

1. **Stage at which project can be done** : Candidates are permitted to start the project work only after completion of Ist semester examination of the PGDASCA program.
2. **Selection and Approval of the topic** : Candidates may select a project on any topic covered in the 2nd semester of PGDASCA program. Candidates who are also working as executives are advised to select a topic which is related to their work provided such topic is covered in the subject of 2nd semester of PGDASCA.
   Candidates are required to submit a brief write-up of the tentative contents of the proposed project in the department. The candidates should follow strictly the" **FORMAT OF PROJECT SYNOPSIS".**
3. **No Joint Project Report** :Every candidate will have to do the project work by himself/herself. That is, candidates are not expected to do the project work as a group & submit a joint project report. Each candidate should do the project on his/her own and submit a report.
4. **Duration of Project work & guidance** : The project will be carried out over duration of 2(two) months, involving about 120(One twenty ) hours. Every student should do a project under the guidance of at least one of the faculty members and/or expert/ profession from an organisation outside of the college. The project report should have a certificate from the college stating it to be a bonafide work of the student that has not been submitted for any other examination..
5. **Application of concepts & Techniques:** In the course of the project work , candidates should make maximum use of the various concepts & techniques covered in their program of study. The project work should be viewed as an opportunity for application of the concepts learnt and to reinforce their understanding of the topics.
6. **Approaching the Organisations for Project work:** Candidates should make formal request through the Principal of the college to the organisations/ companies to permit the candidates to carry out the project work.
7. **Primary source of Information:** While doing the project work, candidates should they to obtain as much literature from the organisation as possible to make the project work objective & meaningful.
   In certain cases, it may become necessary to prepare a questionnaire to collect the data. The questions should be clear, brief, corroborative, non-offending, courteous in tone, unambiguous & to the point so that not much scope of guessing is left on the part of the respondent.

8. **Secondary source of information:** Candidates should make use of the library Facilities available to them to make references in the course of their project work.

9. **Presentation of the project report** :Candidates are advised to prepare the project report in the following format to the extent possible:

(a) Title of the project
(b) Acknowledgements
(c) Certificate from Head of the Institution
(d) Organisation's letter certifying the project ( where the project is done with an organisation).
(e) Table of contents
(f) Executive summary
(g) Objectives
(h) Methodology
(i) Organisation/company profile (where the project is done with an organisation)
(j) Observations & analysis
(k) Detailed report.
(l) Suggestions & recommendations.
(m) Conclusion.
(n) Annexures
(o) Bibliography

Generally the project report should have a minimum of 40-50 pages. They should be neatly typed and supported by graphs/tables/charts wherever required.

10. **Evaluation of the project report:** The project work will be evaluated both by internal as well as by external examiners. Wherever the project report is found to be incomplete or lacks of clarity in some areas, the candidates will be given the feedback and advised to either submit the report or to provide additional information/clarifications.

11. **Viva-voce** : The viva-voce will be conducted by an external examiner appointed by the University and an internal examiner from the college. Other members of the faculty may be present. In the viva-voce , the candidates are expected to substantiate and support the project done with additional information which could not be documented in the report. In the viva test the candidates understanding of the basic concepts and ability to apply them effectively.

12. **Benefits:** Candidates should note that the benefit obtained out of the project work depends on the seriousness & earnestness with which they carry out the same. The project work is the stage which exposes the candidates to the various areas of applied statistics in a practical way.

**Distribution of Marks:**

| | |
|---|---|
| **Project Report** | **: 50 Marks** |
| **Viva-voce** | **: 20 Marks** |
| **Internal Assessment** | **: 30 Marks** |

SUGGESTED READING

**SUGGESTED READING :**


1.Aitken, A.C. Determination and Matrices, Oliver & Boyd.
2. Apostole, T.M, Calculus, Vol. I, II, Blaisdell International Text Book Series.
3. Sexena, H.C, Finite Differences and Numerical Analysis, S. Chand and Company Ltd.New Delhi
4.Simpson, Alan. Alan Simpson's easy guide to Windows 95, BPS publications, New Delhi.
5. Weingarten, Teach yourself Excel for Windows 95, BPS publications, New Delhi.
6. Cleveland, W.S, The elements of graphing data, Menteray, CA, Wadsworth Advanced books & software,1985.
7.Mood, Graybill & Boes, Introduction to Theory of Statistics, MeGraw Hill .
8. Gupta, S. and Kapoor, V.K, Fundamental of Mathematical Statistics, S. Chand & Co. New Delhi.
9.Hoel, P.G, Introduction to Mathematical Statistics, John Wiley & Sons.
10. Cochran, W.G, Sampling Techniques, John Wiley & Sons.
12. Guy, D.M, Audit Sampling: An introduction to statistical sampling in audting, John Wiley & Sons.
13. Richard, I.L. and David, S.R, Statistics for management , Prentice-Hall of India, New Delhi
14. Gupta, S. and Kapoor, V.K, Fundamental of Applied statistics, S. Chand & Co.
15. Conover, W.J, Practical Nonparametric statistics, John Wiley & Sons.
16. Juran, J.M & F.M, Gryna Jr., Quality Planning & Analysis, McGraw Hill Book Co.
17. Mills, T.C, Time Series Techniques for Economist, Cambridge University Press.
18. Klein, L.R, An Introduction to Econometrics, Prentice Hall of India
19. Rangaswamy, R., A text book of Agricultural Statistics, Wiley Eastern India.
20. Garret, H.E, Statistics in Psychology & Education, Longman
21. Spiegelman, M, Introduction to Demography, Society of Actuaries.
22. Kanti,S, Gupta & Monmohan, Operations research, S. Chand & Co.
23. Maheswari, S.N, Management Accounting & Financial control, S.Chand & Co.
24. Das, M.N and Giri, N.C, Design and analysis of Experiments, Wiley. Eastern Ltd. Publishers, New Delhi
25. Murthy, M.N, Sampling Theory and Methods, Statistical Publishing Society,

# MINUTES OF THE JOINT MEETING OF BUGS IN STATISTICS AND COMPUTER SCIENCE

A joint meeting (local) of the BUGS in Statistics and BUGS in Computer Science was held on 27.11.2000 at 2 p.m. in the Department of Economics, NEHU, Shillong to discuss:-

1. Letter received from the Controller of Examination regarding maximum number of students in a group appearing at a practical examination at Bachelor's degree level on any particular day.
2. Any other matter.

The following members were present:-

1. Dr. M.K.Das, Member
2. Mr. B.Roychoudhury, Member
3. Mr. M.Barua, Member
4. Mr. Sanku Dey, Member
5. Fr. Joseph Nellanatt, Member
6. Dr. A.B.Chakraborty, Member
7. Dr. S.K.Mishra, Chairman

The members discussed the letter written by the Controller of Examinations and resolved the following:

(a) There should be different question papers (practical) to be administered to different groups of students appearing at different days/hour or shift as the case might be.

(b) In case a college has enough laboratory facilities to support a large group of sutdents sitting for practical examination on a specified day/hour/shift, the college may be allowed to do so and all students appearing at the practical examination that day/hour/shift will be administered the question paper specified for that day/hour/shift in the examination schedule.

(c) The BUGS in Statistics and Computer Science are not Particular about the maximum number of students making a group for examination purpose.

Contd.....2

Any other matter:

A: The Chairman put up before the Board the letter of Deputy Registrar (Academic), NEHU, Shillong, along with the letter of Joint Secretary, UGC, regarding recommended course module on Information Technology, suggested to be introduced at degree level in all institutions of higher education, and the suggested curriculum enclosed with the said letter. The BUGS members deliberated on the same and resolved that in principle introduction of IT course at graduation level (in all streams) is agreed. It was suggested that a course on Certificate in Computing for Common Man as formulated by DoEACC may be adopted for this purpose.

B: Dr. A.B.Chakraborty, Head, Department of Statistics, St.Anthony's College, Shillong, informed the Chairman that St.Anthony's College has proposed P.G.Diploma in Applied Statistics and Computer Application (a modular course of one year's duration). The minimum qulification for admission to this course is Bachelor's degree in any stream and it does not presuppose any prior exposure to Statistics/Computers, though a good performance at the Bachelor's degree is required. It is like a PGDCA course.

The members discussed the syllabus, suggested certain modifications and the Chairman, BUGS was authorised to send the modified syllabus to higher bodies for further action/ present the modified syllabus before the appropriate bodies in the University.

C: Dr. A.B.Chakraborty, Head, Department of Statistics, St.Anthony's College, Shillong suggested some minor alteration in the contents of syllabus in Statistics, namely that two topics, Concept of Random Variables and Expectation and Theorems on Expectation should be shifted to First Year Course. It was resolved to accept his suggestion and the proposed changes may be communicated to appropriate bodies for incorporation in the syllabus of Statistics.

It was also proposed that in Third Year Paper V-Practical of 100 marks, 25 marks should be devoted to Project Work.

Contd.....3

The Board considered the suggestion and suggested that the process of the proposed changes be started and brought to the appropriate bodies of the University.

The meeting ended with a vote of thanks from the Chair.

Dated: November 28,2000

Sd/-

(S.K.Mishra)
Chairman
BUGS in Statistics
and
BUGS in Computer Science

5:3-RESEARCH

i) Starting of Ph D Programme in the Centre of Environmental Studies.

The matter relating to starting of Ph D Programme in the Centre of Environmental Studies was placed before the Council in its 64th meeting wherein the Council vide its resolution No:AC:64:2000:5:3:(i) resolved to constitute a Committee to look into the matter.

Now, the report of the said Committee is placed herewith as annexure-'A'

The matter is placed before the Council for consideration.

5:3:1(2) Annexure-'A'

**MINUTES OF THE COMMITTEE APPOINTED BY THE ACADEMIC COUNCIL VIDE RESOLUTION NO: AC:64:2000:5:3:(i) TO LOOK INTO THE STARTING OF PH.D. PROGRAMME IN THE CENTRE OF ENVIRONMENTAL STUDIES HELD ON 3RD MAY, 2001 AT 2.30.P.M.**

The following members were present:

| | |
|---|---|
| 1. Prof. JC Binwal | Chairman |
| 2. Prof. SS Khare | Member |
| 3. Prof. AN Rai | Member |
| 4. John MS Khongwir | Member |

After deliberation the Committee was of the view that:

1.(a) It would be difficult to consider the case of one Centre in isolation.

2. The Academic Council may issue directives whether all the Centres of Studies are to be considered.

3. It was felt that a distinction should be made between Service Centres and Centres of Studies.

Sd/-
JC Binwal
Chairman

Sd/-
Prof. AN Rai

Sd/-
Prof. SS Khare

Sd/-
John MS Khongwir

i) Nomination of three members to the Boards of Under-Graduate Studies.

The term of the following Boards of Under-Graduate Studies have expired. In terms of Proviso (i) of the Ordinance OA-9, three members not below the rank of Reader are to be nominated by the Council to the Board of Under-Graduate Studies.

1. Board of Under-Graduate Studies in Bio-Technology.

2. Board of Under-Graduate Studies Studies in Industrial Chemistry.

The matter is placed before the Council for consideration.

ii) Nomination of three members to the BUGS.

The following two new subjects have been introduced at the Under-Graduate level for which Boards of Under-Graduate Studies are required to be constituted .

1. Clinical Nutrition or Dietetics Course.

2. Bachelor of Engineering.

In this connection, in terms of Provisio (i) of Ordinance OA-9, three members not below the rank of Reader are to be nominated by the Council to the aforesaid Boards.

The matter is placed before the Council for consideration.

iii) Ph.D. Registration of Md. Mushahidunnabi.

Prof. R.P. Bajpai, I.S.O.S.B. in his letter No.F. 1-21/ISOSB/2000, dated 20.3.2001 (Annexure-'A') has informed that the case of Ph.D. registration of Md. Mushahidunnabi was brought before the Academic Council in its 64th meeting in which he has presented the case as given in the minutes of the Institute Board meeting (Annexure-'B'). He stated that the A.C. has agreed that the Head, Deptt. of Zoology would provide the grounds for non acceptance of the Synopsis in writing for a remedial actions. In response to the A.C.'s Resolution, the Head, Deptt. of Zoology wrote a letter to the Head, ISOSB.(Annexure-'C') without any ground for non acceptance of the synopsis but informed that the information provided to the A.C. was incorrect. Prof. Bajpai after receiving the letter from the Head, Deptt. of Zoology, requested Dr. Debjani Roy, the supervisor of the candidate to give an updated progress report of the candidate's work (Annexure-D).

The matter regarding Ph.D. registration is therefore placed to the A.C. meeting for decision.

No:G.26-9/Acad/Genl/Zoo/2001

5:8:3(2)

NORTH EASTERN HILL UNIVERSITY
SHILLONG.
INSTITUTE OF SELF ORGANISING SYSTEMS & BIOPHYSICS.

No.F.1-21/ISOSOB/2000/- Dated: 20.3.2001

ANNEXURE 'A'

To
The Vice-Chancellor,
NEHU., Shillong.

Sub: Ph.D. Registration of Md. Mushahidunnabi.

Sir,

The case of Ph.D. registration of Md. Mushahidunnabi was brought before the Academic Council in its 64th meeting. I presen-ted the case as given in the minutes of the Institute Board meeting(Encl.1). It was agreed in the Academic Council that the Head Department of Zoology would provide us the grounds for non acceptance of the synopsis in writing for a remedial actions. In response to the resolution of the Academic Council, the Head, Deptt. of Zoology wrote a letter to us (Encl.2). The letter does not give any ground for non acceptance of the synopsis and in addition makes an insinuation that the information provided to me and the Academic Council was incorrect. After receiving the letter, I requested Dr. Debjani Roy, the supervisor of the candidate, to give an updated progress report of the candidate's work.(Encl.3).

I find the fnformation supplied to me to be correct and further notice hesitancy on the part of the Head, Department of Zoology to provide any ground for the non acceptance of the synopsis. I, therefore, request you to place the matter before the Academic Council and suggest that the recommendation of the Institute Board be accepted and the candidate be registered for Ph.D. Programme.

With regards.

Yours sincerely,

Sd/-
( R.P. Bajpai )
Professor.

5:8:3(3)

ANNEXURE 'B'

INSTITUTE OF SELF ORGANISING SYSTEMS AND BIOPHYSICS
NORTH EASTERN HILL UNIVERSITY SHILLONG-793022, INDIA

MINUTES OF THE INSTITUTE BOARD(SCHOOL BOARD)MEETING.

The meeting of the local members of Institute Board(School Board) was held in the Institute at 11 A.M. on 26.4.2000.The following were present:

1. Prof. R.P. Bajpai
2. Prof. R.K. Rai
3. Prof. S.K. Srivastava
4. Dr. Anis Alam
5. Dr. Satish Kumar
6. Dr. Debjani Roy.

The members elected Prof. R.P. Bajpai to the Chairman of the meeting The Chairman welcomed the members and briefed about the ongoing activities of the Institute and informed that the Vice-Chancellor has permitted the Board to consider the case of Mr.Md.Mushahidunabbi as well. The Chairman further informed that the Municipal Corporation of Gola Gokarannath,Lakhimpur Kheri is honouring Dr. Vinod Singh for his outstanding contributions in Science on 28.4.2000.The local members of the Board congratulated Dr. Vinod Singh for this honour and then took the following decisions:

1. The Board granted extension of TWO years under ordinance OC4-5(2) to Mr. V.A.Sivadasan, Mr.Sivadasan was registered for the Ph.D.degree vide Reg.No.70 of 1995 under the new ordinance of the university.The registration was notified by D.R.(Academic) vide letter No.G.26-23/2/96/SivadasanØBio-Phy/Ph.D./96/-8099 dated 19.3.96.The approved title of his thesis is "Coherent states of damped oscillators and their relevance to light induced ultra weak photon emission in plant tissues".The stipulated FIVE-year period has expired on 7.4.2000.The Board also approved the list of Examiners for his thesis.

2. The Board desired that the research proposal for Ph.D. work of Mr. Md.Mushahidunabbi under the Supervision of Dr. Debjani Roy in the Institute be accepted.The Board,therefore, recommended his registration in the Ph.D. programme to the Board of Research Studies(BRS) of the University. The Board further desired that BRS be apprised of the following facts of this case for Ph.D. registration.

   Facts of the Case for Ph.D. registration: Mr.Md. Mushahidunabbi did his M.Sc. from the Zoology Department of this University in 1996.He was admissted in the Institute on 11.11.1997. The Institute, in pursuance of the suggestion of the Academic Council advised the candidate to get himself registered through the Deptt. of Zoology. He applied to the Deptt. of Zoology through the Institute in March 1999. The Department of Zoology verbally informed the candidate that his proposal was not found fit by the BPGS of Zoology for forwarding to the School Board. The Institute finds the research proposal of the candidate to be appropriate. The World Wide Fund for Nature, India is funding his work. Because of the inability of the Deptt. of Zoology to register the candidate,the institute contacted three leading experts in the relevant area about the suitability of the proposal for work leading to a Ph.D. degree.The experts were Dr. Monique Halloy; Dr. S.K. Saidapur and Dr.J.R.B.Alfred.All the three

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experts have found the proposal good and appropriate. The local members of the Institute Board(School Board) have desired that the proposal be accepted for the registration to the Ph.D. programme.

The meeting ended with thanks from the chair.

Sd/-
(Prof.R.K.Rai)

Sd/-
(prof.S.K.Srivastava)

Sd/-
(Dr. Anis Alam)

Sd/-
(Dr.Debjani Roy)

Sd/-
(Dr.Satish Kumar)

Sd/-
(Prof.R.P.Bajpai)

Dated: April 26,2000.

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ANNEXURE 'é'

DEPARTMENT OF ZOOLOGY.
NEHU.Shillong.

Prof.K. Chatterjee
Head.

Dated 14.3.2001
No.F.1-20/Zoo/BPGS/2000/42.

To

The Head
Institute of Self-Organizing Systems & Bio-Physics,
NEHU., Shillong-22.

Sub: Ph.D.registration in respect of Mr.Md.Mushahidunabbi,. ISOS & BP.

Sir,

With reference to the mentioned subject and decision of the 64th AC(AC:64:2000:5:8:(viii),December,2000, I wish to inform the following.

1. BPGS(Zoology) in its meeting held on 7.4.1999 considered Ph.D. Synopsis entitled "Studies on habitat,ecology and breeding biology of the Himalayan newt for their in-situ conservation" of the said candidate,suggested major revision and resolved that the revised synopsis may be considered in the next BPGS meeting The candidate was advised accordingly to do the needful and submit the revised synopsis.
2. The revised synopsis was never submitted to this Deptt.again(till date for its consideration any any of subsequent BPGS meetings nor this Deptt. was approached at any time during this period and relating to the stated matter.
3. The Deptt. of Zoology has "no hindrance"(what so ever)relating to consideration of Ph.D Synopsis of the candidate.
4. The Deptt. of Zoology is bound to honor the decision of BPGS Zoology vide meeting held on 7.4.1999 to consider revised Ph.D synopsis of the candidate.This,under our present set up,will be considered by the Department Research Committee(DRC)and then put to BPGS(Zoology)for its consideration.The candidate is welcome to contact this Deptt. at any time.
5. The Deptt. of Zoology,however,strongly feels that the information provided to you and to the Academic Council is not correct and

Contd...3/-

the undersigned finds"no hindrance" on any account subjected to compliance of the decision of BPGS.

This information is for your kind and necessary action.

Yours sincerely,
Sd/-
(Prof.K.Chatterjee)

Copy to:
1. The Asstt.Registrar(Conf.)NEHU.Shillong for information.

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ANNUXURE 'D'

Status Report of the progress of Mr.Md.Mushahidunabbi, ISOS & BP.

Mr.Md.Mushahidunabbi was admitted as a student of ISOS&B in Nov.1997. He Started working towards his Ph.D.degree with funding from WWF on the Himalayan Newt at Darjeeling.The work after having progressed well, he wanted to get himself registered for his Ph.D.Accordingly he prepared a synopsis.Deptt Research Committee of Zoology examined the synopsis and suggested several inclusions in the synopsis.Mr.Md.Mushahidunabbi rewrote the synopsis and showed it to several faculty members who made the necessary corrections.Only one suggested inclusion involving the histologican and gonadal studies was not included in the work plan, as it would have required catching and killing of Himalayan newts,which is not permissible because it is an endangered species. The Departmental Research Committee presumably approved the changed synopsis and forwarded it to the BPGS of the Deptt. of Zoology.The BPGS in its meeting in April,1999 considered the synopsis. The decision of the BPGS in any written form has not been communicated to either the student or the guide till date.On enquiry he was verbally told that since most of the work has already been done,he needs to think about his work plan.

Undeterred by the setback,Mr.Md.Mushahidunabbi continued to work in Darjeeling.He did not give up the idea of leaving research.The Synopsis was sent to national and international experts in the field to seek their opinion about the suitability of the proposed plan work for a Ph.D.degree.The national and international referees gave very favourable and encouraging reports,which are enclosed herewith.The favourable reports persuaded the Institute to take up his case for Ph.D. registration on 6.3.2000.

The work carried out by Mr. Nabbi is of great importance. It has generated an immense enthusiasm amongst the local inhabitants of Darjeeling to protect the endangered species.Mr.Mike Pandey,the Green Oscar Awardee of 1994 and 2000, filmed his work. The film was shown in the TV series "Earth Matters" several times in August 2000.Mr. Md.Mushahidunabbi has published his work in ZOOS PRINT and FROGLOG. One manuscript is in press and two are under preparation.

...3

March 20,2001

Sd/-
( Dr. Debjani Roy )

iv) Implementation of Five Day Week in the University.

The proposal for implementation of Five Day Week in the University was placed in the 109th meeting of the Executive Council vide agenda note as placed at Annexure-'A' wherein the Council vide its Resolation No:EC:109:2001:5:8(i)considered the proposal and resolved that the matter may be first placed before the Academic Council.

The matter is placed before the Council for consideration.

Annexure-'A'

5:8:4(2)

## IMPLEMENTATION OF FIVE-DAY WEEK IN THE UNIVERSITY

The matter of Implementation of Five-days week in the University was placed before the Executive Council in its 78th meeting held on 30th March 1993. The decision of the Executive Council is given as follows :

EC:78:93:05:8(I) : The Council considered the proposal for a Five day working week in the University and RESOLVED that since this would also affect the teaching in the Departments the matter may first be discussed in the Academic Council and thereafter be placed before the Executive Council again.

The 46th meeting of the Academic Council held on 14th May 1993 wherein the Council considered the introduction of Five-day week and RESOLVED that the same may be introduced with effect from the next semester. The Council however, desires that a Committee may be appointed to look into the modalities for implementing the same. The Committee consists of the following.

1. Prof R R Misra
2. Prof (Mrs)H Ila
3. Prof M P Mahajan
4. Dean Student's Welfare
5. Registrar_____Convenor.

The Committee appointed by the Academic Council met on 25th June and 5th July 1993 and proposed that:

1. On saturdays three buses may be put into service.
2. Library may be kept open on Saturdays from 10 am to 4 pm for all purposes.
3. Administration may make arrangements for Kitchen Staff to be on duty all days as at present.
4. Other staffs as such as Cleaners, Safaiwalas and and other essential staffs may be required to work for 6 days a week.

The 47th meeting on the Academic Council considered the proposal for Implementation and RESOLVED to reiterate its stand for the same.

But the 79th Executive Council vide Resolution No: EC:79:93:05:08:(v) had RESOLVED that the matter regarding implementation of a Five Day working week in the University may be treated as closed without assigning any reason.

The University is getting much pressure from all the Administrative Staff members and Non Teaching Staff association that the case of Five day a week may please be reopened in view of the following points.

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1. This University (NEHU) has already curtailed Casual Leaves from 12(Twelve) days to 8(Eight) as per the recommendation of the fifth pay commission but still this University is having 6(Six) days a week. The Teaching community is enjoying 3 months Winter and Autumn vacation whereas the administrative staff are having 30 days Earned Leave at the discretion of the University authority.

2. In the Meghalaya State all Central Govt. and State Govt. establishments and Offices are having Five day a week except NEHU. On the other hand most of the Central government Universities like Delhi University, Jawaharlal Nehru University, IGNOU, Jamia Milia University, Tezpur University etc, are also having Five day a week as per the recommendation of the Fifth Pay Commission.

3. In case, Five day a week is implemented in this University, the University shall get atleast two days time to get service or repairs of heavy vehicles which are plying on the roads daily without rest from early morning till late night. Secondly, this University can save two days petrol expenditure and checking of vehicles can be done with peace of mind.

4. The 46th and 47th Academic Council Meeting recommended the introduction of Five-day a week.

5. Teachers particularly Researchers would get two days to concentrate in their work.

6. The Transport section shall also save POL, in case of Five days a week is implemented. This would be atleast 15% of present annual expenses.

7. The University would also save lot in telephone, electricity and heating expenses if Five days a week is adhered to.

8. Implementation of Five day a week shall encourage the staff of this University to do their works more efficiently on all working days.

9. Regarding the Office timings, the State Government's Office starts from 10 am till 5 pm from the inception of this University, the timings followed are as per State Government timings. Therefore, the University can fix timings from 9:30 a.m. till 4:30 p.m.

Item No.6-Administrative Matters.

6:1-Seledtion Committee. 6:1:1(1)

1) Change of effective date in respect of teachers placed in the Sr.Scale/Selection Grade/Reader under C.A.S, after 1.1.1996.

The University Grants Commission in its notification dt.24.12.98 has revised the guidelines for placement of Lecturer in Sr.Scale/Selection Grade/Reader/Professor under C.A.S with effect from 1.1.1996. In this connection, there are a number of candidates, whose cases have been processed as per old guidelines, and their cases were duly recommended by the Selection Committees and approved by the Executive Council respectively. Now, the teachers desire that since their cases have been cleared by the Selection Committee as well as by the Executive Council their effective date for placement/promotion be made effective from 1.1.96(under new guidelines of C.A.S).

This matter was placed before the Executive Council in its 106th meeting held on 13.4.2000. However, the Executive Council vide its resolution No:EC:106:2000:6:1: dt.13.4.2000 resolved that "such teachers desiring placement/promotion under the time frame stipulated under the Vth pay package may apply for consideration under the new rules".

In view of the decision made by the Council in its 106th meeting as mentioned above, the NEHUTA has submitted the representation stating that lecturers who have completed the requisite number of years for this promotion before 1.1.96,but promoted after 1.1.96 to Sr.Scale/Selection Grade/Reader,the effective date of promotion/placement for these lecturers should be notified as 1.1.96,since their cases have already been cleared by Selection Committees and duly approved by the Executive Council respectively and need not be processed again as decided by the Executive Council in its 106th meeting.

The representation of the NEHUTA,was placed before the Executive Council in its 108th meeting held on 8.12.2000, however the Executive Council invide resolution No:EC:108: 2000:6:1:(iii) has decided that the matter may be referred to the Academic Council.

The matter is therefore, placed before the Council for consideration and approval.

No.F.5-1(Estt.II(B)

6:1:1(2) ANNEXURE-'I'

NORTH-EASTERN HILL UNIVERSITY TEACHERS'S ASSOCIATION
SHILLONG-793022

October 16, 2000

DEMANDS AND OBSERVATIONS OF NEHUTA ON THE CAREER ADVANCEMENT SCHEME(CAS) OF TEACHERS:

1. CAS for Promotion of Lecturers to Sr.Lecturers and Sr.Lecturers to Lecturer(Selection Gr.)/Reader:

   - The Lecturers who completed the requisite number of years for their promotion before January 1, 1996 but promoted after January 1, 1996 to Lecturer(Sr.Scale)orLecturer(Sr. Scale) to Lecturer(Selection Gr.)/Reader, the effective date of promotion for these lecturers should be notified as January 1, 1996.

2. CAS for Promotion of Teachers:

   - Counting of Past Service(New Ordinance OE-4, 3(c) Copy enclosed. The details are provided in the following Table.

   Minimum length of service for eligibility to move into next grade.

| Status at the entry level | Lecturer (Sr.Scale) | Lecturer (Sl.Grade)/ Reader | Professor | Total length of service needed for promotion to Professor |
|---|---|---|---|---|
| Lecturer without M.Phil*/Ph.D** | 6 years | 5 years | - | - |
| Lecturer with M.Phil | 5 years | 5 years | - | - |
| Lecturer with Ph.D | 4 years | 5 years | 8 years | 17 years |
| Lecturer(Sr.Scale) without M.Phil*/Ph.D)** | - | 5 years | - | - |
| Lecturer(Sr.Scale)with M.Phil | - | 5 years | - | - |
| Lecturer (Sr.Scale)with Ph.D | - | 5 years | 8 years | 13 years |
| Lecturer(Selection Grade) | - | - | - | - |
| Reader(Promoted under CAS) | - | - | 8 years | 8 years |
| Reader | - | - | 8 years | 8 years |

* Those who complete M.Phil during the service(years5-6)they would be promoted to the Sr.Scale from the date of acquiring their M.Phil degree.

** Those who complete Ph.D during the service(year 4-6), they would be promoted to the Sr.Scale from the date of acquiring their Ph.D degree.

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3. Status of CAS Applications Candidates and Department wise: The Vice-Chancellor's Office maintain the follwing information in a Tabular form:

- Date of Receipt of the Application
- Date of despatch of Application to Reviewers
- Date of Receipt of Reports of Reviewers
- Date of Reminders ( if reports not received after stipulated time)

4. Shuttling of CAS Application between Administration and Head of Department/ Centre for the Dean;

- If the application is forwarded by the Head/Dean /a person nominated by the Vice-Chancellor, the application need not to be sent back again
- The administration should not ask the Head to sign in all the places as "seen and verified". One place of signature on the column is sufficient.
- If the application is sent back to the Head/Dean/ a person nominated by the Vice-Chancellor for unavoidable reasons, the same should be returned to the office in 10 days time failing which the office should ask to return the application and an explanation be sought for the cause of delay.

Sd/-
( H.Lamin)
( Preside nt)

Sd/-
( Satish Kumar)
( General Secretary )

OE-4 ( NEW CLAUSE)

3(c) - Counting of Past Service

If the number of years required in a feeder cadre are less than those stipulated under the Career Advancement Scheme, thus entailing harship to those who have completed more than the total number of years in their entire service for eligibility in the cadre, may be placed in the next higher cadre after adjusting the total number of years.

The details of the procedure shall be worked out through a regulation.

6:2 - Appointment/Creation of Posts/Termination etc.

i) Re-employment of teachers

The representation received from Prof A K Baruah, Department of Pol.Science, NEHU, on the subject re-employment of teachers was placed in the 108th meeting of the Executive Council wherein the Council vide its Resolution No:EC:108:2000: 6:2(v) considered the letter of Prof Baruah and resolved that his letter as at Annexure 'A' may be placed before the Academic Council.

Accordingly, the matter is placed before the Council for consideration.

Annexure-'A'

Apurba K Baruah
Professor of Political Science
793022
Member of the Court and the Academic Council
North-Eastern Hill University
Shillong :-793022

Add.For Communication
Qr.9,NEHU Mawlai, Shillong
Ph.0364.561484(R)250773(O)
Fax 0364-250076
E-mail:akbaruah @hotmail.com

November 22,2000

To

The Chairman Executive
Council,NEHU, Shillong.

Subject :- Re-employment of NEHU Teachers

Sir,

Before expressing my views on the above matter I would like to clearly state my locus standi. As a member of the University's Court and the Academic Council and also as a Conscientious teacher of the University I am duty bound to help the highest executive body of the University to avoid decisions which may have serious repercussions for the academic standards of the University. Moreover the University is run with funds from the public exchequer. Therefore, as a citizen of the country it is my duty to advise it in situations where there is a possibility of its taking decisions, may be as a result of pressures built by conflicting values and interests, which may not be in public interest. The Honourable Supreme Court's decissions on PILS have increased responsibilities of average citizens and particularly of informed sections. I must also add that principles of transparency and accountability are now in my view two absolutes of our contemporary reality overriding all conventional ideas of autonomy and confidentiality.

Sir, reemployment of University teachers involves considerable amount of public funds. It also becomes an instrument of encouraging or discouraging adherence to academic commitments and standard. Reemployment of teachers whose academic commitments, particularly in the areas of teaching and research supervision, are not above doubts sends wrong signals to teachers. Sincere teachers conclude that sincerity is of no value and insincere teachers conclude that being irregular in classes do not affect there careers adversely. After having seen that the National Accreditation Council has asked students to fill the Proforma about their assessment of regularity of classes and teaching standards I realise that irregular teacher must be cautioned so that the University does not suffer in the matter of accreditation.

Sir, I understand that the executive Council will have to take a decission on the reemployment of a teacher about whom there are serious complaints. I also understand that some members of the University faculty are of the view that at the time of retirement we should forget the omissions and commissions of senior faculty members in view of their seniority. Other argue that we should reemploy teachers on humanitarian grounds. It must be kept in mind that in a recent judgement the Supreme court of India has advised that all dead wood must be removed from public appointments. In a world of Professionalism and

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competition compassionate grounds for privileged sections like University Professors drawing good salaries from Public funds have no meaning, except in situations where a person has suffered because of reasons beyond his/her control or is visited by unanticipated misery. I therefore suggest that no teacher should be reemployed if there are complaints about his regularity in teaching and research supervision. All such complaints must be investigated before taking any decision on such cases. I also suggest that if necessary a guideline from the Academic Council should be sought because it is a matter which involves academic standards in the University. Re-employing an insincere teacher implies encouraging irregular teaching. I must also state that even undertakings from teachers with lack of commitment are no use.

I am sure you and the Executive Council will consider these arguments before taking any decision in relevant cases.

Yours sincerely

Sd/-
(Apurba K Baruah)