

**PART-III AGENDA PAPERS FOR THE 70<sup>TH</sup> MEETING OF THE  
ACADEMIC COUNCIL  
TO BE HELD ON 8<sup>TH</sup> AND 9<sup>TH</sup> DECEMBER, 2003.**

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2:1(1)

Item No:2 REPORTING ITEM

1) Constitution of various Committees.

As resolved by the Academic Council in its 69th meeting held on 16th and 17th June, 03, the following Committee were constituted:

Sl.No:	Resolution of Academic Council	Action taken
1.	2.	3.
1	1. No.AC:69: 5:8:(1) "Rationalization of Fee Structure in the University/College System".	Report awaited.
	2. No.AC:69: 2003: 5:8(iv) "Appointment of Rajiv Gandhi Chair".	Report awaited.
	3. No.AC:69:2003: 6:7(i) "Recommendations on Academic & Financial Management of NEHU.	Report placed.
	4. No.AC:69:2003: 5:1(iv) " To prepare the document "Vision 2025" for NEHU.	Report awaited
5.55	No:AC:69:2003:5:1(iv) " Decentralization of decision making"	Report awaited
	6. No:AC:69:2003:5:6(iv) " Vision Plan for Jowai Campus"	Report placed
	7. No:AC:69:2003:5:1(ii) " UGC Guidelines on Break-up of work-load of teachers proposal for amendment of the University Ordinance OB-5 in line with UGC guidelines"	Report awaited
	8. No:AC:69:2003:5:1(i) "Framing an Ordinance on Guidelines for Award of Honorary Degree"	Report placed
	9. No:AC:68:2002:5:1(ii) "Framing necessary provisions under the relevant Statutes for removal of Dean of Schools/Head Departments/ Centres etc".	Report placed
10.	No:AC:69:2003:8(ii) "Private Educational Institutions VIZ, NIIT, ZILS, ZEE etc."	Report placed

The matter is reported to the Council for information.

5:1:4(1)

Item No:5 ACADEMIC MATTERS

5:1 Statutes/Ordinance/ Rugulations and Rules

- (iv) Provision for  
Removal of Dean of School,  
Head of Departments/Centres etc.

In pursuance of the Academic Council Resolution No:AC:68:2002:5:1(ii) adopted at the 68th meeting held on 4th and 5th December,02,a Committee was constituted for framing necessary provisions under the relevant Statutes for removal of Dean of Schools, Head of Departments/Centres etc.

The Committee which met on 4th December,03 has submitted its report as per Annexure-'A'.

The matter is placed before the Council for consideration.

SG

**Report of the Committee constituted by the Academic Council for framing provisions under the relevant Statutes for removal of Deans of Schools of Studies, Heads of Deptts/ Centres etc.**

A Committee was constituted vide notification No. AC:-4/Conf/2002-1044 dated the 11<sup>th</sup> March, 2003 for "framing provisions under the relevant Statutes for removal of Deans of Schools, Heads of Deptt./Centres etc." consisting of the following members :

<b>Prof. R.S. Tripathi</b>	<b>Chairman</b>
<b>Prof. Manorama Sharma</b>	<b>Member</b>
<b>Prof. R. Sharma</b>	<b>Member</b>

The term of reference was to frame the Ordinances on the following:

- (i) Manner in which the Deans of Schools & Heads of Deptts. Are to be removed.
- (ii) Functioning of Deptts. and Schools of Studies
- (iii) Provisions for removal of other Officers for whom such provisions do not exist.
- (iv) Re-examination/elaboration of powers and functions of Heads of Deptts/Deans of Schools of Studies.

The Committee met on the 4th December, 2003 for the whole day, and after duly examining the relevant Statutes and the Ordinances, and after detailed discussion, finalized the Report which is attached as Annexure-A for consideration of the Academic Council.

Sd/-

( Prof. R.S. Tripathi )  
Chairman

Sd/-

( Prof. Manorama Sharma )  
Member

**Provision for removal of Deans, Heads and other officers for whom such provisions do not exist (Ref. Terms of reference no. (I) and (II))**

(I) As there is no provision in the Statutes for the removal of Deans of Schools, Heads of Deptts/Centres, DSW and Proctor from their respective Offices before the completion of their tenure, the Committee recommends that the following clauses may be included in the Statute 6, 7, 8 and 9 governing the appointment of Deans of Schools of Studies, Heads of Deptts/ Centres, Dean of Students' Welfare and Proctors.

The following may be included as clause (5) in the Statute 6 pertaining to Dean of School of Studies:

"If Deans do not perform their functions as per the Statutes, the Ordinances, and the Regulations, they shall be liable to be removed from the office of the Dean before the completion of their tenure."

The following may be included as clause (6) in the Statute 7 pertaining to Head of Department:

"If Heads of Deptts/ Centres do not perform their functions as per the Statutes, the Ordinance, and the Regulations, they shall be liable to be removed from their respective offices before the completion of their term."

The following may be included as clause (6) in the Statute 8 pertaining to Dean of Students' Welfare:

"If Dean of Students' Welfare does not perform her/his functions as per the Statutes, the Ordinances, and the Regulations, she/he will be liable to be removed from her/his respective office before the completion of the term."

The following may be included as clause (6) in the Statute 9 pertaining to Proctors, and Dean of Students' Welfare, respectively:

"If Proctors do not perform their functions as per the Statutes, the Ordinance, and the Regulations, they shall be liable to be removed from their respective offices before the completion of their term."

5:1:4(4)

(II). The committee also recommends the inclusion of the following provisions under the Statute 6(1):-

Provided that it shall be open to a Professor to decline the offer of appointment as the Dean of a School.

Provided that the Dean of a School may resign her/his office at any time during her/his tenure of office.

Note: Similar provisions may be included under the Statute 8 on Dean of Students' Welfare and the Statute 9 on Proctors

(III). The Deans of Schools of Studies, Heads of Deptts /Centres/ Dean of Students' Welfare/Proctors and all officers of the University shall act in accordance with the provisions of the Statutes, the Ordinances and the Regulations of the University as adopted from time to time. In case of any willful violation of the said provisions, the Vice-Chancellor, as the Chairman of the Executive Council may constitute an enquiry/ fact finding committee comprising at least three senior Professors of this University to examine the matter and may take appropriate disciplinary measures, including suspension or removal from the office before the completion of the tenure, if there is sufficient ground to do so. However, the concerned officer should be given an opportunity to explain his position.

**Functioning of Deptts. and Schools of Studies, and re-examination /elaboration of powers and functions of Heads of Deptts/Deans of School of Studies ( Ref. Terms of reference no. (ii) and (iv) )**

The Committee examined the provisions under OB-3 on the powers and functions of Deans of Schools, and the provisions under OB-4 on the powers and functions of the Heads of the Departments and recommends as follows:

( I ). Powers and Functions of the Deans of Schools (OB-3)

The following may be added to OB-3.1 (c)

“ (i) For facilitating the above, the Heads of Deptts/Centres shall forward copies of all relevant documents to the Dean of the School.”

5:1:4(5)

The following new clause (OB-3.2) may be added to OB -3.

O.B-3.2.

- (a) For proper coordination and supervision of the functioning of the School, the Dean shall convene regular meetings of the Heads of Deptts/Centres. A minimum of three such meetings should be held in each semester.
- (b) The Dean shall implement all decisions arrived at by a majority opinion in the meetings of the Heads of Deptts/Centres, provided such decisions do not violate the Statutes, the Ordinances, and the Regulations of the University.

**(II). The Functions of the Heads of the Departments (OB-4)**

The Committee noted that under this Ordinance there is no mention regarding powers of the Heads of Departments. The Committee, however, felt that for this, a detailed discussion in a larger committee is required.

The committee recommends the inclusion of the following additional provision i.e., 2 (e), under OB-4.

OB-4. 2 (e) "To facilitate the above, the Heads of Deptts shall convene regular meetings of the Departments and shall, in consultation with the faculty, implement all such decisions as may be arrived at by a majority in the meetings of the Department, provided that such decisions do not violate the provisions of the Statute, the Ordinances and the Regulations of the University".

The Committee felt that the amendments proposed under O-B-3 and O.B-4 would contribute to the improvement in the functioning of the Departments and Schools. There is already a separate Ordinance (OB-5) on the functioning of the academic Departments.

Sd/-

(Prof. R.S. Tripathi)  
Chairman

Sd/-

(Prof. Manorama Sharma)  
Member

5: 2: 10(1)

(x) Syllabus for B.A/B.Sc (Mathematics)

Prof. M.B. Rege vide letter No.877 dt. 24.11.03 has forwarded the draft new Mathematics Under-Graduate Syllabus for B.A/B.Sc(Mathematics) which is placed as Annexure 'A'.

The matter is therefore placed before the Council for consideration.

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**SYLLABUS FOR B.A./B. Sc. (MATHEMATICS)****Course Structure: Yearwise distribution.****Total marks: General – 400, Honours – 800****First Year (Total marks: General – 100, Honours - 200)**

- GH 101 : Calculus I (60 marks, 48 lectures)
- GH 102 : Algebra I (40 marks, 32 lectures)
- H 103 : Elementary Number Theory (50 marks, 40 lectures)
- H 104 : Optional Paper I (50 marks, 40 lectures)

**Second Year (Total marks: General – 200, Honours - 300)**

- GH 201 : Calculus II (60 marks, 48 lectures)
- GH 202 : Algebra II (40 marks, 32 lectures)
- GH 203 : Mechanics I (60 marks, 48 lectures)
- GH 204 : Vector Calculus (40 marks, 32 lectures)
- H 205 : Advanced Calculus I (60 marks, 48 lectures)
- H 206 : Differential Equations (40 marks, 32 lectures)

**Third Year (Total marks: General – 100, Honours - 300)**

- GH 301 : Geometry (50 marks, 40 lectures)
- GH 302 : Mechanics II (50 marks, 40 lectures)
- H 303 : Advanced Calculus II (50 marks, 40 lectures)
- H 304 : Advanced Algebra (60 marks, 48 lectures)
- H 305 : Dynamics (40 marks, 32 lectures)
- H 306 : Optional Paper II (50 marks, 40 lectures)

**Optional Papers I**

- OPI 1 : Operations Research – (50 marks, 40 lectures)
- OPI 2 : Computer Oriented Numerical Analysis – (50 marks, 40 lectures)
- OPI 3 : Probability Theory – (50 marks, 40 lectures)
- OPI 4 : Astronomy – (50 marks, 40 lectures)

**Optional Papers II**

- OPII 1 : Computer programming in Fortran – (50 marks, 40 lectures)
- OPII 2 : Computer programming in C – (50 marks, 40 lectures)
- OPII 3 : Hydrostatics – (50 marks, 40 lectures)
- OPII 4 : Complex Function Theory – (50 marks, 40 lectures)
- OPII 5 : Real Number System – (50 marks, 40 lectures)

**(Abbreviation: G = general, H = honours, GH = general and honours)**

GH 101  
CALCULUS I

(Number of Lectures: 48; Time: 3 hrs; Marks: 60)

(To answer four questions out of eight to be set)

**UNIT I. Functions and graphs:** real valued functions such as polynomials, rational functions, logarithmic functions, exponential functions, hyperbolic functions; limits,  $\epsilon - \delta$  definition, standard theorems on limits; standard limits; continuity : Intuitive idea,  $\epsilon - \delta$  definition, theorems on sum, difference, product, quotient and composite of continuous functions; discussion of continuity of the functions mentioned earlier and their composites; properties of continuous functions defined on closed and bounded intervals : (statements with illustrations only for the following) boundedness, intermediate value theorem, uniform continuity .

**UNIT II. Derivatives of real valued functions on intervals :** definition; derivative as a rate measurer, derivative as the gradient of tangent; theorems on sum, difference, product, quotient and composite of differentiable functions; review of methods of differentiation; successive differentiation; Leibnitz's theorem; L'Hospital's Rule (statements only with applications)

**UNIT III. Anti-derivative :** review of the standard methods; integration by parts and by partial fractions; integral of a continuous function as the limit of Riemann sum (including sums arising out of unequal distribution of interval); examples of evaluation of integrals from the definition; statements with illustration of the following two results; fundamental theorem of integral calculus; differentiability of integrals of continuous functions; properties of definite integral, evaluation of integrals using these properties; reduction formulas for  $\int \sin^n x dx$ ,  $\int \cos^n x dx$ ,  $\int \tan^n x dx$ ,  $\int e^{ax} \sin(mx) dx$ ,  $\int e^{ax} x^n dx$ ,  $\int e^{ax} (\log x)^n dx$ ,  $\int \sin^n x \cos^m x dx$  and their combinations; improper integrals, convergence and evaluation from definition.

**UNIT IV. Sequences of real numbers :** definitions of bounded sequence, convergent sequence, limit of a sequence, monotonic sequence; examples; proof of the fact that monotonic and bounded sequences are convergent (using completeness of  $\mathbb{R}$  as an axiom); Cauchy sequence; Cauchy's general principle of convergence; evaluation of limits of standard sequences by Riemann integrals; infinite series of real numbers: partial sums, convergent series, comparison test, ratio test, Raabe's test, root test; absolute convergence; Leibnitz's theorem for alternating series; power series; radius of convergence (without the notion of limit superior), standard examples of power series.

- Text Books:** 1. Maity, K. C. and Ghosh, R. K. : Differential Calculus, New Cental Book Agency Pvt Ltd., 2001 Edition.  
2. Maity, K. C. and Ghosh, R. K. : Integral Calculus, New Cental Book Agency Pvt Ltd., 2002 Edition.  
3. Thomas, G. B., and Finney, R. L. : Calculus and Analytic Geometry (Narosa Publishing House), 2002 Edition.

## GH 102

## ALGEBRA I

(Number of Lectures: 32; Time: 2 hrs; Marks: 40)

(To answer two questions out of four to be set).

UNIT I. Brief review of basics in set theory such as ways of describing a set, set operations, empty set, disjoint sets, De Morgan's laws, Venn diagrams; power sets, cartesian products, cardinality results; relation as a subset of cartesian product (notation:  $xRy$  if  $(x,y) \in R$ ); relation on a set: reflexive, symmetric, anti-symmetric, transitive; examples from geometry and number systems; equivalence relation and equivalence classes; partitions; functions/mappings from A to B as a rule of correspondence; as a subset of  $A \times B$ ; graph of a real-valued function on  $\mathbb{R}$ ; identity map, inclusion map; restriction of a map; composition of maps; associativity; onto, one-one, bijective maps; inverse images of sets, of union of sets, of intersection of sets, of complement of sets with respect to a function which need not be bijective; elementary facts, examples; inverse of a bijective map; finite and infinite sets; proof of "if A is a finite set then  $f : A \rightarrow A$  is one-one if and only if  $f$  is onto"; examples where this assertion does not hold.

UNIT II. A brief review of  $m \times n$  matrix over  $\mathbb{R}/\mathbb{C}$  as a rectangular array of numbers (motivation through systems of linear equations); square matrix; equality of matrices; addition, scalar multiplication and product of matrices; transpose, conjugate transpose; inverse of a matrix; special type of matrices: diagonal, scalar, upper/lower triangular, nilpotent, idempotent, symmetric, skew symmetric, hermitian, skew hermitian matrices; trace of a square matrix; row vectors and column vectors of a matrix; row rank/column rank of an  $m \times n$  matrix (in terms of linear independence of row/column vectors of the matrix); elementary operations; elementary matrices; row/column reduced echelon form of a matrix; determination of the inverse of a matrix by elementary operations; theorem on the equality of row-rank and column-rank; rank of a matrix; determination of the rank by elementary operations; determinants (as eliminants of system of equation), properties (without proof, statements only); adjoint of a matrix; inverse in terms of adjoints; determinantal rank of matrix; equality of rank and determinantal rank; systems of linear equations: homogeneous and non-homogeneous; Cramer's rule; evaluation of standard determinants (upto fourth order).

Text Books – 1. Singh, Shaligram : A text book of set theory, Bharati Bhawan Publishers, 1994 Edition.

2. Bhattacharya, P.B., Jain, S. K., and Nagpaul, S. R. : A First Course Linear Algebra (Wiley Eastern Publication), 2001 Edition.

## GH 201

## CALCULUS II

(Number of Lectures: 48; Time: 3 hrs; Marks: 60)

(To answer four questions out of eight to be set)

UNIT I. Real-valued functions of two or three variables: limits; continuity; partial derivatives of first and second orders; Schwarz's theorem (statement only); differentials; chain rules; Euler's theorem on homogeneous functions, proof upto three variable case; evaluation of line integrals (in a plane); double integrals; change of order of integration; application in determination of area, volume (simple cases only).

UNIT II. Sign of the derivatives of a real valued function of a real variable; vanishing of  $f'(x)$ ; Rolle's theorem; geometric interpretation, mean value theorems; applications of the mean value theorems: (i) increasing and decreasing functions, (ii) concavity upwards and downwards, (iii) points of inflections, multiple roots, (iv) location of roots of  $f'(x)$ , (v) proof of the fundamental theorem of integral calculus; (vi) Taylor's and Maclaurin's theorem with Cauchy's form of remainders; Taylor's and Maclaurin's series; expansion of standard functions such as  $e^x$ ,  $\sin x$ ,  $\cos x$ ,  $\log(1+x)$ ,  $(1+x)^n$ .

UNIT III. Application of differential calculus; equations of tangents and normals to plane curves; Newton's method of approximation of roots; use of differentials in approximation and error estimates; maxima and minima; asymptotes; tracing of simple plane curves having no singular points; curvature of plane curves (cartesian and parametric equations only); applications of integral calculus: determination of (i) areas under simple plane curves, (ii) lengths of simple plane curves, (iii) volume and surface areas of solids of revolution in standard cases.

UNIT IV. Formation of differential equations; equations of first order and first degree; solutions by separation of variables, by substitution; homogeneous equations; linear equations; Bernoulli's equation; exact equations; reduction to exact form by integrating factors; differential equations of first order but higher degrees; Clairut's equation and singular solution; geometrical interpretation; applications of first order differential equations to geometric and physical problems (simple cases only) including orthogonal trajectories; linear equations of second and third order with constant coefficients – complementary functions and particular integrals for  $e^{ax}$ ,  $\sin(mx)$ ,  $\cos(mx)$ ,  $e^{ax}\sin(mx)$ ,  $e^{ax}\cos(mx)$ ,  $x^n\sin(mx)$ ,  $x^n\cos(mx)$ ; equations of type  $a_1x^2y'' + a_2xy' + a_3y = f(x)$ .

Text Books – 1. Maity, K. C. and Ghosh, R. K.: Differential Calculus, New Cental Book Agency Pvt Ltd., 2002 edition.

2. Maity, K. C. and Ghosh, R. K. : Integral Calculus, New Cental Book Agency Pvt. Ltd., 2002 edition.

3. Thomas, G. B., and Finney, R. L. : Calculus and Analytic Geometry (Narosa Publishing House), 2002 Edition.

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5: 2: 10(6)

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**GH 202  
ALGEBRA II**

(Number of Lectures: 32; Time: 2 hrs; Marks: 40)

(To answer two questions out of four to be set)

**UNIT I.** Binary operations as maps from  $A \times A \rightarrow A$ ; commutative and associative binary operations; identities and inverses (one-sided as well as two sided); examples; groups: definition; detailed study of groups such as  $Z, Q, R, C, Q^*, R^*, C^*, Z_n, S_n, M_2(R), GL_2(R), D_{2n}, R^2, R^3, n^{\text{th}}$  roots of unity etc; laws of indices in both additive and multiplicative notation; right and left cancellation laws; uniqueness of identity and inverses; group tables of groups of low order (up to 8); subgroups: examples; cyclic subgroup generated by an element; cyclic group; abelian group; subgroups of cyclic groups; determination of all subgroups of  $Z$ ; order of an element; examples of elements of finite order, of infinite order, coset of a subgroup; cosets as equivalence classes;  $Z_n$  as cosets; Lagrange's theorem and its applications; groups of prime order, Fermat's (little) theorem; Euler's generalizations; application to simple number theoretic problems; homomorphism, kernel and image of homomorphism, isomorphism of groups – examples and elementary properties.

**UNIT II.** Polynomials over  $Z / Q / R / C$ ; addition and multiplication; degree of a polynomial; degree of sum and product of polynomials; the division algorithm; remainder theorem; gcd; the Euclidean algorithm; irreducible polynomials; application of Eisenstein's theorem; unique factorisation theorem; roots of a polynomial; factor theorem; fundamental theorem of algebra (statement only); its failure for polynomials over  $Z / Q / R$ ; simple tests of irreducibility of polynomials with rational / integer coefficients; detailed study of roots of a polynomial with real coefficients; immediate consequence of the fundamental theorem of algebra; multiple roots, common roots, complex roots, surd roots; relation between roots and coefficients of a polynomial; symmetric function of the roots of a polynomial equation with special reference to cubic and biquadratic equations; transformation of equation; Descartes' rule of signs – simple applications; location of roots using Rolle's theorem; solution of a cubic by Cardan's method; De Moivre's theorem – application to solution of equation.

**Text Books** – 1. Fraleigh, John B. : A First Course in Abstract Algebra (Narosa Publishing House), 1999 Edition.

2. Bhattacharya, P. B., Jain, S. K., and Nagpaul, S. R. : First Course in Linear Algebra (Wiley Eastern), 2001 Edition.

3. Das, B. : Higher Algebra (Asoke Prakashan, Calcutta), 2000 Edition.

**Reference Book** – Bernside, W. S., and Panton, A. W.: Theory of Equations, Vol. I (S. Chand & Co., New Delhi), 2000 Edition.

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## GH 203

## MECHANICS I

(Number of Lectures: 48; Time: 3 hrs; Marks: 60)

(To answer three questions out of six to be set)

**UNIT I.** Velocity and acceleration in cartesian co-ordinates; rectilinear motion with variable acceleration; simple harmonic motion; collision of elastic bodies; direct and oblique impact.

**UNIT II.** Projectiles; rectilinear motion in resisting media on a horizontal plane where resistance varies as (i) velocity, (ii) square of velocity, (iii) displacement; vertical motion under gravity where resistance varies as (i) velocity, (ii) square of velocity.

**UNIT III.** Tangential and normal acceleration on smooth curves; motion on a smooth plane curve such as vertical circles and cycloids; radial and transverse accelerations on smooth curves (simple problems only); work done by a force; work energy equation; potential function; conservative forces.

**Text Books** – 1. Gupta, P. K., and Juneja, R. : Dynamics (Ramesh Book Depot, Jaipur), 2003 Edition.

2. Ray, M. : A Text Book on Dynamics for B.A./B.Sc. students (S. Chand Publication, Delhi), 2002 Edition.

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## GH 204

## VECTOR CALCULUS

(Number of Lectures: 32; Time: 2 hrs; Marks: 40)

(To answer two questions out four to be set)

(Vectors only up to dimension 3 are to be considered)

**UNIT I.** Products (scalar and vector products) of two, three and four vectors – properties, geometrical significance and applications; vector valued functions (up to 3 variables); derivatives of such a function of a single variable; properties and geometrical applications; arc length, unit tangent vector, curvature, normal vector, derivatives of scalar and vector products, tangential and normal components of velocity and acceleration.

**UNIT II.** Directional derivatives, gradient of a scalar-valued function, tangent planes; vector fields, curl and divergence of a vector field, surface integrals, surface integral for flux, line integrals and work, Stokes' theorem and Gauss' divergence theorem (statements and applications only).

**Text Books** – 1. Ghosh, R. K. and Maity, K. C.: Vector Analysis (New Central Book Agency), 2001 Edition.

2. Thomas, G. B. and Finney, R. L. : Calculus and Analytic Geometry (Narosa Publishing House), 2002 Edition.

**Reference Book** – Shanti Narayan, and Mittal, P. K.: A Text Book of Vector Analysis (S. Chand & Co. Ltd., New Delhi), 2003 Edition.

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GH 301

## GEOMETRY

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

(All equations to be derived in both vector and cartesian notations).

UNIT I. Change of axes – invariants; pairs of straight lines; general equation of second degree; the standard form; reduction of the general equation to standard form; conditions for different conics; general conics : equations of tangents, normals, pairs of tangents, chord of contact, chord in terms of middle points, pole, polar, conjugate lines, diameter, asymptotes; polar equation, equation of a conic, directrix, chord, tangent and normal; parabola, ellipse, hyperbola; conjugate diameters of ellipse and hyperbola; rectangular hyperbola; conjugate hyperbola.

UNIT II. Space co-ordinates: rectangular, cartesian, cylindrical, spherical, and polar, equation of planes; angle between two planes; perpendicular distance of a point from a plane; bisectors of two planes; equations of straight lines in space; co-planarity of two straight lines; perpendicular distance of a point from a straight line; shortest distance between two straight lines in space; sphere – plane section and its equation; sphere through a given circle; tangent plane; pole and polar plane; intersection of two spheres; radical plane; equation of a cone with a conic as a guiding curve; enveloping cone; mutually perpendicular generators; tangent planes; reciprocal cone; right circular cone; equation of a cylinder with a conic as a guiding curve; right circular cylinder.

**Text Books** – 1. Das, B. : Analytical Geometry and vector Analysis (Orient Book Co., Calcutta), 1998 Edition.

2. Shanti Narayan : Analytical Solid Geometry (S. Chand & Co., New Delhi), 2003 Edition.

3. Thomas, G. B., and Finney, R. L. : Calculus and Analytic Geometry (Narosa Publishing House), 2002 Edition.

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GH 302

**MECHANICS I**

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of any four to be set)

**UNIT I.** Coplanar forces : reduction of coplanar forces; equilibrium of coplanar forces; general condition of equilibrium of any system of coplanar forces; friction : laws of statical friction; laws of limiting friction; coefficient of friction, angle of friction, cone of friction; solution of problems on equilibrium of heavy bodies (such as uniform rods, solid spheres) resting on plane surfaces.

**UNIT II.** Centre of gravity of thin uniform rod; uniform lamina, triangular lamina and lamina in the form of a parallelogram; centre of gravity of circular arcs; of uniform sector of a circle; moments and products of inertia; theorems of parallel and perpendicular axes; angular momentum of a rigid body about a fixed axis; principal axes.

**Text Books** – 1. Das, B. C. and Mukherjee, B. N. : Statics (U. N. Dhar & Sons Publications, Kolkata), 2002 Edition.

2. Ray, M.: A Text Book on Dynamics for B.A./B.Sc. students (S. Chand Publication, Delhi), 2002 Edition.

3. Loney, S. L. : An elementary treatise on the Dynamics of a particle and of rigid bodies (Rahda publishing House, Kolkata), 2000 Edition.

**Reference Book** – 1. Varma, R. S.: Statics (Pothishala, Allahabad), 2001 Edition.

2. Loney, S. L.: An elementary treatise on Statics (Rahda publishing House, Kolkata), 2000 Edition.

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H 103

**ELEMENTARY NUMBER THEORY**

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

**UNIT I.** Divisibility in the set of integers; basic properties; the division algorithm; gcd; elementary properties; the Euclidean algorithm; lcm; primes (in the set of natural numbers); fundamental theorem of arithmetic; Euclid's proof of the infinitude of primes; arbitrary gaps in the distribution of primes; congruences in the set of integers modulo a positive integer; basic properties; complete residue system; reduced residue system; Euler's  $\phi$  - function; Fermat's theorem; Euler's generalization of Fermat's theorem; applications; Wilson's theorem.

**UNIT II.** Solution of congruences; linear congruences; chinese remainder theorem; congruences of higher degree modulo a prime; greatest integer function; elementary properties; arithmetic functions; multiplicative functions; functions such as  $\phi(n)$ ,  $\mu(n)$ ,  $\tau(n)$ ,  $\sigma(n)$ ,  $\sigma_k(n)$ ; Möbius Inversion formula; solutions of (i) linear Diophantine equation, (ii) Pythagorean equation.

**Text Books** – 1. Niven, I., Zuckerman, H.S., and Montgomery, H. L. : An introduction to the Theory of Numbers (Wiley Eastern Ltd.), 2000 Edition.

2. Burton, David M. : Elementary Number Theory (Universal Book Stall), 2001 Edition.

**Reference Book** – 1. Telang, S. G. : Number Theory (Tata McGraw-Hill, New delhi), 1996 Edition.

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H 104

### OPTIONAL PAPER I

OPI 1

### OPERATIONS RESEARCH

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

**UNIT – I.** Definition and scope of operations research, theorem on a linear function which attains its optimum values at the vertices of a convex polygon, linear programming problem, mathematical formulation, graphical method of solution, simplex method of solution, minimax theorem, initial simplex table, terminal simplex table, pivot entry, algorithm of simplex method, duality in linear programming problem (statement only).

**UNIT – II.** Theory of games, two person zero – sum games, the maximin – minimax principle, saddle point, relation between minimax and maximin game without saddle point, pure and mixed strategies, dominance property, modified dominance property, reduction of a game problem to an linear programming problem, and its solution.

**Text Book** – Swarup, K., Gupta, P. K. and Singh, M. M. : Operations Research (Sultan Chand & Sons, New Delhi), 2002 Edition.

**Reference Books** – 1. Gupta, P. K., and Hira, D. S. : Operations Research – An Introduction (S. Chand & Co. Ltd., New Delhi), 2002 Edition.

2. Rao, S. S. : Optimisation Theory and Applications (Wiley Eastern Ltd., New Delhi), 2001 Edition.

3. Maulik, T. N. : Linear Programming, (U. N. Dhar & Sons Publications, Kolkata), 2001 Edition.

H 104

## OPTIONAL PAPER I

OPI 2

## COMPUTER ORIENTED NUMERICAL ANALYSIS

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

(The methods mentioned below are to be supported by algorithms)

UNIT I. Interpolation – Lagrange's interpolation polynomials; difference tables – divided difference, forward difference, backward difference; Newton's forward and backward interpolation formula; differentiation – first derivative; integration – Simpson's 1/3rd rule, trapezoidal rule.

UNIT II. Newton-Raphson method; regula-falsi method, secant method, bisection method for solving polynomial equations; Gauss elimination method for solving system of equations; numerical solution of differential equations – Euler's method, Runge-Kutta methods (up to second order) i.e; Heun's method, polygon method, predictor-corrector method.

**Text Book** – Rajaraman, V. : Computer Oriented Numerical Methods (Prentice-Hall of India Pvt. Ltd., New Delhi), 2002 Edition.

**Reference Books** – 1. Jain, M. K., Iyenger, S. R. K., Jain, R. K. : Numerical Methods (Problems and solutions) Wiley Eastern Ltd., (New Age International Publishers Ltd.) 1995 Edition.

2. Kandasamy, P., Thilagavathy, K., and Gunavathy, K. : Numerical Methods, (S. Chand & Co. Ltd., New Delhi), 2003 Edition.

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H 104

## OPTIONAL PAPER I

OPI 3

## PROBABILITY THEORY

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

UNIT I. Probability; classical definition and its limitation; the axiomatic approach; theorems on total probability, conditional probability and compound probability; Bayes' theorem; statistical independence of events; continuous probability; density functions, distribution functions, geometrical and other related problems; random variable; definition; mathematical expectation of random variable; theorems on the sum and product of several random variables.

UNIT II. Moments as expectations; mean and variance; moment generating functions; characteristic functions; Tchebyshev's lemma and inequality; Weak law of the large numbers; distributions; hypergeometric; binomial and Poisson distributions and their elementary properties; derivation of the expectation of  $X_{(p)} = X(X - 1)(X - 2) \dots (X - p + 1)$ ; moments (up to the 4<sup>th</sup> order); recursive relations among the moments of the binomial and Poisson distributions; normal distributions; properties; its importance in theory and in practice; normal distribution as the limit of the binomial.

**Text Book** – Mukharjee, K. K. : Probability and Statistics (New Central Book Agency pvt. Ltd.), 1993 Edition.

**Reference Books** – 1. Feller, W. : An Introduction to Probability Theory and Its Applications, Vol. I, Third U. S. Edition (1968), Wiley Eastern Limited, New Delhi.

2. Parthasarathi, K. R. : Introduction to Probability and Measure (Macmillan Co. of India Ltd., New Delhi), 1997 Edition.

3. Kapur, J. N. and Saxena, H. C. : Mathematical Statistics, (S. Chand & Co. Ltd., New Delhi), 2001 Edition.

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H 104

## OPTIONAL PAPER I

O.P. I 4

## ASTRONOMY

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

UNIT I. Spherical triangles; formulas for spherical trigonometry; solution of spherical triangles; position of a point of a sphere; length of a small circular arc; the celestial co-ordinates; rising and setting of stars; dip of the horizon; atmospheric refraction, twilight.

UNIT II. Orbital and synodic periods of a planet; direct and retrograde motions of planets; stationery points; phases of the planets and the moon; brightness of planets; Kepler's laws; apparent solar motion; signs of the zodiac, sidereal time and mean time; correction of time; equation of time; seasons, calendar, geocentric parallax, stellar parallax; effects on right ascension; declination; longitude and latitude; paralactic eclipse; aberration; eclipses.

**Text Books** – 1. Todhunter, I. : Spherical Trigonometry (Macmillan Publishing Co), 1996 Edition.

2. Dey, K.K. : Astronomy (Book Syndicate Pvt. Ltd., Kolkata), 2001 Edition.

3. Kar, J. M. : Astronomy (K. P. Basu Publishing Co.), 2001 Edition.

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H 205

## ADVANCED CALCULUS I

(Number of Lectures: 48; Time: 3 hrs; Marks: 60)

(To answer three questions out of six to be set)

UNIT I. Riemann integral of functions of one variable; Darboux's theorem; conditions for integrability; classes of bounded and integrable functions; properties of integrable functions; inequalities for integrals; functions defined by integrals; their continuity and differentiability; mean value theorems for integrals; improper integrals; test for convergence when the integrand is non-negative; absolute convergence; tests for absolute and conditional convergence, beta and gamma functions; Abel's theorem, Dirichlet's theorem; Frullani's integral.

**UNIT II.** Integrals as functions of parameters; continuity, differentiability and integrability of such a function; applications to evaluation of integrals. improper integrals as functions of a parameter, uniform convergence and tests for uniform convergence; continuity, differentiability and integrability of uniformly convergent improper integrals of continuous functions involving parameters; evaluation of integrals; line integral in  $R^2$ ; Riemann integral of real valued functions of two variables; evaluation of double integrals – change of order of integration; change of variable; Green's theorem in  $R^2$ .

**UNIT III.** Sequences of (real valued) functions: pointwise and uniform convergence; properties of uniformly convergent sequences of functions; series of functions; uniform convergence, tests for uniform convergence; properties; term by term integration and differentiation of power series.

**Text Book** – Shanti Narayan : A Course of Mathematical Analysis (S. Chand and Co. , Delhi), 2003 Edition.

**Reference Books** – 1. Apostol, T. A.: Mathematical Analysis (Narosa Publishing House), 2002 Edition.

2. Rudin, W. : Principles of Mathematical Analysis (Mc Graw – Hill Publications), International Editions 1976 (Reprint 1996).

3. Malik, S. C. and Arora, S. : Mathematical Analysis (New Age International (P) Ltd., Publishers) 1992 Edition (Reprint 2001).

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**H 205**

**DIFFERENTIAL EQUATIONS**

(Number of Lectures: 32; Time: 2 hrs; Marks: 40)

(To answer two questions out of four to be set)

**UNIT I.** Linear differential equations of second order with variable coefficients; homogeneous equations; exact equations; transformation of the equation by changing the dependent variable/the independent variable, method of variation of parameters; simultaneous equations; total differential equation:  $Pdx + Qdy + Rdz = 0$

**UNIT II.** Partial differential equation of first order, origin of first order equation, linear equations of first order, Lagrange's methods, integral surfaces passing through a given curve, orthogonal surfaces, non-linear equations of first order, Cauchy's method of characteristic, compatible systems of first order equations, Charpit's method.

**Text Books** – 1. Coddington, Earl A. : An Introduction to Ordinary Differential Equations (Prentice-Hall, India), 1998 Edition (For Unit I).

2. Piaggio, I. : An Elementary Treatise on Differential Equations and Applications (G. Bell & Sons), 2000 Edition.

3. Sneddon, I. N. : Elements of Partial Differential Equation (McGraw Hill). International Edition 1957 (For Unit II ).

**Reference Books** – Raisinghania, M.D. : Ordinary and Partial Differential Equations (S. Chand & Co. Ltd., New Delhi), 2002 Edition.

## H 303

## ADVANCED CALCULUS II

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

**UNIT I.** Basic properties of Euclidean distance function in  $\mathbb{R}^n$ ; neighbourhoods, open sets, closed sets, limit points, interior points in  $\mathbb{R}^n$  ( $n = 1, 2, 3$ ); Bolzano-Weierstrass theorem; Cantor intersection theorem (nested interval) Lindelof covering theorem, compact sets; Heine-Borel theorem; equivalent statements; study of maps from subsets of  $\mathbb{R}^n \rightarrow \mathbb{R}^m$  ( $m, n = 1, 2, 3$ ): continuity, in terms of  $\epsilon$ - $\delta$  notation, in terms of inverse images of open and closed sets; elementary properties of continuous functions; continuous functions on compact sets; special cases of continuous real valued functions on closed, bounded intervals of  $\mathbb{R}$ : bounds; intermediate value theorem; uniform continuity; discontinuities of real valued functions; monotonic functions; continuity of the inverse of a strictly monotonic function.

**UNIT II.**  $\mathbb{R}^m$ -valued functions of two or three variables ( $m = 1, 2, 3$ ); partial derivatives; directional derivatives; total derivative, Jacobian; change in the order of partial derivatives; differentiation of composite functions; chain rule; mean value theorem for two variables; Taylor's expansion of functions of two variables; extreme value of such functions; critical points; Lagrange's multipliers (only applications).

**Text Books** – 1. Shanti Narayan: A Course of Mathematical Analysis (S. Chand, Delhi), 2003 Edition.

2. Apostol, Tom A. : Mathematical Analysis (Narosa Publishing House), 2002 Edition (for Unit II).

**Reference Book** – Bartle, R. G. , and Sherbert, D. R. : Introduction to Real Analysis (John Wiley & Sons, Inc), 2000 Edition.

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## H 304

## ADVANCED ALGEBRA

(Number of Lectures: 48; Time: 3 hrs; Marks: 60)

(To answer three questions out of six to be set)

UNIT I Normal subgroups, examples; conditions for a subgroup to be normal; center of a group; examples; quotient group; fundamental theorem of group homomorphism; isomorphism theorems; automorphisms; inner automorphisms; examples; rings (motivation through  $\mathbb{Z}$ ): definitions and examples of (i) rings with identity, (ii) commutative rings, (iii) rings with and without zero-divisors, integral domains, (iv) division rings (v) fields (examples to include  $\mathbb{Z}_p$ , integers mod  $p$ , fields  $\mathbb{Q}, \mathbb{R}, \mathbb{C}$ , polynomial rings  $R[x]$ , matrix rings  $M_n(R)$ ); basic properties of rings; characteristic of rings; finite integral domains; ( $\mathbb{Z}_p$  as an example); subrings; ideals: right, left and two-sided; generated by a subset, more specifically by a finite number of elements in a commutative ring with 1; principal ideals; examples of ideals in  $\mathbb{Z}, \mathbb{Z}_n, M_n(R)$ ; prime ideals, maximal ideals in a commutative ring with 1; examples; quotient ring,  $\mathbb{Z}_n$  as a quotient ring.

UNIT II. Ring homomorphisms, kernels, isomorphism; homomorphisms and isomorphism theorems including the correspondence theorem; determination of ideals in  $\mathbb{Z}_p$ ; divisibility in integral domains (with 1), units, associates, prime elements, irreducible elements, gcd, Euclidean domain, principal ideal domain, unique factorisation domains – definition, examples and basic results (including illustrations with the help of polynomial rings and Gaussian integers).

UNIT III. Vector spaces (motivation through  $\mathbb{R}^2, \mathbb{R}^3$ ) – examples, basic properties; subspaces; homomorphisms or linear maps between vector spaces; isomorphisms; standard homomorphism and isomorphism theorems; direct sum (internal and external); linear dependence and independence; basis, dimension; vector space axioms for the set  $L(V, W)$  of linear maps from  $V$  to  $W$ ; algebra axioms for  $L(V, V)$ ; dimension of  $L(V, W)$  (statements only); dual space; statement of the vector space property of  $M_{m \times n}(\mathbb{F})$ ; of algebra property of  $M_n(\mathbb{F})$ ; The matrix of a linear transformation in  $L(V, W)$ ; similar matrices, change of basis theorem; the vector space isomorphism between  $L(V, W)$  and  $M_{m \times n}(\mathbb{F})$ , and the algebra isomorphism between  $L(V)$  and  $M_n(\mathbb{F})$  (only statements for these two isomorphism theorems); rank and nullity of a linear transformation; "rank + nullity = dimension" theorem; equality of rank of a linear transformation and rank of the associated matrix; characteristic roots, characteristic polynomial and characteristic vector of a linear transformation / matrix; determination of characteristic roots and characteristic vectors ( $2 \times 2$  or  $3 \times 3$  matrices over  $\mathbb{R}$ ); linear independence of characteristic vectors and the corresponding diagonalisation theorem.

Text Books – 1. Herstein, I. N. : Topics in Algebra (Vikas Pub. House), 1988 Edition (reprint 1998).

2. Fraleigh, J. B. : A First Course in Abstract Algebra. (Narosa Publishing House), 1999 Edition.

3. Hoffman, K. and Kunze, R. : Linear Algebra, second edition, Prentice-Hall, Englewood Cliffs, New Jersey, 1971 Edition (reprint 1996).

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**H 305  
DYNAMICS**

(Number of Lectures: 32; Time: 2 hrs; Marks: 40)  
(To answer two questions out of four to be set)

(Introduction to the following concepts should be made in vector as well as Cartesian method)

**UNIT I.** Motion on a rough curve; cycloidal motion with resistance; motion of a particle under central forces; use of reciprocal coordinates; use of pedal co-ordinates and pedal equations; Kepler's laws of planetary motion.

**UNIT II.** Kinetic energy of a rigid body rotating about a fixed axis; momental ellipsoid; equimomental systems; coplanar distributions; general motion of a rigid body; two dimensional rigid body dynamics : problems illustrating the laws of motion, laws of conservation of energy; impulsive motion.

**Text Books** – 1. Chorlton, F. : Text Book of Dynamics (CBS Publishers and distributors, Delhi), 2002 Edition.

2. Loney, S. L. : An Elementary Treatise on The Dynamics of a Particle and of Rigid Bodies (Rahda publishing House, Kolkata), 2002 Edition.

**Reference Book** – Ramsay, A. S. : Dynamics, Part I (Cambridge University Press), 1993 Edition.

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**H 306**

**OPT 1**

**OPTIONAL PAPER II**

**COMPUTER PROGRAMMING IN FORTRAN**

(Number of Lectures: 24; Time: 1 hr 30 mins; Marks: 30)  
(To answer two questions out of four to be set)

**UNIT I.** Flowcharts, Algorithms - definitions and characteristics; Euclid's algorithm for gcd; FORTRAN fundamentals - characters, variables, variable names, syntax, statements, constants, variables and expressions; names, types, evaluation of expressions; input-output statements : unformatted and formatted input - output; integers, reals, complex, double precision, logical variables, alphanumeric information, data statements.

**UNIT II.** Branches and loops - unconditional, computed; assigned GO TO statement; IF and DO statements; nesting of DO loops; arrays : DIMENSION statement; order of storage; equivalent statements; input and output of arrays; implied DO notation; subprograms, functions and subroutines; functions and their references; statement function; subroutines call and return statements; common statements; library functions.

**Text Book** – Rajaraman, V. : Computer Programming with Fortran 77 (Tata McGraw Hill Publishing Company), 2002 Edition.

**Reference Books** – 1. Gupta, V. K. : Computer Programming in Fortran IV (Pragati Prakashan, Meerut.), 1988 Edition.

2. Ram Kumar. Programming with Fortran 77 (Tata McGraw Hill Publishing Company), 2002 Edition.

**PRACTICALS**

(Time: 3 hrs Marks : 20)

Practice the following programs.

1. Evaluation of roots of quadratic equations,
2. arranging given set of numbers in increasing/decreasing order, calculation of Mean,
3. evaluation of sum of power series eg.  $e^x$ ,  $\sin x$ ,  $\cos x$ ,  $\log(1+x)$ ,
4. calculation of HCF/LCM of two integers,
5. evaluation of factorials and binomial coefficients,
6. sieve method for primality test,
7. generation of twin primes,
8. solution of congruence using complete residue system,
9. evaluation Legendre polynomial from recurrence relation,
10. solving simple/algebraic/transcendental equations; Newton's method (real roots only),
11. matrix operations : sums and products,
12. transpose, determinant (up to order 4),
13. inversion of real matrices (up to order 4).

NOTE : There will be practical examination of three hours in which a candidate has to do two programs.

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E 306

OPTIONAL PAPER II

OPII 2

COMPUTER PROGRAMMING IN C

(Number of Lectures: 24; Time: 1 hr 30 mins; Marks: 30)

(To answer two questions out of four to be set)

UNIT I. C fundamentals: The C character set, identifiers and keywords, Data types, constants, variables and arrays, declarations, symbolic constants, Operators (Arithmetic, unary, relational, logical, bitwise, assignment), expressions, statements, C program structure, Need of header files, Process of compiling and running a C program; I/O functions: Header files (stdio.h, conio.h) getch(), getche(), getchar(), putchar(), scanf(), printf(), gets(), puts(), clrscr(), window); Control statements: Decision making and branching (if, else, switch), Decision making and looping (while, do .. while, for), Jumping (break, continue, goto), Nested loops; Functions: Overview (definition, declaration), defining a function, accessing a function, function prototypes, call by value, call by reference, recursion, iteration, Advantages and disadvantages of recursion over iteration, Storage classes (Automatic, Register, External, Static), String functions (strcmp (), strlen (), strcmp (), strcat (), toupper (), tolower ()), Math functions (sqrt (), abs (), sin (), cos ()), Standard function- exit (), Memory allocation functions (malloc (), free (), realloc(), calloc()).

**UNIT II. Arrays and Pointers:** Defining an array, array initialization, processing an array, passing array to a function, multidimensional arrays, arrays and strings, pointer declarations, passing pointer to a function, pointer and one dimensional arrays, Operation on pointers, pointers and multidimensional arrays, arrays of pointers, functions returning pointers; **Structures and Unions:** Defining a structure, processing a structure, user defined data types, structures and arrays, structures and pointers, passing structures to a function, self referential structures, Union, Union of structures, Enumerated, typedef, **Data files:** File opening modes, character I/O(getc(), putc()), String I/O (fgets(), fputs()), Formatted console I/O(fscanf(), fprintf()), text mode versus binary mode, Unformatted console I/O functions – record I/O(fread(), fwrite(), ftell(), fseek(), rewind(), rename()), Record operations (append, delete, update, search, display, sorting of records) checking file opening error, closing data files; **Command line parameters.**

**Text Book – Kanetkar, Y.: Let us C (B. P. B Publication), 1993 Edition.**

**Reference Books –** 1. Gottfried, B. S.: Theory and Problems of Programming with C (Tata McGraw Hill Publication), 1998 Edition.  
2. Balaguruswamy, E.: Programming in ANSI C (Tata McGraw Hill publication), 2002 Edition.  
3. Rajaraman, V.: Computer Programming in C (Prentice Hall of India), 2002 Edition.

### PRACTICALS

(Time: 5 h , Marks : 20)

Practice the following programs.

1. Roots of quadratic equation  $Ax^2+Bx+C=0$ ,
2. arrangement a given set of numbers in increasing/decreasing order, calculation of mean,
3. evaluation  $e^x$ ,  $\sin x$ ,  $\cos x$ ,  $\log(1+x)$  using power series method,
4. solution of simple/algebraic/transcendental equations, Newton's method (real roots only),
5. addition, subtraction and multiplication of matrices using function,
6. evaluation of factorial of a positive integer and evaluation of binomial coefficients,
7. determination of the transpose, determinant of the given matrix (up to order 4),
8. determination of the inverse of a given real matrix (up to order 4),
9. searching a pattern in a given text and replacing every occurrence of it with another given string,
10. writing a given number in words using function,
11. copying the contents of one text to another text file using command line arguments,
12. merging two text files to another text file,
13. copying the contents of one text file to any number of given files using command line arguments,
14. printing of every line of a text file containing a given pattern.

**NOTE :** There will be practical examination of three hours in which a candidate has to do two programs.

H 306

OPII 3

## OPTIONAL PAPER II

## HYDROSTATICS

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

UNIT I. Perfect fluid; fluid pressure, pressure of heavy fluids; transmissibility of fluid pressure; conditions for equilibrium; pressure equation; surfaces of equal pressure; surfaces of equal density; conditions of equilibrium of a floating body, freely floating bodies and bodies floating under constraint; stability of equilibrium.

UNIT II. Resultant pressure on surfaces (plane or curved) – horizontal thrust and vertical thrust; centre of pressure, effect of additional depth; oscillation of floating bodies; oscillation due to vertical displacement and rotational displacement; rotating fluids; atmosphere; adiabatic expansion; isothermal convective equilibrium.

Text Book – Kar, J. M.: Hydrostatics, K. P. Basu Publishing Company, 1992 Edition.

Reference Books – 1. Ray, M. and Sharma, H. S. : Hydrostatics (S. Chand Publications), 1999 Edition.

2. Besant, W. H. and Ramsay, A. S. : A Treatise on Hydromechanics, Part I Hydrostatics (ELBS and G. Bell and Sons Ltd., London), 1991 Edition.

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H 306

## OPTIONAL PAPER II

OPII 4

## COMPLEX FUNCTION THEORY

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

UNIT I. Complex numbers; field properties; absolute value, conjugate : basic properties; real and imaginary parts; identification of the plane with the complex numbers; distance function (in terms of the absolute value); triangle inequality, parallelogram law; related inequalities; polar representation; magnitude, argument; De Moivre's theorem; roots of unity; geometry of complex numbers : straight lines, circles in terms of complex numbers, equation of circle through three points; spherical representation, stereographic projection; sequence of complex numbers; convergence, ratio test, root test,  $\liminf$ ,  $\limsup$ , Cauchy sequence; power series; absolute convergence, uniform convergence; circle of convergence; Cauchy-Hadamard formula for the radius of convergence; ratio test; analytic function; basic properties; analyticity of power series; power series definition of (complex) exponential function, sine, cosine function; branch of a logarithm; principal branch of a power function  $z^\alpha$  for complex  $\alpha$ ; Necessary and sufficient condition for analyticity in terms of Cauchy-Riemann equations.

UNIT II. Integration of complex valued function along a "piece-wise differentiable" curve (using real integral for real and imaginary parts); basic properties; (including inequalities); Cauchy's theorem for disc, Cauchy's integral formula for disc; power series representation of analytic functions; Cauchy's estimate; Liouville's theorem; fundamental theorem of algebra; zeroes of an analytic function; related results; maximum modulus theorem.

**Text Book** – Ponnusamy, S.: Complex Analysis (Narosa Publishing House), 2002 Edition.

**Reference Books** – 1. Shanti Narayan : Theory of a complex variable (S. Chand & Co.; Delhi), 2001 Edition.

2. Conway, J.: Functions of one Complex Variable (Narosa Publishing House), 2000 Edition.

3. Alforhs, L. V. : Complex Analysis (McGraw Hill Publications), 1979 International Edition (for the definition of integrals and properties in UNIT III).

4. Shastri, A. R. : An Introduction To Complex Analysis ( Macmillan India Ltd.), 2003 Edition.

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GH 306

OPTIONAL PAPER II

OPII 5

REAL NUMBER SYSTEM

(Number of Lectures: 40; Time: 2 hrs 30 mins; Marks: 50)

(To answer two questions out of four to be set)

UNIT I. Natural numbers – successor function, Peano's axioms, recursive theorem, addition and multiplication of natural numbers as semigroup operation, ordering in natural numbers, counting of natural numbers, axiom of choice, infinite sets, countable/denumerable sets; indexing of sets; integers – construction from natural numbers, set of integers as an ordered integral domain; embedding of natural numbers in integers; rational numbers – construction from integers, set of rational numbers as an ordered field and its minimality; absolute value of rational numbers; density of ordering of rational numbers, Archimedean property of rational numbers; countability of rational numbers.

UNIT II. Gaps in the order of rational numbers – examples; sequences of rational numbers as approximations to gaps – fundamental (Cauchy) sequences; existence of non-convergent fundamental sequences; positive and negative fundamental sequences, null sequences, construction of real numbers using fundamental sequences of rational numbers; set of real numbers as an ordered field, completeness of real numbers (statement of equivalent properties); uncountability of real numbers.

**Text Book** – Cohen, L. W. and Ehrlich, G. : The Structure Of The Real Number System (East-West Press Pvt. Ltd.), 1996 Edition.

**Reference Books** – 1. Rudin, W. : Principles of Mathematical Analysis (McGraw – Hill Publications, 1976 International Editions (Reprint 1996).

2. Simmons, G. F. : Introduction to Topology and Modern Analysis (McGraw – Hill Publications), 1963 International Editions (Reprint 1995).

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- (xi) Revised B.A.Pass and B.A.Honours Syllabus in History.

The Head, Deptt. of History vide letter dt.3.12.03 has forwarded the draft revised B.A.Pass and B.A.Honours Syllabus in History as approved by the Board of Under-Graduate Studies in its meetings held on 27.9.03 & 2.12.03. The Syllabus is placed as Annexure 'A'.

The matter is therefore placed before the Council for approval.

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## **Draft Revised History BA Pass and BA Honours Syllabus**

### **Introduction:**

The revision of the NEHU History BA Pass and Honours courses has long been overdue. The revision of the courses started with a Workshop on the revision of the NEHU undergraduate courses in History attended by College and University teachers, meeting on 21 March 2002. The report of the Workshop then guided the Committee constituted by the BUGS to prepare a draft syllabus. A Meeting of the local members of the Board of Under Graduate Studies in History in its meeting of 26 May 2003 decided to meet again with co-opted members from the Colleges to prepare the draft syllabus. The Committee met on 7-8 August 2003, discussed and prepared a draft syllabus. The Board of Undergraduate Studies in History in its meetings of 27 October and 2 December 2003 approved the draft with the suggestion that the final draft be forwarded to the University for approval of the Academic Council.

Two suggestions that were given in the course of the revision of the syllabus were: 1. That the Department of History organise a workshop for college teachers of history to acquaint them with the revised syllabus; 2. that the University also organise a workshop on question setting and evaluation of examinations.

The BA Pass and Honours Courses in History ( New Syllabus) will be taught as follows:

First Year: Paper I **History of India upto 1525** (common for Pass and Honours ).

Second year: Paper II **History of India 1526-1950** (common for Pass and Honours ).

Third year: Paper III **Modern World 15<sup>th</sup> Century to World War II** (Common for Pass and Honours).

First year : Paper IV **Historiography** ( Honours).

Second year : Paper V **Making of Indian Culture** (Honours).

Third year: Paper VI optional of one the following: ( Honours)

**North East India ( From Earliest Times to the 13<sup>th</sup> Century)**

**History of north East India ( 1228-1822)**

**History of North East India ( 1822-1972)**

Third year : Paper VII optional of one of the following: (Honours)

**History of South East Asia 1859-1946**

**History of China and Japan 1839-1949**

**History of the United States of America 1763-1956**

Third year : Paper VIII **Contemporary World 1939-2000, (Honours)**

The teachers are encouraged to refer to the latest books and journals relevant to the courses and to familiarise their students with the most recent literature.

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### **Paper I**

#### **History of India (upto 1526)**

**Objective:** This course is designed to familiarize students with the social, economic, political and cultural developments in India from the Chalcolithic period to the end of the Delhi Sultanate. The focus is on the material roots of the developments, not on dynastic history. The purpose is to introduce students to elements of change and continuity in Indian history.

#### **Course content:**

**A.** Survey of sources and approaches to early Indian history (literary works, inscriptions, coins, tools, weapons, structural and other archaeological finds; how these have been used by history writers; broad trends in history writing). Geographical background with reference to the areas under study (physical features and their potential for economic growth and socio-political organization). Brief introduction to important concepts (e.g. culture, urbanization, civilization, etc). The Harappan Civilization (origins and distribution of urban and rural settlements; salient features [structural activities, trade, agriculture, art and crafts, and religious beliefs, as reflected in archaeology] of the major sites, with special reference to Mohenjodaro, Harappa, Kalibangan and Lothal; the problem of urban decline, late Harappan and non-Harappan cultures).

**B.** The emergence of Vedic culture (society, economy, polity and religion as reflected in the *Rig Veda* and the later Vedic

literature; corroborative evidence of archaeology [notably iron weapons and the Painted Grey Ware], particularly for the later Vedic culture); the geographical spread; absence of civilization for the greater part of the Vedic period. The material and ideological background of the Upanisads (conflicts with Vedic ideology; emphasis on *tapas* instead of the Vedic *yajña*). The rise of post-Vedic civilization (iron technology in production; expansion of settlements, the use of coined money, trade, markets and urbanization, territorial states [monarchies and oligarchies]; the geographical extent of post-Vedic cultures; society and religion as reflected in literature and various objects of material culture (the relevance of heterodox sects [particularly Buddha's and Mahavira's] to post-Vedic society); the emergence of Magadha as the paramount political power.

C. The Maurya Empire (the immediate prelude to its foundation [political and economic integration of Magadha under the Nandas; further territorial integration in the wake of Alexander's invasion]; its expansion and consolidation [for extending the scope of revenue inflow: broadening and strengthening the agrarian base; regulating various economic activities, particularly trade, arts and crafts; maintaining and deploying professional law-enforcing agents at different levels of administration, and a large standing army; by Ashoka's times, facilitating improvements in the network of communications on an extensive scale]; polity, religion and society as reflected in the literary [particularly relevant portions of the Arthashastra, Megasthenes's accounts], inscriptional and archaeological sources; the social context of Ashoka's *Dhamma*; the decline of the Mauryas vis-à-vis the expanding economy). The post-Maurya economy, society and polity (technology; Indo-Roman trade; the rise and growth of new kingdoms in northwestern India and the Deccan [of foreign and indigenous origins respectively]; the socio-economic base of the kingdoms: case study of the Kushanas and the Satavahanas; agrarian expansion and urbanization; administrative organization and varna concept with reference to these two kingdoms); the Sangam age; sectarian trends (with reference to Vishnuism, Jainism and Buddhism); society as reflected in the *Manusmriti*.

D. The Gupta Empire (economy, society and polity [as reflected in the literary, numismatic, epigraphical and other sources of the period]: settlement patterns [rural and urban]; the agrarian structure; landgrants; coinage; trade; administrative organization and the revenue system; the *samanta* system; cultural developments [an overview of art, architecture, sculpture, painting, literature, religion, with special

emphasis on the significance of the Purānic tradition; relevance of jātidharma; the social context of women's lowly social position and the rise of untouchability]; the decline of the Guptas). Post-Gupta polity, economy and society, with special reference to: (a) Northern India under Harshavardhana (political organization and the growing importance of the samanta system; religious developments); (b) South India under the Pallavas and Cholas (stages in administrative organization under their rule; the relevance of the varna concept; the agrarian structure; trade, markets and urban centres; art and religion, and the role of temples in socio-economic and political life); (c) other contemporary ruling families, with the focus on the Gurjara-Pratiharas, Palas, Rashtrakutas, Varmans (socio-economic and political institutions -- similarities and variations [reasons thereof]; administrative organization; the implications of the theory of mixed castes [varnaśamkara]; regional cultures). Arab invasion -- its impact.

**E.** Invasions by Ghazni and Ghorī -- nature and impact. The Delhi Sultanate (stages in political structure [upto 1296; upto 1450; upto 1526]; the iqta system; territorial and military organization; symbols and rituals of sovereignty; the Sultans' relations with autonomous chieftains. Rural society and the revenue system; technology and agricultural production. Urbanization, technology and non-agricultural production; trade, markets and monetization. Religion and culture: Sufi and Bhakti movements. Sultanate architecture and literature. Regional perspectives of socio-economic, political and cultural history with special reference to Vijayanagar and Bahmani.

**Essential reading:**

F.R.Allchin & Bridget Allchin, *The Rise of Civilization in India and Pakistan*, London, 1988.

Romila Thapar, *A History of India, Vol., I* Penguin Books, 1996 reprint.

H.Kulke and D.Rothermund, *A History of India*, London, 1986.

S.C.Malik, *Indian Civilization: The Formative Period*, Indian Institute of Advanced Studies, Shimla, 1971.

**Additional reading:**

Irfan Habib, *Interpreting Indian History*, NEHU, Shillong, 1985.

R.C.Majumdar et al. (ed.), *The History and Culture of the Indian People*, Vols. I-V, Bharatiya Vidya Bhavan, Delhi, 1945-1960.

Mohammad Habib & K.A.Nizami (eds.), *Comprehensive History of India, Vol. V A.D.1206-1526: The Delhi Sultanate*, Delhi, PPH, 1987.

N. Karashima, *South Indian History and Society, Studies from Inscriptions AD 850-1800*, OUP, Delhi, 1984.

## Paper II :

### Paper II HISTORY OF INDIA (1526-1950)

**Objective:** Catering to the need of both pass and honours students, this course offers an overview of the main trends and developments in India during the Mughal (1526-1757), colonial (1757-1947) periods as well as the period immediately after independence (1947-1950). The emphasis of this history will be the socio-economic and cultural patterns in understanding the polity and society as they took shape in the periods under study.

#### Course Content:

**A. Mughal period:** Sources and their uses, literary and historical records, and memoir (Babar Nama, Tuzuk I Jahangiri,) chronicles (Akbar Nama and Ain I Akbar) and accounts of foreign travelers (F. Bernier and Tavernier). Advent of the Mughal and the Afghan interlude, territorial expansion and consolidation 1526-1556, Akbar and Aurangzeb's relations with the Rajputs, Sikhs, Marathas, Deccan kingdoms; formation of the Maratha state; Mughal administration and institutions with special reference to the Mansabdari, composite ruling class, Sher Shah's administration, Rajput administration and that of Shivaji; society and economy- social structure, status of woman, literature, art and architecture, religion- Bhakti and Sufi movements, patterns in economy- agriculture, industry trade and commerce.

**B. Eighteenth - twentieth centuries:** political, socio-economic and cultural trends in the 18<sup>th</sup> century India, Advent of the European trade, struggle for supremacy; expansion and consolidation of British power from Clive to Dalhousie 1717-1857; ideologies of expansion, Mercantilism, Orientalism, Utilitarianism and Evangelicalism.

C. Society and economy: rise of new social classes, growth of western education, the press and national literature, socio-religious movements and their influence on Indian renaissance, Drain of Wealth, British commercial policy and deindustrialisation, land revenue policy, rise of modern industries, transport and communication, rise of economic nationalism.

D. Resistance to Colonial rule; Revolt of 1857- causes, aftermath and nature; peasant and tribal resistance, Indigo, Santhal and Assam riots.

E. National movement, independence and aftermath: emergence of nationalism, early political associations, origin and aims of Indian National Congress; rise of extremism in Indian politics, Partition of Bengal (1905), Swadeshi movement, militant nationalism, early phase of Muslim politics; rise of Gandhi, Khilafat Movement, Non Cooperation and Civil Disobedience Movements, Swaraj party, Left Wing in the INC, Round Table Conferences, Communal Award, Revolutionary activism, Rise of the Left Movement; Quit India Movement, Pakistan movement, Indian National Army; Independence, partition and transfer of power, integration of Indian states, making of the Constitution.

#### **Essential Reading**

Satish Chandra, *Medieval India, Part two, Mughal Empire 1526-1748*, Har Anand Publications, New Delhi, 1999.

R.C. Majumdar, H.C. Roychoudhury and K.K. Dutta, *An Advanced History of India*, Macmillan India Ltd., New Delhi, latest edition.

R. P. Tripathi, *Rise and Fall of Mughal Empire*, Allahabad, 1990.

R.P. Tripathi, *Some Aspects of Muslim Administration*, Allahabad, 1974.

Bipin Chandra, *India after Independence*, Penguin, New Delhi, 2000.

Sumit Sarkar, *Modern India 1885-1947*, Macmillan, New Delhi, 2001.

A. R. Desai, *Social Background of Indian Nationalism*, Popular Prakashan, Mumbai, 2000.

#### **Additional reading**

Percival Spear, *History of India, vol. 2*, Pelican, Hammondsworth, latest edition.

W. H. Moreland, *Agrarian System of Mughal India*, New Delhi, 1998.

Bipan Chandra, *The Rise and Growth of Economic Nationalism in India*, Peoples Publishing House, New Delhi, 1982.

Bipan Chandra, *India's Struggle for Independence 1857-1947*, Penguin, New Delhi, latest edition.

Harman Kulke and Dietmar Rothermund, *A History of India*, Manohar, New Delhi, 1986.

### PAPER III

#### MODERN WORLD—MID 15<sup>TH</sup> CENTURY TO WORLD WAR II

**Objective:** The course aims at introducing students to some of the major developments in the modern world from the mid-15<sup>th</sup> century to the beginning of World War II. The focus of the course will not be so much on dynastic changes but more on social and economic trends of developments and the resultant emergence of ideologies that helped to shape the modern world.

#### Course content:

**A:** Crisis of feudalism and the rise of new monarchies: England, France, Spain, Scandinavian kingdoms—Denmark, Norway and Sweden, Poland.

Decline of Feudalism and the rise of the modern era—Renaissance and Reformation.

Economic origins of the modern western world—Merchantilism and the commercial revolution; Beginnings of colonialism.

**B:** Rise of the Absolutist state: Spain—economic integration through merchantilist inclinations; France — agrarian change, rural industry and market economy; England—agrarian development, industry and trade.

**C: Era of Revolutions:**

Scientific Revolution, Agricultural and Industrial Revolution and the rise of new social classes.

Glorious Revolution (1688)

American War of independence (1776).

French Revolution - The background and end of monarchy; rise of Napoleon and the reforms; Congress of Vienna and the Concert of Europe.

**D: Liberalism and Nationalism : The ideologies.**

Liberalism in England.

Nationalism in Europe: German nationalism - from unification to 1914; Italian nationalism and its developments from unification to 1914.

The ferment in the Balkans.

The Russian Revolution 1917

Nationalism in China-Sun Yat Sen, Chiang Kai Shek and the Koumintang.

**E: Rise of New Imperialism:**

World War I - Beginnings and peace settlements.

Economic and social crisis in the inter-war years and the emergence of new ideologies -Nazism and Fascism.

Origins of the Second World War

Consequences of the Second World War-Decline of Imperialism and the concept of decolonisation.

**Essential Reading:**

Perry Anderson, *Lineages of the Absolute State*, (Verso, London, 1974).

D.K.Fieldhouse, *The Colonial Empires-A Comparative Survey from 18<sup>th</sup> Century*, Macmillan, London, 1982.

C.Hayes, *Contemporary Europe since 1870*, Macmillan, 1970

Eric, J.Hobsbawm, *Industry and Empire: The Birth of the Industrial Revolution*, New Press, 1999.

James Joll, *Europe since 1870 : An International History*, Hammondsworth, 1976.

Meenaxi Phukan, *Rise of the Modern West: Social and Economic History of Early Modern Europe* Macmillan, 1998.

M.M.Postan(ed.), *Cambridge Economic History of Europe Vol.I* Cambridge University Press, 1966).

M.M.Postan(et.al. ed.), *Cambridge Economic History of Europe, Vol.III* (Cambridge University Press, 1971).

E.E.Rich&Wilson, C.H.Wilson(ed.), *Cambridge Economic History of Europe Vol.V*, Cambridge University Press, 1977.

Taylor, A.J.P., *Origins of the Second World War*, Harper-Row, 1973.

David Thomson, *Europe since Napoleon*, Penguin, 1990.

David Thomson, *World History, 1914 - 1968*, OUP, 1969.

*Encyclopaedia Britannica* - Relevant sections of the latest editions.

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#### PAPER IV

#### HISTORIOGRAPHY

**Objective:** The course content of this paper should be able to introduce the students to the very basic concepts that go to make up the subject matter of history. The aim of the paper is not to raise very complex philosophical issues but to enable the students to understand that the very nature of the discipline of history is rooted in some fundamental concepts.

**Course content:**

**A.** Definitions of History - from the Classical age to the twentieth century; Nature of History: History as science- History as literature.

**B.** Meaning of Generalisation and Causation in History: Objectivity and Truth in History.

**C.** History and the other social sciences : Archaeology, Anthropology, Sociology, Economics, Political Science and Geography. Periodisation in History.

**D.** Major trends in Historiography: Herodotus; Empiricism and L.V.Ranke; Historical Materialism; A.J.Toynbee; Marc Bloch.

**E.** Trends in modern Indian Historiography: Imperialist historiography; Nationalist historiography; Marxist historiography; Subaltern historiography.  
 A few Indian historians: R.C.Majumdar; Sir Jadunath Sarkar; D.D.Kosambi.

**Essential Reading:**

E.H.Carr *What is History*, Penguin, London, reprinted 1990.  
 R.G.Collingwood, *The Idea of History*, OUP, Madras, 1989.  
 Irfan Habib, *Interpreting Indian History*, NEHU, Shillong nd.  
 Arthur Marwick, *The Nature of History*, Penguin, reprinted 1993.  
 Romila Thapar, *Interpreting Early India*, OUP, Delhi, 1993.  
 John C.B.Webster, *Studying History*, Macmillan India, New Delhi, 1997.

**Additional Reading:**

B.Sheikh Ali, *History: Its Theory and Method*, Macmillan, Madras, 1993.  
 Keith Jenkins, *Rethinking History*, Routledge, London, 1991.  
 C.H.Phillips, *Historians of India, Pakistan and Ceylon*, OUP, London, 1967.

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**Paper V**

**The Making of Indian Culture**

**Objective:** The people of India even in modern times present a picture of endless variety in physical appearance, food and clothing habits, beliefs and practices, living standards, language and ethnic groupings, among other things. This course aims at familiarizing students with the factors underlying the diversity, including the many elements from within and outside the subcontinent that went into the making of the composite Indian culture. The period of study covers the prehistoric to the modern.

**Course content:**

**A.** Introduction to the concept of India in History; definition of 'culture'; the land and the people. The beginnings and development of Stone Age cultures (sequence, geographical distribution [including Northeast India], hunting-gathering, food production, understanding linkages in technology, economy and social organization and areas of distribution). Growth of Chalcolithic villages, from Baluchistan to Gujarat. The Harappan civilization (origin, distribution and morphology of urban sites; new developments in technology and economy, and their socio-cultural implications; the decline of urban culture and the appearance of late Harappan cultures). Non-Harappan Neolithic-Chalcolithic cultures .

**B.** Cultural patterns in Vedic and post-Vedic times, with special reference to their geographical context, technological developments and the socio-religious ramifications. Impact of India's contacts with the Mediterranean world, Central Asia and Southeast Asia: Continuity and change in cultural patterns during the succeeding periods, from Maurya to Gupta times, as reflected in literature, art and architecture.

**C.** Cultural patterns in post-Gupta India upto the twelfth century. The growth of regional cultures and their expression in language, codes of law, art and architecture. The contribution of South India to Indian civilization. The place of Northeast India in Indian civilization.

**D.** Continuity and change in cultural patterns from the period of the Delhi Sultanate to that of the Mughals as reflected in religion and society (Bhakti movement, the ideas of Kabir, Nanak, Chaitanya, Sufi; schools of philosophy, and religious cults), art, architecture, painting, sculpture, arts and crafts, science and technology.

**E.** Contribution of Western thought and institutions to Indian culture: Renaissance in Modern India: Brahmo Samaj, Arya Samaj, Prarthana Samaj; Ramakrishna-Vivekananda Movement, Deoband School and

Modernization. Reformation and the abolition of social practices like child marriage, sati, etc.

**Essential reading:**

F. Raymond Allchin and Bridget Allchin, *The Rise of Civilization in India and Pakistan*, London, 1988.

A.L. Basham, *The Wonder that was India*, Rupa & Co., New Delhi, 2002 edn.

S.A.A. Rizvi, *The Wonder that was India*, Rupa & Co., New Delhi, 2002 edn.

Romila Thapar, *A History of India, Vol. I*, Penguin Books, 1990 reprint.

**Additional reading:**

Percival Spear, *A History of India, Vol. II*, Penguin Books, 1990 reprint.

K.M. Pannikar, *A Survey of Indian History*, Bharatiya Vidya Bhavan, Bombay, 1974.

K.A. Nilakanta Sastri, *History of South India*, OUP, Delhi, 1966.

S.K. Chatterjee, *The Place of Assam in the History and Civilization of India*, Gauhati University, 1995.

**PAPER VI**

**NORTH-EAST INDIA (From Earliest Times to the 13th Century)**

**Objective :** The course is intended to familiarize students with the major political and socio-economic developments in the Brahmaputra Valley from the earliest times to A.D. 1228.

**Course content:**

**A.** The sources and the geographical background: the emergence and development of stone-using cultures; literary and archaeological evidence of iron technology; the rise of the kingdom of Kamarupa in the fourth century A.D.

**B. Polity:** The nature of kingship in the context of dynastic history, from the Varman line of kings to the reign of Vallabhadeva; administrative functionaries and the system of governance; mechanisms of political authority.

**C. Society:** Various social groups (occupational, professional), social differentiations and the relevance of

the concept of varna thereto; the significance of Sudras and Brahmanas as the only distinct varna categories.

**D. Economy:** The land system with special reference to revenue administration; the principles and sources of taxation; settlement patterns (rural / urban); the character of trade, arts and crafts.

**E. Religion:** The 'autochthonous' background in relation to the major Brahmanical sects; the significance of the Kamakhya cult; other religious cults of the Puranic tradition; the process of 'syncretism'.

**Essential Reading:**

P.C.Choudhury, *A History of Civilization of the People of Assam to the Twelfth Century*, 3<sup>rd</sup> revised edn., Spectrum Publications, Delhi, 1987.

B.K.Barua, *A Cultural History of Assam*, Gauhati, 1951.

Nayanjot Lahiri, *Pre-Ahom Assam* Delhi, 1991.

B.N.Puri, *Studies in the Early History and Administration in Assam*, Gauhati University, 1968.

N.N. Basu, *Social History of Kamarupa*, New Delhi, reprinted 1997.

**Additional Reading:**

B.N.Mukherjee, *External Trade of Early North-Eastern India*, New Delhi, 1992.

B.K.Kakati, *The Mother Goddess Kamakhya or Studies in the Fusion of Aryan and Primitive Beliefs of Assam*, Gauhati, 1948.

Reba Ray, *Ancient Settlement Patterns of Eastern India*, Pearl Publishers, Calcutta, 1987.

R.D.Choudhury, *Archaeology of the Brahmaputra Valley of Assam*, New Delhi, 1985.

S.Kchatterjee, *Kiratas Jana Kriti*, Asiatic Society of Calcutta, Reprinted 1998.

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**PAPER VI**

**HISTORY OF NORTH EAST INDIA ( 1226 - 1822 )**

**Objective:** The course is designed to present a broad overview of major political and socio-economic developments in North-East India from the thirteenth century till 1824.

**Course content:**

**A.** Historiography ; sources and their uses ; Thirteenth century background, Emergence of new politics - Chutiya, Cachari, Ahom and Koch.

**B.** Consolidation of Ahom State, System of government and Administration, Paik & Khel System, Trade and markets, Shankaradeva and the Neo-Vaishnavite Movement, Decline of Ahom State.

**C.** Formations and political Developments-Koch, Kachari (Dimas) Tripura, Jaintia and Meithei State.

**D.** Pre-Colonial Hill Polities and economy - Khasi, Garo, Naga, Mizo.

**E.** British Relations with North East States. 1765-1824, Early British Policy, Welsh Mission to Assam 1792, Phase of Neutrality, Burmese War.

**Essential Reading**

H.K. Barpujari, *The Comprehensive History of Assam*, Vols II and III. Publication Board Assam, Guwahati, 1992.

Edward Gait, *A History of Assam*. L.B.S Publications, Guwahati, 3<sup>rd</sup> edition, Reprint, 1984.

S.K. Bhuyan, *Anglo Assamese Relation 1771-1826*.

N.K. Basu, *Assam in the Ahom Age 1228-1826*. Sanskrit Pustak Bhandar, Calcutta, 1970.

Hamlet Bareth, *The History and Culture of the Khasi People*, Calcutta, 1967.

Sangmomei Kabui, *History of Manipur*, National Publication House, New Delhi 1991.

Nalini Ranjan Roychoudhury, *Tripura Through the Ages*, Sterling Publication, Revised edition, New Delhi, 1983.

Chittaranjan Nag, *Mizo Polity and Political Moderization*. Vikas Publication House. New Delhi, 1998.

M. Horam, *Naga Polity*, B.R Publication Corporation, Delhi, 1975.

Surajit Sinha : *Tribal Polities and State Systems in Pre-Colonial Eastern and North Eastern India*, K.P. Bagchi, Calcutta, 1987.

**Additional Reading**

- Amalendu Guha : *Medieval and Early Colonial Assam*  
K.P. Bagchi, Calcutta, 1991.
- D.Nath : *History of the Koch Kingdom, c 1515-1615*, Mittal  
Publications, Delhi, 1989.
- J.N. Chowdhury : *The Khasi Canvas*, Shillong, 1990.

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**PAPER VI**

**HISTORY OF NORTH EAST INDIA (1822 - 1972 )**

The objective of this course is to familiarize the students with the major trends of the political, social and economic developments in North East India from 1822 to the reorganization of states 1972.

**Course content**

- A. Early British Policy, Non-Regulation System; First Anglo-Burmese War and the Treaty of Yandaboo; Annexations of Assam, Cachar, Jaintia .
- B. Consolidation of British Rule in the Hills-Khasi, Garo, Naga, Mizo Hills, Pattern of administration; British relations with Arunachal tribes, Manipur and Tripura states.
- C. Economic and social changes under British. Rule-Land Revenue, Plantation Industry, Trade and Communication, Western Education.
- D. Impact of Nationalist Movement in Assam-Partition of Bengal, Assam Association, non-Co-operation Movement, Civil disobedience and Quit India Movements, Cabinet Mission and Independence.
- E. Political Developments since Independence - Integration of Manipur, Khasi States and Tripura into the Indian Union; The Sixth Schedule; Emergence of Nagaland; Hill State movement; Reorganization of North Eastern states 1972.

**Essential reading**

- H. K. Bapujari, *Assam in the Days of the Company*, NEHU, 1997.
- J. B. Bhattacharjee, *The Garos and the English*, Radiant Publishers, New Delhi, 1997.
- A. Guha, *Planter Raj to Swaraj : Freedom Struggle and Electoral Politics in Assam, 1826-1947*, PPH, New Delhi, reprinted 1988.
- H.K. Barpujari, *The Comprehensive History of Assam*, Vols. IV and V., Publication Board of Assam, Gauhati, 1992.
- H.K. Barpujari & A. Bhuyan, S.P. Dey, *Political History of Assam*, Vols, Government of Assam, Gauhati, Vol. I, 1997. Vol. II, 1978, Vol. III, 1980.
- R.M. Lahiri, *Annexation of Assam*, Firma KHM Calcutta, 1975.
- S.K. Bhuyan, *Anglo-Assamese Relations*, Lawyers Book Stall, Gauhati, 1974.
- S.K. Chaube, *Hill Politics in North East India*, Orient Longmans, Calcutta, reprinted 1999.

**Additional reading**

- Arun Bhuyan, *Nationalist Upsurge in Assam*, Government of Assam, Gauhati, 2000
- D.R. Syiemlieh, *British Administration in Meghalaya, Policy and Pattern*, Delhi 1989.
- E. Gait, *History of Assam*, Thacker Spink and Co., Calcutta, 1963, refer to latest edition.
- F. Downs, *History of Christianity in North East India*, Bangalore, 1992.
- H.K. Barpujari : *Problem of the Hill Tribes : North East India*, Vol. I, Lawyers Book Stall, Gauhati 1970; Vol. II, Basanti Prakash, 1976; Vol. III, Spectrum Publishers, Gauhati, 1981.
- J.B. Bhattacharjee , *Trade and Colony*, Shillong, 2000.

**PAPER VII****HISTORY OF CHINA AND JAPAN (1839 - 1949)**

**Objective:** The object of studies of this course is to acquaint the students with the beginning and growth of European colonization in China and Japan and the various historical forces and factors that inter-acted to these developments.

**Course content:**

A. Traditional China and Japan : Political, Social and Economic conditions in the Middle of the 19<sup>th</sup> Century.

B. European expansion, The opening of China, Opium Wars and consequences, China's Response to the European challenge, Taiping Rebellion, Reform Movements : Boxer Rebellion.

C. Meji Restoration and process of modernization, Emergence of Japan as an imperial power: Sino-Japanese relations: Anglo-Japanese alliance, Russo-Japanese War: Japan and World War I; Washington Conference.

D. Birth of the Republic China, Career of Sun Yat Sen; Revolution of 1911: The Kuomintang (KMT); Politics of Warlordism; May Fourth Movement. The origin and Growth of the Chinese Communist Party (CCP), Civil War and the Communist seizure of Power (1949).

E. Rise of Japanese militarism; Japan and the Western Powers; Manchurian Crisis, Japan and the Second World War.

**Essential Reading**

Paul Clyde and B.F. Beers: *The Far East*; Prentice Hall of India, New Delhi, 1976.

H.M. Vinacke: *History of Far East*, F.S. Crafts, New York, 1963.

C.P. Fitzgerald : *A Concise History of East Asia*, Pelican, 1974, .

Scott Kenneth : *The Chinese-their Culture of History* New York, 3<sup>rd</sup> Edition 1957.

Lalourette Tanage : *Japan Since Perry*, McGraw Hill, New York, 1994.

Malcolm Kennedy : *History of Japan* Weidenfield and Nicholson, London, 1963.

Y.Hsu Immanuel : *The Rise of Modern China*, OUP, 1989.

Franz Schurman and Orville Schell : *China Readings*, 2 Volumes (Imperial China and Republican China)

**PAPER VII**

**HISTORY OF MODERN SOUTH EAST ASIA ( 1859 - 1946 )**

**Objective :** The object of the study of this course is to acquaint the students with the growth and development of colonial policy and practice in South East Asia and the beginnings of nationalism in the region.

**Course content:**

**A.** Spread and influence of India Culture in South East Asia : The coming of the Europeans - Rivalry among them.

**B.** The Dutch in the Archipelago : British in Burma and Malaya : Spanish and American Power in the Phillipines.

**C.** The French in Indo-China : Siam and the West.

**D.** The South East Asian Response : Beginnings of Nationalism in South East Asia.

**E.** The Rise and Fall of Japanese Power in South East Asia; attempts at colonial restoration, Decolonisation in South east Asia

**Essential Reading**

D.G.E.Hall : *A History of South East Asia*, Macmillan Asian Histories series, N.Y, 1988.

F. John Cady : *South East Asia ; Its Historical Development*, McGraw Hill, New York, 1964.

Brian Harrison : *South East Asia, A Short History*, London NY, 3<sup>rd</sup> Edition, 1964.

Nicholas Tarling : *A History of Modern South East Asia*, Practice Hall, New Jersey, 1968.

Nicholas Tarling (ed.), *The Cambridge History of South East Asia*, Vol. 2, Cambridge University Press, 1992.

J. M. Pluvier, *South East Asia from Colonialism to Independence*, Oxford University Press, Kuala Lumpur, 1974.

**Paper VII**

**History of the United States of America (1763-1945)**

**Objective:** This course intends to familiarize the students of the Honours level with the rise of the USA as a nation as well as a major power. In its later aspect this course traces the role of the USA in international politics till the end of the Second World War.

**Course Content:**

**A :** Colonial background of the American revolution: Socio-economic conditions in the colonial period-sources of conflict; Revolutionary groups; and Ideological basis of the American Revolution. War of Independence-its results, nature and significance.

**B :** Constitution and democracy: Making of the Constitution : Issues and Debates; Federalists and Anti-Federalists- Jefferson and Hamilton. Jeffersonian and Jacksonian democracy ; Political parties, 1840 to 1860 ; Role of the Judiciary; Limitations of American Democracy. War of 1812- Background, results and significance.

**C :** Issues at stake: Westward Expansion; Monroe doctrine and Turner's thesis of expansion of frontier; Native Americans: A brief reference to 'Reservation'. Sectional conflict : Basis of conflict, Plantation economy, Abolitionism and sectionalism. Civil War - Issues and interpretations ; Lincoln's role in the War and emancipation of Slavery.

**D :** Economy and society, changes & development: Economic Developments (pre-1865)-Differential patterns of development in the North and the South ; Tariff Question; Conditions of the Labourers and Slaves ; Industrial developments. Post-1865 Developments : Reconstruction- Presidential, Radical and Congressional Plans; the emergence of the new South; Social tensions and reactions; Growth of Capitalism and big business; Labour Movements. Changes in Agriculture; Populism; Progressivism-Theodore Roosevelt & Woodrow Wilson. The Great Depression. Rumblings of Discontent - The Blacks and Women. Franklin Roosevelt and the New Deal. Scientific and Cultural Developments.

**E :** THE U.S.A in international arena: Monroe doctrine in Practice ; Spanish-American War; Relations with the Phillipines. US interests in the Far-East-Relations with Japan and China. The USA in the First and Second World Wars.

**Essential reading**

Beard, Charles & Mary, *The Beards' New Basic History of the United States*, Doubleday, 1968.

Hugh Brogan, *The Penguin History of the U S A.*, Penguin Books Ltd., Harmondsworth, 1999.

Foster Rhea Dulles, *The United States Since 1865* Surjeet Publications, New Revised edition, 1989.

Faulkner, H.U. *American Social and Political History* Appleton Century Craft, New York, 1952.

R.P. Kaushik, *Significant Themes in American History* Ajanta International, Delhi, 1983.

Michael Kraus, *The United States to 1865*, Surjeet Publications, New Revised edition, Delhi, 1989.

H.B. Parkes *The United States of America : A History* Scientific Book Agency, Calcutta, 2002.

**Additional reading**

Charles Beard, *An Economic Interpretation of the Constitution of the United States*, Free Press, 1986.

H.U. Faulkner, *American Economic History*, Harper and Brothers, New York, 1954.

Thomas Johnson, *Oxford Companion to American History*, Oxford Univ. Press,

Linda Kerba, *Women's America : Refocussing the Past*, OUP, New Delhi, 1987.

Allan Nevins & Henry S. Commager, *A Short History of the United States*, Alfred Knopf Inc., New York, 1972.

J. W. Pratt, *A History of the United States Foreign Policy*, Prentice Hall, New York, 1955.

James Randall (et. al.), *The Civil War and Reconstruction*, Heath & Co., New York, 1969.

Charles Sellers and Henry May & Neil Mcmillen R., *A Synopsis of America History*, 2 vols., MacMillan India, New Delhi, 1990.

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**PAPER - VIII****CONTEMPORARY WORLD 1939 - 1990**

**Objective:** This course is designed to acquaint the students with the major political, social, economic and scientific developments in the contemporary world and their resultant effects.

**Course content:**

- A.** Formation, objectives and organization of U.N., decolonisation, case studies of Asia (India, Burma, Indonesia) and Africa (Algeria, Kenya, Congo, Ghana).
- B.** Cold War and Power Relations, The Unstable Interwar system, Nato, Warsaw Pact, Invasion of Hungary, Czechoslovakia, Afghanistan, the Cuban Missile Crisis, the Berlin Blockade and Wall, the Arab-Israeli Wars, Vietnam War, Non Allied Movement.
- C.** Oil & New Colonialism, Oil policies and crisis leading to formation of OPEC, Gulf Wars, OAU.
- D.** Liberation Movements, Apartheid (South Africa, Zimbabwe, Namibia), Feminist Movement.
- E.** Social and Technological Development in contemporary world, space exploration and communication revolution, information technology revolution, nuclear politics.

**Essential reading**

Ramesh Thakur(ed) : *Past Imperfect, Future Uncertain : The United Nations at Fifty*. New York : St.Martin's Press, 1998.

Peter R Bachr: *The United Nations at the end of the 1990s*. New York, St.Martin's Press, 1999.

Cameron R Hume: *The United Nations, Iran and Iraq : How Peacemaking Changed*, Bloomington, Indiana University Press, 1994.

Daniel Yergin: *Shattered Peace : The Origins of the Cold War and the National Security State*.

Nicholas Berry, & Michael Roskin : *The New World of International Relations*, Prentice Hall of India, Pvt. Ltd, New Delhi, 2002.

Betty Friedan , *The Feminine Mystique*, 1963.  
Shiela Rowbotham , *Hidden From History*,  
Jytirmoy Banerjee , *Nuclear World, Defence and Politics  
of Major Power*, Manas Publications, New Delhi, 2002.  
M Fulbrook: *Europe Since 1945*, OUP, New Delhi, 2001.  
Timothy Garton Ash : *History of the Present* . Penguin  
Books, UK ,1999.  
Peter Mansfield : *History of the Middle East*, Penguin  
Books, England 1991.  
N Lowe, *Mastering Modern World History*, Revised Indian  
edition, Macmillan, New Delhi, 1992.

xii) Syllabus for Electronic & Communication Engineering. (EC & E) for VII-VIII.

The Head, Deptt. of Library & Information Science, NEHU vide his letter dt. 2.12.03 has forwarded the Syllabus of Bachelor in Electronic & Communication Engineering (EC & E) for VII-VIII semester which has been approved by the Board of Under-Graduate Studies in its meeting held on 28th, Nov'03.

The Syllabus is placed as Annexure-'A'.

The matter is placed before the Council for consideration.

5:2:12 (2)

Answer - 'A'

**NORTH-EASTERN HILL UNIVERSITY (N.E.H.U.) : SHILLONG**  
(A Central University)

**DRAFT**  
**SYLLABI**

***for***

**BACHELOR OF ENGINEERING ( ELECTRONICS & COMMUNICATION  
ENGINEERING)**

***( A FOUR YEAR DEGREE COURSE )***

**For SEMESTER VII and SEMESTER VIII**

**SEVENTH SEMESTER**

Subject Code	Subject	Number of hours Per week			Duration of Examination in hours		Marks		
		L	T	P	Theory	Practical	Examination	Sessional*	Total
ECE 4101	Integrated Circuits and System	3	1	-	3	-	100	25	125
ECE 4102	Computer Networking and Communication	3	1	-	3	-	100	25	125
ECE 4103	Antenna and Wave Propagation	3	1	-	3	-	100	25	125
ECE 4104	Digital Signal Processing	3	1	-	3	-	100	25	125
ECE 4105	Elective - I	3	1	-	3	-	100	25	125
ECE 4106	Project - I	-	4	-	-	-	200(125+75) **	-	200
ECE 4107	Industrial Training	-	-	-	-	-	50 (25+25) ***	-	50
ECE 4108	Laboratory - VII	-	-	4	-	4	100	25	125
	<b>Total</b>	<b>15</b>	<b>9</b>	<b>4</b>	<b>Total Marks 1000</b>				

\* Distribution of marks : Best of 2 class tests – 16 marks, Viva-voce – 4 marks, Assignments–5 marks.

\*\* 125 from dissertation and 75 from Viva \*\*\* 25 from the organization in which student goes for training and 25 from presentation on training given by the student at the college.

**DETAILED SYLLABUS**

**Seventh Semester**

**ECE 4101 INTEGRATED CIRCUITS AND SYSTEM**

**Unit-I**

Integrated circuit processes :

Planner process : Silicon Wafer Preparation, Epitaxial growth, Oxidation, Photolithography, Diffusion, Ion implantation, Isolation Technique, Metalization, Assembly and Packaging.

Semiconductor Processes : NMOS Process, CMOS Process, Practical Considerations : Processes and device design constraints, Scaling theory, Latch-up control, bipolar technology, hybrid technology.

**Unit-II**

Basic Integrated Building Block :

Switches, Active resistors, Current Sources and Sinks, Current Mirrors/Amplifiers Voltage and Current References, Amplifiers : Inverting Amplifiers, Differential amplifiers, Comparators.

**Unit-III**

Digital Circuits :

Characteristics of digital circuits, Transfer characteristics of NMOS and CMOS inverters, Noise Margins, Transient Analysis, Calculation of delays, power delay product, NMOS and CMOS logic Gates, NMOS pass transistor, CMOS transmission gate.

**Unit-IV**

Analog Systems :

D/A and A/D converters : Current scaling D/A converters, Voltage Scaling D/A converters, Charge Scaling D/A converters, D/A converters using Combinations of scaling approaches, Serial D/A Converters, Serial A/D Converters, Successive approximation D/A Converters, Parallel A/D Converters, High Performance A/D Converters.

**Unit-V**

Switched capacitor circuits :

Resistor realization, Filters, Oscillators, Modulators & Multipliers, Voltage controlled oscillator & Phased lock Loop.

Semiconductor Memories.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) VLSI : Design Techniques for Analog and Digital Circuits by Geiger *et al*, McGraw-Hill International Edition, 2003.
- 2) Modern VLSI Design by Wayne Wolf, 3<sup>rd</sup> Edition, Addison Wesley Longman, 2002.
- 3) Principles of CMOS VLSI Design : A System Perspective by N.H.E. Weste and K. Eshraghian, Addison Wesley Longman, 2003.
- 4) Applications of Specific Integrated Circuits by Michael J. S. Smith, 4<sup>th</sup> Edition, Addison Wesley Longman, 2002.

# **CSE 4102 COMPUTER NETWORKING AND COMMUNICATIONS**

## **( Common Paper for Computer Science & Engineering )**

### **Unit-I**

#### **Introduction :**

Network Hardware : Local Area Network (LAN), Metropolitan Area Network (MAN), Wide Area Network (WAN), Wireless Networks, Internetworks.

**Network Software:** Protocol Hierarchies, Design Issues for Layers, Interfaces and Services, Connection Oriented versus Connectless Services, Service Primitives, Relationships of Services to Protocols.

**Reference Models:** The ISO-OSI reference model, The TCP/IP reference model, Comparisons of OSI and TCP reference model.

#### **Medium Access Sublayer :**

Channel Allocation : Static versus Dynamic Channel Allocation.

### **Unit-II**

**LAN Protocols :** Persistent and Nonpersistent CSMA, CSMA/CD, Collision-free Protocols, Broadcast Recognition with Alternating Priorities (BRAP), Multi-Level with Multi-Access Protocol, Limited Contention Protocols, The Adaptive Tree Walk Protocol, The Urn Protocol, IEEE standard 802 for LAN : 802.3, 802.4, 802.5, Fibre Optic Networks, Satellite Networks, Packet Radio Networks.

#### **Data link Layer :**

Design Issues : Service provided to Network Layer, Framing, Error Control, Flow Control, Link Management, Error detection and Correction.

**Elementary Protocols :** unrestricted Simplex Protocol, Simplex Stop-and-Wait Protocol, Simplex Protocol for Noisy Channel.

**Sliding Window Protocol :** One-Bit Sliding Window Protocol, Go Back  $n$  Protocol, Protocol with Selective Repeat, Protocol Performance.

#### **Network Layer :**

Design Issues : Service provided to , Internal Organization, Routing, Congestion, Internetworking.

Routing Algorithms : Shortest Path Routing, Multi-Path Routing, Centralized Routing, Isolated Routing, Flooding, Distributed Routing, Optimal Routing, Hierarchical Routing, Broadcast Routing.

### **Unit-III**

**Congestion Control Algorithms :** Preallocation of Buffers, Packet Discarding, Isarithmic Congestion Control, Flow Control, Choke Packets, Deadlocks.

**Internetworking :** Internetwork Architectures, Internetworking Issues, Bridges, Gateways, Tunneling, Internetwork Routing, Fragmentation, Firewalls.

**Network Layer for Internet :** The IP Protocols, IP Addresses, Subnet, Internet Control Protocols : ICMP, ARP, RARP, OSPF, BGP, Internet Multicasting, CIDR, Ipv6.

### **Unit-IV**

#### **Transport Layer :**

Design Issues : Services provided to Session Layer, Quality of Service, Service Primitives, Berkeley Sockets.

**Connection Management :** Addressing, Establishing a Connection, Releasing a Connection, Timer-Based Connection Management, Flow Control and Buffering, Multiplexing, Crash Recovery.

### **Unit-V**

**Internet Transport Protocols :** TCP Protocols, TCP Segment Header, TCP Connection Management, TCP Transmission Policy, TCP Congestion Control, TCP Timer Management, UDP.

**Session layer and Presentation Layer :** Issues and Solutions.

#### **Application Layer :**

TCP/IP Application Protocols : TELNET, FTP and TFTP, SMTP, SNMP.

**ISO Application Protocols :** VT, File Transfer Access and Management (FTAM).

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Computer Networks by Andrew S. Tanenbaum, 5th Edition, Prentice-Hall of India, 2002.
- 2) An Engineering Approach to Computer Networking by S. Keshav, 3<sup>rd</sup> Edition, Addison Wesley Longman, 2002.
- 3) Data and Computer Communications by W. Stallings, 5<sup>th</sup> Edition, Prentice-Hall of India, 2003.
- 4) Computer Networks and Distributed Processing : Software, Techniques and Architecture by James Martin, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2003.
- 5) Data Communications and Distributed Networks by U.D. Black, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.

**ECE 4103 ANTENNA AND WAVE PROPAGATION****Unit-I**

Brief Review of Wave Equation :

Basic Antenna Concept : Definitions, Antenna types, Radiation mechanism, Radiation from a short current element, Antenna parameters : radiation pattern, directivity and gain, radiation resistance, radiation from a small current loop, radiation from arbitrary current distribution, Concept of antenna impedance, Antenna as an aperture.

**Unit-II**

Wire antennas : Dipole concept, Short dipole, Half wave dipole, Monopole antenna, Linear elements near or on infinite conducting plane, Ground effects, Resonant long wire antenna, V antenna, Rhombic antenna, Long wire antenna with travelling wave current.

**Unit-III**

Aperture antennas : Field as source of radiation, Field equivalence principle, Radiation from planar aperture : rectangular and circular, Radiation from open W/G, Horn antennas, Parabolic reflector system, Microstrip patch and slot antenna.

**Unit-IV**

Array concept : Principle of pattern multiplication, Uniform one dimensional array, Parasitic arrays, Yagi antenna : binomial & Chebyshev.

Introductory concepts of broadband and CP antennas : Log periodic antenna, Spiral antenna, Helical antenna, Biconical antenna.

**Unit-V**

Wave propagation : Different types of Wave propagation, Surface Wave propagation, Ionospheric propagation, Effect of earth magnetic field, Faraday rotation, Line of sight propagation, Tropospheric scatter propagation, Duct propagation.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Antenna Theory : Analysis and Design by C.A. Balanis, 3<sup>rd</sup> Edition, John Wiley & Sons, 2002.
- 2) Antennas by J.D. Kraus, McGraw-Hill International Edition, 2002.
- 3) Antenna and Radio Wave Propagation by R.E. Collin, McGraw-Hill International Edition, 2003.
- 4) Electromagnetic Waves and Radiating Systems by E.C. Jordan & K.G. Balmain, 4<sup>th</sup> Edition, John Wiley & Sons, 2002.
- 5) Fields and Waves in Communications Electronics by S.Ramo, J.R. Whinnery & T.Van Suzer, 3<sup>rd</sup> Edition, John Wiley & Sons, 2002.

**ECE 4104 DIGITAL SIGNAL PROCESSING**  
( Common Paper for Computer Science & Engineering )

**Unit-I**

**Discrete Time Signals & Systems :**

Advantages of digital over analog signal processing , discrete-time signals and sequences : representation of sequences and elementary operations, classifications of discrete-time signals. Resolution of discrete-time signals into impulses, Analysis of discrete-time LTI systems: Response to arbitrary inputs, the convolution sum, properties of LTI systems and their interconnections, causality and stability. Linear constant coefficient difference equations and their solutions, Impulse response of LTI recursive system. Response to complex exponential and sinusoidal signals- the frequency response function.

**Unit-II**

**Transforms :**

Representation of sequences by Fourier-transforms – symmetry properties and theorems. Z-transforms – two-sided and one-sided Z-transforms, properties of ROC, the inverse Z-transforms, Z-transform properties, analysis of LTI system in the Z-domain: Sampling of continuous-time signals-periodic sampling, frequency domain representation of sampling.

**Transform Analysis of LTI Systems :**

System functions-linear constant coefficient difference equations: poles and zeros, rational system function, causality and stability, frequency response of LTI systems-phase distortion and delay, frequency response for rational system functions and for single zero or pole systems.

**Unit-III**

**Structures for Discrete-Time Systems :**

Block diagram representation of linear constant coefficient difference equations- their interconnection schemes, direct form-I, direct form-II, cascade form and parallel form structures. Finite precision word-length effect-number representation, analysis of effect of coefficient quantization and rounding of noise, zero input limit cycles in fixed-point realizations of IIR digital filters.

**Unit-IV**

**Filter Design Techniques :**

Characteristics of practical frequency selective filter, design of FIR filters by windowing. Characteristics of Butterworth & Chebyshev filters, design of IIR filters from continuous-time filters- Impulse invariance & bilinear transformation methods.

**Unit-V**

**Discrete Fourier Transforms :**

Frequency domain sampling, The DFT and properties of DFT, circular convolution, linear convolution using DFT.

**Applications :**

Dual-tone multifrequency signal detection, spectral analysis using DFT, musical sound processing, digital FM stereo generation, Digital audio sampling rate conversion.

**Distribution of Marks:**

Theory

: 100 marks

Exam 3 hrs. Duration

Unit 1 to 5 : 20 marks each  
Sessional : 25 marks

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Discrete-Time Signal Processing by Alan V. Oppenheim & Ronald W. Schaffer, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.
- 2) Signal and Linear Systems by R.A. Gabel and R.A. Roberts, 5<sup>th</sup> Edition, John Wiley & Sons Inc., 2002.
- 3) Digital Signal Processing : Principles, Algorithm and Applications by John G. Proakis & Dimitris G. Manolakis, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.
- 4) Digital Signal Processing : A Computer Based Approach by Sanjit K. Mitra, 2<sup>nd</sup> Edition, Tata McGraw-Hill, 2003.
- 5) Understanding Digital Signal Processing by Richard G. Lyons, 4<sup>th</sup> Edition, Addison Wesley Longman, 2002.
- 6) Computer Exploration in Signals and Systems using MATLAB by J. R. Buck *et al.*, Prentice-Hall of India, 2003.
- 7) Digital Signal Processing – a laboratory approach using PC-DSP by O. Alkin, Prentice-Hall, 2002.

***ELECTIVE - I***

**ECE 4105A TELEVISION ENGINEERING**

**Unit-I**

Introduction :

Analysis and synthesis of picture, Scanning processes, Camera tubes, Composite video signals, Video amplification methods : Compensation and DC restoration, Television transmission : TV transmitter, transmitter receiver relation, overall system response, TV Receiver : Block diagram of TV Receiver, Receiving antennas, Picture tubes, IF section, Video detector, AGC, Synchronization separator, Deflection systems, AFC, power supplies, EHT generation, High voltage safety.

**Unit-II**

Introduction to colour television :

Colour : vision, representation and reproduction.

**Unit-III**

Formation of chrominance signal ,

Colour fundamentals, Mixing of colour and colour perception, Chromacity diagram, NTSC, SECAM and PAL-D systems, Merits and demerits of PAL-D system.

Colour signal transmission and reception.

**Unit-IV**

Colour camera and picture tubes :

Different types of cameras and picture tubes including multichannel CCD array camera.

Digital television ,

Reasons for using digital televisions, Pulse modulation system applicable to TV transmission, Bandwidth reduction technique, Different types of coding technique used in digital TV.

### Unit-V

Cable TV : Introduction to cable TV systems, Characteristics of different types of cable, Two way and multi way cable system, Cable TV converter, wave traps and scrambling methods, Long distance link, Fibre optic link.

### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

### Books for study :

- 1) Basic Radio and Television by S.P. Sharma, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2003.
- 2) Basic Television and Video Systems by B. Grob, 7<sup>th</sup> Edition, Tata McGraw-Hill, 2002.
- 3) Communication Receivers by U.L. Rohde, McGraw-Hill International Edition, 2003.
- 4) Colour Television by S.P. Bali, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2002.
- 5) Television-Maintenance and Repair by Anokh Singh, 5<sup>th</sup> edition, Tata McGraw-Hill, 2003.
- 6) Television and Video Engineering by A.M. Dhake, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2002.

## ECE 4105B INTRODUCTION TO COMPILER DESIGN

### Unit-I

Introduction to Attributed Translation :

Attributed Translation Grammar, L – Attributed Translation Grammar, Example Language Constructs: Declarations, Expressions, Assignment Statements, Control Statements, Procedure Calls and Returns, Input and Output Statements.

Symbol Table Handling Techniques :

When to construct and Interact with the Symbol Table, Symbol-Table Contents, Operations on Symbol Table.

Symbol Table organizations for Non-Block-Structured Languages :

Unordered Symbol Tables, Ordered Symbol Tables, Tree-Structured Symbol Tables, Hash Symbol Tables.

### Unit-II

Symbol Table organizations for Block-Structured Languages :

Block-Structured Language Concepts, Stack Symbol Tables, Stack-Implemented Tree-Structured Symbol Tables, Stack-Implemented Hash-Structured Symbol Tables.

Run-Time Storage Organization and Management : Static Storage Allocation, Dynamic Storage Allocation: Activation Records, parameter Area, Display Area, Run-Time Address Calculation, Handling Recursive Procedures.

Heap Storage Allocation : Implicit Storage Requests, Explicit Storage Requests, Management of Fixed – Length Blocks, Management of Variable-Length Blocks, Garbage Collection and Compaction.

Error Detection and Recovery :

Description of possible errors, Lexical-phase Errors, Syntactic-phase Errors : Error handling in LL(1) parsers, Error handling in LR parsers, Semantic Errors.

### Unit-III

Code Optimization :

Principal Sources of Optimization, Loop Optimization : Dominators, Reducible Flow Graphs, Depth-First Search, Loop-Invariant Computation, Induction variable elimination, Other Loop Optimization, The DAG representation of Basic Blocks.

Global Data-Flow Analysis :

Reaching Definitions again, Available Expressions, Copy Propagation, Backward Flow problem Handling of pointers, Inter-procedural Data-Flow Analysis.

Code Generation :

Object Programs, Problems in Code Generation, A machine model, A simple Code Generator. Register Allocation and Optimization : Register Allocation in Single Register Machine, Register Allocation in Multi-Register Machine, Code Generation from DAG, Peephole Optimization.

#### Unit-IV

Action :

Issues : elated to Programming Language Design, Issues related to Finite-State Machines, Phases of Compiler Design, Lexical Analysis.

Basic Parsing Techniques :

Parsers, Shift-Reducing Parsers, Operator-Precedence Parsing, Predictive Parsers.

Top-Down Parsing :

Brute-Force Approach, Recursive-Descent Parsers, Top-Down Parsing with Limited Backup.

Top-Down Parsing with no Backup :

Simple LL(1) Grammars, LL(1) grammars without & Rules, LL(1) grammars with & - Rules.

Bottom-up Parsing :

LR Grammars, Concepts and Terminology, LR(0) Parsers, SLR(1) Parsers, Canonical LR(1) Parsers, LALR(1) Parsers, Using ambiguous grammar.

#### Unit-V

Syntax-Directed Translation (SDT) :

SDT Schemes, Implementation of SDTs, Intermediate Code, Postfix Notation, Parse Trees and Syntax Trees, Three-Address Code, Quadruples and Triples, Translation of Assignment Statements, Translation of Boolean Expressions, Translation of Statements that alter flow of control, Postfix translation, Translation with top-down parsers, Translation of Array references in Arithmetic Expressions, Translation of Procedure Calls, Translation of Procedure Calls, Translation of Declarations, Translation of Case Statements, Translation of Record Structures.

Semantic Analysis :

Introduction, Implicit-Stacking in Recursive-Descent Compilation, Semantic Stacks in Bottom-up compilation, Action-Symbols in Top-Down Compilation.

#### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

#### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

#### Books for study :

- 1) Compilers : Principles, Techniques and Tools by Alfred V. Aho, Ravi Sethi & Jeffrey D. Ullman, 4<sup>th</sup> Edition, Addison Wesley Longman, 2003.
- 2) The Theory and Practice of Compiler Writing by Jean P. Tremblay & Paul G. Sorenson, McGraw-Hill International Edition, 2002.
- 3) Compiler Design in C by Allen I. Holub, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.
- 4) Practice and Principles of Compiler Building with C by Henk Alblas & Albert Nymeyer, 2<sup>nd</sup> Edition, Prentice-Hall of India, 2002.

### ECE 4105C / CSE 4105D ADVANCED CONTROL SYSTEM ( Common Paper for Computer Science & Engineering )

#### Unit-I

State space description : Some basic concepts, Some canonical realizations, parallel and cascaded realization, matrix rotations and state space equation.

## Unit-II

Controllability and observability of continuous realization, determining the initial conditions, state observability, setting up initial conditions, state controllability, joint observability and controllability, the uses of diagonal form, standard form for uncontrollable and/or nonobservable systems. Test for controllability and observability.

## Unit-III

Review of stability theory, external and internal stability, the Liyapunov criterion, stability results for linearized systems.

## Unit-IV

### Linear state variable feedback :

Analysis of stabilization by output feedback, state variable feedback and model controllability, formulae for the feedback gain, a transfer function approach, aspects of state variable feedback.

## Unit-V

**A symptotic observers and compensator design :** A symptotic observers for state measurement, combined observer-controller compensators, reduced order onserver, transfer function reformulation of the observer-controller design some variants of the observer-controller design.

### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

### Books for study :

- 1) Linear Systems by Thomas Kailath, 4<sup>th</sup> Edition, Prentice-Hall of India, 2002.
- 2) Modern Control Engineering by R.C. Dorf & R.H. Bishop, 3<sup>rd</sup> Edition, Addison Wesley Longman, 2003.
- 3) Feedback and Control Systems Schaum's Outline Series, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2002.
- 4) Modern Control Engineering by K. Ogata, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.
- 5) Control Systems Engineering by I.J. Nagrath & M. Gopal, 2<sup>nd</sup> Edition, New Age International, 2003.
- 6) Control System Design – An Optimal Approach by B. Sarkar, 2<sup>nd</sup> Edition, Wheeler Publishing, 2002.

## ECE 4105D / CSE 4105E BIOMEDICAL INSTRUMENTATION ( Common Paper for Computer Science & Engineering )

## Unit-I

### Introduction to Biomedical Instrumentation :

Introduction, Biometrics, physiological systems of the body, Biomedical Transducer, Sources of bio-electric signals, propagation of action potential, Electrodes : theory, physical sensors, chemical transducers.

### Cardio-Vascular System and Electrocardiography :

The heart and cardiovascular system, Blood pressure, The heart sound, The Electrocardiography.

## Unit-II

### Biomedical Recorders :

Electrocardiograph (ECG), Phonocardiograph, Electroencephalograph (EEG), Electromyograph(EMG).

### Implantable Bio-Electric Devices :

Introduction, function of implantable electronic device, Implantable electrodes and leads, Cardiac pacemaker – types, working principle and performances, Implantable electrodes and leads.

### Unit-III

#### Patient care and Monitoring :

System concept and requirement, Measurement of blood : pressure, heart beat rate, temperature and respiration, The organisation of the hospital for patient care monitoring., Defibrillators.

#### Related Topics :

Hearing Aids – Hearing fundamentals, disorders.

### Unit-IV

#### Biotelemetry :

Introduction, Classification and principles of biotelemetry, Ultrasound and light telemetry, Telephonic telemetry, Implantable units, Application of telemetry in patient care.

#### Medical Imaging :

Instrumentation of diagnostic X-rays, X-ray computed tomography, Basic NMR components, Ultrasonic imaging systems – Medical ultrasound, A-SCAN, Echocardiograph (M-mode), B-SCANNER, Biological effect of ultrasound.

### Unit-V

#### Computers in Biomedical Instrumentation :

Database management : Introduction, in-house and commercially available systems, desirable features, specific medical application, Computerized critical care areas : Planning and designing a computerised critical care unit, selection of monitoring equipment, The computer in clinical laboratories, Computer in medical research : Introduction, interacting with experimental preparations, Artificial intelligence : Introduction, medical applications of artificial intelligence, developing a medical expert system.

#### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

#### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

#### Books for study :

- 1) Biomedical Instrumentation and Measurements by L. Cromwell *et al*, 4<sup>th</sup> Edition, Prentice-Hall of India, 2002.
- 2) Handbook of Biomedical Instrumentation by R.S. Khandpur, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2003.
- 3) Handbook of Biomedical Engineering by Jacob Kline, 2<sup>nd</sup> Edition, Academic Press, 2002.
- 4) Medical Instrumentation : Application and Design by J.G. Webstein, 4<sup>th</sup> Edition, John Wiley, 2002.

### ECE 4106 PROJECT – I

A mini-project implemented in an 8085 (Chosen by the institution )

The mini-project may be carried out individually or by a batch of not more than two students.

The students will pick a topic in consultation with a local faculty.

The mini-project must be carried out in the College only

The faculty is expected to guide the students

The mini-project tasks would involve:

Understanding the mini-world description and the application specification of the mini-project.

Bringing out the conceptual design( Entity-relationship representation) of the mini-project.

Converting the conceptual design to the relational design.

Documentation and Submission of Report

Each student in a team should equally participate in the tasks mentioned above.

**Distribution of Marks:**

Dissertation	: 125 marks (Based on presentation, project work done, quality of report etc.)
Viva-voce	: 75 marks

**ECE 4107 INDUSTRIAL TRAINING**

An eight week industrial training after the sixth semester in an industry having large electronics application.

**Distribution of Marks:**

Sessional	: 50 marks ( 25 marks from the organization in which the student goes for training and 25 marks from presentation on training given by the student at the college)
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**ECE 4108 LABORATORY - VII**

Following experiments are to be conducted in the laboratory :

- (1) IF Amplifier using Transistors.
- (2) Amplitude Modulator using transistors and demodulation by envelope detection.
- (3) IC based Balanced Modulator and Demodulator.
- (4) Frequency Modulators using 8038 and 566.
- (5) Capture range and lock range measurement of a PLL.
- (6) Frequency Demodulation using PLL.
- (7) IC based Sample and Hold.
- (8) Pulse Width Modulator.
- (9) Delta Modulator using D-Flip Flop.
- (10) IF Amplifier using IC 3028.
- (11) Frequency Synthesizer using PLL.

**Distribution of Marks:**

Practical	: 100 marks	Exam 4 hrs. Duration
Sessional	: 25 marks ( Based on laboratory work done, attendance etc.)	

**Instruction for Paper Setter:**

- All the experiments listed above to be included in the question paper. The candidate shall be asked to draw any three of the experiments from the lot and to carry out the experiments in the laboratory.

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**Branch : Electronics & Communication Engineering**

**EIGHTH SEMESTER**

Subject Code	Subject	Number of hours Per week			Duration of Examination in hours		Marks		
		L	T	P	Theory	Practical	Examination	Sessional*	Total
ECE 4201	Applied & Industrial Electronics	3	1	-	3	-	100	25	125
ECE 4202	CAD of VLSI	3	1	-	3	-	100	25	125
ECE 4203	Microwave Engineering	3	1	-	3	-	100	25	125
ECE 4204	Elective - II	3	1	-	3	-	100	25	125
ECE 4205	Elective - III (Open)	3	1	-	3	-	100	25	125
ECE 4206	Project - II	-	4	-	-	-	200(125+75) **	-	200
ECE 4207	Seminar	-	-	3	-	-	-	50	50
ECE 4208	Laboratory - VIII	-	-	4	-	4	100	25	125
ECE 4209	Environmental Studies	3	1	-	3	-	100	25	125
	<b>Total</b>	<b>18</b>	<b>10</b>	<b>7</b>	<b>Total Marks 1125</b>				

\* Distribution of marks : Best of 2 class tests – 16 marks, Viva-voce – 4 marks, Assignments – 5 marks.

\*\* 125 from dissertation and 75 from Viva.

**DETAILED SYLLABUS**

**Eighth Semester**

**ECE 4201 APPLIED AND INDUSTRIAL ELECTRONICS**

**Unit-I**

Review of Semiconductor Physics and Power Diodes :

LED, Zener diode, Varactor diode, Photo diode, Schottky diode, Bipolar transistor as a switch, MOS switch.

SCR :  
Theory of operations of SCR, SCR waveforms, SCR gate characteristics, Typical gate control circuits, SCR applications.

**Unit-II**

Thyristor :

Thyristor fundamentals, Two-transistor analogy, Series and parallel operation of thyristors, Firing circuits for thyristor.

UJT :  
Theory and operation of UJT, UJT Relaxation oscillator, Programmable UJT, Complementary UJT, Silicon controlled switch.

**Unit-III**

Other Thyristors : DIAC, TRIAC, Light activated silicon-controlled rectifier.

Phase controlled rectifiers and choppers :

Principles of phase control, Full wave (single phase) controlled converters, Three Phase diode & thyristor converter circuits, Principles of chopper operation, Step up chopper.

**Unit-IV**

DC Regulated Power Supplies :

Basic series regulator, Switching Regulator : Step up, Step down, Inverter.

Relays and Timers :

The Relay (Basic Construction), AC Relay, Reed Relay, Solid State Relay, 555 Timer.

**Unit-V**

Industrial circuits :

Temperature Control Circuit, Proximity detector, AC Voltage regulators, Fan Regulators/Lamp dimmers, Uninterruptible power supply (UPS).

Automation & Robotics :

Programmable Controllers, A typical system, Programming terminals, Input/output track, Robots, Machine visions.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Industrial Solid State Electronics : Devices and Systems by Timothy J. Maloney, 3<sup>rd</sup> Edition, Prentice Hall of India, 2003.

- 2) Power Electronics : Converters, Applications and Design by N. Mohan, T.E. Undeland & W.P. Robbins, 4<sup>th</sup> Edition, John Wiley & Sons, 2002.
- 3) Power Electronics by J.G. Kassakian, M.F. Schlecht & C. Verghese, 3<sup>rd</sup> Edition, Addison-Wesley Longman, 2003.
- 4) Thyristor and Application by Ram Moorthy, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2002.
- 5) Industrial Electronics by C.D. Simpson, 4<sup>th</sup> Edition, Prentice-Hall of India, 2003.

## **ECE 4202 CAD OF VLSI**

### **Unit-I**

Review of CMOS Processing Technology : Basic CMOS Technology : Basic CMOS technology, n-well, p-well, twin tub, SOI, CMOS Process Enhancement, Interconnect : Metal interconnect, Polysilicon interconnect, Local interconnect, Circuit elements : resistors, capacitors, Layout Design Rules : Layer representations : CMOS n-well Rules, Latchup.

Circuit Characterization and Performance :

Resistance estimation : resistance of nonrectangular region, contact via resistance, Capacitance estimation : MOS – Capacitor Characteristics, MOS Device capacitances, Diffusion capacitances, Routing capacitances, Distributed RC effects, Capacitances design guide. Wire length design guide.

### **Unit-II**

Switching Characteristics :

Analytical delay models : fall time, rise time, delay time, Empirical delay models, Gate delays.

CMOS gate transistor sizing : Cascaded complementary inverters, Cascaded pseudo nMOS inverters, Stage ratio.

Power dissipation :

Static dissipation, Dynamic dissipation, Total power dissipation, Power economy. Charge sharing, Reliability, Scaling.

CMOS Circuit & Logic design :

Basic physical design of simple logic gates, CMOS logic structures, Clocking strategies, I/O structures, Low power design.

### **Unit-III**

CMOS design methods :

Design strategies : structured design strategies, hierarchy, regularity, modularity, locality.

CMOS chip design options : Programmable logic, programmable logic structures, programmable interconnect, field programmable gate arrays, Sea-of-gate and gate array design, standard cell design, full custom design, symbolic layout.

Design Methods : Behavioural Synthesis, RTL Synthesis, Logic optimization, structural to layout synthesis (placement, routing).

Design Capture tools : HDL Design, Schematic design, layout design, floor planning, chip composition.

### **Unit-IV**

Design verification tools : Simulation : circuit level simulation, timing simulation, logic level simulation, switch level simulation, mixed mode simulators, Timing verification, "Ngvwork" isomorphism, Netlist comparison, Layout extraction, Back-annotation, Design rule verification, Pattern generation, Design economy.

CMOS testing : The need for testing : Functionality test, manufacturing test, Manufacturing test principles, Fault models, observability, controllability, fault coverage, automatic test pattern (ATPG), fault grading and fault simulation, delay fault testing, statistical fault analysis, fault sampling, Design strategies for test, Chip level test techniques, System level test techniques, Layout design for improved testability.

### **Unit-V**

CMOS subsystem design :

Datapath operations : Addition/subtraction, Parity generator, Compactor, Zero/one detectors, Binary counters, Multipliers, Shifters, Memory elements, Control.

VHDL Simulation : Basic concepts in VHDL, Structural concepts in VHDL, Description of inverter, NAND Gate and 4 bit compactor, VHDL grammar.

CMOS System Case Studies : A core RISC Micro controller, A Flash A/D Converter.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Principles of CMOS VLSI Design : A Systems Perspective by N.H.E. Weste & E. Eshraghian, Addison Wesley Longman, 2002.
- 2) An Introduction to VLSI Physical Design by M. Sarrafzadeh & C.K. Wong, McGraw-Hill International Edition, 2003.

**ECE 4203 MICROWAVE ENGINEERING**

**Unit-I**

Transmission Line and Wave Guides :

Transmission line equations and solutions, Reflection coefficient and transmission coefficient, Standing wave and SWR, Input impedance of a transmission line terminated to a load, Wave guides : rectangular and circular, Solution of wave equations : TE and TM modes, Cut-off frequency, Guide wave length, excitation of different mode, Power flow through wave guides, Introductory ideas of planner transmission lines.

**Unit-II**

Circuit Theory for Wave Guide System :

Equivalent voltages and current, Scattering matrix formulation for microwave junction.

Passive microwave devices :

Matched termination, Variable short, Attenuator, Phase shifter, Directional coupler, E&H plane Tee, Faraday rotation isolator and circulator, Cavity resonator, Microwave filter.

**Unit-III**

Impedance transformation and matching :

Smith chart, Quarter wave, transformer, Stub matching, Theory of small reflection, Approximation theory for multi section quarter wave transformer.

**Unit-IV**

Microwave tubes :

Velocity modulation principles, Two cavity klystron, Reflex klystron, Magnetron, TWT.

Microwave semiconductor devices :

Gunn oscillator, IMPATT diode, PIN diode, Tunnel diode, Microwave BJT and FET.

**Unit-V**

Microwave measurements :

Measurement of guide wavelength, VSWR, Microwave power, Determination of unknown load impedance.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Foundations of Microwave Engineering by R.E. Collin, McGraw-Hill International Edition, 2003.
- 2) Microwave Engineering by David M. Pozar, 4<sup>th</sup> Edition, John Wiley & Sons, 2002.
- 3) Microwaves by K.C. Gupta, 4<sup>th</sup> Edition, John Wiley & Sons, 2003.
- 4) Microwave Devices and Circuits by S.M. Liao, 5<sup>th</sup> Edition, Prentice-Hall of India, 2002.
- 5) Microwave Circuit Design Using Linear and Nonlinear Techniques by G.D. Vendelin, A.M. Pavio & U.L. Rohde, 3<sup>rd</sup> Edition, John Wiley & Sons, 2002.

***ELECTIVE - II*****ECE 4204A / CSE 4204A ARTIFICIAL INTELLIGENCE  
( Common Paper for Computer Science & Engineering )****Unit-I****Scope of Artificial Intelligence :**

Games, theorem proving, Natural language processing, Vision & speech processing, Robotics, Expert systems, Artificial Intelligence techniques – Search, Knowledge, Abstraction.

Problem Solving

State space search

Control Strategies

Depth-first search, Breadth-first search, Production System.

Problem characteristics

Decomposable, ignorable, recoverable, predictable.

**Unit-II**

Use of Heuristics

Hill climbing, Best first search, A\*algorithm : Admissibility, AND/OR graph – AO\*, Constraint satisfaction,

Crypto arithmetic, Waltz Line Labelling,

Game Playing

Minimax search, Alpha-Beta pruning.

Knowledge representation

Predicate Logic, Well formed formulae, quantifiers, Prenex Normal Form, Skolemization

Unification, modes pones, Resolution refutation-various strategies, Rule Based Systems, Forward reasoning

: Conflict resolution, Backward reasoning : Use of No backtrack, Structured Knowledge Representations,

Semantic Net : slots, inheritance, frames – exceptions and defaults – attached predicates, Conceptual

Dependency formalism, Object Oriented Representations.

**Unit-III**

Artificial Intelligence Programming Languages

PROLOG : Syntax, Procedural and Declarative meaning, Prolog unification mechanism, Anonymous variable, Lists, Use of fail, Cut, not.

LISP : Basic Concepts, Eval Function, Functions and Variables, Scoping of LISP variables, Iteration and recursion.

**Unit-IV**

Handling uncertainty

Probabilistic reasoning, Bays Net, Dumpster Shafer Theory, Use of certainty factors, Fuzzy Logic, Non-monotonic reasoning : Dependency directed backtracking, Truth maintenance systems.

Learning :

Concept of learning, learning automation, The Genetic Algorithm, Learning by induction, Neural Networks : Hop field Networks, Perceptions – Learning algorithm, Back propagation Network, Boltzman Machine. Recurrent Network

Planning :

Components of Planning System, Plan Generation Algorithm, Forward State Propagation, Backward State Propagation, Nonlinear Planning using constraint posting

#### Unit-V

Expert Systems

Need and justification for expert systems – cognitive problem

Expert System Architectures : Rule Based System, Non Production System

Knowledge acquisition, Case studies : MYCIN, R1

Natural Language Processing

Syntactic Analysis, Top down and bottom up parsing, Augmented Transition Networks, Semantic Analysis, Case grammar.

#### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

#### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

#### Books for study :

- 1) Artificial Intelligence by E. Rich & K. Knight, 5<sup>th</sup> Edition, Tata McGraw-Hill, 2002.
- 2) Introduction to Artificial Intelligence and Expert Systems by Dan W. Patterson, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2002.
- 3) Introduction to Expert Systems by P. Jacson, 4<sup>th</sup> Edition, Addison Wesley Longman, 2003.
- 4) Principles of Artificial Intelligence : A New Synthesis by Nils J. Nilsson, 2<sup>nd</sup> Edition, Morgan Kaufmann, 2002.
- 5) Programming on PROLOG by Clocksm & Mellish, 2<sup>nd</sup> Edition, Narosa Publishing House, 2002.

### **ECE 4204B / CSE 4204B PATTERN RECOGNITION** ( Common Paper for Computer Science & Engineering )

#### Unit-I

**Introduction** : Machine perceptions, pattern representation, segmentation, feature extraction, learning and adaptations, scene analysis, shape determinations. Baye's decision theory – Minimum error rate classification, discriminant functions and decision surfaces for two category and multi-category cases, univariate and multivariate normal density, Baye's theory for discrete features, error probability and error bounds, Hidden Markov model. Parameter estimation.

#### Unit-II

Non-parametric techniques – Parzen indows, -nearest neighbour rule. Linear discriminant function and decision surface-minimising the perceptron criterion functions, relaxation procedure, minimum squared error procedure, Ho-Kashyap procedure, linear programming techniques, multi category cases.

#### Unit-III

**Unsupervised learning and clustering** : Various clustering strategies based on minimisation of objective functions, tree based techniques, cluster validation issues. Neural network based learning - Back propagation algorithm, relating back propagation with Baye's theory, practical techniques for improving performance, training methods.

#### Unit-IV

**Non-metric methods in pattern classification** : decision trees, classification and regressions trees. Structural pattern recognition – recognition with strings, concepts of formal language theory and automata theory, high-dimensional grammars, grammatical inference. Fuzzy sets theoretic pattern classification strategies , Applications of Pattern Recognition.

#### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 4	: 25 marks each	
Sessional	: 25 marks	

#### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 4 and one question from each Unit is to be answered.

#### Books for study :

- 1) Pattern Recognition (Pattern Classification and Scene Analysis) by Richard O. Duda & Peter E. Hart, 2<sup>nd</sup> Edition, Addison Wesley Longman, 2002.
- 2) Pattern Recognition by Tou & Gonzalez, 2<sup>nd</sup> Edition, Addison Wesley Longman, 2003.
- 3) Pattern Recognition : Statistical, Structural and Neural Approaches by Robber J. Schalkoff, 3<sup>rd</sup> Edition, John Wiley & Sons Inc., New York, 2002.
- 4) Pattern Recognition and Image Analysis by Earl Gose, Johnsonbaugh & Jost, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.

### ECE 4204C MODERN COMMUNICATION THEORY AND SYSTEMS

#### Unit-I

Spread spectrum concepts, techniques, systems, performance and applications.

Introduction to mobile communication. Cellular mobile telephone architecture overview. Cellular radio system design – frequency assignments, frequency reuse channels. Concept of cell splitting. Handover in cellular systems. Handoff algorithms.

#### Unit-II

Multiple access schemes in mobile communications – TDMA, FDMA, CDMA. Random Multiple Access Schemes. Performance analysis issues. MAC layer scheduling and connection admission in mobile communication. Interference suppression and Power Control.

#### Unit-III

Teletraffic modelling and Queuing theoretical analysis of cellular mobile networks. Resource allocation and mobility management.

Practical Cellular mobile systems – AMPS and GSM system, architecture overview, Call management system operation.

#### Unit-IV

CDMA based cellular system.

Wireless in Local Loop – DECT and CDMA WLL.

Health hazard aspects of the use of cellular mobile communication.

#### Unit-V

Introduction to switching and signalling systems. Single and multi-stage space switching. Analysis and design. Time/Digital switching systems. TS, ST, STS, TST systems. Practical systems. Circuit switching hierarchy. Signalling systems – SS7. Telephone instruments. Pulse and tone dialling. BORSCHT functions. Modems. Digital subscribers loops. ISDN, BISDN. Telephone traffic theory.

#### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Mobile Cellular Telecommunications Systems by W.C.Y. Lee, McGraw-Hill International Edition, 2002.
- 2) Mobile Communications Design Fundamentals by W.C.Y. Lee, Prentice-Hall of India, 2002.
- 3) Mobile Radio Communications by Raymond Steele, IEEE Press, New York, 2002.
- 4) Principles of Spread Spectrum Communications by A.J. Viterbi, Addison Wesley Longman, 2002.
- 5) Wireless and Personal Communication Systems by V.K. Garg & J.E. Wilkes, Prentice Hall, 2003.

**ECE 4204D OPTICAL COMMUNICATION****Unit-I**

Transmission characteristics of optical fibres, Advantages and disadvantages of fibre technology. Fibre optic communication systems. Optical transmitters, Principle of design, Noise in optical transmission system, source and transmitter selection, source-wavelength characteristics, temperature effects, degradation over time.

**Unit-II**

Receiver and detector specifications, Preamplifier design, Effects of signal distortion, Temperature effects, Effects of aging, detector coupling loss. Receiver SNR and required optical power, Selection of optical fibres, Connectors, Couplers and splice for specific applications, Standards of data, voice and video transmission for fibre optic technology.

**Unit-III**

Modulation, Carrier modulated analog and digital transmission, Pulse code modulation, Encoding, Optical pulse formats for fibre optic digital communication.

**Unit-IV**

Multiplexing, Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Wavelength Division Multiplexing (WDM), Applications of FDM, TDM and WDM.

**Unit-V**

Reliability of the fibre optic network : methods and tests. Determination of the cost of installing fibre optic networks, the comparative study of various types of network systems.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Optical Communication Systems by J. Gowar, 2<sup>nd</sup> Edition, Prentice-Hall of India, 2002.
- 2) Optical Fibre Communications : Principles and Practice by Senior, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2003.
- 3) Optical Communication Systems by G.P. Agrawal, 2<sup>nd</sup> Edition, John Wiley, 2002.
- 4) Optical Fibre Communications by G. Keiser, 3<sup>rd</sup> Edition, Tata McGraw-Hill, 2003.

## ***ELECTIVE (OPEN)***

### **ECE 4205A SIMULATION OF CIRCUITS AND DEVICES**

#### **Unit-I**

Formulation of network equations : Nodal, mesh, modified nodal and hybrid analysis equations.  
Sparse matrix techniques ,

#### **Unit-II**

Solution of nonlinear networks through Newton-Raphson technique Multi-step methods : Convergence and stability, Special classes of multi-step methods : Adams-bashforth, Adams-Moulton and Gear's methods, Solution of stiff systems of equations, Adaptation of multi-step methods to the solution of electrical networks, General purpose circuit simulators.

#### **Unit-III**

Review of semiconductor equations : Poisson, continuity, drift-diffusion, trap rate. Finite difference formulation of these equations in 1D and 2D. Grid generation.

#### **Unit-IV**

Physical/empirical models of semiconductor parameters : mobility, lifetime, band gap, etc.

#### **Unit-V**

Computation of characteristics of simple devices : ( p-n junction, MOS capacitor, MOSFET, etc.), Small-signal analysis.

#### **Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

#### **Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

#### **Books for study :**

- 1) Computer Aided Analysis and Electronic Circuits by L.O. Chua & P.M. Lin, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2003.
- 2) Analysis and Simulation of Semiconductor Devices by S. Selberherr, 2<sup>nd</sup> Edition, Tata McGraw-Hill, 2002.
- 3) Fundamentals of Computer Aided Circuit Simulation by N.J. McCalla, 3<sup>rd</sup> Edition, Kluwer Academic Publishers, 2003.

### **ECE 4205B ADVANCED INSTRUMENTATION**

#### **Unit-I**

Introduction : Generalized performance of an instrumentation system, Instrument standards and calibration for temperature pressure, flow, weight, time, speed and frequency, Functional description of instrumentation system, review and selection of various control actions. Transducers and telemetering systems.

Definitions, classification and selection of transducers, resistive (Strain gauge), capacitive, inductive (LVDT), Piezoelectric transducers, Measurement of displacement, force, velocity, acceleration and temperature (thermistors), Magneto strictive, Photoelectric transducers, Feedback transducers including inverse transducers, temperature balance system, servo operated electromagnetic flow meter, Definition of telemetry, Classifications, Current, Voltage and position telemetering systems, Multiplexing in telemetry, Industrial significance.

## **Unit-II**

### Analytical Industrial Instrumentation

Pressure measurements, Flow measurements (EM flow meter etc.), Temperature measurements, Liquid Level measurements – the study of the process of measurements or instrumentation for the above quantities by using mechanical or electrical transducers, Measurements of vibration, pH-value, viscosity, humidity, moisture, speed, force and torque.

## **Unit-III**

### Industrial Measurements with radio isotopes

Nuclear radiation transducers, Geiger Muller counter, Scintillation Counters, Spectrometer, Radioactive Vacuum, Thickness and Level gauges.

## **Unit-IV**

### Non Destructive Testing Equipment

Magnetic particle, Dye penetrants, X-Rays, Gamma Rays, Neutron Radiography, Ultrasonic, Ultrasonis Holography, Eddy current testing, Signature analysis as an NDT tool, Pulse Echo Method of Flow Detection.

### Environmental and Pollution Measurements

Air Pollutant measurements, Industrial air measurement and control, Noise measurement, Liquid pollution measurement and control.

## **Unit-V**

### Gas Chromatography

Operational aspects of instrumentation systems, Control center requisite, Basic idea of industrial instrumentation (block diagram representation) in industries like Food, Pulp and Paper, Ceramics, Tea, Petroleum products, Iron and Steel, Nuclear Reactor, Electrical, Automotive appliances, Basic characteristics of Automatic control, The Computer control systems.

### **Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

### **Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

### **Books for study :**

- 1) Principles of Industrial Instrumentation by D. Patranabis, 3<sup>rd</sup> Edition, Wheeler Publications, 2002.
- 2) Modern Electronics Instrumentation and Measurement by A.D. Helfrick & W.D. Cooper, 3<sup>rd</sup> Edition, Prentice-Hall of India, 2002.
- 3) Transducers and Instrumentation by D.V.S. Murthy, 4<sup>th</sup> Edition, Prentice-Hall of India, 2003.
- 4) Industrial Electronics by G.D. Simpson, 4<sup>th</sup> Edition, Prentice-Hall of India, 2003.

## **ECE 4205C HIGHER POWER SEMICONDUCTOR DEVICES**

### **Unit-I**

#### Basic Device Models

Theory of bipolar and MOS transistors. Small-signal models of bipolar and MOS transistors, Gummel-Poon Model.

### **Unit-II**

#### High Current Effects in Diodes

Dependence of lifetime on high-level injection, non-uniform current distribution under high current injection.

### Unit-III

Power Bipolar Transistors

Onset of high-current effects in transistors, Theories of Kirk effect, crowding, Pinch-in effects, Second Break-down etc., Emitter geometries for high current and HF operation.

### Unit-IV

SCR

Theories of operation, Relation between shorted emitter and  $dv/dt$  ratings, Gate turn-off devices, inverter grade SCRs, special diffusion techniques for SCRs. Power VMOS devices. Heat transfer in power devices.

### Unit-V

Power MOS Devices

VMOS and DMOS device structure and models, device packaging.

### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

### Books for study :

- 1) Physics of Semiconductor Devices by S.M. Sze, 3<sup>rd</sup> Edition, John Wiley & Sons, 2002.
- 2) Solid State Electronic Devices by B.G. Streetman, 4<sup>th</sup> Edition, Prentice-Hall of India, 2002.
- 3) Semiconductor Devices by D. Nagchoudhuri, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2003.
- 4) Semiconductor Materials and Devices by T.S. Tyagi, 3<sup>rd</sup> Edition, John Wiley & Sons, 2002.

## **ECE 4205D / CSE 4205F OPERATIONS RESEARCH** ( Common Paper for Computer Science & Engineering )

### Unit-I

#### **Introduction to Operations Research (O.R.)**

The historical development of O.R., Principles of Modelling. Features and phases of O.R.

### Unit-II

#### **Linear Programming :**

Introduction, Formulation of Linear Programming Problems (L.P.P.), Graphical solution procedure. Idea of Convex set, Convex combination of two points, Boundary point, Extreme point. Fundamental Theorem of L.P.P. (proof not required). Feasible, Basic, Basic Feasible solutions of L.P.P. Simplex Method. Big-M methods.

### Unit-III

#### **Transportation Problems (T.P.)**

Introduction. Mathematical formulation. Tabular representation. Definitions of Balanced, Unbalanced T.P. Rules to find initial Basic Feasible Solution (B.F.S) of T.P. – North West Corner Rule, Lowest Cost Entry (Matrix-minima) method, Vogel's Approximation Method. Solution algorithm of T.P. Solution technique for unbalanced T.P. Degeneracy in T.P. Resolution of degeneracy. Examples.

#### **Assignment Problems (A.P.)**

Introduction. Mathematical formulation. Reduction theorem (proof not required). Definitions of Balanced and Unbalanced A.P. Hungarian Algorithm for solving A.P. Solution technique for unbalanced (A.P.) Examples.

#### Unit-IV

##### Sequencing Problems :

Introduction. Definition. Solution of Sequencing problems, Processing  $n$  jobs through two machines, two jobs through  $m$  machines (Graphical method), Processing  $n$  jobs through  $m$  machines.

##### Integer Programming Problems (I.P.P.) :

Introduction. Pure and mixed integer programming problems. Gomory's Cutting Plane technique for solving I.P.P. Examples.

#### Unit-V

##### Dynamic Programming Problems (D.P.P.)

Introduction. Multistage process. Definition and scope of D.P., Advantage of D.P. Characteristics of D.P.P. Bellman's Principle of Optimality, Use of D.P. to solve some standard optimizing problems (Single additive constraint with multiplicatively separable return, Single additive constraint with additively separable return, Single multiplicative constraint with additively separable return).

##### Queuing Theory :

Introduction. Characteristics of queuing systems. Pure birth and death process. Queuing models. Kendall's notation (M/M/1,a, FCFS) models.

##### Distribution of Marks:

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

##### Instruction for Paper Setter:

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

##### Books for study :

- 1) Operations Research by Kanti Swarup Manmohan & Gupta, 4<sup>th</sup> Edition, S. Chand & Co. Ltd., 2002.
- 2) Operations Research by Panneerselvam, 4<sup>th</sup> Edition, Prentice-Hall of India, 2002.
- 3) Operations Research by S. D. Sharma, 14<sup>th</sup> Edition, Kedarnath Ram Nath & Co., 2002.
- 4) Operations Research by J. K. Sharma, 6<sup>th</sup> Edition, MacMillan India Ltd., 2003.
- 5) Operations Research by P.K. Gupta & D.S. Hira, 4<sup>th</sup> Edition, S. Chand & Co. Ltd., 2003.
- 6) Introduction to Operations Research by Frederick Hillier & Gerald Lieberman, 4<sup>th</sup> Edition, Tata McGraw-Hill, 2002.

## ECE 4206 PROJECT – II

##### Objective:

The purpose behind the inclusion of this is to consolidate the concepts and practices that were imparted during the course and to serve as record of competence. It should enable the student to apply concepts gained from the field of applied electronics.

##### Guidelines :

This project will be carried out over a duration of six weeks, involving about 100 hours. Every student should do a project individually and not in a group, under the guidance of at least one of the faculty members and / or expert / professional from an organization outside of the College. The Project Report should be submitted covering the application aspect of electronics. 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.

##### 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 and students may be present. It will be of a duration of about 15 to 20 minutes. The design aspects relevant to the project mentioned under assessment

would be the main subject matter for the viva. However the general proficiency of the candidate should also be tested.

**Distribution of Marks :**

Dissertation : 125 marks (Based on presentation, project work done, quality of report etc.)  
Viva-voce : 75 marks

**ECE 4207 SEMINAR**

Presentation of talk and discussion on practical training/topics of current interest in electronics field.

**Distribution of Marks:**

Practical : 25 marks Exam 3 hrs. Duration  
Sessional : 25 marks (from presentation on seminar by the student at the college)

**ECE 4208 LABORATORY - VIII**

Following experiments are to be conducted in the laboratory :

- (1) Measurement of crystal characteristics and proof of the square law characteristics of the diode.
- (2) Measurement of Klystron characteristics.
- (3) Measurement of USWR and standing wave ratio.
- (4) Measurement of Dielectric constant of solids and liquids.
- (5) Measurement of Directivity and coupling coefficient of a directional coupler.
- (6) Measurement of "Q" of a cavity.
- (7) Calibration of the attenuation constant of an attenuator.
- (8) Determination of a radiation characteristics and gain of an antenna.
- (9) Determination of the phase shift of a phase shifter.
- (10) Measurement of the polar pattern and gain characteristics of the Pyramidal horn, Slotted wave guide horn and parabolic antennas.
- (11) Determination of the standing wave pattern on a transmission line and finding the length and position of the short circuited stub.

**Distribution of Marks:**

Practical : 100 marks Exam 4 hrs. Duration  
Sessional : 25 marks ( Based on laboratory work done, attendance etc.)

**Instruction for Paper Setter:**

All the experiments listed above to be included in the question paper. The candidate shall be asked to draw any three of the experiments from the lot and to carry out the experiments in the laboratory.

**ECE 4209 ENVIRONMENTAL STUDIES**

**Unit-I**

**The Multidisciplinary nature of environmental studies:**

Definition, scope and importance. Need for public awareness.

**Natural Resources: Renewable and non-renewable resources**

Natural resources and associated problems.

Forest resources : Use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams-benefits and problems.

Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

Food resources : World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

Energy resources : Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case studies.

Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable lifestyles.

## **Unit-II**

### **Ecosystems :**

Concept of an ecosystem, Structure and function of an ecosystem,

Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession.

Food chains, food webs and ecological pyramids.

Introduction, types, characteristic features, structure and function of the following ecosystems :-

Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

## **Unit-III**

### **Biodiversity and its conservation**

Introduction : Definition : genetic, species and ecosystem diversity, Biogeographical classification of India.

Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values.

Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot-spots of biodiversity .

Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity : In-situ and Ex-situ conservation of biodiversity.

## **Unit-IV**

### **Environmental Pollution :**

Definition, Causes, effects and control measures of air pollution, water pollution, soil pollution, marine pollution noise pollution, thermal pollution, nuclear pollution.

Solid waste management : causes, effects and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution, Pollution case studies.

Disaster management : floods, earthquake, cyclone and landslides.

## **Unit-V**

### **Social Issues and the Environment :**

From Unsustainable to Sustainable development, Urban problems related to energy.

Water conservation, rain water harvesting, watershed management.

Resettlement and rehabilitation of people – its problems and concerns, case studies.

Environmental ethics – Issues and possible solutions.

Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies.

Wasteland reclamation, Consumerism and waste products, Environment Protection Act, Air ( Prevention and Control of Pollution) Act, Water ( Prevention and Control of Pollution) Act, Forest Conservation Act.

Issues involved in enforcement of environmental legislation, Public awareness.

### **Human Population and the Environment**

Population growth, variation among nations, Population explosion – Family Welfare Programme.

Environment and human health, Human Rights, Value Education, HIV/AIDS.

Women and Child welfare, Role of Information Technology in Environment and human health.

Case studies.

5:2:12 (28)

**Field Work :** Visit to a local area to document environmental assets – river/forest/grassland/hill/mountain, visit to a local polluted site – urban/rural/agricultural/industrial, study of common plants, insects and birds, study of simple ecosystems-pond, river, hill slopes etc.

**Distribution of Marks:**

Theory	: 100 marks	Exam 3 hrs. Duration
Unit 1 to 5	: 20 marks each	
Sessional	: 25 marks	

**Instruction for Paper Setter:**

There shall be two questions each from Unit 1 to 5 and one question from each Unit is to be answered.

**Books for study :**

- 1) Environmental Biology by K.C. Agarwal, 2<sup>nd</sup> Edition, Nidhi Publications Ltd., Bikaner, 2002.
- 2) Matter Hazardous by A.K. Mhaskar, 4<sup>th</sup> Edition, Techno-Science Publications, 2002.
- 3) Marine Pollution by R.S. Clark, 3<sup>rd</sup> Edition, Clarendon Press, Oxford, 2003.
- 4) Environmental Science by T.G. Miller, 5<sup>th</sup> Edition, Wadsworth Publishing Co., 2003.
- 5) Fundamentals of Ecology by E.P. Odum, 3<sup>rd</sup> Edition, W.B. Saunders Co., USA, 2002.
- 6) Environmental Chemistry by B.K. Sharma, 2<sup>nd</sup> Edition, Goel Publishing House, Meerut, 2003.
- 7) Essentials of Ecology by C. Townsend, J. Harper and Michael Begon, 3<sup>rd</sup> Edition, Blackwell Science, 2002.
- 8) Introduction to Air Pollution by R.K. Trivedi and P.K. Goel, 2<sup>nd</sup> Edition, Techno-Science Publications, 2002.

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5:2:13(1)

xiii). Revised M.sc Syllabus in Botany.

The School Board of Life Science in its meeting held on 27th October 2003, considered and approved the Revised M.sc Syllabus in Botany with the project works in lieu of the special paper. Accordingly, the same will be visually demonstrated on the day of the meeting.

The matter is placed before the Council for consideration.

5:6:5(1)

(v) Vision Plan for NEHU College of Technology, at Jowai.

Prof. H. Lamin, Department of Anthropology, NEHU vide letter dt.27.11.03 which is placed as Annexure 'A' has submitted the report of the Committee of the Vision Plan for establishing a NEHU College of Technology at Jowai.

The matter is therefore placed before the Council for Consideration.

## VISION PLAN FOR NEHU COLLEGE OF TECHNOLOGY, JOWAI

North-Eastern Hill University is one of the leading Universities in the region. Over thirty years of its existence it has given a good account of itself. However, the University was developed in traditional areas and has no technological centres. Keeping in mind, the responsibility assigned to the University under Article 4 of NEHU Act, it is important that the University ventures into areas of technological education which addresses the resource potentials of the region as well as the employment avenues for the products. In view of the high capital cost involved, for such education, NEHU proposes to start a College of Technology on self financing basis.

This college will not duplicate the existing discipline offered in Shillong and Turis Campuses, but will supplement and re-enforce academic activities in those Campuses. The emphasis here will be on non-traditional, job oriented professional courses.

In this direction, the NEHU College of Technology, Jowai, may emerge as a leading centre for the entire Northeast region for providing courses to the students, which will help them to find employment and to establish career independently. By offering professional courses, in emerging areas, the Departments in this College can be mostly self-supporting. Most of the courses can be five-year integrated (three year degree and two year post-graduate) in line with Pune, Bangalore and some other Universities.

The University intends to make the college self supporting after a few years. Initially, there will be capital requirement under infrastructural development including laboratory facilities and salary of teachers (for five years).

5:6:5(3)

Fifty per cent of the seats in various disciplines would be on line with regular fee structure as in other technical institutions and fifty per cent will be on the basis of payment seats (enhanced fees). Fifty per cent of the funds collected as fees will go into a corpus fund created for future non-plan liabilities of the college. The college will be developed in phased manner. In the first phase, it is proposed to have four departments which are inter-related.

**Phase I:**

1. Department of Biotechnology (B. Tech.)
2. Department of Alternative Medicines (B. Tech. Alternative Medicines).
3. Department of Pharmacy (B. Pharma.).
4. Centre for Disaster Management (Diploma Programmes with Extension Services).
5. Department of Ecology and Environment.

**Phase II:**

1. Department of Forensic Science.
2. Department of Food Technology.
3. Department of Physical Education.
4. Department of Information Technology.

**Phase III:**

1. Centre for Tribal Culture Studies.
2. Centre for Study of Border & Neighbouring Countries
3. Centre for Women Studies.

**JUSTIFICATION****Phase I:**

Biotechnology is an upcoming field and is a priority area with the Government of India with good employment potential. The department of,

5:6:5(4)

biotechnology will help in conservation and management of rich biological resources of the region. The area is rich in folk medicine system which have not been scientifically studied/explored and documented. The Department of Alternative Medicines is aimed to play an important role in this area. Similarly, the rich medicinal plant resources available in the region can be exploited and used for economic development of the region. The Department of Pharmacy can play a vital role towards conservation and use of this resource.

There has been a tremendous change in the landscape and environment of this region over the years on account of various anthropogenic activities such as coal mining, khum cultivation, deforestation, limestone quarrying extraction etc. The ecosystems of this region are highly diversified and also fragile due to high precipitation, undulating topography and loose soils in many hilly areas of the region. The landslides/landslips are also common in some of the states. The erosion losses have been accelerated which has resulted in land degradation and bio-diversity loss. The water sources (streams, rivers, lakes) are becoming gradually polluted and in certain pockets even the air pollution problem is also serious. In our University we have certain departments/centres where valuable ecological studies are being carried out seriously, however, since we do not have a separate Department of Ecology and Environment, many important ecological and environmental issues are not being adequately addressed. Therefore, it would be appropriate if a separate Department of Ecology and Environment is established at NEHU to cover the whole gamut of ecological and environmental researches.

#### **Phase II:**

In the second phase the University plans to have the Department of Forensic Science, a discipline in which there is a dire need of trained manpower in the country in general, and the region in particular.

The region is endowed with diverse culture and traditions of dietary systems and food processing practices. These need to be studied and integrated with modern systems of food processing and preservation technologies. This will be the thrust area of the department of food technology.

5:6:5(5)

In general, the tribal youths are more aimed to sports, games and all kinds of outdoor activities which need to be promoted through scientific training and development. The University also proposes to collaborate with Sports Authority of India in this regard. The Department of Physical Education will cater to this unfulfilled needs of the youths of the region.

The opportunity for young people, specially the scheduled tribes of the region is limited in the field of information technology. In spite of the fact that the country has exhibited great employment potential in this area, there is a need to open these avenues for the youths in the region. Opening of a Department of Information Technology with B. Tech. Programme will enable the young generation in realizing their potentials not only in the region but in the whole country.

### **Phase III:**

The University also proposes to study specifically the various tribal cultures of the region and problems of their development as well as problems related to borders of neighbouring countries that in recent times has acquired great importance in relation to northeast vis-à-vis the neighbouring countries. The proposal of establishing these two departments will fulfill their needs as it emerges now.

Since the UGC is having a programme of Women Studies, the University proposes to take benefit of the ongoing programme of the UGC.

The proposed College of Technology will be an independent school under the existing structure of the University.

The University has also kept in mind that the following are strictly observed while proposing this Vision Plan:

- i) The project needs and employment opportunity.
- ii) The available resources.
- iii) The need to avoid duplication of the existing departments in the University.
- iv) The need to develop as far as possible disciplines which would accelerate the rate of development in Northeast region including Meghalaya.

5:65(6)

Therefore, with the establishment of NEHU College of Technology, the University will fulfill the needs of the technical and professional education among the tribal people of northeast in general, and Meghalaya in particular. The area included will help in realizing the potentialities of the region and accelerate the development. The region is rich in biological resources, some of the intended technical and professional courses will fulfill in developing the expertise in those areas like Biotechnology and alternative system of medicines.

This college will also fulfill the aspiration of the people to a great extent and also provide academic future to the various tribes and communities in the Northeastern region.

5:6:6(1)

V) Discussion on the possibilities of collaboration with various outside institutions like ZILS,NIIT etc in teaching computer course to generate financial resources for NEHU.

Prof S N Rai, vide letter No:3952 dated 4.12.03 has forwarded the report of a Committee to discuss the possibilities of collaboration with various outside institution like ZILS,NIIT etc which is placed as Annexure-'A'

The matter is therefore placed before the Council for consideration.

REPORT

A Committee has been constituted by the Vice-Chancellor, NEHU, Shillong vide notification No.F.51-1/Acad/Distance/03 to discuss the possibilities of collaboration with various outside institutions like ZILS, NIIT etc in teaching computer courses to generate financial resources for NEHU

The Committee consisted ~~of~~ of the following members:

1. Dr S N Rai, Chairman
2. Professor R N Sharan, Member
3. Professor D K Nayak, Member
4. Mr JMS Khongwir, Member.

Two proposals were submitted to NEHU, one by the ZILS (Zee Interactive Learning Systems Ltd) and the other by NIIT to start a collaborative BCA programme. The Committee met several times and deliberated on these proposals. The Committee decided that ZILS and NIIT should sponsor the visit of a member of the Committee to one such Institution where ZILS and NIIT are running a collaborative BCA course for an on the spot assessment. The ZILS has already sponsored the visit of a member of the Committee and an on the spot assessment has been made. Though NIIT agreed initially to sponsor the visit of a member of the Committee to make an on the spot assessment of their study centres, they did not finalise the travel arrangements of the member on dates decided upon twice. Hence no on the spot assessment could be made.

On 3rd December, 03 the Committee met to finalize its recommendations on the proposals submitted by the ZILS and the NIIT to be placed before the Academic Council for consideration. The recommendations of the Committee is given in Annexure-I.

S N Rai  
(S N Rai)

Sd/-  
( D K Nayak)

Sd/-  
(JMS Khongwir)

ANNEXURE-I

1. The North-Eastern Hill University may start a BCA course in collaboration with the ZILS.
2. The ZILS must sign a MOU with the NEHU as proposed in Annexure II.
3. A Committee may be constituted by the University to monitor this programme. The Committee should consist of personnel from the Centre of Distance Education, Examination Department, Finance Department and Computer Centre with a provision to co-opt other members, if necessary.
4. The Committee shall submit its report to the appropriate authorities at regular intervals apprising the progress of the programme and suggestions for further improvements. The Committee may also recommend to start new collaborative programmes with the ZILS and also with other outside institutions.
5. In order to launch this course in the coming academic session, an early positive decision by the University would be greatly appreciated.

SG

ANNEXURE-II

PROPOSED MOU TO BE SIGNED BY THE ZILS (ZEE INTERACTIVE LEARNING SYSTEMS LTD) AND NEHU (NORTH EASTERN HILL UNIVERSITY, SHILLONG)

1. ZILS' responsibilities:

- \* Marketing the course thro' Zee Network resources as per requirement
- \* Assist NEHU to market the above courses thro' the various Study Centres in the region, by providing adequate training to the staff at these centres.
- \* Assist NEHU to complete the enrollment procedure at the various authorized study Centers and forward the enrollment document along with the payments to NEHU.
- \* Inform and train the faculty members at these study centres regarding conducting these courses. Schedule of classes are informed to NEHU on a regular basis.
- \* Ongoing student and faculty feedback is monitored and shared with NEHU.
- \* Conduct classes-both theory and practical at the authorized study Centres as per university norms.
- \* Conduct internal tests and assignments as per university norms.
- \* Provide administrative and logistics support to the Study Centres, including distribution of prospectus, student enrollment details, NEHU study materials, routine notices of NEHU, admit card, etc.
- \* Assist NEHU during conducting of yearly examination and inform students their results,

NEHU's responsibility:

- \* Create awareness of this course using various media including print and electronic, thro' press releases, interviews, etc.
- \* Provide prospectus and curriculum of the course and printed materials to the enrolled students.
- \* Provide list of reference books that needs to be provided at the libraries of study centres and also for student reference.
- \* Provide guidelines to training methodologies to be followed at the study centres.
- \* Enrollment of students and providing them with enrollment numbers.
- \* Examination procedure, including providing Admit Cards to students, creation of Examination Centres at Locations with more than 30 enrolled students, conducting the yearly examination as per schedule thro' university appointed invigilators, correction of answer scripts, declaration of results and final award of Degrees and Diplomas.
- \* Interacting with Govt. bodies and media regarding the above mentioned courses.

## 2. Eligibility and Admission Criteria

The eligibility criteria for BCA would be +2 graduation, clearing the Outline Test and Interview. For the online test, we would upload the required question bank and the test could be conducted online thro' our test engine, LITMUS, at the enrolling center, with the help of password enabled for the identified candidates.

## 3. Prospectus and CCM

The curriculum and course material could be developed by ZILS and approved by NEHU. The same could be developed and provided by NEHU too. ZILS would create the awareness of the courses thro' their Zee Network channels that would be providing coverage of the target segment. The study centres would be conducting various local level activities, to promote the courses in their surrounding and enroll students on university's behalf.

## 4. Examination Procedure.

Module and practice tests and assignments would be conducted at the Study Centres during the course of training as per University guidelines. Year-end examination would be conducted by the University and students have to provide undertaking that they would make their own arrangement to appear for such exams. The practicals of students could be conducted at the Study Centres as per University norms. Final evaluation and awarding of marksheet, degrees and diplomas would be conducted by the university. Any assistance required administratively for the purpose of conducting the examination would be provided by ZILS. If there warrants an examination center, beyond North Eastern States, due to concentration of students, University could decide to avail external venues for the same.

## 5. Financial Aspects

The Course Fees for BCA programme will be Rs.18,000-Rs.21,000 per annum. The Examination Fees, Registration Fees and Processing Fees would be additional amount over the proposed/suggested Course Fees and may be decided by the University. NEHU's share of fees are paid directly by the students and separately to the study center for undertaking their classes there. The Registration Fee and Examination fee is payable to NEHU 100% as per your norm. The processing fee is retained by ZILS towards administrative expenses. The Course fees is shared between NEHU and ZILS in the ration of 20:80 respectively. Students could pay NEHU's share separately in the form of DDs, which would include Registration fee + Examination fee +20% of Course Fee.

6:6:1(1)

6:6-Service conditions/  
Financial & other Benefits.

- i) Eligibility criteria and terms and conditions for promotion to the post of Reader under C.A.S.

The U.G.C. vide its letter No. F.3-3/2000(PS) dated 21st February, 2002 (Annexure-I) has conveyed the norms and procedures for promotion of Reader to Professor, whereby one of the distinct features of these norms was that Professor once appointed under direct recruitment will not be eligible under C.A.S. Now, the Commission vide letter No. F.2-15/2003 (PS) dated 29th October, 2003 has decided that a Reader once appointed under direct recruitment quota will not be eligible for consideration under C.A.S.

The matter is therefore, placed for consideration and adoption by the Council.

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6:6:1(2)

UNIVERSITY GRANTS COMMISSION  
BAHADUR SHAH ZAFAR MARG  
NEW DELHI-119 002.

Annexure-I

F.2-5/2003 (PS)

29 October, 2003.

The Registrar  
North Eastern Hill University  
P.O. NEHU, Campus, Mawkynroh Umshing  
Shillong.- 793 022.

Sub : Eligibility creteria and terms and conditions for  
promotion to the post of Reader Under CAS Regarding.

Sir/Madam,

This is in continuation of our earlier communication No.F.3-3/2000(PS) dated 21st February, 2002 (copy enclosed) whereby Universityes were conveyed the norms and procedure for promotion of Reader to Professor under CAS. One of the distinct features of these norms was that a Professor once appointed under direct recruitment will not be eligible under CAS. On similar lines, it has now been decided that a Reader once appointed under direct recruitment quota will not be eligible for consideration under CAS.

This shall also be bought to the notice of the Colleges affiliated to your University.

Yours faithfully

Sd/

( A.K. Dogra )  
Joint Secretary.

Encl : as above.

6:6:1(3)

UNIVERSITY GRANTS COMMISSION  
BAHADURSHAH ZAFAR MARG  
NEW DELHI-110002

No.F.33/2000(PS)

February 21, 2002.

Dear,

The Commission at its meeting held on 18.1.2002 considered the modification in the procedure for promotion of Reader to Professor under the Career Advancement Scheme in University Departments.

The Commission RESERVED that the following criteria and terms must be adhered to in selecting a candidate for promotion from Reader to Professor under Career Advancement Scheme in University departments.

- that a minimum of 8 years experience as a Reader be an eligibility.
- that the Professor already appointed under direct recruitment be not eligible.
- that self-appraisal report for the period including five years before the date of eligibility be submitted.
- that minimum of five research publications out of which two could be the books be submitted for evaluation/assessment before the interviews.
- that the assessment of the research publications, including books be done by three eminent experts on the subject which shall be different than those called for interview to be conducted later on.
- that all the recommendations be positive from the three experts in case the recommendation of one out of the three is negative the research publications be sent to the fourth expert for evaluation and assessment. In all there has to be a minimum of three positive recommendations out of the total of four experts, in case the fourth expert has participated in the exercise due to one negative report out of the initially three experts involved in evaluation.
- that there be a separate column in the evaluation report of the expert saying whether the research publications and books are recommended or not recommended.

Contd.....2/-

6:6:2(1)

Subject :- North-Eastern Hill University Statute on General Provident Fund.

The Statute on General Provident Fund was placed to the Executive Council in its meeting held on 21.8.03 and the Council vide resolution No:EC:116:2003:5:III(X) considered the draft Statute and resolved to approved the same. This may kindly be seen Annexure A & B .Subsequently this Office had received a letter from Prof S N Rai vide letter dated 16th October,03 at Annexure-C requesting the Office to place the matter before the Academic Council for consideration on the proposed draft Statute-I and the Central Universities retirement benefit Rule 1967 Annexure-2.Prof S N Rai was informed of the Statute approved by the Executive Council in its meeting held on 21st August,03 vide letter dated 5.11.03 Annexure-E referring to Section 33 of the NEHU Act stating the the University shall constitute for the benefit of its employees such as pension or provident fund. He also referred to Section 24 (f) of the NEHU Act which provide the conditions of service of employees including provision for Pension, Insurance and Provident Fund. He is of the view that the Government of India Rule must be suitably adopted and incorporated in our NEHU Statute Prof M N Karna in his letter dated 3rd November,03 at Annexure-F has stated that the Statute on GPF is not appropriately presented and decided that some more details is to be looked into before it is sent to Ministry for approval. He has also referred that in the meeting it was decided to constitute a Committee to look into amendment Act and Statute and thus requested for correction of minutes.

The matter is placed before the Academic Council for decision.

SG

6.6:2(2)

NORTH-EASTERN HILL UNIVERSITY STATUTE ON  
GENERAL PROVIDENT FUND.

1. Title :- North Eastern Hill University Statute on General Provident Fund.
2. Authority :- Section 33 of the North-Eastern Hill University Act 1973.
3. Jurisdiction : All regular employees of NEHU both teaching and non teaching other than those appointed on contract basis, or holds a lien to a post maintained by the University will be covered by the provisions of this Statute.
4. PROVISIONS OF THE STATUTE:
  - a) The North Eastern Hill University by proviso to section 33 of the north eastern hill university act 1973 for the benefit of its employees shall provide General Provident Fund Scheme.
  - b) The University by virtue of such provision shall recover from the employees such amount (being the minimum subscription towards the GPF as laid down by the Government of India from time to time) which shall be treated as subscription of the individual employee towards the GPF.
  - c) The money so collected by way of subscription towards General Provident Fund shall be deposited in a fund constituted by the University under the name 'North-Eastern Hill University General Provident Fund'. The fund so created shall be solely managed by the North-Eastern Hill University.
  - d) The University shall provide interest to the employees on such subscription at the rates prescribed by Government of India from time to time.
  - e) The terms of eligibility nomination conditions of subscription, rates of subscription interest, advances from the fund, recovery of advances, final payment, procedure on death of a subscriber, Deposit Link insurance scheme and investment of such fund shall be as laid down by the Government of India under General Provident Fund Rules and shall be subject to such changes as may be laid down by the Government of India from time to time under the General Provident Fund Rules.
  - f) Notwithstanding the provisions of this statute any dispute in this regard will be placed before the Executive Council of the University whose decisions shall be final and binding.

Annexure-'B'

6:6:2(3)

(x) Draft Statute on GPF

EC:116:2003:5:1(x): The Council considered the Draft Statute on GPF RESOLVED to approve the same.

SG

- that the University be permitted to hold the interview for promotion under CAS only for those candidates who have cleared by obtaining minimum of three positive recommendations from the experts on their research publications/Books.
- that then after the interview be conducted inviting three experts of the concerned subject making sure that these experts be different than those who had assessed and evaluated the research publications;
- that repeat process of promotion/interview for the rejected candidates can be conducted only after a minimum period of one year from the date of promotion process/ interview in which the candidate was rejected.
- that the promotion from Reader to Professor under CAS being a personal position and not against a sanctioned post, the teaching work load of the Reader be carried forward with him/her and be undertaken by the promotee even in the capacity of the CAS Professor.
- that the aforesaid communication be communicated to all the Universities for immediate compliance with effect from March 1, 2002.

This is for your information & necessary action.

Yours faithfully

Sd/-

( Dr. (Mrs). Pankaj Mittal )

COMPUTER CENTER  
NORTH-EASTERN HILL UNIVERSITY  
BIJNI COMPLEX  
SHILLONG + 793022

ANNEXURE-C

No:3935

October 16,03

The Vice-Chancellor,  
North-Eastern Hill University,  
Shillong :-22

Subject :- A proposed draft Statute on Provident Fund and Pension Scheme.

Sir,

The Section 33 of the North-Eastern Hill University Act,1973 stipulates that the University shall frame Statutes providing conditions for Provident and Pension Funds for the benefit of its employees. It is now more than 30 years since the Act received the assent of the President of India, the University has not framed the necessary Statutes/Ordinances/Regulations/Rules on Provident and Pension Fund and Retirement Benefits. It is worth mentioning at this point that there already exist the Central Universities Retirement Benefit Rules 1967 approved by the Central Government and as I have been given to understand, it is mandatory for all Central Universities to follow these Rules. Considering the importance and seriousness of the subject matter, I humbly take your permission to present a proposed draft Statute on Provident Fund and Pension Scheme for your kind perusal. The proposed draft Statute is enclosed herewith as Annexure 1 and the Central Universities Retirement Benefit Rules 1967 as Annexure 2. The copy of the Retirement Benefit Rules has been procured from the Banaras Hindu University and these may not be up to date. However, this may be used as reference and in the meantime the University may try to procure an up to date version of the Rules from the University Grants Commission or elsewhere. After perusal of the documents submitted herewith and if you find worth considering, I request you sir, to place this matter before the Academic Council for consideration and necessary actions.

Thanking you,

Yours faithfully,

Sd/-

S N Rai  
Director

Enclosures : As stated above.

NORTH-EASTERN HILL UNIVERSITY STATUTE  
ON THE PROVIDENT FUND AND PENSION SCHEME  
( Under Section 33 of the North-Eastern Hill  
University Act, 1973)

1. Every employee of the University appointed permanently or on temporary basis having completed one year continuous service to a substantive post shall as a condition of his/her service subscribe to the provident fund (being the minimum subscription as laid down by the Government of India from time to time) such subscription shall be deducted from his/her salary every month.
2. Every employee shall be governed by the "Central Universities Retirement Benefit Rules 1967" as approved by the Central Government. These Rules shall be subject to such changes as may be laid down by the University Grants Commission and the Government of India from time to time.
3. The amount of the deduction made from the salary of an employee shall be deposited in the State Bank of India in the name of "North-Eastern Hill University Provident Fund" as early as practicable or at any rate within three days of the date on which the payment of the salary is made.
4. The University may from time to time, invest such part of the Provident fund, as may be considered expedient, in such Government securities as the Executive Council may determine and may change the nature of the securities.
5. All interest or profit realised from the securities or from any deposit or account arising out of the Fund, shall after deducting the incidental expenses of investment or realisation, be credited to the Provident Fund account to be distributed rateably in the account of each subscriber.
6. The amount at the credit of any subscriber shall be payable
  - (a) on his/her ceasing to be in the service of the University to subscriber.
  - (b) on the death of the subscriber to the person or persons nominated by him/her or when no such nomination is made, to his/her legal heir or heirs.
7. The University shall not be entitled to recover from the amount to the credit of any subscriber on account of subscription made by him/her thereto (including interest on or profit from such subscriptions) any sum on account of any loss or damage sustained by the University through the misconduct or negligence of the subscriber or any other sum due to the University from him/her.
8. An employee, who is on leave on full pay shall continue to subscribe to the Provident Fund, any may do so at his/her option, if he/she is on leave on less than full pay.
9. The terms of advances from the fund, recovery of advances, final payment procedure on death of a subscriber, Deposit Linked Insurance Revised Scheme and investment of such fund shall be as laid down by the Government of India under General Provident Fund Rules and shall be subject to such changes as may be laid down by the Government of India from time to time under the General Provident Fund rules.
10. As separate account shall be kept in the Office of the University on account of every employee subscribing to the Provident Fund, and a copy of the account shall be furnished to every employee at the end of each financial year.

**CENTRAL UNIVERSITIES RETIREMENT BENEFIT  
RULES 1967**

**ARRANGEMENT OF SECTIONS**  
Short Title, Definition, Scope and Application of  
the Rules.

1. Title and Commencement.
2. Application of rules
3. Definitions
4. Exercise of Option
5. Transfer of an employee from one University to another
6. General (Miscellaneous)

Appendix 'A'

**GENERAL PROVIDENT FUND CUM PENSION CUM GRATUITY SCHEME  
SECTIONS.**

- I. General Provident Fund
- II . Pension
- III . Gratuity.
- IV. Family Pension
- V. Extraordinary Pension and Gratuity.

Appendix 'B'

**CONTRIBUTORY PROVIDENT FUND-CUM-GRATUITY SCHEME SCHEDULES**

- A. Scale of Pension .
- AA . Scale of Pension in respect of the employees who  
retire from service on or after 1.1.1973
- B. Commutation value for a Pension of rupee one per  
annum.
- C. Scale of Gratuity
- D. Scale of injury Gratuity and Pension
- E. Family Gratuity and Pension
- F. Classification of injuries.

Annexure

6:6:2(7)

FORMS

- I. Form of nomination when the subscriber has a family and wishes to nominate one member thereof.
- II. Form of nomination when the subscriber has a family and wishes to nominate more than one member thereof.
- III. Form of nomination when the subscriber has no family and wishes to nominate one person.
- IV. Form of nomination when the subscriber has no family and wishes to nominate more than one person.
- V. Form of nomination-Nomination for Death-Cum-Retirement Gratuity when the employee has a family and wishes to nominate one member thereof.
- VI. Form of nomination-Nomination for Gratuity when the member of staff has a family and wishes to nominate more than one member thereof.
- VII. Form of nomination-Nomination for additional Gratuity when the employee has no family and wishes to nominate one person.
- VIII. Form of nomination-Nomination for additional Gratuity when the employee has no family and ~~will~~ wishes to nominate more than one person.
- IX. Form of Family Pension.
- X. Form of application for injury Pension or Gratuity.
- XI. Form of application for family of a person who died of injuries received, as a result of special risk of Office.
- II. Form to be used by consulting Medical Officer when reporting on injuries.

CENTRAL UNIVERSITIES RETIREMENT BENEFIT  
RULES 1967

The Rules constitute the following two alternative schemes.

1. General Provident Fund-cum-Pension-Cum-Gratuity Scheme  
(Given in Appendix-'A')
2. Contributory Provident Fund-cum-Gratuity Rules  
(Given in Appendix-'B')

SHORT TITLE, DEFINITION, SCOPE AND APPLICATION OF  
THE RULES

1. Title and commencement:

- i) These rules shall be called the "Central Universities Retirement Benefit Rules, 1967"
- ii) These rules shall come into force with effect from 1st April, 1964

2. Definitions :

In these rules unless there is anything repugnant in the subject or context.

2.1 "University" means a University established or incorporated by or under a Central Act.

2.2 'Executive Council' means Executive Council of the University.

2.3 Emoluments means emoluments which a member of the staff was receiving immediately before his retirement or relinquishment of Office and include :-

- a) Substantive pay in respect of a permanent post other than a tenure post held in a substantive capacity;
- b) Dearness pay admissible in respect of (a) above
- c) Personal allowance which is granted in lieu of loss of substantive pay in respect of a permanent post other than a tenure post;
- d) Fees or Commission if they are authorised emoluments of an appointment and are in addition to pay (in this case emoluments means the average earning for the last six months of service);
- e) Special pay attached to the permanent post other than a tenure post when the special pay has been sanctioned permanently and the post is held in a substantive capacity.
- f) Save as otherwise provided in Rule 2.3.1 one half of :-
  - i) The difference between the emoluments referred to in clauses (a), (c) & (e) above and the pay actually drawn in higher Officiating or temporary appointments;

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1. As substituted vide UGC letter No:F.8-16/72(CU-1) dated the 9th April, 1974 and renumbered vide UGC letter No:F.8-6/74(D-5c) dated the 30th April, 1974.

\* Added vide UGC letter No:F.8-6/74(D-5c) dated the 30th April, 1976

- ii) Special pay other than referred to in clause (e) above;
- iii) Pay drawn in temporary or Officiating appointments.
- iv) Personal allowance other than the referred to in clause (c) above.
- v) The difference between the substantive pay and the pay actually drawn in higher tenure appointments whether held in substantive or Officiating capacity, provided that service in the tenure appointments does not qualify for the grant of a special additional pension.

\*(Note 1. In respect of employees who retire on or after 1st January, 1973 emoluments for the purpose of determining pension and death cum-retirement gratuity, in respect of the period prior to 1st January, 1973, shall include besides pay and Dearness pay (where admissible):-

- i) The dearness allowance where dearness pay is not admissible;
- ii) The balance of dearness allowance where dearness pay is admissible;
- iii) The interim relief.

Notes 2 In respect of employees who continue to draw dearness allowance and interim relief on or after 1st January, 1973 by virtue of opting for the revised scales of pay on the basis of the decisions of the Govt. of India on the recommendations of the Third pay Commission in case of non-teaching staff and the revised scales of pay accepted by the Govt. of India effective from 1st January, 1973 in case of teaching staff (Prof. Readers and Lecturers) from the date subsequent to 1st January, 1973, besides pay and dearness pay (where admissible), dearness allowance and the interim relief as admissible on such pay under the orders in

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\* Notes 1 & 2, 3 added vide UGC letter No: F.8-6/74(D-5c) dated the 30th April 1976.

SG

force on 31.12.1972 and drawn by the employee for the period beyond 31.12.1972 till the date the revised scales of pay as mentioned above become applicable to him shall be treated as emoluments for the purpose of determining pension and death-cum retirement gratuity the dearness allowance granted from 1st May'1973 and thereafter shall not be treated as emoluments. These rules will also apply to the employee who opts for the existing rules of pay and retires from service without coming over to the revised scale of pay)

\*(2.3.1 If an employee holding a permanent post in a substantive capacity:

I) Officiates in a higher post (other than a tenure post) continuously for not less than 3 years and retires or dies while holding the higher post; or is confirmed in such higher post at any time during the last ~~the~~ three years or more; his emoluments for pension in respect of the higher post for any period beyond three years continuous service in that post shall be determined under rule 2.3 as if he held that post in a substantive capacity.

ii) for computing the length of continuous service in respect of a higher post under clause (i) above, all kinds of leave, all periods during which an employee officiated in a higher post and the time spent on deputation and foreign service shall be included provided that it is certified that but for his proceeding on leave or serving in other post ~~for~~ going on deputation or foreign service, as the case may be, the employee concerned would have officiated in or held the higher post.

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\* As substituted via UGC letter No:F.8-16/72(CU-I) dated the 9th April'1974.

Note : For extending the benefit of clause (i) in respect of a temporary post, the temporary post should be borne on a cadre which includes permanent post in the same time scale as the temporary post.

2.3.2 Provided further that for purposes of calculation of the amount of gratuity admissible to an employee in receipt of emoluments in excess of Rs 1,800 p.m. his emoluments shall be reckoned at Rs.1,800 p.m. (In respect of employees who retire on or after the 1st January, 1973 the maximum ceiling of emoluments to be taken into account for calculation of gratuity has been raised to Rs.2,500 per mensem)

Provided further that if immediately before retirement or relinquishment of service, an employee has been absent from duty on leave with allowances, his emoluments for the above purpose shall be taken at what they would have been had he not been absent from duty.

'Average emoluments' means the average of the emoluments as defined above, calculated in respect of the last three years of service.

\*\* (In respect of employees who retired or may retire on or after the 29th February, 1976 the average emoluments' will be determined with reference to emoluments drawn by the employee concerned during the last 10 complete months)

2.4 'Family' for the purpose of General Provident Fund and Contributory Provident Fund means :-

a) In the case of a male subscriber, the wife or wives and children of a subscriber and the widows and children of a deceased son of the subscriber.

Provided that if a subscriber proves his wife has been judicially separated from him or has ceased under the customary.

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\*\* Inserted vide UGC letter No.F.8-6-74(D-5<sub>c</sub>) dated 30.4-1979

\*\* Inserted vide UGC letter No:F.26-21,77(D-5<sub>c</sub>) dated 21.9.1988

Law of the community to which she belongs to be entitled to maintenance, she shall henceforth be deemed to be no longer a member of the subscribers family in matters to which these rules relate, unless the subscriber subsequently intimates in writing to the Registrar that she shall continue to be so regarded.

b) In the case of a female subscriber, the husband and children of the subscriber, and the widows and children of deceased son of the subscriber.

Provided that if a subscriber by notice in writing to the Registrar expresses her desire to exclude her husband from her family the husband shall henceforth be deemed to be no longer a member of the subscribers family in matters to which these rules relate; unless the subscriber subsequently cancels such notice in writing.

Note:- "Child" means a legitimate child and includes an adopted child where adoption is recognised by the personal law governing the subscriber.

2.5 "Fund" means the General Provident Fund or the Contributory Provident Fund of the University as per context.

2.6 'Leave' mean any variety of leave recognised by the University.

2.7 'Pay' means the amount drawn monthly by an employee as pay which has been sanctioned for the post held by him substantively or in an Officiating capacity and includes special pay and personal pay if any.

2.8 "Personal Pay" means additional pay granted to an employee.

a) to save him from a loss of substantive pay in respect of a permanent post owing to a revision of pay or to any reduction of such substantive pay otherwise than as a disciplinary measure; or

b) in exceptional circumstances on other personal consideration.

2.9 "Qualifying Service" means service rendered as a member of the staff of the University in a substantive capacity including periods spent on probation. All service rendered to the University on a fulltime basis in a temporary or Officiating capacity followed without interruption by confirmation in the same or another post shall count as qualifying service except in respect of periods of service (\*\*\*\*) paid from "Contingencies"

Note:- 1\* An employee may add to his service qualifying for superannuation pension but not for any other class of pension:

6:6:2(13)

The actual period not exceeding one fourth of the full length of his service or the actual period by which his age at the time of recruitment exceeds twentyfive years or a period of five years whichever is least, if the post is one :-

- a) for which postgraduate research or specialist qualifications, or experience in scientific, technological or professional field is essential, and
- b) to which candidates of more than twenty five years of age are normally recruited.

Provided that this concession shall not be admissible to any such employee unless his qualifying service at the time he quits University service is not less than ten years.

The decision to grant this concession shall be taken by the Executive Council at the time of recruitment of the employee.

Notes:-2 The powers of condonation of break in service will ordinarily rest with the Executive Council of the University. The condonation of break in service can be done under the following circumstances :-

1. The interruptions should have been caused by reasons beyond the control of the employee concerned.

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1. The words in "work-changed" establishment and periods of service" deleted vide UGC letter No:F.8-11/72(CU-I)dated the 31st October, 1973.
  2. Inserted vide UGC letter No:F.8-11/72(CU-I)dated the 31st October, 1973  
\* Numbered as 1 vide UGC letter No:F.6-5/71(CU-I/D-5c)dated the 26th September, 1977.
  3. Inserted vide UGC letter No:F.6-3/71(CU-I/D-5c)dated the 26th September 1977.

SG

2. Service preceding the interruption should not be less than of five years duration and in cases where there are two or more interruptions, the total service, pensionary benefits in respect of which will be lost if the interruptions are not condoned should not be less than five years.

3. The interruption should not be of more than one year's duration. In cases where there are two or more interruptions the total of the period of all the interruptions that are condoned should not exceed one year.

Provided that, in exceptional cases the Executive Council shall recommend to the Visitor for condonation of the break in service for a period exceeding one year; in case of an employee who has put in ten years qualifying service preceding the interruption or the first of the interruptions of the service, when there are more than one; if such condonation is considered necessary in the interest of the University. The period of break even though condoned by the Executive Council, shall not count as qualifying service.

Explanation I—Counting of period of leave as qualifying Service.

a. All periods of leave with pay and allowances shall count as qualifying service.

b. The period spent on deputation for training or deputation for any special purpose including periods of travel to and from the country of deputation shall count as qualifying service; provided that if the employee has availed himself of any extraordinary leave without allowances during the period of deputation, the period of such extraordinary leave shall be excluded.

Explanation II - Periods of Counting as qualifying Service

The following periods in the service of a member of the staff shall not count as qualifying service.

- i) Time passed under suspension by a member of the staff pending enquiry into his conduct, if the suspension is not immediately followed by reinstatement.
- ii) Extraordinary leave without allowances.
- iii) Unauthorised absence in continuation of authorised leave of absence.
- iv) Service below the age of 18 years

Note :- Provided that the extraordinary leave may be allowed to count at the discretion of the Executive Council in the following circumstances :-

- i) If it is taken for academic pursuits directly connected with the teaching/research job of the employee in the University.
- ii) If it is taken on medical certificate.
- iii) If it is taken due to the inability of the employee concerned to join or rejoin duty due to civil commotion or a natural calamity provided that he has not any other type of leave at his credit.
- iv) If it is taken to take full time assignments in another University/Institution or any other authority and that the University/Institution/Authority or the person concerned makes necessary contribution towards pension.

Note :- 2. Provided further that extra ordinary leave availed prior to 11.7.1973 shall not ~~be~~ count as qualifying service.

2.10 "Registrar" means the Registrar of the University or other person appointed by the Executive Council to discharge the duties of the Registrar.

2.11 "Special Pay" means an addition of the nature of pay to emoluments of a post or of a member of the staff of the University granted in consideration of the specially arduous nature of his duties or a specific addition to his work or responsibility.

1. Inserted vide UGC letter No:F.8-11/72(CU-I) dated the 31st October' 1973.

2. Inserted vide UGC letter No.F.26-34/76(D-5<sub>c</sub>) dated the 27th April' 1977.

2.12 'Year' means the financial year of the University.

2.13 'Injury' means bodily injury resulting from violence, accident or disease assessed by the Consulting Medical Officer of the University as being not less than severe involving loss of earning power.

Note : Examples of injuries of certain categories are given in Schedule 'F'

2.14 "Accident" means -

- a. A Sudden and unavoidable mishap, or
- b. A mishap due to an act of devotion to duty in an emergency arising otherwise than by violence out of and in the course of service

2.15 "Disease" means -

- a. disease solely and directly attributable to an accident, or
- b. an epidemic disease contracted by an employee in consequence of his being ordered on duty to an area in which such disease is prevalent, or in consequence of his attending voluntarily, out of humanitarian motives, upon a patient suffering from any such disease in an area where he happens to be in the performance of his duties, or
- c. venereal disease or septicaemia where such disease or septicaemia is contracted by a medical Officer as a result of attendance in the course of his Official duty on an infected patient or of conducting a postmortem examination in the course of that duty.

2.16 'Risk of Office' means any risk, not being a special risk of accident or disease to which an employee is exposed in the course of and as a consequence of his duties, but nothing shall be deemed to be a risk of Office which is a risk common to human existence in modern conditions in India, unless such risk is definitely enhanced in kind or degree by the nature, conditions, obligations or incidents of service.

Note :- The term risk of office shall include risk of death or injury to which a member of the staff is exposed where he attends on a working day, or is required to attend on a holiday, the place of his employment for the performance of his duties during any riot or civil.

commotion in the locality and while proceeding from his residence to the place of his employment or vice versa, becomes a victim of the said riot or civil commotion.

2.17 'Special risk means-

- a. a risk of suffering injury by violence;
- b. a risk of injury by accident to which an employee is exposed in the course of and as a consequence of the performance of any particular duty which has the effect of materially increasing his liability to such injury beyond the normal risks of his office;
- c. a risk of contracting disease to which a medical Officer is a result of attending in the course of his Official duty to a venereal or septicaemia patient or conducting a postmortem examination in pursuance of that duty.

2.18 "Violence" means the act of a person who inflicts an injury on an employee.

- a. by assaulting or resisting him in the discharge of his duties, or in order to deter or prevent him from performing his duties, or
- b. because of anything done or attempted to be done by such member of the staff or by another member of the staff in the lawful discharge of his duty as such, or
- c. because of his Official position.

2.19 "Employee" means members of the staff (both academic and Non-academic) of the University.

2.20 "Vice-Chancellor" means the Vice-Chancellor of the University.

3. Application of rules.

- (i)(a) These rules shall apply to all the employees of the Central Universities both 'Academic and Nonacademic' (Other than contract Officers, part-time employees; reemployed pensioners, deputationists and purely temporary and daily wage staff), who joined the university service on or after the 1st April, 1964. They shall be entitled.

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\* Inserted vide UGC letter No:F.8-2/75(D-5c) dated the 26th December'1975.

to opt for one of the two alternative schemes set out in Appendices 'A' and 'B' to these rules.

Provided that the employees who do not exercise their option within the period prescribed under these rules be deemed to have opted for the schemes set out in Appendix 'A' despite the fact that they have been permitted to contribute to the CPF benefit prior to promulgation of these rules.

b) Employees who joined the university service before the 1st April, 1964, may continue to be covered by the provisions of the CPF Scheme in the university prior to the promulgation of these rules or may at their option elect to be covered by either of the two schemes referred to above.

i) Those who joined the university service on or after the 1st April, 1964, before the enforcement of these rules and who were therefore, permitted to contribute to the CPF obtaining in the university, will not be entitled to continue under the provisions of those rules.

ii) The service of the employees who joined the university service before 1st April, 1964 and who opt for General Provident Fund-cum-Pension-cum-Gratuity Scheme shall be deemed to have been in pensionable posts from the commencement of the employees' service in the University irrespective of the period of service for which the employees might have subscribed to the University Contributory Provident Fund.

iii) Such of the employees of the university who joined the university service before the 1st April, 1964 and have retired on or after 1st April, 1964 before having an opportunity of exercising option under this clause shall be entitled to exercise their option for the schemes set out in Appendices 'A' and 'B'

(iv) Employees who hold temporary appointment in the service of the University on the 1st April, 1964 shall after continuous service of one year be entitled to the retirement benefits from the date of commencement of service or from the 1st April, 1964 whichever is earlier.

v) In the case of employees in service prior to 1st April, 1964 who have retired from the university service on or after the 1st April, 1964 and died before having an opportunity of exercising option under these rules, the nominee or nominees validly nominated under the existing University CPF Rules can make a specific request for option to choose one of the two schemes, and either the university will have the discretion to give the benefit of either of the two schemes to a validly nominated nominee or nominees of the deceased.

Explanation :- The cases of those employees who died while in service after 1.4.1964 before exercising the option can also be covered under rule 3(v) provided the benefit is restricted to families of employees of Central Universities who died without exercising the option during the time prescribed for exercising option. In their case the existing nominees who have been validly nominated can be permitted to exercise the option.

#### 4. Exercise of option.

i) All the employees who joined the University service before 1st April, 1964 and are in service on 1st April, 1964, have to send their option in writing to the Registrar, within three months of the date of notification of these rules. Employees failing to exercise their option ~~wh#~~ within the aforesaid three months shall be treated to have opted for the existing rules obtaining before 1st April, 1964, provided that the University may at its discretion extend the date in any individual case on its merits.

Option once exercised shall be final )

ii) An employee who is initially appointed on contract basis and is subsequently continued permanently will have on cancellation of his contract terms, the option to choose either of the two schemes and he will have

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1 Assubstituted vide UGC letter No:F.33-19/62(CU-I)Vol.V dated the 1st July 1970

for the purpose of these schemes the benefit of the service rendered under contract, if the retirement benefits under the contract terms are paid back by him to the University.

5)(i) Transfer of Employees of one Central University to the other.

As a general policy, when an employee of one Central University gets transferred to any other Central University and the latter decides to absorb him permanently, the absorption should be made with the consent of the parent University provided the transfer is in public interest. The new employer will be the sole judge to decide whether the transfer is in public interest or not.

"Employees joining a University after leaving the service of another Central University shall, in the event of their permanent absorption in the new University, be allowed retirement benefits in respect of their previous service rendered under the old University provided that there is no break in the service, excepting for the admissible transit time to join the new post, and the service rendered is qualifying. They will however, not be allowed to change over from scheme in Appendix 'A' to that in Appendix 'B' or vice-versa"

Note :- For the purpose of these rules resignation of an appointment in a University to take up with proper permission another appointment in another University is not a resignation of service"

In regard to the allocation of retirement benefits liability, the entire liability should be met by the University from which the employee finally retires.

In case of CPF, however, the leading University's contribution together with the employees contributions should on permanent absorption in the borrowing University be transferred to the borrowing University.

ii) When an employee of a reputed Institution/authority not covered above is permanently absorbed in a Central University and vice-versa.

2. This rule (5) was firstly substituted as under vide UGC letter No:F.8-13/72(CU-I) dated the 27th March, 1973 and again substituted as above vide UGC letter No:F.8-12/72(D-5<sub>c</sub>)/11 dated the 29th July, 1974

The past services in this case will also count as in other categories under this rule and with the same conditions provided that the University Grants Commission gets the names of such Institutions/authorities approved in advances from the Central Government.

(iii) When an employee of an autonomous organisation under the Central Government is permanently absorbed in a Central University.

On his permanent absorption in a Central University such of the past services of an employee of an autonomous organisation set up by the Central Government, as would have counted for retirement benefits in that autonomous body, should count for retirement benefit payable by the University provided that the transfer is certified to be in the public interest, of which the Executive Council of the University shall be the sole judge subject to the following :-

a) The transfer is with the consent of the autonomous organisation.

b) The autonomous organisation concerned pays to the Central University at the time of his permanent absorption in the Central University, the capitalised value of the retirement benefits in respect of the past service of the employee in that organisation.

c) In case the employee in question is on CPF Scheme, the accumulations in his CPF account and the capitalised value of gratuity, shall be transferred by the autonomous organisations to the Central University at the time of permanent absorption.

(iv) When an employee of Central University is transferred to an autonomous organisation.

The past service of an employee of a Central University will count for retirement benefits in the case of his permanent absorption in an autonomous organisation provided that the transfer is certified to be in the public interest and the service rendered is qualifying, subject to the following :-

a) The transfer should be with the agreement of Central University though the autonomous organisation will be the sole judge to decide whether a transfer is in public interest;

b) The Central University pays the capitalised value of the pension and gratuity in respect of the past service of the employee in the Central University to the autonomous organisation at the time of his permanent absorption therein;

(c) In case the employee in question is on CPF scheme, the accumulations in his CPF account and the capitalised value of gratuity will be transferred by the Central University to the autonomous organisations concerned.

(v) When an employee of a state Government University is permanently absorbed in a Central University and vice-versa.

The past service will count for retirement benefits provided that the transfer is certified to be in the public interest and also subject to the following conditions :-

(a) The transfer is made with the consent of parent institution;

(b) The institution to which the employee is transferred shall be the sole judge to decide as to whether the absorption is in the public interest or not ;

(c) The parent institution pays the capitalised value of pension and gratuity in respect of past service of the employee in that institution to the latter employer at the time of his permanent absorption; and

(d) In case the employee in question is on CPF Scheme, the accumulations in the CPF account and the capitalised value of gratuity be transferred by the parent organisation to the new employer.

\*(vi) Transfer of Central Government employees to a Central University.

The terms and conditions of permanent absorption of Central Government employees in the Central University will be regulated by the instructions contained in the Ministry of Finance Department of expenditure) office Memorandum No:F.24(12)-EU/66 dated the 16th June 1967 as amended from time to time and since incorporated (Consolidated) in the Ministry of Finance Office Memorandum No:26(18)-EV(B)/75 dated the 8th April 1976 (Vide-Appendix-F).

The above decisions will apply both to the academic and non-academic employees.

In cases where the liability of retirement benefits is to be borne by a body other than a Central University prior approval of that body to the arrangements proposed should be obtained).

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\* Inserted vide UGC letter No:F.26-3/78(D-5<sub>c</sub>) dated the 26th April, 1978

Contd....P....

Note:1 A resignation shall not entail for forfeiture of past service if it has been submitted to take up with prior and proper permission of the previous Organisation, an other appointment under the University or any other organisation mentioned in this Rule,2 (provide-1 that cases prior to the 31st March 1977 shall not be re-opened)

\*Note :2 Government of India, Ministry of Education & Culture after careful consideration of the matter in all its aspects have agreed that the benefit of the orders regarding counting of past service for the purpose of retirement benefit in cases of transfer of employees mentioned in para 5(i),5(iii),5(iv) and 5(v) may be made applicable to all those employees who were in service on 3.9.1973,i.e. the date on which the instruction was issued by the Ministry (and conveyed to the Central Universities etc.in the Commissions letter dated 26th November,1973)subject to the fulfilment of the conditions laid down therein viz transfer being with the consent of the parent institution and in the public interest, payment of capitalised value of pension and gratuity in respect of past service by the parent institution to the organization where an employee is transferred etc.

The past cases which have already been settled otherwise will not be reopened.

#### (6) General (Miscellaneous)

(i) The sanction and payment of retirement benefits admissible under these Rules shall be regulated by such precedural instructions as would be issued by the Executive Council

#### (ii) Interpretation

(i) If any question arises relating to the interpretation of these rules, it shall be referred to the Visitor whose decision there on shall be final

1. Insrcted vide UGC letter No.F23-33/76(D-5<sub>c</sub>)dated the 26th April,1977.

2. Added in term of UGC letter No.F.28-38/76(D-5<sub>c</sub>)dated the 26th September,1977.

\* (Authority UGC letter No:8-1/75-D-5<sub>c</sub>/NP-1)dated 22-7-1983)

## APPENDIX 'A'

## GENERAL PROVIDENT FUND-CUM PENSION CUM-GRATUITY SCHEME

## SECTION I

## GENERAL PROVIDENT FUND

## 1. Nominations :

1.1 A subscriber shall, at the time of joining the Fund, send to the Registrar, a nomination in the prescribed form conferring on one or more persons the right to receive the amount that may stand to his credit in the Fund, in the event of his death, before that amount has become payable or having become payable has not been paid.

1.1.1 Provided that if at the time of making nomination, the subscriber has a family the nomination shall not be in favour of any person or persons other than the members of his family.

1.1.2 Provided further that the nomination made by the subscriber in respect of any other fund to which he was subscribing before joining the Provident Fund shall, if the amount to his credit, in such other fund, has been transferred to his credit in the Fund, be deemed to be a nomination duly made under this rule until he makes a nomination in accordance with this rule.

1.2 If a subscriber nominates more than one person under Rule 1.1 he shall specify in the nomination the amount or share payable to each of the nominees in such manner as to cover the whole of the amount that may stand to his credit in the Fund at any time.

1.3 Every nomination shall be in such one of the forms appended here to as is appropriate in the circumstances (Vide Forms I to IV in Annexure).

1.4 A subscriber may at any time cancel a nomination by sending a notice in writing to the Registrar. The subscriber shall along with such notice or separately, send a fresh nomination made in accordance with the provisions of this rule.

1.5 A subscriber may provide in a nomination :

(a) in respect of any specified nominee, that in the event of his predeceasing the subscriber, the right conferred upon that nominee shall pass to such other person or persons as may be specified in the nomination, provided that such other person or persons shall if the subscriber has other members of his family, be such other member or members. Where the subscriber confers such a right on more than one person under this clause, he shall specify the amount or share payable to each of such persons in such a manner as to cover the whole of the amount payable to the nominee:

(b) that the nomination shall become invalid in the event of the happening of a contingency specified therein;

Provided that if at the time of making the nomination the subscriber has no family, he shall provide in the nomination that it shall become invalid in the event of his subsequently acquiring a family;

Provided further that if at the time of making the nomination the subscriber has only one member of the family he shall provide in the nomination that the right conferred upon the alternate nominee under clause (a) shall become invalid in the event of his subsequently acquiring other member or members of his family.

1.6 Immediately on the death of a nominee in respect of whom no special provision has been made in the nomination under clause (a) of Rule 1.5 or on the occurrence of any event by reason of which the nomination becomes invalid in pursuance of clause (b) of Rule 1.5 or the proviso thereto, the subscriber shall send to the Registrar a notice in writing cancelling the nomination, together with a fresh nomination made in accordance with the provisions of this rule.

1.7 Every nomination made and every notice of cancellation given, by a subscriber shall to the extent that it is valid, take effect on the date on which it is received by the Registrar.

2. The University will not be bound by nor will recognise any assignment or encumbrance executed or attempted to be created which affects the disposal for the amount standing to the credit of a subscriber who dies before the amount becomes payable.

3. Subscriber's Account :

3.1 An account shall be opened in the name of each subscriber to which shall be credited the subscriber's subscription and interest as provided by these rules on subscription.

(3.2 If an employee admitted to the benefit of the fund was previously a subscriber to any contributory/noncontributory provident fund of the Central Government/State Government or of a body corporate, owned or controlled by Government or Universities/Institutions of University Status or an autonomous organisation registered under the Societies Registration Act 1860, the amount of his accumulations in such contributory or noncontributory provident fund shall be transferred to his credit in the fund)

4. Conditions and Rates of Subscription:

4.1 Every subscriber shall subscribe monthly to the Fund when on duty in the service of the university or on foreign service.

4.1.1 Provided that a subscriber shall not subscribe during the period when he is under suspension and may at his option not subscribe during any period of leave other than leave on average pay or earned leave of less than thirty days as duration, as the case may be .

4.1.2 Provided further that a subscriber on reinstatement after a period passed under suspension shall be allowed the option of paying in one sum or in instalments any sum not exceeding the maximum amount of arrear of subscription payable for that period.

4.2 The subscriber shall intimate his election not to subscribe during leave by a written communication addressed to the Registrar before he proceeds on leave. Failure to make due and timely intimation shall be deemed to constitute an election to subscribe. The option of a subscriber intimated under this subrule shall be final.

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\*1 Inserted vide UGC letter No:F8-1/72(CU-I) dated the 26th April, 1973.

## 5. Rates of Subscription :

5.1 The rate of subscription shall be fixed by subscriber himself subject to the following conditions.

(5.1.1 The rate of subscription may not be less than 6% of his emoluments and not more than his total emoluments, the amount so calculated being rounded off to the nearest rupee, provided that in the case of subscriptions at the minimum or maximum rates, the rounding off will be to the next higher or the next lower rupee respectively. This is effective from 1.6.1971

5.2. For the purpose of this rule, the emoluments of a subscriber shall be :

5.2.1 In the case of a subscriber who was in service on 31st March of the preceding year, the emoluments to which he was entitled on that date, provided as follows :

i) if the subscriber was on leave on the said date and elected not to subscribe during such leave or was under suspension on the said date, his emoluments shall be the emoluments to which he was entitled on the first day after his return to duty.

ii) if the subscriber was on deputation out of India on the said date or was on leave on the said date and continues to be on leave and has elected to subscribe during such leave; his emoluments shall be the emoluments to which he would have been entitled had he been on duty in India;

iii) if the subscriber joined the Fund for the first time on a day subsequent to the said date, his emoluments shall be the emoluments to which he was entitled on such subsequent date.

5.2.2 In the case of a subscriber who was not in service on the 31st of March of the preceding year, the emoluments to which he was entitled on the first day of his service or, if he joined the Fund for the first time on a date subsequent to the first date of his service, the emoluments to which he was entitled on such subsequent date.

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1. As substituted vide UGC letter No:F.81-1/71(CU-I)dated the 5th September,1971.

5.3 The amount of subscription so fixed may be enhanced or reduced once at any time during the course of a year, provided that when the amount of subscription is so reduced it shall not be less than the minimum prescribed under Rule 5.1.1.

6) Interest :

6.1 The university shall pay to the credit of the account of each subscriber, interest at such rate as may be determined by the Executive Council for each year at the beginning of the year.

6.2 Interest shall be credited with effect from the last day in each year in the following manner;

6.2.1 On the amount at the credit of a subscriber on the 31st March of the preceding year less any sum with drawn during the current year - Interest for twelve months;

6.2.2 on sums dithdrawn during the current year- Interest from the 1st of April of the current year up to the last date of the month preceding the month of withdrawal;

6.2.3 On all sums credited to the subscriber's account after the 31st of March of the preceding year- Interest from the date of credit up to the 31st of March of the current year;

6.2.4 The total amount of interest shall be rounded to the nearest rupee @ and above counting as the next higher rupee)

6.3. Provided that when the amount standing at the credit of a subscriber has become payable, interest thereon shall be credited under this sub-rule in respect only of the period from the beginning of the current year or from the date of credit as the case may be, up to the date on which the amount standing to the credit of a subscriber becomes payable.

6.4 For the purpose of this rule, the date of credit shall be deemed to be the first day of the month in which it is credited.

6.5 In all cases interest shall be paid in respect of balance at the credit of a subscriber up to the close of the month preceding that in which payment is made or up to the end of the sixth month after the month in which such amount becomes payable, whichever of these periods is less, provided that no interest shall be paid in respect of any period after the date on which the Registrar has intimated to the subscriber or his agent as the date on which he is prepared to make payments.

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1. Note : Payment of interest on the Fund balances beyond a period of six months upto a period of one year may be authorised by the Finance Officer in the University after he has personally satisfied himself that the delay in payment was occasioned by circumstances beyond the control of the subscriber and in every such case the administrative delay involved in the matter shall be fully investigated and action, if any required, taken.

#### 7. Advances from the Fund.

The Vice-Chancellor or any other authority to whom power has been delegated may sanction the payment to any subscriber of advance existing of a sum of whole rupees and not exceeding in amount three months pay or half, the amount standing to his credit in the Fund, whichever is less, for one or more of the following purposes.

a) to pay expenses in connection with the illness, confinement or a disability including where necessary, travelling expenses of the subscriber and members of his family or any person actually dependent on him;

b) To meet the cost of higher education, including where necessary the travelling expenses of the subscriber and members of his family or any person actually dependent on him in the following cases, namely:

i) for education outside India for an academic, technical, professional or vocational course beyond the High School stage and

ii) for any medical, engineering or other technical, or specialised course in India beyond the High School stage provided that the course of study is for not less than three years;

c) to pay obligatory expenses on a scale appropriate to the subscriber's status which by customary usage the subscriber has to incur in connection with betrothal or marriages, funerals or other ceremonies;

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1 Inserted vide UGC letter No:F.26-15/76(D-5c) dated the 14th March, 1978.

d) to meet the cost of legal proceeding instituted by the subscriber for indicating his position in regard to any allegations made against him in respect of any act done or purporting to be done by him in the discharge of his Official duty, the advance in this case being available in addition to any advance admissible for the same purpose from any other university source.

Provided that the advance under this subclause shall not be admissible to a subscriber who institutes legal proceedings in any court of law either in respect of any matter unconnected with his Official duty or against university in respect of any condition of service or penalty imposed on him;

e) to meet the cost of his defence where the subscriber is prosecuted by university in any court of law or where the subscriber engages legal practitioner to defend himself in an enquiry in respect of any alleged Official misconduct on his part;

f) to meet the cost of plot or construction of a house or flat for his residence or to make any payment towards the allotment of plot or flat by the Delhi Development Authority or a State Housing Board or a House Building Cooperative Society;

g) to meet the cost of travel abroad of the applicant, when permitted by the Executive Council to attend scientific conferences symposia or for scientific/technical work.

(\*1A) The Executive Council may, in special circumstances, sanction the payment to any subscriber of an advance if he is satisfied that the subscriber concerned requires the advance for reasons other than those mentioned in sub-rule (1)

2) An advance shall not, except for special reasons to be recorded in writing be granted to any subscriber in excess of the limit laid down in sub-rule(1) or until repayment of the last instalment of any previous advance.

Note 1: For the purpose of this rule, ~~DM~~ pay includes dearness pay, where admissible.

Note:2: A subscriber shall be permitted to take an advance once in every six months under item (b) of sub-rule(1) of rule 7

3) When an advance is sanctioned under sub-rule(2) before repayment of last instalment of any previous advance is completed, the balance of any previous advance not recovered shall be added to the advance so sanctioned and the instalments for recovery shall be fixed with reference to the consolidated amount.

4) An advance shall be recovered from the subscriber in such number of equal monthly instalments as the sanctioning authority may direct but such number shall not be less than twenty unless the subscriber so elects and more than twenty four. In special cases where the amount of advance exceeds three months pay of the subscriber under sub rule (2) of Rule (7) the sanctioning authority may fix such number of instalments to be more than twenty four but in no case more than thirty six. A subscriber may, at his option, repay more than one instalment in a month. Each instalment shall be a number of whole rupees, the amount of the advance being raised or reduced, if necessary, to admit of the fixation of such instalments.

5) Recovery shall be made from the emoluments of a subscriber in accordance with the procedure laid down to be laid down by the University and shall commence, with the issue of pay for the month following the one in which the advance was drawn. Recovery shall not be made except with the subscribers consent while he is in receipt of subsistence grant or is on leave for ten days or more in a calendar month which either does not carry any leave salary or carries leave salary equal to or less than half pay or half average pay as the case may be. The recovery may be postponed, on the subscribers written request by the sanctioning authority during the recovery of an advance of pay granted to the subscriber.

6) If an advance has been granted to a subscriber and drawn by him and the advance is subsequently disallowed before repayment is completed, the whole or balance of the amount shall, forth with be repaid by the subscriber to the Fund or in default, be ordered by the sanctioning authority to be recovered by deduction from the emoluments of the subscriber in a lump sum or in

451) monthly instalments not exceeding twelve as may be directed by the authority competent to sanction an advance for the grant of which, special reasons are required under sub-rule(2) of rule 7.

7. Recoveries made under this rule shall be credited as they are made to subscribers account in the Fund.

Note 1 : The terms 'Emoluments' as used in this rule does not include subsistence allowance, if any, granted in cases of suspension of an employee pending an enquiry into his alleged misconduct.

Note 2: The sanctioning authority shall record its reasons for granting the advance but if the reason is of a confidential nature it may be communicated to the Registrar personally and/or confidentially.

8. Notwithstanding anything contained in these rules, if the sanctioning authority is satisfied that money drawn as an advance from the Fund under rule 7 has been utilised for a purpose other than that for which sanction was given to the drawal of the money, the amount in question, shall forthwith be repaid by the subscriber to the Fund, or in default, be ordered to be recovered by deduction in one sum from the emoluments of the subscriber even if he be on leave. If the total amount to be repaid be more than half the subscribers emoluments recoveries shall be made in monthly instalments of moities of his emoluments till the entire amount is repaid by him.

Note: The term 'emoluments' in this rule does not include subsistence grant.

#### 8. WITHDRAWAL FROM THE FUND

8.1 Subject to the conditions specified herein, withdrawals from the fund may be sanctioned by the Vice-Chancellor or any other authority to whom power has been delegated.

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Authority : Substituted vide UGC letter No:F.20-36/81 (NP-1)  
dated 27.4.83 Approved vide ECR No:193 dated 25/26th  
July,1983

Authority : Denotes to item 7 full advances from the Fund.

A. After the completion of twenty years of service (including broken periods of service, if any) of a subscriber or within ten years before the date of his retirement on superannuation, whichever is earlier, from the amount standing to his credit in the Fund, for one or more of the following purposes, namely :-

a) meeting the cost of higher education, including where necessary the travelling expenses of the subscriber or any child of the subscriber in the following cases, namely :-

- i) For education outside India for academic, technical, professional or vocational course beyond the High School stage and
- ii) For any medical, engineering or other technical or specialised course in India beyond the High School stage.

b) meeting the expenditure in connection with the betrothal/marriage of the subscriber or his sons or daughters, and any other female relations actually dependent on him;

c) meeting the expenses in connection with the illness, including where necessary the travelling expenses of the subscriber and members of his family or any person actually dependent on him;

B. After the completion of fifteen years of service (including broken periods of service, if any) of a subscriber or within ten years before the date of his retirement on superannuation whichever is earlier, from the amount of subscription and interest thereon standing to the credit of the subscriber in the Fund for one or more of the following purposes, namely:-

a) Building, or acquiring a suitable house or ready built flat for his residence including the cost of the site;

b) Repaying an outstanding amount on account of loan expressly taken for building or acquiring a suitable house or ready-built flat for his residence;

c) Purchasing a house-site for building a house thereon for his residence or repaying any outstanding amount on account of loan expressly taken for this purpose;

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- d) Reconstructing or making additions or alterations of a house or a flat already owned or acquired by a subscriber;
- e) Renovating additions or alterations or upkeep of an ancestral house at a place other than the place of duty or to a house built with the assistance of loan from University/Government at a place other than the place of duty;
- f) Constructing a house on a site purchased under clause(c);

C. Within six months before the date of the subscribers retirement from the amount standing to his credit in the Fund for the purpose of acquiring a farm land or business premises or both.

Note 1: A subscriber who has availed himself of an advance under the scheme of the University for the grant of advance for house-building purpose or has been allowed any assistance in this regard from any other Government source, shall be eligible for the grant of final withdrawal under sub-clause(a),(c),(d)and (f)of clause (B) for the purposes specified therein and also for the purpose of repayment of any loan taken under the aforesaid scheme subject to the limit specified in the proviso to sub-rule (1)of rule 8.2

If a subscriber has an ancestral house or built house at a place other than the place of his duty with the assistance of loan taken from the University/Government, he shall be eligible for the grant of a final withdrawal under sub-clause (a),(c) and (f)of Clause (B) for purchase of a house site or for construction of another house or for acquiring a ready built flat at the place of his duty.

Note 2 : Withdrawal under subclause (a),(d),(e) or (f) of clause (B) shall be sanctioned only after a subscriber has submitted a plan of the house to be constructed or of the additions or alterations to be made, duly approved by the local Municipal Body of the area where the site or house is situated and only in case where the plan is actually got to be approved.

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Note 3 The amount of withdrawal sanctioned under sub-clause (b) of clause (B) shall not exceed  $\frac{3}{4}$  of the balance on date of application together with the amount of previous withdrawal under sub-clause (a) reduced by the amount of previous withdrawal. The formula to be followed is  $\frac{3}{4}$ th of the balance (as on date plus amount of previous withdrawal(s) for the house in question) minus the amount of the previous withdrawals).

Note 4 Withdrawals under sub-clause (a) or (d) of clause (B) shall also be allowed where the house site or house is in the name of wife or husband provided she or he is the first nominee to receive Provident Fund money in the nomination made by subscriber.

Note 5 Only one withdrawal shall be allowed for the same purpose under this rule. But marriage or education of different children or illness on different occasions or a further addition or alteration to a house or flat covered by a fresh plan duly approved by the local municipal body of the area where the house or flat is situated shall not be treated as the same purpose. Second or subsequent withdrawal under sub-clause (a) or (f) of clause (B) for completion of the same house shall be allowed upto the limit laid down under Note 3.

Note 6 A withdrawal under this rule shall not be sanctioned if an advance under rule 7 is being sanctioned for the same purpose and at the same time.

#### CONDITIONS FOR WITHDRAWAL

8.2 (1) Any sum withdrawn by a subscriber at any one time for one or more of the purposes specified in rule 8.1 from the amount standing to his credit in the fund shall not ordinarily exceed one-half of such amount or six months pay whichever is less. The sanctioning authority may, however, sanction the withdrawal of an amount in excess of this limit upto  $\frac{3}{4}$ th of the balance at his credit in the fund having due regard to (i) the object for which the withdrawal is being made (ii) the status of the subscriber and (iii) the amount to his credit in Fund.

Provided that in no case the maximum amount of withdrawal shall exceed Rs 1,25,000 or 75 times the monthly pay, whichever is less: Provided further that in the case of a subscriber who has availed himself of an advance under the scheme of the University for the grant of advance for house-building purpose, or has been allowed any assistance in this regard from any other Government source, the sum withdrawn under this sub-rule together with the amount of advance taken under the aforesaid scheme of the University or the assistance taken from any other Government source shall not exceed Rs.1,25,000/- 75 times the monthly pay, whichever is less.

Note 1 A subscriber shall be permitted to make a withdrawal once in every six months under sub-clause (a) of clause (A) of rule 8.1. Every such withdrawal shall be treated as a withdrawal for a separate purpose for the purposes of sub-rule (1) of rule 8.2

Note 2 In cases where a subscriber has to pay in instalments for a site or a house or flat purchased, or a house or flat constructed through the Delhi Development Authority or a state housing Board or a House Building Cooperative Society, he shall be permitted to make a withdrawal as and when he is called upon to make a payment in any instalment. Every such payment shall be treated as a payment for a separate purpose for the purposes of sub-rule (1) of Rule 8.2

8.3 (1) A subscriber who has been permitted to withdraw money from the Fund under rule 8.1 shall satisfy the sanctioning authority within a reasonable period as may be specified by that authority that the money has been utilised for the purpose for which it was withdrawn, and if he fails to do so, the whole of the sum so withdrawn, or so much thereof as has not been applied for the purpose for which it was withdrawn shall forthwith be repaid in one lump sum by the subscriber to the Fund and in default of such payment, it shall be ordered by the sanctioning authority to be recovered from his emoluments either in a lump sum or in such number of monthly instalments as may be determined by the Executive Council.

2. (a) A subscriber who has been permitted under clause (d) clause (e) or clause (f) of rule 8.1 to withdraw money from the amount standing to his credit in the Fund shall not part with the possession of the house build or acquired or house site purchased with the money so withdrawn, whether by way of sale, mortgage (Other than mortgage to the University) gift, exchange or otherwise without the previous permission of the Vice-Chancellor.

Provided that such permission shall not be necessary for :-

i) the house or house-site being leased for any term not exceeding three years, or

ii) its being mortgaged in favour of a Housing Board, the Life Insurance Corporation or any other Corporation owned or controlled by the Central Government which advances loans for the construction of a new house or making additions or alterations to an existing house.

b) The subscriber shall submit a declaration not later than the 31st day of December of every year as to whether the house or the house-site, as the case may be, continues to be in his possession or has been mortgaged, otherwise transferred or let out as aforesaid and shall, if so required, produce before the sanctioning authority on or before the date specified by that authority in that behalf the original sale, mortgage or lease deed and also the documents on which his title to the property is based.

e) If, at any time before his retirement, the subscriber parts with the possession of the house or house-site without obtaining the previous permission of the Vice-Chancellor, he shall forthwith repay the sum so withdrawn by him in a lump sum to the Fund, and in default of such repayment, the sanctioning authority shall after giving the subscriber a reasonable opportunity or making representation in the matter, cause the said sum

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Authority : Substituted vide UGC letter No:F.26-34/81 (NP-I dated 27.4.1983 Approved vide E C R No:191 dated dated 25/26th July, 1983.

to be recovered from the emoluments of the subscriber either in a lump sum or in such number of monthly instalments as may be determined by it.

\* 8.4 A subscriber who has already drawn or may draw in future an advance under rule 7 for any of the purposes specified in Rule 8.1(A) may convert at his discretion by written request to the sanctioning authority, the balance outstanding into a final withdrawal on his satisfying the conditions laid down in rule 8.1(A), 8.2 and 8.3

#### 9. Final withdrawals of accumulations in the fund

9.1 When a subscriber quits the service of the university, the amount standing to his credit in the Fund shall become payable to him.

9.1.1 Provided that a subscriber who has been dismissed from the service of the university and is subsequently reinstated in service, shall if required to do so, repay any amount paid to him from the fund in pursuance of this rule with interest thereon at the rate provided in these rules in the manner provided. The amount so repaid shall be credited to his account in the fund.

Explanation : A subscriber who is granted refused leave shall be deemed to have quit the service from the date of compulsory retirement or on the expiry of an extension of service.

#### 10. Retirement of a subscriber.

10.1 When a subscriber (a) has proceeded on leave preparatory to retirement or if he is entitled to vacation, on leave preparatory, combined with vacation, or (b) while on leave has been permitted to retire or has been declared by the Consulting Medical Officer of the university or by a competent medical authority that may be prescribed by the Executive Council in this behalf to be unfit for further service, the amount standing to his credit in the Fund shall upon an application made by him in that behalf to the Registrar, becomes payable to the subscriber.

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\* Inserted vide UGC letter No:F.33-19/62(CU)Vol V dated the 11th June, 1970.

10.1.1 Provided that the subscriber if he returns to duty shall, if required to do so repay to the Fund for credit to his account the whole or part of any amount paid to him from the Fund in pursuance of this rule with interest thereon at the rate provided, by instalments or otherwise by recovery from his emoluments or otherwise as the Vice-Chancellor may direct.

(11) Procedure on the death of a subscriber.

11.1 On the death of a subscriber before the amount standing to his credit has become payable, or where the amount has become payable before payment has been made:

11.1.1 When a subscriber leaves a family:

a) if a nomination made by the subscriber in accordance with the provisions of Rule 1.1 or of the corresponding rule heretofore in force in favour of a member or members of his family subsists amount standing to his credit in the Fund or the part thereof to which the nomination relates shall become payable to his nominee or nominees in the proportion specified in the nomination;

b) if no such nomination in favour of a member or members of the family of the subscriber subsists, or if such nomination relates only to a part of the amount standing to his credit in the Fund, the whole amount or the part thereof to which the nomination does not relate, as the case may be, shall notwithstanding any nomination purporting to be in favour of any person or persons other than a member or members of his family, become payable to the members of his family in equal shares.

Provided that no share shall be payable to :-

- i) sons who have attained majority;
- ii) married a deceased son who have attained majority;
- iii) married daughters whose husbands are alive;
- iv) married daughters of a deceased son whose husbands are alive.

If there is any member of the family other than those specified in clauses (i), (ii), (iii) and (iv)

Provided further that the widow or widows and the child or children of a deceased son shall receive between them in equal parts only the share which that son would have received if he had survived the subscriber and had been exempted from the provision of clause 1 of the first proviso.

111.2 When the subscriber leaves no family if a nomination made by him in accordance with the provisions of Rule 1.1 or of the corresponding rule heretofore in force in favour of any person or persons, subsists, the amount standing to his credit in the Fund or the part thereof to which the nomination relates, shall become payable to his nominee or nominees in the proportion specified in the nomination.

12. Statement of accounts.

12.1 As soon as possible after the 31st of March of each year, the Registrar shall send to each subscriber a statement of his account in the Fund, showing the opening balance on the 1st of April of the year the total amount credited and debited during the year, the total amount of interest credited as on the 31st of March of the year and the closing balance on that date. The Registrar shall attach to the statement of account an enquiry whether the subscriber.

(a) desires to make any alteration in any nomination made by the subscriber,

(b) has acquired a family (in cases where the subscriber has made no nomination in favour of a member of his family under the rules)

12.2 Subscriber should satisfy themselves as to the correctness of the annual statement, and errors should be brought to the notice of the Registrar within six months from the date of receipt of the statement.

12.3 The Registrar shall, if required by a subscriber, once, but not more than once in a year, inform the subscriber of the total amount standing to his credit in the Fund at the end of the last month for which his account has been written up.

(13) Investment of fund.

13.1 All sums paid into the Fund under the rules shall be credited in the books of the university to an account named 'General Provident Fund Account of the University.....' A deposit account shall be opened in .....

such Scheduled Bank in as the university may decide upon from time to time to be operated in such manner as the Executive Council may direct. The balance of the Fund after reserving suitable amounts for current needs shall be invested in the National Savings Certificates and or other investment covered by Section 20 of the Indian Trust Act of 1882.as soon as possible after monthly accounts are closed.

## SECTION II PENSION

14. Every employee should have put in a minimum of ten years of qualifying service to be eligible for pension subject to such rules as may be applicable to the categories of pension set out below. In case the qualifying service falls below ten years, a gratuity as in Schedule 'C' will be admissible.

14.(a) the minimum age after which service counts for pension shall be eighteen years.

15. Subject to the minimum qualifying service an employee shall be eligible for one or other of the following pension;

15.1 Compensation Pension - if an employee is discharged owing to the abolition of the permanent post, he shall be granted a compensation pension on the scale prescribed in Rule 16 below.

15.2 Invalid pension-(i) an invalid pension shall be granted to an employee on retirement from the service of the University for permanent physical or mental disability incapacitating him for further service, if certified by the Consulting Medical Officer of the University on the scale prescribed in Rule 16 below.

(ii) (In respect of an employee who retired on invalid pension on or after 1st January 1973 or who may retire as such hereafter, the amount of invalid pension shall not be less than the amount of the contributory family pension mentioned at clause (C) of Rule (24) in Section IV-Family Pension, Appendix 'A')

\* Paragraphs number as (i) and (ii) vide UGC letter No.F.26-15/77(D-5<sub>c</sub>) dated the 25th April, 1977.

1. Added vide UGC letter No:F.8-6/74(D-5<sub>c</sub>) dated the 30th April, 1976.

( 461)

iii) (a) If the disability is directly due to the irregular or intemperate habits of an employee no invalid pension shall be granted.

(b) If the disability has not been directly caused by such habits but has been accelerated or aggravated by them it shall be for the pension sanctioning authority to decide what reduction should be made on this account.

15.3 Superannuation or Retiring Pension- A superannuation or retiring pension shall be granted to an employee who may retire from service on completion of the age of retirement or on completion of thirty years of qualifying service, whichever is earlier.

15.3.1 Provided that in the event of retirement after thirty years of qualifying service but before the completion of the age of sixty years the member of the staff concerned shall give in this behalf a notice in writing to the Registrar at least three months before the date on which he wishes to retire.

16.1 (a) An employee eligible for pension under any of the categories mentioned above shall be granted on retirement  $\frac{1}{2}$  80th of the average emoluments for each complete six monthly period of qualifying service subject to a maximum pension as stipulated in the table appended (Schedule 'A') and subject also to the total pension not exceeding  $\frac{30}{80}$ th of the average emoluments.

\*\* (b) In respect of employees who retire on or after 1st January 1973 or who may retire thereafter the amount of pension interms of this Rule shall be the appropriate amount set-out in Schedule 'AA'.

\*\*\* (c) (1) In respect of the employees who were in service on the 31st March, 1979 and retiring from service on or after that date the amount of pension shall be determined in accordance with the following slabs.

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1 Added vide UGC letter No:F.26-15/77(D-5<sub>c</sub>) dated the 25th April, 1977.

\* Re-numbered as 16 1 vie UGC letter No:F.26-19/77(D-5<sub>c</sub>) dated the 21st September, 1977

\*\* Sub-clause added vide UGC letter No:F.8-6/75(D-5<sub>c</sub>) dated the 30th April, 1976.

\*\*\* Sub-para(c) to rule 16-1 added vide UGC letter No:F.26-9/79 (NP-1) dated 23.8.1980.

- |    |  |  |
|----|--|--|
| 1. | Upto first Rs.1000/- of average emoluments reckonable for pension. | - 50% of average emoluments.   |
| 2. | Next Rs.500/- of average emoluments reckonable for pension.        | - 45% of average emoluments.<br>Subject to an overall ceiling as per para (iii) below. |
| 3. | Balance of average emoluments reckonable for pension.              |  |

- (ii) The amount of pension arrived at on the basis of the above slabs will be related to the maximum qualifying service of 33 years. For employees, who, at the time of retirement, have rendered qualifying service of ten years or more but less than 33 years, the amount of their pension will be such proportion of the maximum admissible pension as the qualifying service rendered by them bears to the maximum qualifying service of 33 years. A few illustrations have been given in Annexure.
- (iii) The pension as determined in accordance with the above slabs plus the maximum relief on pension at the rate of Rs.100 per month admissible to an employee as on 1.12.1978 in accordance with the orders issued by Government of India and made applicable to the employees/Pensioners to whom these rules apply will, be subject to an overall ceiling of Rs.1500/- p.m. If the pension itself exceeds Rs.1500/- then the maximum pension for full service of 33 years will be restricted to Rs.1500/- p.m. and no relief will be payable upto index level 328.
- (iv) The existing provisions of these Rules regarding admissibility of service gratuity, Death-cum-Retirement Gratuity, Family Pension and determination of the average emoluments, service qualifying for pension including the provision for treating completed six monthly period of service as qualifying and fraction of a rupee being rounded off to next higher rupee, will remain unaltered.

## Annexure

## CALCULATION OF PENSION ACCORDING TO SLAB SYSTEM IN RESPECT OF CERTAIN CATEGORIES OF EMPLOYEES

Average Emoluments	Pension on 33 yrs of service	Pension	Pension on 30 yrs of service	Pension on 30 1/2 yrs of service	Pension on 20 yrs of service	Pension on 20 1/2 yrs of service
Rs.1000/-	Pension Rs.500/-		500x30 33 Rs.454.50	500x30 1/2 33 Rs.462.12	500x20 33 Rs.303.03	500x20 1/2 33 Rs.310.60
Rs.1300/-	First Rs.1000/- 50% Next Rs.300/- 45%	Rs.500/- Rs.135/-	Rs.635x30 33 Rs.577.27	Rs.635x30 1/2 33 Rs.586.89	Rs.635x20 33 Rs.384.84	Rs.635x20 1/2 33 Rs.394.46
	Total	Rs.635/- or	Rs.578/- or	Rs.587/- or	Rs.385/- or	Rs.395/-
Rs.1500/-	First Rs.1000/- 50% Next Rs.500/- 45%	Rs.500/- Rs.225/-	Rs.725x30 33 Rs.659.09	Rs.725x30 1/2 33 Rs.670.07	Rs.725x20 33 Rs.439.39	Rs.725x20 1/2 33 Rs.450.37
	Total :	Rs.725/- or	Rs.660/- or	Rs.671/- or	Rs.440/- or	Rs.451/-
Rs.2000/-	First Rs.1000/- 50% Next Rs.500/- 45% Balance Rs.500/- 40%	Rs.500/- Rs.225/- Rs.200/-	Rs.925x30 33 Rs.840.90	Rs.925x30 1/2 33 Rs.854.92	Rs.925x20 33 Rs.560.61	Rs.925x20 1/2 33 Rs.574.62
	Total :	Rs.925/- or	Rs.841/- or	Rs.855/- or	Rs.561/- or	Rs.575/-
Rs.2500/-	First Rs.1000/- 50% Next Rs.500/- 45% Balance Rs.1000/- 40%	Rs.500/- Rs.225/- Rs.400/-	Rs.1125x30 33 Rs.1022.72	Rs.1125x30 1/2 33 Rs.1039.77	Rs.1125x20 33 Rs.681.81	Rs.1125x20 1/2 33 Rs.698.86
	Total :	Rs.1125/-	Rs.1023/- or	Rs.1040/- or	Rs.682/- or	Rs.699/-
Rs.3500/-	First Rs.1000/- 50% Next Rs.500/- 45% Balance Rs.2000/- 40%	Rs.500/- Rs.225/- Rs.800/-	Rs.1500x30 33 Rs.1364/-	Rs.1500x30 1/2 33 Rs.1388.36	Rs.1500x20 33 Rs.910/-	Rs.1500x20 1/2 33 Rs.931.80
	Total :	Rs.1525/-	or	Rs.1387/-	or	Rs.932/-

Restricted to Rs.1500/- and no relief will be payable for against the entitlement of relief of Rs.100/- p.m. as on 1.12.1978.

\*16.2 (a) In case an employee who retires on superannuation, retiring, invalid or compensation pension on or after 1st March, 1970, and the amount of pension including ad-hoc increase in accordance with the rules/orders in force at the time of his retirement, is less than Rs.40.p.m. (inclusive of ad-hoc increase, where applicable) with effect from 1.3.1970.

(b) In case of a pensioner under this scheme, if the amount of pension including ad-hoc increase or temporary increase or both which the pensioner may be in receipt on 1.3.1970, is less than Rs.40.p.m. the same shall be raised to Rs.40 p.m. (inclusive of ad-hoc or temporary increase as the case may be, where applicable) with effect from 1.3.1970.

(17) Commutation of pension:

17.1 An employee shall, subject to the condition specified below, be allowed to commute for lump payment any portion or portions of his pension not exceeding one-third of the pension granted to him.

17.2 No commutation shall be sanctioned unless the consulting Medical Officer of the University certifies that the pensioner's health and prospects of duration of life are such as to justify commutation.

2 Provided that an employee who applies for commutation of pension within one year of the date of his retirement on superannuation will not be subjected to medical examination for the purpose of payment of commuted value, subject to the limit prescribed in rule 17.1. This will neither apply to persons retiring otherwise than on superannuation nor cover persons retiring on superannuation who apply for commutation of pension after one year of the date of their retirement. Application for commutation of pension under this proviso will be made after the date of retirement and the commutation shall become absolute, that is the retired employee shall become entitled to receive the commuted value on the date on which his application is received by the Finance Officer/Registrar of the University. An employee who has applied for commutation of pension under this proviso, will have no option to withdraw his application. This proviso will take effect from the 26<sup>th</sup> December, 1977 and will also apply to those who have retired before this date but have not crossed the age next birthday after superannuation and have not gone before the Consulting Medical Officer of the University.

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1. Added vide UGC letter No.F.26-19/77 (d-5c) dated the 21<sup>st</sup> September, 1977.
  2. Added vide UGC letter No.F.26-7/78 (D-5c) dated the 2<sup>nd</sup> May, 1979.
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- 17.3 The lump sum payable on commutation shall be calculated in accordance with the table prescribed by the Govt. of India from time to time.
- 17.4 Commutation when sanctioned shall take effect on the date to be specified in the order. Such date shall be the first of a month and ordinarily about one month later than the date of the order and all calculations shall be made with reference to the date specified.

### SECTION III Gratuity

1[18 (i) \* an employee who has completed five years of qualifying service at the University may be granted a additional (Death-cum-Retirement) gratuity in accordance with the scale indicated in Rule (19). This gratuity shall be payable on his retirement from the service of the University. In the event of his demise, the gratuity shall be payable to the nominee or nominees of the deceased employer in the manner prescribed (vide annexure Forms I to VIII).

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1. As substituted vide UGC letter No.F.8-5/72(CU-I) dated the 11<sup>th</sup> August, 1972. Prior to this, the rule as amended vide UGC letter No.L.33-19/62(CU)/Vol.IV dated the 15<sup>th</sup> July, 1969 was as under:-

(18) An employee who has completed five years of qualifying service at the University shall be granted gratuity, as distinct from the gratuity referred to in Rule 14 of Section II, in accordance with the scale of gratuity indicated in Schedule 'C'. This gratuity shall be payable on his retirement from service of the University. In the event of his demise, this gratuity shall be payable to the nominee or nominees of the deceased in the manner prescribed (vide Annexure Forms V to VIII).

No gratuity shall be payable on resignation from the service of the University or dismissal or removal from it for misconduct, insolvency, inefficiency not due to age.

Numbered as (i) vide UGC letter No.F.8-11/75(D-5c) dated the 2<sup>nd</sup> April, 1976.

1[2 (ii) If there is no such nomination or if the nomination made does not subsist the gratuity shall be paid in the manner indicated below:-

(a) If there are one or more surviving members of the family as in the following

sub-clauses (aa), (bb) and (cc) (dd), to all such members in equal shares;

(aa) wife or wives, in the case of a male employee,

(bb) husband, in the case of a female employee,

(cc) sons including step sons and adopted sons,

(dd) unmarried daughters including step daughters and adopted daughters.

(b) If there are no such surviving members of the family as in clause (a) above, but there are one or more members as in the following sub-clauses (aa), (bb), (cc), (dd), (ee) (ff) and (gg), to all such members in equal shares;

(aa) widowed daughters including step daughters and adopted daughters.

(bb) father } including adoptive parents in the case of individuals

(cc) mother } whose personal law permits adoption,

(dd) brothers, below the age of eighteen years including step brothers,

(ee) unmarried sisters and widowed sisters including step sisters,

(ff) married daughters, and

(gg) children of pre-deceased son.

\*(iii) 1 2[NO gratuity shall be payable on resignation from the service of the University or dismissal or removal from it for misconduct, insolvency, inefficiency not due to age.]

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1. Added vide UGC letter No.F.8-11/75 (D-5c) dated the 2<sup>nd</sup> April, 1976.

\* Substituted vide UGC letter No.F.8-5/72(CU-I) dated the 11<sup>th</sup> August, 1972.

2. Numbered vide UGC No.F.8-11/75(D-5c) dated the 2<sup>nd</sup> April, 1976

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- **Note I:** The right of a female members of the family that of a brother, of an employee who dies while in service or after retirement, to receive the share of gratuity shall not be affected if the female member marries or re-marries, or the brother attains the age of eighteen years, after the death of the employee and before receiving her or his share of gratuity.
- **Note II:** Where gratuity is granted under this rule to a minor member of the family of the deceased employee, it shall be payable to the guardian on behalf of the minor.
- **Note III:** Where an employee dies while in service, or after retirement without receiving the amount of gratuity, and
  - (a) leaves behind no family; or
  - (b) has made no nomination, or
  - (c) the nomination made by him does not subsist, the amount of death-cum-retirement gratuity payable to him under this rule shall lapse to the University.]

- 19. (i) 2[The amount of gratuity will be one-fourth of the emoluments of an employee for each completed six monthly period of qualifying service subject to a maximum of fifteen times the emoluments. In the event of death of an employee while in service the gratuity will be subject to a minimum of twelve times the emoluments of the employee at the time of his death.  
Provided that in no case it shall exceed Rs.24,000/- and that the amount of gratuity payable is further subject to the provision of Rule (24) (A) (vi) and the note thereunder.]

- Added vide UGC letter No.F.8-11/55(D-5c) dated the 2<sup>nd</sup> April, 1976.
- Numbered the clause as (i) vide UGC letter No.F.8-6/74 (D-5c) dated the 30<sup>th</sup> April, 1976.
- 2. As substituted vide UGC letter No.F.8-5/72(CU-I) dated the 11<sup>th</sup> August, 1972. Prior to this, the provision of the rule was as under:-

(19) The amount of gratuity shall be subject to a maximum of fifteen times the emoluments. In the event of the death of an employee while in service, the gratuity shall be subject to a minimum of twelve times the emoluments of the employee at the time of his death, provided that in no case shall it exceed Rs.24,000. It is further subject to the provision of Rule 24A(vi).

- 1[(ii) In respect of employees who retired from service on or after 1<sup>st</sup> January, 1973 or who may retire from service thereafter or died while in service on or after the aforesaid date or in the event of their death in service thereafter, for death-cum-retirement gratuity, the existing maximum limit of 'fifteen times the emoluments' as prescribed in clause (i) above shall be raised to '16 ½ times the emoluments'.

Provided that the maximum monetary limit of Rs. 24,000/- applicable to death-cum-retirement gratuity under the proviso to clause (i) above shall respect of cases falling under clause (ii) above be raised to Rs. 30,000/-.]

20. If an employee who has become eligible for a pension under section II dies within a period of five years after he retires from the service of the University 2(\*\*\*) and the sums actually received by him at the time of death on account of such pension together with the gratuity granted under the above rules and commuted value of any portion of the pension commuted by him are less than the amount equal to twelve times the emoluments, a gratuity equal to the deficiency shall be granted to the person or persons nominated by him.
21. If a permanent employee dies before completing five years of qualifying service, his family will be eligible for a gratuity equal to six times his emoluments at the time of his death except in cases in which death occurs in the first year of service, when the gratuity admissible will be equal to two months' emoluments.

22. *Temporary employees.*

22.1 Terminal gratuity-A temporary employee who retires on superannuation or is discharged on account of retirement or is declared invalid for further service will be eligible for a gratuity at the rate of one-third of a month's pay for each completed year of service, provided that he has completed not less than five years of continuous service at the time of retirement, discharge or invalidment.

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1. Inserted vide UGC letter No.F.8-6/74(D-5c) dated the 30<sup>th</sup> April, 1976.
  2. The words "as the case may be" deleted vide UGC letter No.F.33-19/62 (CU-I) Vol.V dated 27<sup>th</sup> October, 1970.

- (i) If such son or daughter is one among two or more children of the employee, the family pension shall be initially payable to the minor children in the order set out in item (c) of sub-para (iv) of this rule until the last minor child attains the age of 18 or 21, as the case may be and there after the family pension shall be resumed in favour of the son or daughter suffering from disorder or disability of mind or who is physically crippled or disabled and shall be payable to him/her for life,
- (ii) If there are more than one such son or daughter suffering from disorder or disability of mind or who are physically crippled or disabled, the family pension shall be paid in the following order namely:-
  - (a) Firstly, to the son, and if there are more than one son, the younger of them will get the family pension only after the life time of the elder,
  - (b) Secondly, to the daughter, and if there are more than one daughter, the younger of them will get the family pension only after the life time of the elder,
- (iii) The family pension shall be paid to such son or daughter through the guardian as if he or she were a minor,
- (iv) before allowing the family pension for life to any such son or daughter, the sanctioning authority shall satisfy that the handicap is of such a nature as to prevent him or her from earning his or her livelihood and the same shall be evidenced by a certificate obtained from a medical officer not below the rank of a Civil Surgeon setting out, as far as possible, the exact mental or physical condition of the child.
- (v) the person receiving the family pension as guardian of such son or daughter shall produce every three years a certificate from a medical officer not below the rank of a Civil Surgeon to the effect that he or she continues to suffer from disorder or disability of mind or continues to be physically crippled or disabled.]

Note: (1) Where an officer is survived by more than one widow, the pension will be paid to them in equal shares. On the death of a widow her share of the pension will become payable to her eligible minor child. If at the time of her death a widow leaves no eligible minor child, the payment of their share of the pension will cease.

Note: (2) Where an officer is survived by a widow but has left behind an eligible minor child from another wife, the eligible minor child will be paid the share of the pension which the mother would have received if she had been alive at the time of the death of the officer.

- 1(vi) (a) Except as provided in notes (1) and (2) below sub-para (v), the family pension shall not be payable to more than one member of the family at the same time.
- (b) If a deceased employee or pensioner leaves behind a widow or widower, the family pension shall become payable to the widow or widower, failing which to the eligible child.
- (c) If sons and unmarried daughters are alive, unmarried daughters shall not be eligible for family pension unless the sons attain the age of 21 years w.e.f. 9<sup>th</sup> March 1978 and thereby become ineligible for the grant of family pension.]
- (vii) In the event of re-marriage or death of the widow/widower the pension will be granted to the minor children through their natural guardian. In disputed cases, however, payments will be made through a legal guardian.
- (viii) Every employee eligible to the benefit of the above scheme will be required to surrender a portion of gratuity where admissible equal to two months' emoluments or 'pay' as the case may be subject to a maximum of Rs.3,600\* (However, in respect of employees who retired from service on or after 1<sup>st</sup> January, 1973 or who may retire from service thereafter or died, while in service on or after the aforesaid date or in the event of their death in service thereafter the maximum limit of gratuity required to be surrendered shall be Rs.5,000 (instead of Rs.3,600). Where an employee governed by this scheme retires, as a bachelor who has not adopted any child, no deduction from his gratuity will be made. In case where the gratuity admissible is less than two months' pay, the same will be resumed by University against the family pension benefit admissible under the scheme.

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1. As substituted vide UGC letter No.F.8-4/74 (D-5c) dated the 18<sup>th</sup> April, 1976.  
\* Added vide UGC letter No.F.8-6/74(D-5c) dated the 30<sup>th</sup> April, 1976

**\*\* With effect from the 22<sup>nd</sup> Sept. 1977, no deduction should be made from Death-cum retirement gratuity as a Contribution towards the family pension.**

**Note:** In the case of employees retiring without wife/husband or minor children including the adopted children the deduction of two months' pay/emoluments from the gratuity will not be made as in the case of bachelor.

(vii) Under the scheme the following benefits will be awarded:-

Pay of the employee	Monthly pension of widow/widower/ children
1. Rs.800 and above	12% of pay subject to a maximum
2. Rs. 200 and above but below Rs.800	15% of pay subject to a maximum of Rs.96 & a minimum of Rs.60 of Rs.150
3. Below Rs.200	30% of pay subject to a minimum of Rs.25.

1[Note:1. In case an employee dies on or after the 28<sup>th</sup> February, 1970 and his family is eligible for pension under this scheme and the amount of family pension including ad-hoc increase in accordance with the rules/orders in force at the time of his death, is less than Rs.40 p.m. the same shall be raised to Rs.40 p.m. (inclusive of ad-hoc increase where applicable) with effect from 1.3.1970.

**\*\* GIMF OM No.F.1(14)-EV (B)/76 dt. The 22<sup>nd</sup> September, 1977.**

1 Inserted vide UGC letter No.F.26-19/77(D-5c) dated the 21<sup>st</sup> September, 1977.

Note:2. In case of recipients of family pension under this scheme, if the amount of pension including ad-hoc increase or temporary increase or both which the beneficiary may be in receipt on 1.3.1970 is less than Rs.40 p.m., the same shall be raised to Rs.40 p.m. (inclusive of ad-hoc or temporary increase as the case may be where applicable) with effect from 1.3.1970).

(B) For those who are in service on or after 1<sup>st</sup> January, 1966 the following additional provision will apply:

- (i) If the employee has put in 7 years of service or more prior to his death, for a period of 7 years from the date of death or till the date on which the officer would have reached the normal age of superannuation had he remained alive, whichever period is shorter, the pension payable under the aforesaid orders will be at 50% of 2\*\*\*\* pay last drawn subject to a maximum of twice the pension admissible under (ii) below.
- (ii) if the employee has not put in 7 years of service prior to death or after 7 years of payment as in (i) above, the rate of the family pension will be as under:

Pay of employee	Monthly pension of widow widower/children
1. Rs. 800 and above	12% of pay subject to a maximum of Rs. 150.
2. Rs. 200 and above but below Rs.800	15% of pay subject to a maximum of Rs. 96 and minimum of Rs. 60
3. Below Rs. 200	30% of pay subject to a minimum of Rs. 25.

Note : 1.\* 'Pay for this purpose means the pay which the employee was drawing on the date of his death while in service of immediately before his retirement. If on the date of his death, while in service, or immediately before his retirement, an employee has been absent from his duty on leave (including extraordinary leave). Or suspension 'pay' means the pay which he draw immediately before proceeding on such leave or suspension.

2 The word "the basic" omitted vide UGC letter No.F.8-11/72(CU-1) dated the 31<sup>st</sup> October, 1973.

\* Numbered as I vide UGC letter No.F.26-19/77(D-5c) dated the 21<sup>st</sup> September, 1977.

**Note:2** In case of recipients of family pension under this scheme, if the amount of pension including ad-hoc increase or temporary increase or both which the beneficiary may be in receipt on 1.3.1970 is less than Rs.40 p.m., the same shall be raised to Rs.40 p.m. (inclusive of Ad-hoc or temporary increase as the case may be where applicable) with effect from 1.3.1970).

**Note:3** In case of recipient of family pension under this scheme, if the amount of pension including ad-hoc increase or temporary increase or both which the beneficiary may be in receipt on 1.3.1970 is less than Rs.40 p.m., the same shall be raised to Rs.40 p.m. (inclusive of ad-hoc or temporary increase as the case may be where applicable) with effect from 1.3.1970.

2[(C) For the employees who died while in service on or after the 1<sup>st</sup> January, 1973 or in the event of their death after retirement on or after 1<sup>st</sup> January, 1973 and were receipt of compensation, invalid, retiring and superannuation pension on the date of death the rates of the Contributory Family Pension shall be revised as follows:-

<i>Pay of the employee</i>	<i>Amount of monthly family pension</i>
(a) Below Rs.400	30% of pay subject to a minimum of Rs.60 and a maximum of Rs.100
(b) Rs.400 and above but below Rs.1,200.	15% of pay subject to a minimum of Rs.100 and a maximum of Rs.160
(c) Rs.200 and above	12% of pay subject to a minimum of Rs.160 and a maximum of Rs.250

The amount of the contributory family pension at enhanced rates as determined under clause (B) (i) above shall be payable:-

(a) In the event of the death of an employee while in service for a period of seven years or up to the date on which he would attain the age of 65 years had he survived, whichever period is less.

1. Added vide U.G.C. letter No.F.26-19/77 (D-5c) dated the 21<sup>st</sup> September, 1977.

2. [inserted vide U.G.C. letter No.F.8-6/74 (D-5c) dated the 30<sup>th</sup> April, 1976.

- (b) In the event of the death after retirement the family pension at enhanced rates shall be payable up to the date on which the employee would have attained the age of 65 years had he survived, or for seven years whichever period is less, but in no case the amount of family pension shall exceed the pension sanctioned to the employee at the time of retirement. However, in cases where the amount of family pension admissible as per this Clause (c) exceeds the pension sanctioned at the time of the retirement, the amount of family pension sanctioned under this sub-clause shall not be less than that amount. The pension sanctioned at the time of retirement shall be the pension inclusive of any portion which may have been commuted before death.]
- (25) All employees entitled to the benefit of Family Pension shall be required to furnish details of their 'family' as defined in sub-para (ii) of para 24(A) above i.e. the date of birth of each member with his/her relationship with the employee. This statement shall be countersigned by the Registrar and pasted in the service record of the employee. The employee will thereafter be required to keep the statement upto date. Additions and alterations in this statement will be made by the Registrar from time to time on receipt of information. From the employee concerned.
- (26) In cases where death occurs while in service the Registrar on receiving information of death of an employee while in service shall send a letter as prescribed in Form IX to the family of the deceased and ask for necessary documents mentioned therein. On receiving documents the Registrar shall take necessary action to sanction the pension to the eligible member of the family.

## SECTION V

### EXTRA ORDINARY PENSION AND GRATUITY

- (27) Extraordinary pension and gratuity may be sanctioned by the Executive Council of the University on the advice of an ad-hoc committee when an employee sustains injury or dies as a result of an injury or is killed. In making the award the Executive Council will take into consideration the degree of the fault or contributory negligence on the part of an employee who sustains injury or dies as a result of an injury or is killed.

The said ad-hoc committee shall consist of five members, four appointed by the Executive Council from amongst themselves and fifth member will be the representative from the Ministry of Finance, Government of India.

(28) For the purpose of these rules, injury shall be classified as follows:

**Class A:** Injuries caused as a result of special risk of office which have resulted in the permanent loss of an eye or a limb or are of a more serious nature.

**Class B:** Injuries caused as a result of special risk of office and equivalent in respect of the degree of disablement which they cause to the loss of a limb or are very severe; or injuries, caused as a result of risk of office which have resulted in the permanent loss of an eye or a limb, or are of a more serious nature.

**Class C:** Injuries caused as a result of special risk of office which are severe, but not very severe, and likely to be permanent or injuries caused as a result of risk of office which are equivalent, in respect of the degree of disablement which they caused, to the loss of a limb or which are very severe or severe and likely to be permanent.

(29) If an employee sustains an injury which falls within Class 'A' he shall be awarded:

(a) a gratuity of the applicable amount specified in Schedule 'D' and

(b) with effect from the date following the expiry of one from the date of the injury.

(i) if the injury has resulted in the permanent loss of more than one limb or one eye, a permanent pension of the applicable amount specified in Schedule 'D' for a higher scale pension; and

(ii) in other cases, a permanent pension the amount of which shall not exceed the applicable amount specified in Schedule 'D' for a higher scale pension and shall not be less than half that amount.

(30) If an employee sustains an injury which falls within Class 'B' he shall be awarded:

(a) If the injury has resulted in the permanent loss of an eye or a limb or is of more serious nature, a permanent pension, with effect from the date of the injury, of an amount which shall not exceed the applicable amount specified in Schedule 'D' for a lower scale pension and shall not be less than half that amount:

(b) in other cases-

(i) for a period of one year with effect from the date of the injury a temporary pension the amount of which shall not exceed the applicable amount specified in Schedule 'D' for a lower scale pension and shall not be less than half that amount, and thereafter,

(ii) a pension within the limit specified in sub-clause (i) if the Consulting Medical Officer of the University from year to year certifies that the injury continues to be very severe.

(31) If an employee sustains an injury which falls within Class 'C' he shall be awarded a gratuity of the applicable amount specified in Schedule 'D' if the Consulting Medical Officer of the University certifies that the employee is likely to be unfit for service for a year, or a proportionate amount subject to a minimum of one-fourth, the amount so specified if he is certified to be likely to be unfit for less than a year.

31.1 Provided that in cases where the injury is equivalent in respect of the degree of disablement which it causes to the loss of a limb, the Executive Council may award if it thinks fit, in lieu of the gratuity a pension not exceeding the amount admissible under clause (b) of Rule 30.

(32) A temporary pension awarded under this section may be converted into a permanent injury pension-

(a) when the employee is rendered invalid out of service on account of the injury in respect of which the temporary pension was awarded, or

(b) when the temporary pension has been drawn for not less than five years, or

(c) at any time if the consulting Medical Officer certifies that he sees no reason to believe that there will ever be a perceptible decrease in the degree of disablement.

(33) The award shall be made to the widow and children of an employee as follows:

- (a) if the employee is killed or dies of injury received as a result of 'special risk' of office-
  - (i) a gratuity of the applicable amount specified in Schedule 'E' and
  - (ii) a pension the amount of which shall not exceed the applicable amount specified in Schedule 'E'.
- (b) if the member of the staff is killed or dies of injuries received as a result of 'risk of office', a pension the amount of which shall not exceed the applicable amount specified in Schedule 'E'.

Note: The rates in Schedule 'E' are subject to the condition that the pension payable to a child/children will in no case be less than the amount of pension which would have been admissible to him/them had the provisions of the family pension been applied (Section IV)

33.1 Provided that if the pay of the deceased member of the staff was less than Rs.200, the monthly pension or the sum of pension that may be granted under this section, shall not, irrespective the rates (including the minimum limits) specified in Schedule 'E' exceed the limit of one-half of his pay, and if in any case the sum of such pensions calculated under Schedule 'E' exceeds the limit of one-half of his pay, such a pro-rata reduction shall be made in the amount of each individual pension as will reduce the sum to such limit.

33.2 \* Provided further that for a period of 7 years from the date of death or till the date on which the employee would have reached the normal age of superannuation had he remained alive, whichever period is shorter the pension payable will be at 50% of the basic pay last drawn subject to a maximum of twice the pension admissible under Rule 24 (Section IV), if the employee has rendered continuous service for not less than 7 years.

Note: This provision is not applicable to those employees who retired before 1.1.1996.

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\* Introduced vide Circular of Ministry of Finance O.M.No.F.9(24)-Ex(A)/65 dated 5.1.1966.

(34) If the deceased member of the staff has left neither a widow nor a child, an award may be made to his father and his mother individually or jointly and in the absence of the father and the mother to minor brothers and sisters, individually or collectively, if they were largely dependent on the employee for support and are in pecuniary need.

34.1 Provided that the total amount of the awards shall not exceed one-half of the pension that would have been admissible to the widow under the preceding rule.

34.2 Provided further that each minor brother's or sister's share shall not exceed the amount of pension specified in Schedule 'E' for a child who is not motherless.

(35) Any award made under Rule 34 will, in the event of an improvement in the pecuniary circumstances of the pensioner, be subject to review in such manner as the Executive Council may by order prescribe.

(36) An extraordinary family pension will take effect from the day following the death of the employee or from such other date as the Executive Council may decide.

(37) An Extraordinary family pension will ordinarily be tenable-

(a) in the case of a widow or mother until death or re-marriage whichever occurs earlier;

(b) in the case of a minor son, or minor brother, until the age of 18;

(c) in the case of an unmarried daughter or minor sister, until marriage or until she attains the age of 21, whichever occurs earlier;

(38) \*The family of the employee dying as a result of 'risk of office' or 'special risk of office' who are paid pension etc. under Rule 33 will not be entitled to the family pension under Section IV.

(39) When a claim for any injury pension or gratuity or family pension arises under any of the rules in this Section, the officer-in-charge of the office or the department or section in which the injured, or the deceased, was employed will forward the claim to the Executive Council through the Registrar with the following documents:

- Opening paragraph of Government of India, Ministry of Finance (Department of Expenditure), O.M.No.F.19(3)-EV(A)/65 dated 9.9.1965.

6: 6: 2 (60)

(a) a full statement of circumstances in which the injury was received, the disease was contracted or the death occurred;

(b) the application for injury or gratuity in Form X or as the case may be, the application for family pension in Form XI, in the Annexure;

(c) in the case of an injured member of the staff or one who has contracted a disease, a medical report in Form XII in the Annexure. In the case of deceased member of the staff, a medical report as to the death or reliable evidence as to the actual occurrence of the death if the member of the staff lost his life in such circumstances that a medical report cannot be secured.

**\*Appendix 'B'**

**CONTRIBUTORY PROVIDENT FUND-CUM-GRATUITY  
SCHEME**

1. The employees who opt for the Contributory Provident Fund-cum-Gratuity scheme will be subject to the rules as contained in Part II of the Central Universities Retirement Benefit Rules, 1967.
2. Gratuity admissible under the scheme will, however, be at the same rate and on the same conditions as laid down in Appendix 'A', Section II of the Central Universities Retirement Benefit Rules, 1967.

**CENTRAL UNIVERSITIES RETIREMENT BENEFIT  
RULES, 1967**

**Part II**

**CONTAINING CONTRIBUTORY PROVIDENT FUND  
RULES**

**1. Application of Rules**

These rules shall apply to all the employees of the Central Universities including Indian Institute of Science, Bangalore, both academic and non-academic except the following:

- (a) Persons appointed against purely temporary vacancies, part-time servants and daily wages staff who are not entitled to the benefit of the fund under their conditions of service.
- (b) Employees of the Central government or any State Government who may be serving with the University.

- 
- Appendix 'B' substituted as above vide U.G.C. letter No.F.50-22/67(CU-I/D-5c) dated the 5<sup>th</sup> December, 1977. Prior to this, the Appendix 'B' was as under:-

**APPENDIX 'B'**

**CONTRIBUTORY FUND-CUM-GRATUITY SCHEME  
SECTION I**

**Contributory Provident Fund**

1. the employees will remain subject to the Contributory Provident Fund Rules provided in the statute ordinance etc. of the university concerned modified as below with regard to the rate of contribution:

- (i) The university's contribution to the fund shall be restricted to 8% of the employee's pay; and

FA.4/GPF-Statute/02-03

3.11.03

To

ANNEXURE-D

Prof S N Rai  
Director,  
Computer Centre,  
NEHU

Sub:- Proposed draft Statute on Provident Fund and Pension Scheme.

Sir,

With reference to your letter on the subject stated above addressed to the Vice-Chancellor I am to inform you that the draft North Eastern Hill University Statute on General Provident Funds has been approved by the 116th Executive Council held on 21.8.03. However your proposal was studied in detail and it is found that all the points in your proposed draft has been included in the draft statute.

Section 33 of the NEHU Act states that "University shall constitute for the benefit of its employees such pension or provident fund....." Hence pension and provident fund has been dealt with separately. However as per GOI norms GPF subscribers are entitled to pensionary benefits unlike CPF holder hence even this aspect is covered by our statute because as per the draft statute the University shall follow GOI rules on GPF.

Clause 7 of your draft statute deals with non attachment of GPF money towards any recovery of the University. The same has been covered under Clause (e) of the draft statute as approved by the EC under the wordings "The terms of eligibility,..... final payment, procedure on death of a subscriber.... shall be as laid down by the GOI under GPF Rules and shall be subject to changes as may be laid down by the Government of India from time to time under the GPF Rules". The GOI rules on GPF bars any attachment of GPF balance towards any recovery to be made from subscribers.

Yours faithfully,

Sd/-

Finance Officer.

COMPUTER CENTRE  
NORTH-EASTERN HILL UNIVERSITY  
BLJNI COMPLEX SHILLONG-793003

Ref No: 3941

5<sup>th</sup> November '03

To  
The Finance Officer,  
NEHU, Shillong.

Subject :- Proposed draft Statute on Provident Fund and Pension Scheme

Ref :- Your letter No: FA.4/GPF-Statute/02-03 dated 3.11.03

Sir,

With reference to your letter on the subject stated above, I have to submit the following points for your kind perusal.

1. All the points in my proposed draft submitted to the Vice-Chancellor has not been included in the draft statute in General Provident Fund referred by you in your letter.
2. Whereas Section 33 of the NEHU Act states that "the University shall constitute for benefit of its employees such pension or provident fund. ..." Section 24(f) of the NEHU Act states that statutes may provide for "the conditions of service of employees including provision for pension, insurance and provident funds. ... This is the reason that the title of my proposed draft reads "Statute on Provident Fund and Pension Scheme" and not as the "Statute on General Provident Fund" in which no explicit mention of pension or retirement benefits has been made.
3. You have mentioned in your letter that since the draft statute shall follow Govt. of India rules on GPF subscribers are entitled to pensionary benefits and also that the nonattachment of GPF money towards any recovery of the University (Clause 7 of my proposed draft) has been taken care of by Govt. of India rules. However, I am still of the view that the relevant Govt. of India rules must be suitably adapted and explicitly incorporated in our own NEHU statutes as stipulated by the Section 24(f) and Section 33 of the NEHU Act. NEHU Statute 13(2) states that no action shall be taken by the Executive Council in respect of service conditions of teachers and other academic staff of the University Council.

In the light of the above mentioned points, I hope that you will agree with me that the proposed draft, on the subject stated above, submitted by me to the Vice-Chancellor alongwith the draft statute on GPF and our views must be placed before the Academic Council for discussion and necessary recommendations.

Yours faithfully,

Sd/-

(S N Rai)

Director

Copy to the PS to the V.C. for kind information.

S N Rai.

6:6:2(64)

DEPARTMENT OF SOCIOLOGY  
NORTH-EASTERN HILL UNIVERSITY  
SHILLONG:-22

ANNEXURE-F

Prof M N Karna  
Member,  
Executive Council

3 November '03.

To  
The Chairman,  
Executive Council,  
NEHU, Shillong.

Subject :- Comment on the Minutes of the 116th meeting of the  
Executive Council.

Sir,

The recording of item EC:116:2003:5:1(x) Draft Statute on GPF is not appropriately presented. Since it involves amendment of the Statutes we decided that we could look into it in some details before it is sent to the Ministry for approval. As in the same meeting we decided to constitute a Committee to look into Amendment of Act and Statutes(vide resolution.EC:116:2003:5:1(viii))this issue could also be examined by it.

It is requested that necessary correction may kindly be done in the minutes.

Yours faithfully,

Sd/-

(M N Karna)

Copy to the F.O. for information.

NORTH-EASTERN HILL UNIVERSITY  
SHILLONG-22

6:6:2(65)

No: E.45/INT-AUDIT/PENSION-STATUTE/2003-04/513 Dated 28.11.03

To

The Deputy Registrar(Cof)  
NEHU, Shillong.

Subject :- 'AGENDA' for pension STATUTE.

Sir,

I am to request you to refer to your U.O. No:AC 70/2/ Conf/03/313 dated 24.11.03 endorsed to Deputy Registrar(Finance) on the subject noted above and to enclose the AGENDA for proposed NEHU Statute on the Provisions relating to pension scheme to be placed in the forthcoming A.C. meeting to be held on 8 & 9th December'03.

This has the approval of the Finance Officer.

Yours faithfully,

Sd/-

( B K Seh)

Audit Officer.

Encl: As stated above.

SG

NORTH EASTERN HILL UNIVERSITY STATUTE ON THE PROVISIONS  
RELATING TO PENSION AND GRATUITY INCLUDING COMMUTATION OF  
PENSION FAMILY PENSION AND OTHER PENSINNARY BENEFITS .

1. TITLE : NORTH EASTERN HILL UNIVERSITY STATUTE ON PENSION RULES, 03
2. AUTHORITY:- Section 33 of the North-Eastern Hill University act,1973.
3. JURISDICTION:- All regular employees of NEHU both teaching Non-teaching and also who holds a lien to a post maintained by the provisions of this statute.
4. Date of implementation:- It shall come into force on such date as the highest body of the NEHU notifies the same.
5. Provisions of the Statute:- Provisions of the CCS Pension Rules, 1972 and as amended from time to time.

iii) Request for recognition as teacher, case of Dr. S.N. Rai,  
Director, Computer Center.

In the year 1990 the University Grants Commission issued the directive containing the guidelines in respect of staffing pattern and their scale of pay and qualification for the Computer Center of the Universities. The said guidelines were sent to the University for Information and adoption.

Keeping in view the staffing pattern as laid down in the guidelines and its applicability, the University adopted the staffing pattern given under level 'C'. Under Level 'C' among other positions, a post of Director is also sanctioned.

Subsequently, the University had advertised the post of Director in Computer Center, on 10<sup>th</sup> April, 1992, with the following qualification:-

Director (a) Ph.D. with 1<sup>st</sup> class degree at Bachelor's or Master's level. in Engineering/Technology/Science.

(b) 10 years experience in teaching/industry/research out of which 5 years must be at the level of Asstt. Professor or equivalent.

Candidate from industry/Professor with recognized Professional work of high standard recognized at National/International level equivalent to Doctorate would also be eligible. Requirement of Ph.D. could be relaxed in view of long experience in Computing in the next lower grade. Experience should be after the Academic qualification required.

Dr. S.N.Rai the then Reader in Chemistry NEHU had applied for the post of Director against the advertisement. On the recommendation of Selection Committee and on the approval of the Executive Council thereto, Dr. S.N Rai was appointed as Director, Computer Center in the pre-revised scale of Ra. 4500-150-5700-200-7300/(revised scale Ra. 16400-450-20900-500-22400/-) w.e.f. 19.8.93. On completion of probation period Dr. S.N Rai was confirmed against the post of Director w.e.f. 19.8.93 and lien held by him in the post of Reader in Chemistry was terminated accordingly.

Contd - 2/-

Now, Dr. S.N Rai under the provision of Statute-23 requested the University to consider and recognize him as teacher of the University. The letter of request received from Dr. S.N. Rai is placed below at (Annexure-A)..

The provision as laid down under Clause-7 of statute-23 underscores the following:

**"The Executive Council may recognize the non-vocation academic staff as teachers provided that such staff possesses the qualification comparable to those prescribed for the corresponding grades of teaching staff".**

Beside Computer Center there are also non-vocational centers such as USIC and RSIC.

In 1990, the UGC had issued guidelines for establishment of USIC in the University and as per guidelines provided by the UGC, the overall objective of the USIC shall be as follows:

1. To encourage the University to establish and develop USIC with a view to strengthen the technology infrastructure with collaborative efforts of the academic community of the University.
2. To undertake programs with a view to nurture and spread the culture of instrumentation in the higher educational system.
3. To maximize use of experience equipments in University through training and suitable pooling mechanism.

In view of varied needs of the Universities, the USIC are envisaged into three different levels, i.e. Level- I, Level- II and Level-III.

The guidelines under scores that USICs shall be non-vocation academic Departments and shall have the requisite functional autonomy for their day to day functioning.

Considering the need of the University, NEHU, has adopted staffing pattern and other associate conditions under Level -II. The teaching staff/technical officers provided under the said level are as follows:-

Sl.No.	Cadre.	No. of post,
1.	Professor/Technical Officer (III)	1
2.	Reader/Technical Officer (II)	1
3.	Lecturer/Technical Officer (I)	3

At present we have a Professor in USIC assisted by technicians.

The guidelines also provides the re designation of staff and rationalization of pay scales to that of teaching staff provided the staff of USIC shall have the (i) qualification similar to those of the University teachers as per UGC norms.(ii)The incumbent has teaching load in his/her or other Departments and participate in other academic activities of the Department related to instrumentation,(iii) he/she has been selected by appropriate Selection Committee of the University for University teachers,(iv) he/she gives in writing concurrence to fulfill all the duties including services that are assigned to him/her by the Head of the Centre.

However, those who do not satisfy the above conditions or do not desire academic designation will be appropriately re-designated in the cadre of technical officers:

On the other hand the RSIC has been established with the objective to provide:

1. Facilities to scientists in the region to carry out measurement for the purpose of Research.
2. To organize short term course/workshop on the use and applications of various instruments for research students and teachers.
3. To train technicians for maintenance and operation of sophisticated instruments.

Setting up of RSIC in University was through Department of Science and Technology, New Delhi and subsequently through MOU the staff of RSIC are treated as employees of NEHU and they are governed by the Rules and Regulations of NEHU.

Under RSIC, among other category of staffs it has a professor in-charge, Sr. Scientific Officer and Scientific Officers in the equivalent grade of Professor, Reader and Lecturer respectively and if the redesignation in the cadre of teaching staff is extended to the aforesaid designated officer of RSIC, perhaps they may have to adhere to the norms of UGC as prescribed for USIC.

The matter is placed before the council for deliberation and decision.

6:6:3(5)

ANNEXURE-A

NORTH-EASTERN HILL UNIVERSITY  
BIJINI COMPLEX, SHILJONG-793003.

Ref.No. 3894

Dated 7<sup>th</sup> July, 2003.

To,

The Vice-chancellor,  
North-Eastern Hill University,  
Shillong-793022.

Sub: Request for recognition as Teacher.

Sir,

Under the provision of the Statute 23 of the North-Eastern Hill University (a copy enclosed herewith),

"The Executive Council may recognize the non-vocation academic staff as teachers provided that such staff possess the qualifications comparable to those prescribed for the corresponding grades of teaching staff."

The Computer Center of the North-Eastern Hill University was established with the financial assistance received from the University Grants Commission, New Delhi and one of the terms and conditions was that the Computer Center will be on Non-Vocational Department of the University. The Center has been actively associated with various academic programs of the University. The Center conducted a University level courses for M.Phil/Ph.D degree student. The course was approved by the Academic Council of the University. The Center is also associated with teaching computer courses to P.G students of some departments of the University as per their curriculum as and when asked for. The Center conducts various short term courses from time to time and is in the process of starting a Certificate course approved by the academic Council of the University. In addition to these activities, the staff of the Center is also involved in various examination works, i.e. paper setting, moderation, evaluation, etc. Also, the Center is conducting DCO, CIC, BCA, and MCA courses of Indira Gandhi National Open University and generates resources for the University. Few members of the staff of the Computer Center are active in their research pursuit and have collaborations with scientist from other academic institutions in India and abroad and have to visit those institutions from time to time for exchange of ideas and making use of facilities available there.

In the light of the facts submitted in the preceding paragraph, I strongly believe that if those staff members of the Computer Center, who may fulfill the requirements of the Statute 23; are recognized as teachers, will be enabled to contribute more significantly towards the academic excellence of the University.

In furtherance to my request, please allow me to submit my case for recognition as a Professor of Chemical Physics while working as the Director of Computer Center. For your kind perusal, I enclosed herewith a copy of my Curriculum Vitae, Research Profile, List of Publications alongwith other details pertaining to my academic achievements. Also, I submit a set of 25 reprints of research papers presenting and

Contd: 2/-

-2-  
6:6:3(6)

overview of my research accomplishments. I shall be glad to provide any further information which you might wish to have.

I shall be grateful for your kind and sympathetic consideration of my case for the recognition as requested by me.

Thanking you,

Sincerely Yours,

Sd/-

(S.N. Rai),

Director,

Computer Center,

NEHU, Shillong-793003.

Enclo a a

**5:2:6(1)**

**(vi) Revised MA/M.Sc. Syllabus in Anthropology.**

**The revised syllabus of MA/M.Sc. in Anthropology as submitted by the Head, Department of Anthropology is placed at Annexure 'A'.**

**The matter is placed before the Council for consideration.**

## REVISED MA/MSc SYLLABUS IN ANTHROPOLOGY 2003

Semester	Course No	Course Title	Total Marks
I	Anth 101	Palaeo-Anthropology	100
	Anth 102	Archaeological Anthropology	100
	Anth 103	Physical Anthropology	100
	Anth 104	Social and Cultural Anthropology	100
II	Anth 201	Human Origin & Evolution	100
	Anth 202	Asian Prehistoric Archaeology	100
	Anth 203	Human Ecology & Adaptation	100
	Anth 204	Language, Culture and Society	100
	Anth 205	Theories & Methods	100
III	Anth 301	Anthropology of India	100
	Anth 302	Economy and Culture	100
	Anth 303	Culture, Health and Medicine	100
	Anth 304	Demography & Biostatistics	100
	Anth 305	Fieldwork Methods & Techniques	100
	Anth 306	Human Genetics	100
	Anth 307	Human Growth and Body Composition	100
	Anth 308	Practical in Physical Anthropology - I	100
IV	Anth 401	Anthropology of Northeast India	100
	Anth 402	Dissertation & Viva Voce*	100
	Anth 403	Development Anthropology	100
	Anth 404	Optional	100
	Anth 405	Practical in Physical Anthropology - II	100
	Anth 406	Optional	100

## Optional Papers (Cultural Stream)

1. Environmental Archaeology
2. Anthropology of Gender
3. Anthropology of Work, Leisure and Sports
4. Anthropology of Communication

## Optional Papers (Physical Stream)

1. Human Population Biology
2. Bio-Social Anthropology
3. Dental Anthropology
4. Forensic Anthropology

Note. Anth 304 to 305 and Anth 401 to 402 are compulsory for students of both the streams. Anth 301 to 303 and Anth 403 to 404 are open to Cultural Stream students only, and Anth 306 to 308 and Anth 405 to 406 are open to Physical Stream students only.

\* Theoretical and methodological preparation for this paper begins in the IIIrd Semester, with Anth. 305. Supervisors for this paper are allotted in the beginning of the IIIrd Semester, and the students leave for fieldwork training soon after the IIIrd Semester examination. They write their dissertations during the IVth Semester period and the same are submitted before the IVth Semester examination starts for evaluation by external examiners.

Distribution of Marks: End-Semester = 75, Sessional = 25, Theory = 60, Practical = 40.

## PREFACE

Anthropology as an integrated discipline for understanding the humankind is threatened today from both within and without. Internally, the various sub-disciplines not only use different tools and techniques of research but even use different concepts, which make the task of integration rather tedious, although many hybrid fields like Medical Anthropology, Ecological Anthropology, and Demographic Anthropology are emerging that naturally integrate the discipline. Externally, the threat comes from various corners due largely to the discipline's not so smooth adaptation to the changing social, economic, and political situations in India over the past half a century or so. There is still a lot of confusion about what is and should be the true identity of this discipline.

The proposed revision of the MA/MSc syllabus in anthropology seeks to make the students aware of the discipline's weaknesses as well as strengths, to familiarize them with the latest developments in the discipline without losing sight of its roots, and to train them for a typical anthropological career as well as a more general career as social scientists. The syllabus is updated content wise as well as reading list wise. It largely takes into consideration the UGC model curriculum 2001, the NET syllabus, the UPSC syllabus, and the MPSC syllabus in anthropology. It also takes into consideration the educational and cultural backgrounds of majority of students joining the department here.

This syllabus was last revised in 1998. In the proposed revision, the total number of papers has been increased from 16 to 18 to create work for the increased faculty strength during the interim period. We have also proposed two interface papers in the IIIrd and one in the IVth semesters, keeping in mind the need to have a more holistic view of the human being. Further, we have tried to give more space than in the previous syllabus to Prehistoric Anthropology, as we now have a colleague who is well trained in this branch of Anthropology. Finally, we have brought the Northeast region more in focus to make the students of the region feel linked with the discipline as well as to make it more contextual. On other details, we have taken into consideration the various suggestions for improvement made by the members of the School Board that met on June 5, 2003, where an earlier version of the proposed syllabus was presented but withdrawn to get more input from anthropologists in India and abroad.

T. B. Subba, Professor & Head  
Department of Anthropology

### Anth 101. Palaeoanthropology [Total Marks=100, Sessional=25, End-Term=75]

1. Definition and scope of palaeoanthropology, its relationship to other disciplines, processes of fossilization, preservation and uses of fossils, introduction to geological time scale.
2. Hominid evolution - Characteristics and phylogenetic position of *Ramapithecus*, *Australopithecines*, *Homo habilis*, *Homo erectus* and Neanderthals,

5:2:6(4)

3. Emergence of modern man - Anatomical features and geographical distribution of Cro-Magnon, Grimaldi, Chancelade, Brun, Offnet and Premost.
4. Palaeo-demography and palaeo-pathology - skeletal analysis, determining demographic variables, morphological and metric variables for determining migration and fertility, mortality and morbidity in prehistoric population, post-Neolithic population growth.

*Suggested Reading:*

- Aufderheide, A.C. and C. Rodriguez-Martin. 1998. *The Cambridge Encyclopaedia of Human Paleopathology*. Cambridge: Cambridge University Press.
- Brace, C.L. 1995. *The Stages of Human Evolution*. New Jersey: John Wiley & Sons.
- Buettner-Janusch, J. 1966. *Origins of Man*. New York: John Wiley.
- Das, B.M. 1997. *Outline of Physical Anthropology*. Allahabad: Kitab Mahal.
- Day, M.H. 1986. *Guide to Fossil Man*. Chicago: University Press.
- Harrison, G. A. *et al.* 1988 *Human Biology*. Oxford: Oxford University Press.
- Hoppa, R. D. and J. W. Vaupel. 2000. *Paleodemography*. Cambridge: Cambridge University Press.
- Leakey, R.E. 1981. *The Making of Mankind*. London: Michael Joseph.
- Lewin, R. 1984. *Human Evolution*. New York: Freeman.
- Lewin R. and R. Foley. 2003. *Principles of Human Evolution*. Oxford: Blackwell Publishing.
- Montagu, M.F.A. 1961. *An Introduction to Physical Anthropology*. Illinois: Charles C. Thomas.
- Poirier, F.E. 1993. *Understanding Human Evolution*. New Jersey: Prentice Hall.
- Shukla, B.R.K. and S. Ratogi. 1998. *Physical Anthropology and Human Genetics*. Delhi: Palaka Prakashan.
- Swedlund, A.C. and G. T. Armelagos. 1976. *Demographic Anthropology*. Dubuque: Wm.C.Brown Co.
- Walter, H. 2002. *The Primate Fossil Record*. Cambridge: Cambridge University Press.
- Wolpoff, M.H. 1980. *Paleoanthropology*. New York: Knopf.

5:2:6(5)

**Anth 102. Archaeological Anthropology**  
[Total Marks=100, Sessional=25, End-Term=75]

Theory = 60 (Sessional 15, End Semester 45 Marks)

1. Scope and aims of Prehistoric Archaeology: historical development; major branches, tools and techniques of archaeology, interpretation of archaeological materials; salvage archaeology, ethno-archaeology, experimental archaeology.
2. Methods: dating methods: stratigraphy, seriation, dating by association, absolute dating, C14, Argon and TL techniques, Thomsen's model; palaeo-ecology, zonal concepts: glacial, periglacial & tropical geomorphology.
3. Prehistoric technology: basic minerals and rock types; behaviour of raw materials, stone tool making techniques; artefact typology: identification and function of stone tools; stone age industries; tool types: type fossil, morphological, functional, temporal, and cognitive types.

5:2:6(6)

Practical = 40 (Sessional 10, End Semester 30 Marks)

4. Laboratory study of stone and bone tools. Identification and classification of stone tools; identification of rocks and minerals used for making prehistoric tools; typo-technological study with necessary representative drawings of prehistoric stone and bone tools; chronological, cultural and functional analysis of tools.

*Suggested Reading:*

- Agarwal, D.P. 1984. The Archaeology of India. New Delhi: Select Book Syndicate.
- Bahn, P.G. 1999. Cambridge Illustrated History of Archeology. Cambridge: Univ. Press.
- Bhattacharya, D.K. 1989. An Outline of Indian Prehistory. New Delhi: Popular Prakashan.
- David, Nicholas and Carol Kramer. 2001. Ethnoarchaeology in Action. Cambridge: Univ. Press.
- Fagan, B.M. 1988. In the Beginning. Illinois: Scott Foresman & Co.
- Hodges, H. 1971. Artefacts: An Introduction to Early Materials and Technology. London: John Baker.
- Hole, F. and R.F. Heizer. 1973. An Introduction to Prehistoric Archaeology. New York: Holt, Rinehart and Winston.
- Oakley, K.P. 1975. Man as Toolmaker. London: British Museum.
- Pollock, Susan. 1999. Ancient Mesopotamia. Cambridge: Univ. Press.
- Renfrew, Collin and Ezra Zubrow. 1994. The Ancient Mind: Elements of Cognitive Archaeology. Cambridge: Univ. Press.
- Roskam, Steve. 2001. Excavation. Cambridge: Univ. Press.
- Sankalia, H.D. 1964. Stone Age Tools: Their Techniques, Names, Probable Functions. Pune: DCPRI.
- Semenov, S.A. 1976. Prehistoric Technology. Wiltshire: Moonraker Press.

**Anth 103. Physical Anthropology**

[Total Marks=100, Sessional=25, End-Term=75]

Theory = 60 (Sessional 15, End semester 45 Marks)

1. Definition, scope, history and development of Physical Anthropology with particular reference to India. Relationship with other branches of anthropology, and other cognate sciences.
2. Evolution: microevolution and macroevolution, evidences for human evolution.
3. Classification and characteristics of primates, relationship of man to higher primates like chimpanzee, gibbon, orangutan and gorilla; primate behaviour.
4. Concept of race, controversies on race, racial criteria and formation races; racial classification of Indian population - Sarkar, Guha and Risley.

Practical = 40 (Sessional 10, End semester 30 Marks)

1. Anthropometry: introduction and scope, anthropometric instruments.

2. Somatometry: introduction and scope; somatometric landmarks, somatometric measurements - height, sitting height, bi-acromial diameter, head length, head breadth, bigonial breadth, nasal height, nasal breadth, nasal depth, mouth breadth, physiognomic facial height, morphological facial height, morphological superior facial height, physiognomic ear length, physiognomic ear breadth, horizontal circumference of head, weight; somatometric indices - ponderal index, relative sitting height (cornic) index, relative biacromial breadth index, cephalic index, total facial index, morphological upper facial index, fronto-parietal index, fronto-zygomatic index, nasal index, transverse cephalic index, and Jugo-mandibular index.

3. Somatoscopic observations - skin color, hair color, form and texture, eye color, eye fold and eye slit, nose (nasal root, nasal bridge, nasal septum, and nasal tip), lips, chin and prognathism.

4. Osteology: Introduction and scope, shape and functions of bones; identification, drawing and description of bones of human skeleton - skull, vertebrae, sternum, sacrum, clavicle, humerus, radius, ulna, femur, tibia and fibula.

*Suggested Reading:*

- Ashley-Montagu, M.E. 1961. *An Introduction to Physical Anthropology*. Illinois: Charles C. Thomas.
- Bhasin, M.K. and S.L.Malik. 2001. *The Science of Man in Service of Man*. Delhi: Department of Anthropology, Delhi University.
- Buettner-Janusch, J. 1966. *Origins of Man*. New Delhi: Wiley Eastern Pvt. Ltd.
- Das, B.M. 1997. *Outline of Physical Anthropology*. Allahabad: Kitab Mahal
- Das, B.M. and R. Deka. 1992. *Physical Anthropology Practicals*. Allahabad: Kitab Mahal.
- Harrison, G.A. *et al.* 1988. *Human Biology*. Oxford: Clarendon Press.
- Jolly, C. J. and F. Plog. 1987. *Physical Anthropology and Archaeology*. New York: Knopf.
- Katz S. H. 1975. *Biological Anthropology: Readings from Scientific American*. San Francisco: W.H. Freeman and Co.
- Lasker, G.W. 1976. *Physical Anthropology*. New York: Holt, Rinehart & Wiston.
- Lewin, R. 1984. *Human Evolution*. New York: Freeman.
- Molnar, S. 1992. *Human Variation: Races, Types, and Ethnic Groups*. New Jersey: Prentice-Hall, Inc.
- Nath, S. 1993. *Anthropometry: The Measurement of Body Size, Shape and Form*. Delhi: Friends Publication.
- Park, M. A. 1996. *Biological Anthropology*. California: Mayfield Publishing Company.

- Poirier, F.E., W.A. Stini and K.B. Wreden. 1990. *In Search of Ourselves: An Introduction to Physical Anthropology*, 4<sup>th</sup> edition. New Jersey: Prentice Hall.
- Sarkar, S.S. 1957. *A Laboratory Manual of Somatology*. Calcutta: Scientific Book Agency.
- Shukla, B.R.K. and S. Ratogi. 1998. *Physical Anthropology and Human Genetics*. Delhi: Palaka Prakashan.
- Singh, I.P. and M.K. Bhasin. 1989. *Anthropometry*. New Delhi: Kamla Raj Enterprises.
- Weiner, J. S. and J.A. Lourie. 1981. *Practicals in Human Biology*. London: Academic Press.

**Anth 104. Social and Cultural Anthropology**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Origin, scope and development of social and cultural anthropology. Relationship with other branches of anthropology and with Linguistics, History, Geography and Sociology.
2. Concepts in social and cultural anthropology: society, institution, function, structure, organization, culture, structure of culture, cultural relativism, cultural diversity and multiculturalism, and syncretism.
3. Approaches to the study of society and culture: evolutionary, structural-functional, culture and personality, cognitive, and postmodern.
4. Emerging fields in social and cultural anthropology: development, environment, health, identity, communication, gender, and diaspora.

*Suggested Reading:*

- Auge, M. 1998. *A Sense of the Other*. Cambridge: Univ. Press.
- Auge, M. 1999. *An Anthropology for Contemporary Worlds*. Cambridge: Univ. Press.
- Beattie, John. 1966. *Other Cultures*. London: RKP.
- Deb, Kushal. 2002. *Mapping Multiculturalism*. New Delhi: Rawat Publications.
- Ember, C.R. and M. Ember. 1981. *Cultural Anthropology*. New Jersey: Prentice-Hall.
- Keesing, Felix. 1958. *Cultural Anthropology*. New York: Rinehart.
- Kuper, Adam. 1988. *Culture: The Invention of Primitive Society: Transformation of an Illusion*. London: Routledge.
- Kuper, Adam. 1999. *Culture: The Anthropologist's Account*. London: Harvard Univ. Press.
- Leach, E.R. 1986. *Social Anthropology*. Glasgow: Fontana Press.
- Lewis, I.M. 1990. *Social Anthropology in Perspective*. Cambridge: Univ. Press.
- Rapport, Nigel and Joanna Overing. 2000. *Social and Cultural Anthropology: The Key Concepts*. London: Routledge.

- Rosehan, Pauline M. 1992. *Postmodernism and the Social Sciences*. Princeton: Univ. Press.
- Wallace, A.F.C. 1961. *Culture and Personality*. New York: Random House.

**Anth 201. Human Origin and Evolution**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Origin of life-forms and transformation, geological ages; theories of evolution - Lamarckism, Neo-Lamarckism, Darwinism, Neo-Darwinism, Synthetic theory - phylogenetic development of man, biological future of man.
2. Processes and principles of human evolution - parallelism and convergence, morphology and speciation, irreversibility, adaptive radiation in primates, orthogenesis, cladogenesis.
3. Anatomical changes in human skeleton due to erect posture and bipedal gait: Skull, vertebral column, thorax, pelvic girdle, femur, hand and foot; evolution of teeth and brain.
4. Modern theories on human evolution - Mitochondrial DNA theory, multiregional hypothesis, replacement theory, punctuated equilibrium theory.

*Suggested Reading:*

- Buettner-Janusch, J. 1966. *Origins of Man*. New Delhi: Wiley Eastern Pvt. Ltd.
- Das, B.M. 1997. *Outline of Physical Anthropology*. Allahabad: Kitab Mahal.
- Futuyma, D. J. 1998. *Evolutionary Biology*, 3<sup>rd</sup> edition. Massachusetts: Sinauer Associates Inc.
- Harrison, G.A. *et al.* 1988. *Human Biology*. Oxford University Press.
- Hooton, E. A. 1965. *Up from the Ape*. New York: Macmillan.
- Jolly, C. J. and F. Plog. 1987. *Physical Anthropology and Archaeology*. New York: Knopf.
- Lewin, R. 1984. *Human Evolution*. New York: Freeman.
- Lewin R. and R. Foley. 2003. *Principles of Human Evolution*. Oxford: Blackwell Publishing.
- Montagu, M.F.A. 1961. *An Introduction to Physical Anthropology*. Illinois: Crowell
- Poirier Frank, E. 1993. *Understanding Human Evolution*. New Jersey: Prentice Hall
- Sarkar, R.M. 1994. *Fundamentals of Physical Anthropology*. Calcutta: Vidyodaya Library Pvt. Ltd.
- Smith, F.H. and F. Spencer. 1984. *The Origins and Evolution of Modern Humans*. New York: Allan Liss.
- Strickberger Monroe, W. 2000. *Evolution*, 3<sup>rd</sup> edition. New York: Jones & Barlett Publishers.
- Tattersall, I. 1995. *Fossil Trail: How We Know, What We Think, We Know About Human Evolution*. New York: Oxford University Press.
- Volpe, P.E. 1989. *Understanding Evolution*. New Delhi: Universal Book Stall.

**Anth 202. Asian Prehistoric Archaeology**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Material culture of early hunter gatherers: Choukoutien, Anyathian, Pajitanian, Soanian, Madrasian; Monsterian and Levalloisian cultures in India; allied development in Northeast India.
2. Early holocene cultures: Langhnaj, Teri sites, Bagor, Sarainahar Rai, Mesolithic art in India, Hoabinhian, Natufian, allied development in Northeast India.
3. Neolithic cultural development: origin and development of food production in West Asia (Near East); food producing cultures in South East Asia; Neo-cultural pattern in India; allied development in Northeast India.
4. Chalcolithic culture in India: Ahar, Malwa, Jorwe; Bronze Age: characteristics, causes of decline; beginning of Iron Age; PG Ware culture (Hastinapur, Atranjikhare), NBP Ware culture (Kansambi); Megalithic cultures of India; allied development in Northeast India.

*Suggested Reading:*

- Agrawal, D.P. 1982. The Archaeology of India. New Delhi: Select Books Syndicate.
- Allchin, B and R. Allchin. 1983. The Rise of Civilization in India and Pakistan. New Delhi: SBS.
- Ashraf, A. A. 1990. Prehistoric Arunachal. Itanagar: Directorate of Research.
- Bhattacharya, D.K. 1989. An Outline of Indian Prehistory. New Delhi: Popular.
- Chang, K.C. 1963. Archaeology of Ancient China. London: Yale Univ. Press.
- Clark, G. 1977. World Prehistory. London: Cambridge.
- Foot, R.B. 1979. Prehistory and Protohistory. Delhi: Leeladevi.
- Lal, B.B. 1998. India: New Light on the Indus Civilization. New Delhi: ASI.
- Sankalia, H.O. 1974. The Prehistory and Protohistory of India and Pakistan. Pune: DCPRI.
- Sharma, A.K. 1996. Early Man in Eastern Himalayas. New Delhi: Aryan Books International.
- Tan, Ha van. 1997. 'The Hoabinhian and Before'. IPPA, Vol. 3.

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**Anth 203. Human Ecology and Adaptation**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Definition, objectives, approaches to the study of human and cultural ecology, variety of human ecosystem, environmental degradation and human health, stress and strain.
2. Acclimatization, adaptation, homeostasis, human adaptation to heat, cold and high altitude, population variation in physiological responses to climatic stresses, body build and climatic adaptation.
3. Nutritional requirements of humans, malnutrition, assessment of nutritional status, homeostatic and genetic potential theories.
4. Infectious diseases - Nature of infectious diseases, cultural evolution and diseases, human adaptability and diseases, co-evolution of people and diseases.

*Suggested Reading:*

- Baker, P.T. 1978. *The Biology of High Altitude Peoples*. Cambridge: University Press.
- Baker, P.T. and J.S. Weiner. 1966. *The Biology of Human Adaptability*. Oxford: Clarendon Press.
- Chapman, J.L. and M.J. Reiss. 1994. *Ecology: Principles and Applications*. Cambridge: Cambridge University Press.
- Damon, A. 1975. *Physiological Anthropology*. New York: OUP.
- Friscancho, A.R. 1981. *Human Adaptation*. Ann Arbor: University of Michigan Press.
- Harrison, G.A. and H. Morphy. 1998. *Human Adaptation*. Oxford: Oxford University Press.
- Harrison, G.A. et al. 1988. *Human Biology*. Oxford: Oxford University Press.
- Himes, J.H. (ed.) 1991. *Anthropometric Assessment of Nutritional Status*. New York: Wiley-Liss.
- Johnson, F.E. 1987. *Nutritional Anthropology*. New York: Wiley-Liss.
- Little, M.A. and J.D. Haas. 1989. *Human Population Biology*. New York: Oxford University Press.
- Malik, S. L. and D. K. Bhattacharya. *Aspects of Human Ecology*. New Delhi: Northern Book Centre.
- Marten, G. G. 2001. *Human Ecology*. London: Stylus Publishing.
- Mascie-Taylor, C.G.N. and B. Bogin. 1995. *Human Variability and Plasticity*. Cambridge: Cambridge University Press.
- Moron, E.F. 1984. *The Ecosystem Concept in Anthropology*. Colorado: West View Press.
- Pelto, G.H., P.J. Pelto and E. Messer (eds.). 1989. *Research Methods in Nutritional Anthropology*. Tokyo: The UN University.
- Roberts, D.F. 1978. *Climate and Human Variability*. California: Cumming.
- Sukhatme, P.V. (ed.) 1982. *Newer Concepts in Nutrition and Their Implications for Policy*. Pune: Maharashtra Association for the Cultivation Sciences Research Institute.
- Ulijaszek, S.J. and S. Strickland. 1993. *Nutritional Anthropology: Prospects and Perspectives*. London: Smith Gordon.

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**Anth 204. Language, Culture and Society**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Meaning and scope of language, sign and symbol in language, linguistic anthropology and structural semiotics, linguistic anthropology and other branches of anthropology. Contributions of Malinowski and Levi-Strauss.
2. Language and culture: cultural setting of language, the role of meaning, Sapir-Whorf hypothesis, cultural analysis of kinship and colour terminologies, ethnography of communication.
3. Language and society: socio-linguistics, multilingualism and diglossia, lingua franca, pidgin and creole.
4. Language and Inequality: linguistic and social inequalities, linguistic prejudices and stereotypes, power and solidarity relations in language, language and social class, language and ethnicity.

*Suggested Reading:*

- Chandler, Daniel. 2001. *Semiotics: The Basics*. London: Routledge.
- Chomsky, N. 1975. *Reflections on Language*. New York: Pantheon.
- Duranti, A. 1997. *Linguistic Anthropology*. Cambridge: Univ. Press.
- Goodenough, W.H. 1971. *Culture, Language and Society*. Mass: Addison Wesley.
- Hardin, C.L. 1997. *Color Categories in Thought and Language*. Cambridge: Univ. Press.
- Hastrup, Kirsten. 1982. *Establishing an Identity: The Emergence of the "Icelanders" in the Early Middle Ages*. In David Parkin, ed. *Semantic Anthropology*. London: Academic Press.
- Henson, Hilary. 1974. *British Social Anthropologists and Language*. London: Clarendon.
- Hickerson, N.P. 1980. *Linguistic Anthropology*. New York: Holt, Rinehart and Winston.
- Hockett, C. F. 1958. *A Course in Modern Linguistics*. New York: Macmillan.
- Hudson, R.A. 1980. *Sociolinguistics*. Cambridge: Univ. Press.
- Hymes, D.H. 1964. *Language in Culture and Society*. New York: Harper & Row.
- Lyons, J. 1982. *Language & Linguistics: An Introduction*. Cambridge: Univ. Press.
- Nuyts, Jan and Eric Pederson. 2000. *Language and Conceptualization*. Cambridge: Univ. Press.
- Perkin, David. *Semantic Anthropology*. London: Academic Press.
- Sapir, Edward. 1963. *Language*. London: Hart-Davis.
- Thomas, Linda et al. 1999. *Language, Society and Power: An Introduction*. London: Routledge.
- Trudgil, P. 1984. *Socio-linguistics: An Introduction to Language and Society*. Harmondsworth: Penguin.
- Whorf, B. L. 1956. *Language, Thought and Reality*. Cambridge: M.I.T. Press.

**Anth 205. Theories & Methods**

[Total Marks=100, Sessional=25, End-Term=75]

1. Theory and method: importance of theory in method and method in theory; relationship between data, concept, hypothesis, theory, and law.
2. Theory construction and validation: structure of theory, types of theory – concatenated and hierarchical, processes of induction and deduction, generalization and theorization.
3. Theoretical approaches in anthropological research - I: evolutionary approach, diffusionist approach, historical-particular approach, functional approach, and structural approach.
4. Theoretical approaches to anthropological research – II: cognitive approach, symbolic-interaction approach, ethno-methodological approach, interpretative approach, and post-modern approach.

*Suggested Reading:*

- Barnard, A. 2000. *History and Theory in Anthropology*. Cambridge: Univ. Press.
- Black, Thomas R. 1999. *Doing Qualitative Research in the Social Sciences*. London: Sage.
- Button, Graham. 1991. *Ethnomethodology and the Human Sciences*. Cambridge: Univ. Press.
- Harris, Marvin. 1968. *Rise of Anthropological Theory*. London: Routledge and Kegan Paul.
- Hastrup, Kristen. 1995. *A Passage to Anthropology: Between Experience and Theory*. London: Routledge.
- Hastrup, Kristen and Peter Hastrup. 1994. *Social Experience and Anthropological Knowledge*. London: Routledge.
- Layton, Robert. 1998. *An Introduction to Theory in Anthropology*. Cambridge: Univ. Press.
- Merton, Robert.
- Manning, Peter. 1987. *Semiotics and Fieldwork*. London: Sage.
- McNeil, Patrick. 1990. *Research Methods*. London: Routledge.
- Rose, Dan. 1990. *Living the Ethnographic Life*. London: Sage.
- Thapan, Meenakshi. 1998. *Anthropological Journeys: Reflections on Fieldwork*. New Delhi: Orient Longman.

**Anth 301. Anthropology of India**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Approaches to the study of Indian society, culture and civilization: indological, historical, and anthropological.
2. Peopling of India: Indian aboriginals, theory of Aryan migration to India, hypergamy, hypogamy, DNA explanation.
3. Indian social structure: caste system, varna and jati, tribal social structure, caste among non-Hindus (Muslims and Christians).
4. Unity and diversity: caste, tribe, ethnic, communal, religious, and political identities and linkages; nation building and national integration.

*Suggested Reading:*

- Bansal, I.J.S. 1984. *Anthropology in Indian Context*. New Delhi: Today & Tomorrow.
- Bayly, Susan. 2001. *Caste, Society and Politics in India from the 18<sup>th</sup> Century to the Modern Age*. Cambridge: Univ. Press.
- Beteille, A. 1991. *Society and Politics in India*. Delhi: OUP.
- Chatterjee, S.K. 1951. *Kiratajanakrti: The Indo-Mongoloids*. Calcutta: Royal Asiatic Society of Bengal.
- Cohn, Bernard. 1971. *India: The Social Anthropology of a Civilization*. London: Prentice-Hall.
- Danda, A.K. 1995. *Foundations of Anthropology in India*. New Delhi: Inter-India.
- Danda, A.K. 1996. 'Anthropology in India: In Retrospect and Prospect'. *Journal of Indian Anthrop. Society*, 31:205-215.
- Das, Veena. 1975. *Structure and Cognition*. Delhi: OUP.
- Dumont, L. 1976. *Homo Hierarchicus*. Delhi: Vikas.
- Gadgil, M. 1998. *Peopling of India*. Hyderabad: Univ. Press.
- Heesterman, Jan. 1985. *The Inner Conflict of Tradition*. Chicago: Univ. Press.
- Inden, Ronald. 1980. *Imagining India*. Oxford: Basil Blackwell.
- Mandelbaum, D.G. 1972. *Society in India*, 2 Vols. Bombay: Popular.
- Rudolph, L. and S. Rudolph. 1979. *The Tradition of Modernity*. London: Chicago Univ. Press.
- Singer, Milton. 1955. 'The Cultural Pattern of Indian Civilization'. *The Far Eastern Quarterly*, 15(1).
- Srinivas, M.N. 1987. *Dominant Caste and Other Essays*. Delhi: OUP.

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**Anth 302. Economy and Culture**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Origin, scope and linkages of Economic Anthropology: world economy and local economies, globalization and its impact on local levels.
2. Production: hunting & gathering, trade and pastoralism, shifting and settled cultivation, cottage and village industries.
3. Distribution: barter, ceremonial exchange, reciprocity, redistribution, and market (Gift, Potlatch, Kula Ring, Jajmani system, and Feast of Merit).
4. Consumption: domestic consumption and market, wealth and socio-political status, socio-economic differentiation and emergence of inequalities.

*Suggested Reading:*

- Belshaw, C. 1975. *Traditional Exchange and Modern Markets*. New Jersey: Prentice-Hall.
- Braudel, Fernand. 1988. *The Perspective of the World*. London: Collins.
- Brouwer, Jan. 1997. 'The Goddess for Development'. *Social Anthropology*, 5(1): 66-82.
- Firth, R. 1975. *Themes in Economic Anthropology*. Tavistock: ASA Series.
- Forde, Daryll. 1986. *Habitat, Economy and Society*. London: Methuen & Co.
- Gregory, C.A. 1997. *Savage Money*. New York: Harvard Academic Publishers.
- Hann, C. M. 1998. *Property Relations*. Cambridge: Univ. Press.
- Herskovits, M.J. 1975. *Economic Anthropology*. New Delhi: Eurasia Publications.
- Holton, Robert and B. Turner. 1990. *Max Weber on Economy and Society*. London: Sage.
- Mauss, Marcel. 2001. *The Gift: The Form and Reason for Exchange in Archaic Societies with an Introduction by Mary Douglas*. London: Routledge.
- Nair, M.K.S. 1987. *Tribal Economy in Transition*. New Delhi: Inter-India.
- Nash, Manning. 1974. *Primitive and Peasant Economic Systems*. San Francisco: Chandler Publications.
- Singh, K.S. 1982. *Economies of Tribes and Their Transformation*. New Delhi: Concept.

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**Anth 303. Culture, Health and Medicine**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Culture, health and medicine: concepts of health and sickness in India, socio-cultural and environmental dimensions of health, sickness and medicine, occupational and life-style ailments.
  2. Ethno-medicine: magico-religious practices, indigenous medical systems and the medical practitioner, ethnography of tribal and folk medical systems in India.
1. Alternative medical practices in India: Ayurvedic, Siddha, Unani, Naturopathy, Tibetan, Chinese, and indigenous tribal medical practices.
  2. Epidemiology of certain common diseases in Northeast India and the associated socio-cultural and environmental factors: Malaria, Tuberculosis, Leprosy, Diabetes, Cardio-vascular diseases, and STD/AIDs.

*Suggested Reading:*

- Budd, Susan and Ursula Sharma. 1994. *The Healing Bond: The Patient-Practitioner Relationship and Therapeutic Responsibility*. London: Routledge.
- Caudill, W. 1953. *Applied Anthropology in Medicine*. Chicago: Univ. of Chicago Press.
- Chaudhuri, B. 1986. *Tribal Health: Socio-Cultural Dimensions*. New Delhi: Inter-India Publication.
- Foster, G.M. 1978. *Medical Anthropology*. New York: John Wiley.
- Good, Byron J. 1993. *Medicine, Rationality and Experience: An Anthropological Perspective*. Cambridge: Univ. Press.
- Jose, Boban K. 1998. *Tribal Ethnomedicine: Continuity and Change*. New Delhi: APH Publishing.
- Landy, D. 1977. *Culture, Disease and Healing*. New York: Macmillan.
- Leslie, C. 1976. *Asian Medical Systems*. Berkeley: Univ. of California Press.
- Paul, B.D. 1955. *Culture, Health and Community*. New York: Russel Sage Foundation.
- Read, M. 1966. *Culture, Health and Disease*. London: Tavistock Publications.
- Singh, B. and N. Mahanti. 1995. *Tribal Health in India*. New Delhi: Inter-India.
- Worsley, P. 1982. 'Non-Western Medical Systems'. *Annual Review of Anthropology*, 11.
- Young, A. 1982. 'The Anthropology of Illness and Sickness'. *Annual Review of Anthropology*, 11.

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**Anth 304. Demography and Biostatistics**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Definition, nature, scope and importance of demography, relationship to anthropology, nature of demographic data and population census, differential fertility and mortality, India's population policy.
2. Population theories - Malthusian, Neo-Malthusian, Optimum theory, Logistic curve theory, demographic transition theory and Herbert's Spencer theory.
3. Migration - nature and causes of migration, anthropological significance of migration, theories and models on migration (Lee's theory, Todaro's model, LFR model).
4. Biostatistics - Definition, scope and importance of biostatistics, sampling techniques, collection of data, measures of central tendency and dispersion, test of significance and confidence, Chi-square, student's t-test, analysis of variance, correlation and regression.

*Suggested Reading:*

- Bailey, N.T.J. 1959. *Statistical Methods in Biology*. Oxford: Oxford University Press.
- Bhende, A. and T. Kanitkar. 2000. *Principles of Population Studies*. New Delhi: Tata Mcgraw.
- Bogue, D. 1969. *Principles of Demography*. New York: John Wiley & Sons.
- Cox, P. R. 1970. *Demography*. Cambridge: Cambridge University Press.
- Dyson, T. and N. Crook. 1984. *India's Demography*. New Delhi: South Asia Publishers.
- Madrigal, L. 1998. *Statistics for Anthropology*. Cambridge: Cambridge University Press.
- Mahadevan, K. and P. Krishnan. 1993. *Methodology for Population Studies and Development*. New Delhi: Sage Publications.
- Snedecor, G. W. and W.G.Cochran. 1967. *Statistical Methods*. New Delhi: Oxford & IBH Publishing Co. Pvt. Ltd.
- Srinivasan, K. 1995. *Regulating Reproduction in India's Population*. New Delhi: Sage Publications.
- Srinivasan, K. 1998. *Basic Demographic Techniques and Applications*. New Delhi: Sage Publications.
- Thompson, W.S. and D.T. Lewis. 1980. *Population Problems*. New Delhi: Tata Mcgraw Hill Publishing House.

**Anth 305. Fieldwork Methods & Techniques**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Fieldwork traditions in anthropology: Haddon and Torres Straits, Spencer in Stone Age in Australia, Rivers and Toda genealogy, Malinowski in Western Pacific.
2. Methods and techniques in anthropological fieldwork- I: Preparing for the field: selection of the locale, review of literature, formulation of research questions/hypotheses, research design; observation, interview, genealogy/pedigree, life history and extended case method; comparative method, synchronic and diachronic methods.
3. Methods and techniques in anthropological fieldwork - II: qualitative and quantitative techniques; schedules and questionnaires, interview guide, focussed group interviews, Participatory Rapid Appraisal, audio-visual recording; use of field guide/interpreter, key informants.
4. Writing the report: organization of the report, classification and analysis of field data, presentation of case studies, preparation of tables, figures and charts; concluding the report, writing references, bibliographies, appendices.

*Suggested Reading:*

- Amit, Vered. 1999. *Constructing the Field*. London: Routledge.
- Barnes, J.A. 1977. *The Ethics of Enquiry in Social Sciences*. Delhi: OUP.
- Bechhofer, Frank and Lindsay Paterson. 2000. *Principles of Research Design in the Social Sciences*. London: Routledge.
- Beteille, A. and T. N. Madan. 1975. *Encounter and Experience*. New Delhi: Vikas.
- Bernard, H.R. 1988. *Research Method in Cultural Anthropology*. Florida: Univ. Press.
- Burgess, Robert G. 1984. *In the Field: An Introduction to Field Research*. London: Routledge.
- Butter, G. 1991. *Ethnomethodology and the Human Sciences*. Cambridge: Univ. Press.
- Danda, A.K. 1977. 'On Synchronic Method'. *Journal of Indian Anthropol. Society*, 12:95-99.
- Durrenberger, E.P. 1996. 'Fieldwork'. *Ency. of Cul. Anthropology*, Vol. 2. New York: Henry Holt & Company.
- Epstein, A.L. 1978. *Crafts in Social Anthropology*. Delhi: Hindustan Publishing Corp.
- Foster, G. M. et al. 1979. *Long Term Field Research in Social Anthropology*. New York: Academic Press.
- Frellich, Morris. 1970. *Marginal Natives: Anthropologists at Work*. New York: Harper & Sons.
- Herz, A. 1998. *Cambridge and the Torres Strait*. Cambridge: Univ. Press.
- Johnson, A.W. 1978. *Quantification in Cultural Anthropology*. Stanford: Univ. Press.
- Jongmans, D.G. and P.C.W. Gutkind. 1967. *Anthropologists in the Field*. Assen: Van Gorcum & Company.
- Misra, P.K. 1982. 'Critique of Anthropological Fieldwork'. *Man in India*, 62 (2).
- Peto, P.J. 1970. *Anthropological Research: The Structure of Enquiry*. New York: Harper & Sons.
- Sarana, Gopala. 1975. *The Methodology of Anthropology*. New York: The Univ. of Arizona Press.
- Srinivas, M.N. 1983. *The Observer and the Observed*. Faculty Lecture 1, Faculty of Arts and Social Sciences, University of Singapore.
- Stocking, George W. 1983. *Observers Observed: Essays on Ethnographic Fieldwork*. Madison: The University of Wisconsin Press.
- Williams, T. R. 1967. *Field Methods in the Study of Culture*. London: Holt, Rinehart and Winston.

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**Anth 306. Human Genetics**

[Total Marks=100, Sessional=25, End-Term=75]

1. Concept of gene, Watson-Crick model of DNA structure, role of mRNA and rRNA, genetic code, evidence of human evolution from DNA sequencing, neutral theory and its reconciliation to synthetic theory.
2. Methods of studying heredity; Mendel's principles of inheritance - autosomal and sex-linked genes, sex-controlled and limited genes; ABO, MN and Rh systems; sex determination; Lyon hypothesis.
3. Laws of equilibrium and probability in human genetics - Problems and solutions concerning dominant, recessive, sex-linked and sex-controlled traits - marriage patterns and their genetic consequences in human populations.
4. Concept of genetic variation; causes of genetic variation between and within human populations with special reference to the role mutation, selection, genetic drift, isolation and gene flow.

*Suggested Reading:*

- Barua, S. 2002. Human Genetics. Kolkata: Classique Books.
- Boyce, A. J. and C. G. N. Mascie-Taylor. 1996. Molecular Biology and Human Diversity. Cambridge: Cambridge University Press.
- Cavalli-Sforza, L. L. and W.F.Bodmer. 1971. The Genetics of Human Population. San Francisco: WH Freeman & Co.
- Crawford, M.H. and P.L.Workman. 1973. Methods and Theories of Anthropological Genetics. Albuquerque: University of New Mexico Press.
- Griffiths, A. J. F., W.M.Gelbart, J.H.Miller and R.C.Lewontin. 1999. Introduction to Genetic Analysis, 7<sup>th</sup> edition. New York: W H Freeman & Co.
- Harrison, G. A. and A.J.Boyce.1972. The Structure of Human Population. Oxford: Clarendon Press.
- Hartl, D.L. 1983. Human Genetics. New York: Harper & Row.
- Hedric, P.W. 1999. Genetics of Populations, 2<sup>nd</sup> edition. Massachusetts: Jones and Bartlett Publishers.
- Kimura, M. 1983. Neutral Theory of Molecular Evolution. Cambridge: Cambridge University Press.
- Mange, E.J. and A.F. Mange. 1995. Basic Human Genetics. Massachusetts: Sinauer Associates, Inc.
- Malhotra, K. C. (ed.). 1988. Statistical Methods in Human population Genetics. Kolkata:ISI
- Maxson, L.R. and C.H.Daugherty. 1992. Genetics: A Human Perspective, 3<sup>rd</sup> edition. Kerper: Wm Charles Brown Publishers
- Race, R.R. and R.Sanger. 1973. Blood Groups in Man. Oxford: Blackwell Scientific.
- Rothwell, N.V. 1976. Human Genetics. New Delhi: Prentice Hall Pvt. Ltd.
- Vogel, F. and A.G.Motulsky. 1986. Human Genetics: Problems and Approaches. Berlin: Springer-Verlag.

**Anth 307. Human Growth and Body Composition**

[Total Marks=100, Sessional=25, End-Term=75]

1. Concept of growth and development, methods of studying growth and development, stages of growth - prenatal, infant, childhood, adolescence, developmental age and maturity - catch up growth.
2. Growth curve (its variation and evolution), assessment of growth and nutritional status, growth and adaptation to stresses of under-nutrition and diseases.
3. Factors affecting growth - role of endocrines and hormones, ethnic variation, migration and hybridization, nutrition and socioeconomic factors, secular trend.
4. Human physique and somatotype - Viola, Carter, Sheldon and Kretschmer - Techniques for estimating body composition - anthropometry, metabolic balance technique, energy balance, water displacement.

*Suggested Reading:*

- Bogin, B. 1999. *Patterns of Human Growth*. Cambridge: Cambridge University Press.
- Eveleth, P.B. and J.M.Tanner. 1990. *Worldwide Variation in Human Growth*. Cambridge: Cambridge University Press.
- Forbes, G. B. 1987. *Human Body Composition: Growth, Aging, Nutrition and Activity*. New York: Springer-Verlag.
- Harrison, G.A. *et al.* 1988. *Human Biology*. Oxford: Oxford University Press.
- Himes, J.H. (ed.) 1991. *Anthropometric Assessment of Nutritional Status*. New York: Wiley-Liss.
- Hooton, E. A. 1965. *Up from the Ape*. New York: Macmillan.
- Jelliffe, D.B. 1966. *The Assessment of the Nutritional Status of the Community*. WHO Monograph No. 53. Geneva: WHO.
- Johnson, F.E. 1987. *Nutritional Anthropology*. New York: Wiley-Liss.
- Mahajan, A. and Nath, S. 1992. *Application Areas of Anthropology*. New Delhi: Reliance Publishing House.
- Roche, A.F. 1992. *Growth, Maturation and Body Composition*. Cambridge: Cambridge University Press.
- Tanner, J.M. 1978. *Foetus into Man*. Cambridge: Harvard University Press.
- Ulijaszek, S.J. *et al.* 1998. *The Cambridge Encyclopaedia of Human Growth and Development*. Cambridge: Cambridge University Press.

**Anth 308. Practical in Physical Anthropology - I**

[Total Marks=100, Sessional=25, End-Term=75]

**3. Somatometry: Introduction, Application**

*Anthropological measurements:* Stature, Sitting height vertex, Body mass, height acromion, height ilio-spinalis, height ilio-cristalis, trunk height, height sternale, chest circumference, biacromial diameter, bio-cristal diameter, maximum hip breadth, upper-arm length, forearm length, hand length, hand breadth, leg length, foot length, foot breadth, humerus bicondylar breadth, femur bicondylar breadth, body mass index, relative sitting height, relative biacromial diameter, relative bicristal diameter, chest girth, acromioliac index, acrom chest index, inter-bicondylar index, index of hand and thoracic index.

**4. Osteometry and odontometry:**

(A) *Osteometry:* Direct measurements on Scapula, Clavicle, Humerus, Ulna, Radius, Femur and Tibia. Diatograph tracing and measurements on Scapula, Clavicle, Humerus, Ulna, Radius, Femur and Tibia.

(B) *Odontometry:* Measurements on incisors and canines - total length, greatest breadth of crown, maximum anterior-posterior diameter of crown, minimum breadth of crown, height of crown. Measurements on premolars and molars - total tooth height, crown height, actual root length, projected root length, mesio-distal diameter and bucco-lingual diameter. Indices - crown index, crown module, incisor-breadth index and lower premolar index.

**3. Craniometry**

(A) *Linear measurements on Skull:*

Maximum cranial length, Maximum cranial breadth, Glabella - inion length, Nasion - inion length, Bi-mastoid diameter, Bi-auricular breadth, Maximum frontal breadth, Minimum frontal breadth, Bizygomatic breadth, Nasion - prosthion line, Nasal height, Nasal breadth, Orbital height, Orbital breadth, Palatal length, Palatal breadth, Maxillo - alveolar length, Maxillo - alveolar breadth, Length of foramen magnum, Breadth of foramen magnum, Frontal chord, Parietal chord, Occipital chord and Horizontal circumference.

(B) *Angular measurements on Skull:*

- (i) Facial profile angle
- (ii) Nasal profile angle
- (iii) Alveolar profile angle
- (iv) Metopic angle
- (v) Bregma angle of Skull
- (vi) Lambda angle of Schwalbe

**4. Measurements of body composition:** Skinfold measurements on Biceps, triceps, subscapular, supra-iliac and calf. Indices - body mass index, lean body mass, body fat, fat free mass. Somatotyping techniques and analyses.

*Suggested Reading:*

- Chaurasia, B.D. 1984. Human Osteology. New Delhi: CBS
- Cummins, H. and C. Midlo. 1961. Finger Prints, Palms and Soles. New York: Dover Publication Inc.
- Das, B.M. and R. Deka. 1992. Physical Anthropology Practicals. Allahabad: Kitab Mahal.
- Dwight, T. 1878. The Identification of the Human Skeleton. Boston: Massachusetts Medical Society.
- El-Najjar, M.Y. and K. R. McWilliams. 1978. Forensic Anthropology. Illinois: Charles C. Thomas
- Krogman, W.M. 1986. The Human Skeleton in Forensic Medicine. London: Charles C. Thomas.
- Montague, M.F.A. 1961. An Introduction to Physical Anthropology. Illinois: Charles C. Thomas.
- Sen, T. 1994. Anthropometry. Calcutta: The World Press.
- Singh, I.P. and M. K. Bhasin. 1989. Anthropometry. Delhi: Kamla Raj Enterprises.
- Ulijaszek, S.J. 1995. Human Energetics in Biological Anthropology. Cambridge: Cambridge University Press.
- Ulijaszek, S.J. and C. G. N. Mascie-Taylor. 1994. Anthropometry: The Individual and Population. Cambridge: Cambridge University.
- Wayne, W. D. 1983. Biostatistics: A Foundation for Analyses in Health Sciences. New York: John Wiley.
- Weiner, J.S. and J.A. Lourie .1981. Practicals in Human Biology. London Academic Press.

**Anth 401. Anthropology of Northeast India**  
[Total Marks=100, Sessional=25, End-Term=75]

*Section A: Social and Cultural Anthropology*

1. Origin and growth of Social and Cultural Anthropology in Northeast India: The pre-independence and post-independence scenario.
2. Social and Cultural change in Northeast India: various reform movements in the valleys, immigration of Hindus and Muslims, spread of Christianity in the hills, education, development, secessionism and insurgency.

*Section B: Physical Anthropology*

3. Origin and growth of physical anthropology in Northeast India: the pre-independence and post-independence scenario.
4. Major trends in physical anthropological research in the region: growth and development studies, dermatoglyphic studies, population genetics, and studies in the field of nutrition and health.

*Suggested Reading:*

- Burling, Robbins. 1999. *Rengsanggiri: Family and Kinship in a Garo Village*. Tura: Tura Books.
- Das, B.M. ed. 1974. *Contemporary Anthropological Research in Northeast India*. Dibrugarh: University Publications.
- Das, Farida Ahmed and I. Barua. 1996. *Communities in Northeast India*. New Delhi: Mittal Publications.
- Elwin, V. 1959. *A Philosophy for NEFA*. Shillong: Govt. Printing.
- Goswami, M.C. and P.B.Das. 1990. *The People of Arunachal Pradesh: A Physical Survey*. Itanagar: Govt. of Arunachal Pradesh.
- Hodson, T. C. 1989. *The Naga Tribes of Manipur*. Delhi: Low Price Publications.
- Khongsdier, R. 2000. *Contemporary Research in Anthropology*. New Delhi: Commonwealth Publishers.
- Lyall, S.C. 1908. *The Garos*. London: David Nutt.
- Misra, U. 1988. *North-East India: Quest for Identity*. Guwahati: Onsons Publications.
- Nakane, Chie. 1976. *Garo and Khasi: A Comparative Study in Matrilineal System*. The Hague: Mouton.
- Playfair, A. 1909. *The Garos*. London: David Nutt.
- Raha, M.K. and A.K. Ghosh. 1998. *North-East India: The Human Interface*. New Delhi: Gyan Pub. House.
- Sengupta, S. 1997. *Studies in Anthropology: Recent Perspectives*. New Delhi: Inter-India.
- Singh, B.P. 1987. *The Problem of Change: A Study of Northeast India*. Delhi: OUP.
- Subba, T.B. and G.C. Ghosh. 2003. *The Anthropology of Northeast India*. New Delhi: Orient Longman.

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**Anth 402. Dissertation & Viva Voce**  
[Total Marks=100, Sessional=25, End-Term=75]

Each student conducts fieldwork for at least three weeks on a topic of his/her choice and writes a thesis in about 10,000 words under the supervision of one of the faculty members. S/he defends his/her thesis internally, in front of the entire faculty, as well as in front of an external examiner appointed by the University for the purpose.

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**Anth 403. Development Anthropology**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Concepts of development in anthropology and other social sciences; Applied, Action, and Development Anthropology; indices of development, development debate, culture and development, alternative development.
2. Anthropological theories of development: Weber, Bailey, Epstein, and Beteille.
3. Contribution of anthropology to development studies: indigenous knowledge and development; anthropological insight and policy implications in the fields of education, health, gender, ethnicity, identity, environment, indigenous peoples and human rights.
4. Selected consequences of development in Northeast India: immigration, environmental degradation, ethnic tension and conflict, crisis of identity, and insurgency.

*Suggested Reading:*

- Arce, Alberto and Norman Long. 1999. *Anthropology, Development and Modernities*. London: Routledge.
- Bailey, F.G. 1972. *Caste and Economic Frontier*. London: Manchester Press.
- Bardhan, Pranab. 1995. *Development and Change*. Delhi: OUP.
- Beteille, Andre. 1969. *Caste, Class and Power*. Calcutta: Oxford University Press.
- Brouwer, Jan. 2000. Conflict between Modern and Indigenous Concepts in the small enterprise workplace. *Social Anthropology*, 8(2): 164-202.
- Cochrane, G. 1971. *Development Anthropology*. Delhi: Kitab Mahal.
- Epstein, Scarlet. 1973. *South India: Yesterday, Today and Tomorrow*. London: Macmillan Press.
- Hobart, Mark. 1993. *An Anthropological Critique of Development: The Growth of Ignorance*. London: Routledge.
- Mair, Lucy. 1984. *Anthropology and Development*. London: Macmillan.
- Malhotra, R. 1992. *Anthropology of Development*. New Delhi: Mittal.
- Mathur, H.M. 1977. *Anthropology in Development Process*. New Delhi: Vikas.
- Mathur, H.M. 1990. *Human Dimension of Development: Perspective from Anthropology*. New Delhi: Concept Publishing House.
- Pathy, J. 1987. *Anthropology of Development*. Delhi: Gian Publishing House.
- Pitt-David, C. 1976. *Development from Below: Anthropologists and Development Situation*. The Hague: Mouton.
- Subba, T. B. 1992. *Ethnicity, State and Development*. New Delhi: Vikas.
- Vidyarthi, L.P. 1980. *Applied Anthropology and Development in India*. New Delhi: National.
- Weber, Max. 1991. *The Protestant Ethic and the Spirit of Capitalism*. London: Harper Collins.

**Anth 404. Optional**

**Anth 405. Practical in Physical Anthropology – II**  
[Total Marks=100, Sessional=25, End-Term=75]

1. Cytogenetics and DNA Isolation - Karyotyping, differential staining, DNA extraction from blood, hair, buccal cells, nails, etc.
1. Genetic markers - ABO, Rh and MN blood systems, total haemoglobin estimation, total blood count - RBC and WBC, serum proteins and red blood cell enzymes.
2. Dermatoglyphics of palms and fingers, Color blindness and PTC taste sensitivity.
3. Physiological tests - Pulse rate, temperature, accelerometry, forced vital capacity and blood pressure.

*Suggested Reading:*

- Bhatia, H.M. 1977. Procedures in Blood Banking and Immuno-haematology. Bombay: Blood Group Reference Centre.
- Cummins, H. and C. Midlo. 1961. Finger Prints, Palms and Soles. New York: Dover Publication Inc.
- Dacie, J.V. and S.M. Lewis. 1975. Practical Haematology. London: Churchill Livingstone.
- King, M. 1973. A Medical Laboratory for Developing Countries. London: Oxford University Press.
- Ulijaszek, S.J. 1995. Human Energetics in Biological Anthropology. Cambridge: Cambridge University Press.
- W.H.O. 1980. Health Laboratory Services in Support of Primary Health Care in Developing Countries. Series No. 24. New Delhi: WHO.
- W.H.O. 1980. Manual of Basic Technique for a Health Laboratory. Calcutta: Academic Publishers.
- Walt, R. and G.F.Katharine. 1999. Molecular Biology Techniques: An Intensive Laboratory Course. New York: Academic Press.
- Weiner, J.S. and J.A Laurie. 1969. Practical in Human Biology. Oxford: Blackwell Scientific Publications.
- Wolf, J. B. 2001. Applied Molecular Biology: Beginning Laboratory Manual. Baltimore: University of Maryland.

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Anth 406. Optional

**OPTIONAL PAPER (CULTURAL)**

**1. Environmental Archaeology**

[Total Marks=100, Sessional=25, End-Term=75]

1. Paleo-ecology: prehistoric environment, quaternary climate, geological framework, geographical and ecological concepts of zones.
2. Pleistocene stratigraphy, methods of studying Pleistocene stratigraphy, periglacial and tropical geomorphology; Tundra, Steppes, Mediterranean.
3. Prehistoric environment: humid, arid and tropical geomorphology; river, stream and lake sediments; geomorphological study of archaeological sites; coastal phenomenon and sea level fluctuations.
4. Environmental changes and cultural adaptations: late Pleistocene and early Holocene (post-glacial period); urban origins in Near-eastern flood plains; interdependence of biological and cultural evolution, impact of man on environment.

*Suggested Reading:*

- Agrawal, D.P. and S. Kusumgar. 1974. Prehistoric Chronology and Radiocarbon Dating in India. New Delhi: Concept Publishing House.
- Allchin, F.R. and D.K.Chakrabarti. 1979. A Source Book of Indian Archaeology, Vol.1. Delhi: Munshiram Manoharlal.
- Bahn, Paul G. 1999. Cambridge Illustrated History of Archaeology. Cambridge: Univ. Press.
- Butzer, K. W. 1972. Environmental Archaeology. London: Aldine.
- Datta, Ashok et al. 1995. India at the Dawn of History. Delhi: Adam Kala Prakashan.
- David, Nicholas and Carol Kramer. 2001. Ethnoarchaeology in Action. Cambridge: Univ. Press.
- Dincauze, Dena F. 2000. Environmental Archaeology: Principles and Practice. Cambridge: Univ. Press.
- Fagan, B. M. 1988. In the Beginning. Illinois: Scott Foresman & Co.
- Hodder, Ian. 1991. Reading the Past: Current Approaches to Interpretation in Archaeology. Cambridge: Univ. Press.
- Pollock, Susan. 1999. Ancient Mesopotamia. Cambridge: Univ. Press.
- Thomas, W.L. 1956. Man's Role in Changing the Face of the Earth. Chicago: Univ. Press.
- Wheeler, Mortimer. 1956. Archaeology from the Earth. Baltimore: Penguin Books.

## 2. Anthropology of Gender

[Total Marks=100, Sessional=25, End-Term=75]

1. Concept of gender, evolution of concept of gender, social and biological theories of gender, cultural construction of gender, cross-cultural concepts of gender, anthropological approach to gender studies.
2. Social organization and gender: gender role; social, psychological and cultural factors determining gender relationship; role of family, kinship and caste in gender relationship; gender in patriarchal and matriarchal societies.
3. Gender and cultural change: comparative status of men and women in society; impact of cultural changes on gender relationships.
4. Gender and development: the gender perspective in development; gender sensitivity, gender equity, and gender discrimination; gender development index.

### *Suggested Reading:*

- Ardener, Shirley. 1985. 'The Social Anthropology of Women and Feminist Anthropology'. *Anthropology Today*, 1 (5).
- Brouwer, Jan. 1999. 'Feminism and the Indigenous Knowledge System in India: An Exploration'. In R. Indira and D.F. Behera (eds.), *Gender and Society*, Vol. I. New Delhi: Manak.
- Carrithers, Michael, S. Collins and S. Lukes. 1986. *The Category of the Person*. Delhi: Sage.
- Croll, Elizabeth. 2000. *Endangered Daughters: Discrimination and Development in Asia*. London: Routledge.
- Dube, Leela et al. 1989. *Visibility and Power: Essays on Women in Society and Development*. Delhi: OUP.
- Dube, Leela. 1997. *Comparative Perspectives in Gender in South and Southeast Asia*. New Delhi: Vistaar.
- Kakar, Sudhir and John M Ross. 1995. *Tales of Love, Sex and Danger*. Delhi: OUP.
- Moser, Caroline. 1993. *Gender, Planning and Development*. London: Routledge.
- O'Reilly, Andrea. 2001. *Mothers and Sons: Feminist Perspectives*. London: Routledge.
- Ostor, Akos. 1995. *Concepts of a Person*. Delhi: OUP.
- Rao, Aparna. 2000. *Autonomy: Life Cycle, Gender and Status among Himalayan Pastoralists*. Herndon: Berghahn Books.
- Rogers, Mary. 1998. *Contemporary Feminist Theory*. New York: Cambridge Univ. Press.
- Singh, A.M. and Anita Kelle-Viitanen. 1987. *Invisible Hands: Women in Home-based Production*. New Delhi: Sage.
- Srinivas, M.N. 1996. *Village, Caste and Gender*. Delhi: OUP.
- Oberoi, Patricia. 1994. *Family, Kinship and Marriage in India*. Delhi: OUP.
- Unnithan-Kumar, Maya. 2001. *Identity, Gender and Poverty: New Perspectives on Caste and Tribe*. Delhi: Rawat.
- Whitehead, Harriet and Sherry Ortner. 1981. *Sexual Meanings: The Cultural Constitution of Gender and Sexuality*. New York: Cambridge University Press.

## 3. Anthropology of Work, Leisure and Sports

[Total Marks=100, Sessional=25, End-Term=75]

1. Work ethics, work and identity; management of everyday life, masculinities and femininities.
2. Games and sports: indigenous and modern games.
3. Masculinities and femininities: football, drinking, smoking, music, and popular culture.
4. Tourism: indigenous concepts of tourism, impact on economy and environment, interface lifestyles and worldviews.

*Suggested Reading:*

- Armstrong, Gary and Richard Giulianotti. 1997. *Entering the Field: New Perspectives on World Football*. New York: Berg.
- Burns, Peter. 1999. *An Introduction to Tourism and Anthropology*. London: Routledge.
- Dick, Noel. 2000. *Games, Sports and Culture*. London: Berg.
- Handelman, Don. 1998. *Models and Mirrors: Toward an Anthropology of Public Events*. Herndon: Berghahn Books.
- Jain, Jasbir and Sudha Rai. 2002. *Films and Feminism: Essays in Indian Cinema*. Delhi: Rawat Publications.
- Klausen, A.M. 1999. *Olympic Games as Performance and Public Event*. Oxford: Berghahn.
- Lewis, Reina. 1995. *Gendering Orientalism: Race, Femininity and Representation*. London: Routledge.
- Miller, Daniel and Don Slater. 2000. *The Internet: An Ethnographic Approach*. New York: Berg.
- Pratt, Mary Louise. 1992. *Imperial Eyes: Travel, Writing and Transculturation*. London: Routledge.
- Taylor, T. D. 1997. *Global Pop, World Music, World Markets*. London: Routledge.

**4. Anthropology of Communication**

[Total Marks=100, Sessional=25, End-Term=75]

1. Approaches to the study of human communication: theories and models of communication, channels of communication, scriptural and oral traditions, written and electronic media of communication.
2. Oral traditions of communication: indigenous/folk and modern modes of communication, art, performing and visual communication, and dormitories.
3. Mass media: role of technology in communication revolution; print media, radio, and television; mass media and social-cultural change.
4. Semiotic analysis of communication: verbal and non-verbal communication; text, music and image.

*Suggested Reading:*

- Barthes, Roland. 1977. *Image-Music-Text*. London: Fontana.
- Bauman, R. and J. Sherzer. 1974. *Explorations in the Ethnography of Speaking*. London: Cambridge Univ. Press.
- Berger, J. 1972. *Ways of Seeing*. Harmondsworth: Penguin.
- Bonvillian, Nancy. 1993. *Language, Culture and Communication*. New Jersey: Englewood Cliffs.
- Brown, G. 1996. *Speakers, Listeners and Communication*. Cambridge: Univ. Press.
- Crystal, David. 2001. *Language and Internet*. Cambridge: Univ. Press.
- Eco, U. 1979. *The Role of the Reader: Explorations in the Semiotics of Texts*. London: Indiana Univ. Press.
- Fiske, John. 1990. *Introduction to Communication Studies*. London: Routledge.
- Gumperz, J. J. and D. Hymes. 1972. *Directions in Sociolinguistics: The Ethnography of Communication*. New York: Holt, Rinehart and Winston.
- Leach, E. R. 1976. *Culture and Communication*. London: Cambridge Univ. Press.
- McLuhan, Marshall. 2001. *Understanding Media*. London: Routledge.
- Said, Edward. 1984. *The Word, the Text and the Critic*. Cambridge: Harvard Univ. Press.
- Saville-Troike, M. 1984. *The Ethnography of Communication*. Oxford: Basil Blackwell.
- Thomas, Linda et al. 1999. *Language, Society and Power: An Introduction*. London: Routledge.

**OPTIONAL PAPERS (PHYSICAL)**

5:2:6(31)

### 1. Human Population Biology

[Total Marks=100, Sessional=25, End-Term=75]

1. Definition of population (demographic, genetic, social and ecological), history of population structure, classical and balanced theories of population structure, genetic demography (relevance of demographic variables to analysis of population structure), genetic variation between and within populations and the causes of such variations.
2. Natural selection-methods, models; interaction of genotype and environment, qualitative and quantitative traits; interplay of natural selection and mutation.
3. Distribution of genetic disease in human populations, natural selection and infectious diseases, genetic load, eugenics and eugenics.
4. Polymorphism and polytypism, anthropological use of genetic polymorphisms - nuclear DNA polymorphisms, mitochondrial DNA, Y-chromosome, G6PD, abnormal haemoglobins, thalassemia and ABO blood groups.

#### *Suggested Reading:*

- Boyce, A. J. and C.G.N. Mascie-Taylor. 1996. *Molecular Biology and Human Diversity*. Cambridge: Cambridge University Press.
- Cavalli-Sforza, L. L. and W.F. Bodmer. 1971. *The Genetics of Human Population*. San Francisco: WH Freeman & Co.
- Crawford, M.H. and P.L. Workman. 1973. *Methods and Theories of Anthropological Genetics*. Albuquerque: University of New Mexico Press.
- Devor, E. J. (ed.) 1992. *Molecular Applications in Biological Anthropology*. New York: Cambridge University Press.
- Futuyma Douglas, J. 1998. *Evolutionary Biology*, 3<sup>rd</sup> edition. Massachusetts: Sinauer Associates Inc.
- Harrison, G. A. and A.J. Boyce. 1972. *The Structure of Human Population*. Oxford: Clarendon Press.
- Harrison, G.A. *et al.* 1988. *Human Biology*. Oxford University Press.
- Hedric, P.W. 1999. *Genetics of Populations*, 2<sup>nd</sup> edition. Massachusetts: Jones and Bartlett Publishers.
- Jha, A.P. 1993. *Genes and Evolution*. Delhi: Macmillan.
- Jones, S. *et al.* 1992. *The Cambridge Encyclopaedia of Human Evolution*. Cambridge: Cambridge University Press.
- Macbeth, H. and P. Collinson. 2002. *Human Population Dynamics*. Cambridge: Cambridge University Press.
- Vogel, F. and A.G. Motulsky. 1986. *Human Genetics: Problems and Approaches*. Berlin: Springer-Verlag.
- Yablokov, A. V. 1986. *Population Biology*. Moscow: MIR Publishers.

### 2. Bio-social Anthropology

[Total Marks=100, Sessional=25, End-Term=75]

5:2:6(32)

1. Definition and scope; biology and culture; structure of human population, social structure in relation to demographic and genetic structure of human population-
2. Nutrition and growth - Malnutrition, nutritional deficiency diseases (Kwashiorkor, Marasmus, anemia, iodine deficiency), biosocial aspects of growth and nutritional status, aging and longevity.
3. Health and disease- concepts, children and adolescent health, reproductive health, culture and diseases, population control; genetic diseases - Sickle-cell hemoglobin, G6PD deficiency and thalassemia.
4. Biosocial implications of demographic characteristics- age, sex, fertility, mortality, migration, marriage patterns, inbreeding.

**Suggested Reading:**

- Bhende, A. and T. Kanitkar, T. 1991. *Principles of Population Studies*. New Delhi: Tata McGraw.
- Bond, J. *et al.* 1996. *Ageing in Society: An Introduction to Social Gerontology*. New Delhi: Sage Publications.
- Cohen, Y.A. (ed.) 1974. *Man in Adaptation: The Biosocial Background*, 2<sup>nd</sup> edition. Chicago: Aldine Publishing Company.
- Crawford, M.H. and P.L. Workman. 1973. *Methods and Theories of Anthropological Genetics*. Albuquerque: University of New Mexico Press.
- Dasgupta, P. 1993. *An Inquiry into Well-being and Destination*. Oxford: Clarendon Press.
- Fox, R. 1975. *Bio-social Anthropology*. London: Malaby Press
- Harrison, G.A. *et al.* 1988. *Human Biology*. Oxford University Press.
- Harrison, G. A. and A.J. Boyce. 1972. *The Structure of Human Population*. Oxford: Clarendon Press.
- Harrison, G.A. 1990. *Diet and Disease in Traditional and Developing Societies*. Cambridge: Cambridge University Press.
- Harrison, G.A. and H. Morphy. 1998. *Human Adaptation*. Oxford: Oxford university Press.
- Johnston, F.E. (ed.) 1987. *Nutritional Anthropology*. New York: Alan R. Liss, Inc.
- Johnston, F.E. 1973. *Microevolution*. New Jersey: Prentice Hall Inc.
- Mahadevan, K. *et al.* 1999. *Reproductive Health of Human Kind in Asia and Africa*. Delhi: BR Publications.
- Strickland, S.S. and P.S. Shetty. 1998. *Human Biology and Social Inequality*. Cambridge: Cambridge University Press.
- Ulijaszek S.J. and S. Strickland. 1993. *Nutritional Anthropology: Prospects and Perspectives*. London: Smith Gordon Publishing.

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### 3. Dental Anthropology

[Total Marks=100, Sessional=25, End-Term=75]

1. Meaning, nature and importance of dental anthropology, its relation with other sciences, evolutionary trends in the dentition of primates and man.
2. Morphology and anatomy of human dentition, structure, function and development of teeth – age and sex determination from human teeth.
3. Dental pathology in various human groups of the world, eruption pattern of teeth in various ethnic groups and the factors influencing the patterns.
4. Occlusion: concepts and development of occlusion, dental arch form and neuro-behavioural aspects of occlusion.

#### *Suggested Reading:*

- Alt, K.W., F.W. Rosing and M. Treschler-Nicola. 1998. Dental Anthropology. New York: Springer.
- Ash, M.M. 1988. Dental Anatomy, Physiology, and Occlusion. Philadelphia: W.B. Saunders C.
- Brothwell, D.R. 1963. Dental Anthropology. New York: Pergamon Press.
- Colyer, J.F. and D. Sprawson. 1974. Dental Surgery and Pathology. London: Longman
- Das, A. K. 1987. Dental Anatomy and Oral Histology. Calcutta: Current Books International.
- Hilson, S. 1990. Teeth. Cambridge: Cambridge University Press
- Hilson, S. 1996. Dental Anthropology. Cambridge University Press
- Kelley, M.A. and C. Larsen. 1991. Advances in Dental Anthropology. New York: Wiley-Liss.
- Keiser, J. A. 1990. Human Adult Odontometrics. Cambridge: Cambridge University Press.
- Rami Reddy, V. 1986. Dimension of Anthropology: Dentition, Pathology and Crown Morphology. New Delhi B.R. Publishers
- Scott, G.R. 1997. The Anthropology of Modern Human Teeth. Cambridge: University Press
- Segal, A.H. 1963. Morphology of the Anatomy of Human Dentition. Chicago: Yearbook Medical Publishers
- Simons, E.L. 1972. Primate Evolution. New York: Macmillan.

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**4. Forensic Anthropology**

[Total Marks=100, Sessional=25, End-Term=75]

1. Definition, Scope and Importance of Forensic Anthropology, definition of Crime, its theories and treatment, aims and techniques of anthropology of crime including heredity, environment and criminal behavior.
2. Skeletal remains: identification, differences between human and non-human bones, sex determination, age determination, reconstruction of stature from skeletal remains.
3. Identification of individual through dermatoglyphics, somatometric and somatostopic observations, and dentition.
4. Biological evidences - semen, blood stain, urine, disputed paternity and blood groups; DNA finger printing and other biochemical markers.

*Suggested Reading:*

- Chaurasia, B.D. 1983. Handbook of General Anatomy. Delhi: CBS
- Chaurasia, B.D. 1984. Human Osteology. New Delhi: CBS
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- Dwight, T. 1878. The Identification of the Human Skeleton. Boston: Massachusetts Medical Society.
- El-Najjar, M.Y. and E.R. McWilliams. 1978. Forensic Anthropology. Illinois: Charles C. Thomas
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- Montagu, M.F.A. 1961. An Introduction to Physical Anthropology. Illinois: Charles C. Thomas.
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- Steward, T.D. 1979. Essentials of Forensic Anthropology. Illinois: Charles C. Thomas.
- Ubelaker, D. H. 1989. Human Skeletal Remains: Excavation, Analysis, Interpretation. 2nd ed. Washington, D.C.: Taraxacum.
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