Chapter-1

CURRICULUM : Overview

With the implementation of fresh autonomous status in the college from the academic session, 2014-2015 under the guidelines of University Grants Commission for Autonomous Colleges, the Undergraduate curriculum introduced for the award of Degrees, Diplomas and Certificates follows that of the existing affiliated mode under the Manipur University with modifications in tune with autonomous scheme of UGC. Some of the related provisions of the Ordinances are highlighted here.

1. As per Ordinances, the college offers Bachelor of Arts (Hons.) and Bachelor of Science (Hons.) degree programmes (Six-Semester System) based on the following 7-tier programme options:
    i. Languages and Foundation subjects
    ii. Honours subjects,
    iii. Elective subjects,
    iv. Honours-supportive subjects ,
    v. Allied subjects,
    vi. Extra-Departmental and Extra- credit courses, and
    vii. Vocational, Add-on and Skill Development courses.

    (Tier nos. 6 and 7 are not compulsory for all students)
2. **Programme structure**: Course Structure for B.A. (Honours) and B. Sc. (Honours) under Semester System (three years):

Semester	Subject/Paper	Status	Full Mark	Pass Mark
1	1. MIL/General English Paper-I	non-credit	100	35
	2. Elective I Paper- I	credit	100	40
	3. Elective II Paper- I	credit	100	40
	4. Hons. Paper- I	credit	100	40
	5. One add-on certificate course	non-credit	100	35
	6. One value added course	non-credit	100	35
2	1. MIL/General English Paper-II	non-credit	100	35
	2. Elective I Paper- II	credit	100	40
	3. Elective II Paper- II	credit	100	40
	4. Hons. Paper- II	credit	100	40
	5. One add-on certificate course	non-credit	100	35
	6. One value added course	non-credit	100	35

3	1.Regional Development (NE India)	non-credit	100	35
	2. Elective I Paper- III	credit	100	40
	3. Elective II Paper- III	credit	100	40
	4. Hons. Paper- III	credit	100	40
	5. One add-on diploma course	non-credit	100	35
	6. Honours Supportive Course	non-credit	100	35
4	1. Environmental Studies	non-credit	100	35
	2. Elective I Paper- IV	credit	100	40
	3. Elective II Paper- IV	credit	100	40
	4. Hons. Paper- IV	credit	100	40
	5. One add-on diploma course	non-credit	100	35
	6. Honours Supportive Course	non-credit	100	35
5	1. Hons Paper- V	credit	100	40
	2. Hons Paper- VI	credit	100	40
	3. Hons Paper- VII	credit	100	40
	4. One add-on advance course.	non-credit	100	35
6	1. Hons Paper- VIII	credit	100	40
	2. Hons Paper- IX	credit	100	40
	3. Hons Paper- X	credit	100	40
	4. One add-on advance course.	non-credit	100	35

3. **Subject offered**: For B.A.(Hons) / B.Sc. (Hons), a student shall select any three of the following Elective and Honours subjects at the time of admission to Semester-I by opting one as Honours subject:

B.A.(Hons) Course			B.Sc. (Hons) Course		
Sl. No.	Subject	Status	Sl. No.	Subject	Status
1	Manipuri	Elective & Hons.	1	Physics	Elective & Hons.
2	English	Elective & Hons.	2	Chemistry	Elective & Hons.
3	Economics	Elective & Hons.	3	Economics	Elective & Hons.
4	Mathematics	Elective & Hons.	4	Mathematics	Elective & Hons.
5	Geography	Elective & Hons.	5	Geography	Elective & Hons.

6	Education	Elective & Hons.	6	Botany	Elective & Hons.
7	Anthropology	Elective & Hons.	7	Anthropology	Elective & Hons.
8	History	Elective & Hons.	8	Zoology	Elective & Hons.
9	Pol. Science	Elective & Hons.			

4. **Subjects involving Practical/Laboratory Classes**: (a) For an Elective/ Hons paper of 100 marks comprising theory and practical components in Semester I to IV, the distribution of marks shall be generally as follows:

(i) Theory - 75 marks,

(ii) Practical -25 marks.

(b) Honours Paper- VII in the 5th Semester and Honours Paper- X in the 6th Semester may be Practical /Field Work paper.

5. **Eligibility**: A student who has passed 10+2 Examination of Council of Higher Secondary Education, Manipur, or equivalent examinations recognized by Manipur University is eligible for admission to B.A.(Hons) /B. Sc.(Hons) course.

6. **Working duration**: Each semester shall be of a working duration of 21 weeks. Imparting of instructions and/or laboratory work (including class tests) shall be not less than 17 weeks.

Details of distribution of time requied shall be provided in the respective syllabus.

7. **Attendance:** A student shall be required to have a minimum attendance of 75% or more in a semester (the aggregate of all the courses taken together in a semester,) provided that the Principal may condone attendance shortage up-to 5%/ for individual student for reasons to be recorded. However, under no condition, a student who has an attendance of less that 70% in a semester shall be allowed to appear in the semester end examination.

8. **Evaluation & Examination**: The overall weightage of a course in the Syllabi and Scheme of Teaching & Examination shall be determined in terms of marks and/or grades and/or credits assigned to the course. The evaluation of students in a course shall have two components:

(i) Continuous & Comprehencive Internal Assessment (CIA) : 40%

(ii) Semester End Examination (SEE) : 60%

The same ratio (60:40) will also follow to the Practical Paper/ Portion. For the course with theory & practical with 75 marks for theory portion and 25 marks for practical portion, 75 is apportioned in the ratio 40% : 60% i.e. 30 :45, similarly, for 25 is 10: 15 unless specifically stated otherwise in the Scheme of Teaching & Examination and Syllabi.

9. **Continuous & Comprehensive Internal Assessment**: For theory courses, continuous & comprehensive internal assessment (CIA) comprises **Unit/Periodical tests, home assignments, group discussions, quizzes, project works, seminars** & **attendance** by the teacher(s) of the course. The distribution of weightage of CIA components shall be as given below:

Sl. No.	CIA Component	Weightage of 40
1	Unit/Periodical Test	25% (10 marks)
2	Home Assignment	12.5% (5 marks)
3	Seminar	12.5% (5 marks)
4	Group- Discussion	12.5% (5 marks)
5	Quiz	12.5% (5 marks)
6	Project work	12.5% (5 marks)
7	Class attendance	12.5% (5 marks)

Pass marks for the CIA components shall be 40% for theory and 45% for practical. There shall be at least 4(four) unit tests carrying 10 marks for each test for a paper in a Semester. The average of the best two of the unit tests of a student shall be the score of his/her unit test.

The distribution of marks of Class Attendance component is given below:

Range (%)	Marks.
75-79.9	2
80- 84.9	3
85- 89.9	4
90- 100	5

However, the components of CIA for practical portion may be varied in some parameters of the above mentioned CIA parameters in consultation with the Dean of the faculty and shall be intimated to the Controller of Examinations for approval by the Principal. The variation rate shall be less than 15%.

Non-credit courses are exempted from the components of CIA process.

10. **Maximum Time allowed for Theory and Practical examinations**:

Theory Paper		Practical Paper	
Full marks	Maximum time allowed	Full marks	Maximum time allowed
60	2 hours	60	3-4 hours(even may spread for two days depending upon the nature of the subject)
45	1.5 hours	15	1-2 hours(depending upon the nature of the subject)

11. **Eligibility to appear at the Semester End Examination**:

(i) A student who has studied a regular course of study for a semester in the college may be admitted to the Semester End examination provided the student has attended not less than 75% of the lecturers delivered including practical, and has passed CIA.

(ii) A student who has enrolled himself/ herself in more than one college/ institute simultaneously shall not be admitted into the Semester End Examinations.

12. **Criteria for passing Examination**: Obtaining a minimum of 40% marks in aggregate in each elective and Honours course in SEE and CIA and a minimum of 35% in aggregate in each of Foundation Courses (FC), Value Added Courses (VAC) and Honours Supportive Courses (HSC) shall be essential for passing the course and earning its assigned grade and/ or credits. A candidate, who secures less than 40% of marks in an elective course or 35% in foundation, supportive and value added courses, shall be deemed to have failed in that course.

A candidate who has earned the minimum number of Grade/ credits prescribed in the concerned Scheme of Teaching & Examination and Syllabi, shall be declared to have passed the programme, and shall be eligible for the award of the relevant degree or diploma. The Scheme of Teaching & Examination and Syllabi shall clearly specify the minimum grade/ credits to be earned to qualify for a degree or diploma.

13. **Marks and Grade:** The college shall introduce the Conversion of Marks to Grades under the structure of the SEVEN (07) Points Grading System. The Grading System is as follows:

Grade	Marks	Grade Points
O	70 & above	7
A	60 to 69.99	6
B	55 to 59.99	5
C	50 to 54.99	4
D	45 to 49.99	3
E	40 to 44.99	2
F (Fail)	39.99 & below	1

The successful candidates will be placed in Grades (7-point scale system) as given below:

(i) A candidate obtaining a Cumulative Performance Index (CPI) at the end of the programme of 40 and above but below 45, shall be placed in Grade E.

(ii) A candidate obtaining a CPI at the end of the programme of 45 and above but below 50 shall be placed in the Grade D.

(iii) A candidate obtaining a CPI at the end of the programme of 50 and above but below 55 shall be placed in the Grade C.

(iv) A candidate obtaining a CPI at the end of the programme of 55 and above but below 60 shall be placed in the Grade B.

(v) A candidate obtaining a CPI at the end of the programme of 60 and above but below 70 shall be placed in the Grade A.

(vi) A candidate obtaining a CPI at the end of the programme of 70 and above shall be placed in the Grade O.

A degree in Grade under the seal of the Manipur University (under the UGC Guidelines of Autonomous colleges) shall be awarded to a student who has passed all the semester examinations.

14. **Promotion:** (i) A student who has passed all the papers of a semester end examination will be promoted to the next higher semester.
(ii) A student who has failed in one, two or three papers in a semester end examination may also be promoted to the next higher semester provided that in no case a student will be promoted to the next higher semester if he/she has failed 4 (four) or more papers at a time.
(iii) The failed student may appear at the next corresponding examination for his/her defaulted paper(s) as BACK.

15. **Permissible period for completion**: The maximum permissible period for completing a programme for which the prescribed programme duration is n semesters, shall be (n + 4) semesters. All the programme requirements shall have to be completed in (n + 4) semesters.

Chapter-2 Elective and Honours Syllabi of Subjects

i. B.A./B.Sc. Syllabus of Anthropology

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	Full marks/ Pass marks	Time required (Hours)
1	ANT: E101	Foundation of Anthropology	75/30	70
	ANT: E101P	Physical Practical	25/10	30
2	ANT: E202	Physical Anthropology	75/30	70
	ANT: E202P	Physical Practical	25/10	30
3	ANT: E303	Social & Cultural Anthropology	75/30	70
	ANT: E303P	Ethnological Practical	25/10	30
	ANT: HSC I (non-credit)	Physical Anthropology & Indian Anthropology	100/35	75
4	ANT: E404	Prehistoric Archaeology	75/30	70
	ANT: E404P	Prehistory Practical	25/10	30
	ANT: HSC II (non-credit)	Culture, Prehistory & Applied Anthropology	100/35	75
5	ANT: H505	Physical Anthropology	100/40	100
	ANT: E506	Prehistoric Archaeology	100/40	100
	ANT: H507P	Practical (Physical Anthropology & Prehistory)	100/40	100
6	ANT: H608	Social & Cultural Anthropology	100/40	100
	ANT: H609	Research Methodology & Applied Anthropology	100/40	100
	ANT: H610P	Pract.: Museology & Fieldwork	100/40	100
	12 Papers		1200	1150

* E for Elective; H for Honours; P for Practical; HSC for Honours Supportive Course

SEMESTER- I

ANT: E101 Foundation of Anthropology Full Marks-75

Unit I: (I) Definition of Anthropology; historical development; scope and main branches of Anthropology.

(II) Essence of study on preliterate societies in Anthropology.

(III) Relationship of Anthropology with other disciplines: Paleontology, Geology, Archaeology, Linguistics, Sociology, History.

(IV) Practical study of Anthropology - Laboratory and Field content- Anthropology and field work tradition. (25 Marks; 26 hours)

Unit 2: (I) Man as biological and social being.
(II) Man's place in the animal kingdom.
(III) Human society vs. animal society; culture (tangible and intangible)
(IV) Cultural relativism: Case study (student self-learning activity in library or field). (25 Marks; 22 hours)

Unit 3: (I) Concept of single species - Homo Sapiens; habitat and environment, ecology and adaptation.
(II) understanding variation : biological and cultural.
(III) Physical characteristics resulted from adaptation to different environmental condition (cold, hot and high altitude).
(IV) Culture as means of adaptation to different eco-niches. (25 Marks; 22 hours)

ANT: E101P Laboratory practical (25-Marks; 30 hours)

(I) Identification of instruments: Sliding Caliper, Spreading Caliper (blunt and pointed), Anthropometer, Rod Compass, Tubular Craniophore, Cubic Craniophore, and Diagraph, Osteometric Board, Goniometer. 2 Marks

(II) Somatometry (to be taken on 5 subjects) Measurements : stature/height vertex, sitting height vertex, body weight, maximum head length, maximum head breadth, least frontal breadth, total facial height, horizontal circumference of head, nasal height, nasal breadth. Indices: Cephalic Index and Nasal Index. 10 Marks

(III) Somatoscopic observation: hair form, skin colour, nose- root, bridge and septum. 4 Marks

Note Book 5 Marks

Viva Voice 4 Marks

Reading list:

1. Beals, and Hoizer, 1975. An Introduction to Anthropology New York, Macmillan Publishing Co.
2. Das, B.M., 1998. Outline of Physical Anthropology, Kitab Mahal, Allahabad.
3. Mair, Lucy, 1972. An Introduction to Social Anthropology, London, Oxford Univ. Press.
4. Majumdar & Madan, 1975. An Introduction to Social Anthropology, APH, New Delhi.
5. Lasker, G.W., 1976. Physical Anthropology, Holt, Rinehart & Wiston, New York.
6. Singh,IP & MK. Bhasin, 1989. Anthropometry. Kamalaraj Enterprises, Delhi.
7. Ember and Ember,2003. Anthropology: A Brief Introduction. Prentice Hall, NJ.
8. Scupin, R. & CR. DeCorse, 2009. Anthropology: A Global Perspective. Sixth ed.,PHI Learning Pvt. Ltd., New Delhi.

9. Burkitt, MC. 1969. Old Stone Age. McMillan, London.
10. Rami Reddy,V. 1982. Elements of Prehistory. Mittal Publication, New Delhi.
11. Kottak, CP., 2002(9th ed.), Cultural Anthropology. McGrow Hill, New York.
12. Herskovits, MJ. 1955. Cultural Anthropology. Oxford & 1BH, New Delhi.
13. Roy, Indrani Basu. 2013(Rev. edn.). Anthropology. S. Chand & Co., Delhi.
14. Adam W.M. Mitchell: Gray's Anatomy for Students. 2nd edition.
15. Chaurasia, BD: Human Osteology. CBS Publisher & Distributors, New Delhi.

SEMESTER- II

ANT: E202 Physical Anthropology Full Marks-75

Unit 1: (I) Definition and scope of Physical Anthropology; its relationship with different branches of Anthropology and other fields - Biology, Demography, Ecology and Forensic sciences.
(II) Man as a primate; salient characters and classification of the order primate.
(III) Characters and distribution of the anthropoid apes. (25 Marks) 26 periods

Unit 2: (I) Human Skeleton : classification and anatomical features.
(II) Changes due to the assumption of erect posture: skull, vertebral column, pelvic girdle, femur and foot.
(III) Comparative anatomy: Ape and Man. (25 Marks) 22 periods

Unit 3: (I) Theories of organic evolution: Lamarckism, Neo-Lamarckism, Darwinism, Neo Darwinism and Mutation Theory of Hugo de Vries.
(II) Hominoid and Hominid fossils: characteristic and phylogenic status of Dryopithecus, Ramapithecus (Ramapethecus bevirostris), Australopithecus (Australopithecus Africanus), Zinjanthropus boisei. Homo erectus: Sinanthropus Pekinensis. (25 Marks) 22 periods

ANT: E202P Laboratory Practical 25 Marks (30 periods)

(I) Human Osteology: drawing and description of bones- Skull: frontal, parietal, occipital and temporal, Girdle bones : clavicle, scapula and pelvis. Limb bones: humerus radius-ulna, femur, tibia-fibula. 5 Marks

(II) Craniometry: direct measurements of two skulls. Linear measurements : Maximum Cranial length, Maximum Cranial breadth, Least frontal breadth, Frontal chord, Parietal Chord, Occipital Chord, Nasal height, Nasal breadth, Bizygometic breadth. Length and breadth of foramen magnum. Indices : Cranial index, Nasal index. Angular measurements : Metopic angle, Nasal profile angle. 5 Marks

(ill) Osteometric measurements (on a pair of bones for each case) Scapula : Anatomical breadth, Anatomical length, Length of Axilliary border.
Humerus: Maximum length, Breadth of proximal epiphysis, Breadth of distal epiphysis, least girth of shaft.

Femur: Maximum length, Physiological length, trochantric length, Girth in the middle of the shaft. 5 Marks

(IV) Laboratory Note -book 5 Marks.

(V) Viva-Voce 5 Marks.

Reading list:

1. Barnauw, Victor. 1971. An introduction to Anthropology, Vol. 1, Physical Anthropology & Archaeology. The Dorsey Press, Illinois.
2. Brace, CL.1967. The Stages of Human Evolution. Prentice Hall, inc. New Jersey.
3. Comas, Juan. 1960. Manual of Physical Anthropology. Charles C. Thomas, Illinois.
4. Buttner, Janusch, J. 1969. Origins of Man. Wiley Eastern Pvt. Ltd., New Delhi.
5. Das, BM. 1989. Outline of Physical Anthropology. Kitab Mahal, Allahabad.
6. Hooton, AE. Up from the Ape. Macmillan Co., New York.
7. Lasker, GW. 1976. Physical Anthropology. Holt, Rinehart & Wiston, New York.
8. Montagu, MFA.1961, An Introduction to Physical Anthropology. Charles C. Thomas, Illinois.
9. Srivastava, RP. 2009. Morphology of the Primate and Human Evolution. PHI Learning Pvt. Ltd., New Delhi.
10. Chaurasia, BD. 1993. Human Osteology. CBS Publishers and Distributors, Bhola Nath Nagar, Shandra, Delhi.
11. Nath, S. 1005. Anthropometry -the Measurement of Body Size, Shape and Form. Friends Publication, New Delihi.
12. Singh, IP and MK Bhasim. 1989. Anthropometry. Kamaia Raj Enterprises, Delhi.
13. —do- 2004. A Manual of Biological Anthropology. —do-
14. Singh, SP & Pamila Mehta, 2009. Human Body Measurements- Concept and Application. PHI Learning Pvt. Ltd., New Delhi.

SEMESTER- III

ANT: E303 Social and Cultural Anthropology **Full Marks-75**

Unit 1: Emergence and growth of Social and Cultural Anthropology, its relationship with Psychology, Economics and Political Science.

Concept of Society and Culture; Social groups (primary and secondary); Communities (rural and urban); Culture and Environment; Cultural Plurality; Status and Role. (25 Marks) 22 periods

Unit 2: Kinship :

(i) Type of kinship - consanguineal and affinal; kin-groups- lineage, clan, phratry and moiety.

(II) Degree of kinship - primary, secondary and tertiary. Terminology - classification and descriptive;

(III) Kinship behavior- avoidance, joking relationship and tecknonymy. Usages - avunculate, amitate and couvade;
(IV) Family: definition, types, function, and residence.
(V) Marriage: definition, forms, prescribed and preferential marriage.
Ways of acquiring mates; hypergamy and hypogamy. (25 Marks) 26 periods

Unit 3: Polity - state and stateless societies; Forms of government and law.
Economy - definition, characteristics of primitive economy; Kula and Potlatch.
Religion- definition, characteristics; magic, religion and science. Animism, Manaism, Fetishism, Totemism, Naturalism.
Rites and ritual: Rites de-passage; Specialist- shaman, priest; divination.
(25 Marks) 22 periods

ANT: E303P Laboratory Practical (25 Marks; 30 hours)

A. Museology: Concept and basis of classification of museum specimens. (6 Marks)
B. Project on documentation of ethnological specimens. (10 Marks)
(Every student is required to prepare a documentation report of at least 5 (five) technological implements, items, under the guidance of the assigned teacher, and submit the same to the Department.)

C. Note - book (4 Marks)
D. Viva Voce (5 Marks)

Reading list

1. Beals, Hoizer & Beals, 1975. An Introduction to Anthropology, New York, MacMillan Publishing Co.
2. Roy, I. Basu. Anthropology, The Study of Man, S. Chand & Co. Litd,Delhi.
3. Mair, Lucy, 1972. An Introduction Social Anthropology, London,Oxford University Press.
4. Majumdar Madan, 1975. An Introduction to Social Anthropology, APH, New Delhi.
5. McIver & Page,1957. Society, Macmillan, London.
6. Davis, Kingsley,1949, Human Society, Macmillan, London.
7. Hoebel & Frost, 1976. Cultural & Social Anthropology, Mc Graw Hill.
8. Herscovits, M. J., 1951. Cultural Anthropology, IBM Publications, New Delhi.

ANT: HSC 1 **Physical Anthropology & Indian Anthropology**

Full marks: 100

Unit 1: (i) Human Genetics as a sub-branch of Anthropology.
(ii) Cells and genes; structure of cell; chromosome: kinds and composition; role of DNA and RNA.
(iii) Concepts of population and gene pool; genetic mechanism of variation.
(iv) Heredity and environment. (25 marks) 15 periods

Unit 2: (i) Evolution: terms and principles - gradualism, punctuated equilibrium, genetic equilibrium, parallelism and convergence, homology and analogy, adaptive radiation, irreversibility, extinction.
(ii) Evidences of evolution: anatomical, embryonic, vestigial and fossil.
(iii) Race; popular concept and anthropological concept; race and racism; UNESCO statement on race.
(iv) Formation of race: factors - gene mutation, natural selection, genetic-drift, hybridization, migration and isolation, sexual selection and social selection.
(25 marks) 20 periods

Unit 3: (i) Definition and scope of Ethnography, its relation to Anthropology; distinction between ethnography and ethnology; concept of New Ethnography.
(ii) Definition of tribe and caste; characteristics, geographical distribution and population patterns of Indian tribes.
(iii) Distribution and population patterns of schedule tribes and castes of Manipur.
(iv) Characteristics of Indian villages. (25 marks) 20 periods

Unit 4: (i) Origin and growth of Indian Anthropology.
(ii) Contributions of the following to the growth of Indian Anthropology:
a) M.N. Srinivas, b) L.P. Vidyarthi.
(iii) Ethnographic account of the following ethnic groups (with special reference to social organization): a) The Kabui, b) The Kom.
(iv) Project work on ethnography of India using library and internet. (Each student/group of students should submit a project report on a problem/topic in consultation with the teacher concerned) (25 marks) 20 periods

Reading List:

1. Das, B.M. (1998 ed): Outline of Physical Anthropology. Kitab Mahal, Allahabad.
2. Beal & Hoijer (2007 rep.): An Introduction to Anthropology. Surjeet Publications, Delhi.
3. Scupin & DeCorse (2008 ed.): Anthropology - A Global Perspective. Pearson Edn. Inc., USA
4. Rey, I.B. (2013 ed.) Anthropology - The Study of Man. S Chand & Co., New Delhi.
5. Carison. E.A. (1982): Human Genetics. Tata McGraw Hill Publishing Co., New Delhi.
6. Jha, M. (1996 Rep.): An Intro. To Indian Anthropology, Vikas Pub. House, New Delhi.
7. —do— (2007 Rep.): An Introduction to Anthropology Thought. —do—
8. Vidyarthi & Rai (1985): The Tribal Culture of India. Concept Publications, New Delhi.
9. Vidyarthi L.P. (1978): Rise of Anthropology in India. Concept Publications, New Delhi.
10. Srinivas (1952): Religion and Society among the Coorgs of S. India. Oxford Uni. Press. Majumdar & Madan (1975 ed.):

SEMESTER- IV

ANT: E404 Archaeological Anthropology Fullmarks-75

Unit 1: Archaeological Anthropology: definition, scope and sources; methods of studying Archaeological Anthropology. Its relationship with other branches of Anthropology and allied Sciences-Geology, Paleontology, Geography, Physics and Chemistry. Basic concepts: artifact, industry, culture, civilization and revolution (Neolithic and Urban) (25 Marks) 23 periods

Unit 2: Geological time scale and emergence of man; significance of Pleistocene epoch in Prehistory; Pleistocene climatic condition (glacial and pluvial) and causes of glaciations (astronomical and plate-tectonic) evidences (moraines, loess, river terraces and sea level changes) methods of dating the finds, relative dating (stratigraphy and fluorine test) and absolute dating- radio carbon (C14) and potassium-argon (K 40) dating. (25 Marks) 24 periods

Unit 3:Tool typology and technology: distinguishing features between man-made tool and naturally-fragmented alleged tool. Stone tool typology-concept and classification; stone tool types and their functions. Stone tool techniques - direct, indirect, pressure flaking, grinding and polishing. Identifying characters: primary and secondary flaking. (25 Marks) 23 periods

ANT: E404P Prehistoric Practical **(**Fullmarks-25; 30 hours)

(1) Systematic drawing and description of the following tools.
(a) Chopper and Chopping tool - (1 each)
(b) Hand axes-Pyriform, Cordiform, Ovate (1 each)
(c) Cleaver - U and V shaped (1- each) (10 marks)
(2) Typo-technological and functional classification of the tools belonging to the Lower Paleolithic Culture. (5 Marks)
(3) Laboratory Note - Book (5 Marks)
(4) Viva-Voce (5 Marks)

Reading List:

1. Bhattacharya, D.K. Old Stone Age Tools (a manual of Lab. Techniques of analysis). Calcutta, PK Bagchi & Co.1979
2. Crabtree, DE. An Introduction to the Technology of Stone Tools. Occasional Papers No. 28. Pocatello, ID: Idaho State College Museum,1972.
3. Das, SR. Stone Tools —History and Origins. Calcutta, Pilgrim Publishers.
4. Michels, JW. Dating Methods in Archaeology. New York: Seminar Press, 1973.
5. Rami Reddy, V. Element of Prehistory. New Delhi: Mittal Publications, 1982.
6. Swanson, Earl (ed.) Lithic Technology. The Hague: Mouton Publishers, 1975.

ANT: HSC I1 Cultural, Prehistoric & Applied Anthropology

Full Marks: 100

Unit 1: (I) Culture- concepts and characteristics.
(II) Views of how culture is originated.
(III) Habitat, culture and environment; meaning of technology and material culture.
(IV) Concept of culture change; factors of culture change. (25 marks) 15 periods

Unit 2: (I) Concepts: culture trait, complex, area, centre, marginal, climax.
(II) Acculturaion, assimilation, cultural focus, reinterpretation and revivalism.
(III) Meaning of cultural configuration, pattern and integration.
(IV) Cultural pluralism and sub-culture, covert and overt culture, emic and etic culture, ethnocentrism and world view. (25 marks) 16 periods

Unit 3: (I) Rise of prehistoric art, Palaeolithic home art and cave art and their motives.
(II) Domestication and settled life: origin and consequences.
(III) Prehistory of Manipur: an overview.
(IV) Project work on the megalithic culture of Manipur (based on library and internet). (25 marks) 22 periods

Unit 4: (I) History of Applied Anthropology (with special reference to India).
(II) Applied Physical Anthropology: sports and medico-legal aspects.
(III) Applied Prehistoric Archaeology: CRM
(IV) Applied Cultural Anthropology: social planning. (25 marks) 22 periods

Reading list:

1. Roy, LB. (2013ed.): Anthropology- the study of man. S. Chand & Co.. New Delhi.
2. Jha, M (2007 Rep): An introduction to Anthropological Thought. Vikas Publ., Delhi
3. Scupin & DeCorse (2008 ed.): Anthropology- A Global Perspective. Pearson Edn. Inc.,USA
4. Herscovirs,M.J. (1955): Cultural Anthropology. Oxford & IBH Publishing House, Delhi.
5. Majumdar and Madan (19/5ed.): An Introduction to Social Anthropology. A.P.H., Bombay.
6. Burkitt, M.C. (1963): Old Stone Age. (Indian edition), Rupa & Co., Calcutta.
7. Vidyarthi, L.P. (1990): Applied Anthropology in India. Kitab Mahal, Allahabad.
8. Kottak, C.P. (2002): Cultural Anthropology. Mc-Gnaw Hill, New York.
9. Singh,O.K. (1986): Prehistory of Manipur. A.I. Antiquities, Imphal.

SEMESTER- V

ANT: H505 Physical Anthropology
Full Mark - 100

Unit 1. Human Genetics: definition and scope, history and development. Theories of Inheritance; Man as an object of Genetical study; laws of heredity (Mendel's Principles).
(25 Marks) 25 periods

Unit 2. Human chromosome complement: cell division; mitotic and meiosis; simple single factor inheritance in man; multiple allelism; polygenic inheritance.
(25 Marks) 25 periods

Unit 3. Different stages of life; growth and development; methods of studying growth (longitudinal, semi-longitudinal and cross-sectional) factors affecting growth.
(25 Marks) 25 periods

Unit 4. Racial criteria - stature, skin colour, hair, eye, nose, face, ABO blood groups, dermatoglyphics.
Major racial group of the world and their characteristics.
Racial classification of India after H.H. Risley and B.S. Guha.
(25 Marks) 25 periods

Reading list:

1. Carlson E.A. Human Genetics. TATA Mc Graw-Hill Publishing Co. Ltd, New Delhi.
2. Comas, Juan. 1960. Manual of Physical Anthropology, C harles C. Thomas, Illinois.
3. Buttner Janusch, 1969. Origins of Man. Willy Eastern Pvt. Ltd., New Delhi.
4. Das, B.M., 1998. Outline of Physical Anthropology. Kitab Mahal, Allahabad.
5. Tanner, 1978. Foetus into Man-Physical growth from conception to maturity, Harvard Univ.Press
6. Harrison,Weiner, Tanner & Barnicot, 1988. Human Biology, Oxford Univ.Press.
7. Montagu M.F.A. 1961. An Introduction to Physical Anthropology, Charles C. Thomas, Illinois.
8. Shukla, B.R.K. and Sudha Rastogi, Physical Anthropology & Human Genetics.
9. Sarkar, R.M. Fundamentals of Physical Anthropology, Vidyalaya Library Pvt. Ltd.
10. Stern,curt, Principles of Human Genetics, Eurasia Building House Pvt. Ltd., New Delhi.

ANT: H506 **Archaeological Anthropology**
Full marks- 100

Unit 1: Palaeolithic Culture of Europe: Lower (Abbevillian, Acheulian, Clactonian, and Lavalloisian); Middle (Mousterian); Upper (Aurignacian, Solutrean and Magdalenian). Palaeolithic Culture of India: Lower (Sohanian and Madrasian), Middle (Nevasian), Upper (Bhimbetka and Belan Valley). (25 marks) 25 periods

Unit 2: Mesolithic Culture of Europe: (Azilian, Tardenoisean, Maglemosean and Kitchen Midden). Mesolithic culture of India: general characters with reference to Langhnaj, Bagor and Terisites. (25 marks) 25 periods

Unit 3: Neolithic Cultures of Europe and India: general features of Neolithic Revolution. Neolithic culture of Europe (Early and Late); Neolithic culture of India: Eastern group, Southern group and Northern group. (25 marks) 25 periods

Unit 4: Metal Age Culture of India: Indus Valley Civilization- geographical extent, features (town planning, social life, art & craft, religion, script), causes of decline. Indian Megalithic culture: definition, typology and general characters. Iron Age culture of India: iron associated with PGW, RBW and Megaliths. (25marks) 25 periods

Reading List

1. Allchin, Bridget & Raymond. The Birth of Indian Civilisation- India and Pakistan before 500 B.C. Cambridge: Penguin Books. 1993.
2. — do — .

The Rise of Civilisation in India & Pakistan. New Delhi: Select Book Service, 1984.
3. Banerjee, NR. The Iron Age in India. Delhi: Munshiram Manoharlal, 1965.
4. Chakrabarti, DK. India- An Archaeological History. New Delhi:Oxford Univ. Press,'99.
5. Childe, V. Gordon. The Dawn of European Civilisation. London: Routledge & Kegam Paul Ltd. 1957.
6. Clark, Grahame. World Prehistory. London: Cambridge Univ. Press, 1961.
7. Fairservis, Jr., WA. The Roots of Ancient India. NewYork: MacMillan, 1971.
8. Jain, KC. Prehistory and Protohistory of India. Delhi, 1972
9. Peregrine, PN. World Prehistory: two-million Years of Human Life. Prentice Hal1, 2003
10. Rami Reddy, V. Palaeolithic and Mesolithic Cultures. Delhi: Mittal Publications, 1987.
11. — do- Neolithic and Post-Neolithic Cultures. — do -
12. Srivastava, KM. New Era of Indian Archaeology, Vol.1, Delhi: Cosmo Publications.

ANT: H507P **PHYSICAL ANTHROPOLOGY AND PREHISTORY PRACTICAL**
Full Marks-100

Group A: Physical Anthropology (60 Marks; 60 hours)

(I) Somatometry (to be taken on 10 subjects)

i. Stature or height vertex (2) Sitting height vertex (3) Body weight (4) Bi-Acromial diameter (5) Maximum head length (6) Maximum head breadth (7) Least frontal breadth (8) Breadth of bi-zytgomatic arch. (9) Total Facial Height (10) Upper Facial Height (11) Horizontal Circumference of head (12) Nasal Height (13) Nasal Breadth (14) Bi-gonial breadth (15) Arm span.

ii. Indices : (1) Cephalic Index (2) Total Facial Index (3) Nasal Index and (4) Body Mass Index.

iii. Somatoscopic observation: (1) Hair Form and Texture (2) Skin Colour (3) Nose-Root, Bridge and Septum, (4) Lip : Form and Eversion, (5) Eye-fold, colour and fissure.

10+5+5=20 Marks

(2) Serology (to be studied on 10 subjects) introduction, ABO and Rh system.

5 Marks

(3) Dermatoglyphics (to be taken on 5 subjects both hands) introduction, finger types (Henry classification). Total ridge count, absolute ridge count, pattern intensity index, Dankmeijer index and Furuhata index, mainline formula, mainline index.

15 Marks

(4) Human Physiology: Measurement of pulse rate and blood pressure on 3 (three) subjects.

5 Marks

(5) Laboratory Note-book 10 Marks

(6) Viva Voce 5 marks

Group B : Prehistory (40 Marks; 40 hours)

1. Systematic drawing and description of the following tools: 20 Marks

(a) Palaeolithic Culture

Flake tools: i. Scrapers (side, round, convex, end concave hollow)

ii. Points (simple, tanged, laurel leaf, Willow leaf).

iii. Borer (simple, borer-cum-scraper).

Blade tools: Simple blade and blunted blade.

Bone tools: harpoons, needle, points, dart thrower, baton-de-commandment.

(b) Mesolithic: Microliths: simple micro-blade, retouched micro-blade, fluted core, and geometric microliths (crescent, triangle and trapeze)

(c) Neolithic culture

(i) Celts (axe, edze, chisel, shouldered cell, and ring stone).

(ii) Pottery (hand-made potsherds, and wheel-made potsherd).

(2) Type-technological and functional identification of the above tools. 5 Marks

(3) Laboratory Note - Book 10 Marks

(4) Viva - Voce. 5 Marks

Reading List

1. Nath, S. 2005. Anthropometry-The Measurement of Body Size, Shape and Form. Friends Publication, New Delhi.
2. Sen, Tulika. 1994. Guide to Anthropology. The World Press, Calcutta.
3. Singh, I.P. and Bhasin, M.K. 1989. Anthropometry, Kamala Raj Enterprises, Delhi.
4. —do- 2004. A Manual of Biological Anthropology. —do-
5. Singh, IP and Mehta, P. 2009. Human Body Measurements. PHIL Learning Pvt. Ltd, New Delhi.
6. Das, BM & Ranjan Deka. Physical Anthropology Practical. Kitab Mahal, Allahabad.
7. Birks, T. Outline guide to pottery. Poole: Blandford Press. 1975.
8. Oakley, K.P. Man the Toolmaker (sixth edn.) London: Trustees of the British museum (Natural History).1972.
9. Sankalia, H.D. Stone Age Tools: Their Techniques, Names and probable functions. Poona: Deccan College. 1964.
10. Semenov, S.A. Prehistoric Technology- an experimental study of the oldest tools and artifacts from traces of manufacture and wear. London: Moonraker Press. 1974.

SEMESTER- VI

ANT: H608 Social and cultural Anthropology Full Marks: 100

Unit 1: Social change: meaning, factors of social change; theories of social change. Assimilation, Acculturation, Enculturation/Socialization and Cultural lag. (25 marks) 25 periods

Unit 2: Theories of Social and Cultural Anthropology: Evolutionism, Neo-evolutionism, Diffusionism (British, Germany, American). (25 marks) 25 periods

Unit 3: Ethnographic account of the following ethnic groups- a) The Nuer (political organisation), b) The Purum (kinship organisation) c) The Onge (economy) d) The Chin (religion) e) The Khasi (inheritance) (25 marks) 25 periods

Unit 4:Indian Anthropology: Profile of Indian tribes (distribution, race, linguistic and socio-economic); land alienation, shifting cultivation. Constitutional safeguards of tribes. Civilization studies: sanskritisation, parochalisation, universalisation, sacred complex; great and little tradition; caste-tribe continuum. Globalization. Caste system. (25 marks) 25 periods

Reading list :

1. Bose, N.K. Tribal Life in India
2. Bottomore, T.B. Sociology. Clarendon Press, London.
3. Davis, Kingsley. 1949. Human Sociology. Macmillan, New York.
4. McIver and Page, Society. Macmillan, London.
5. Sahay and Singh, PK. 1998. Indian Anthropology. KK Publication, Allahabad.
6. Majumdar and Madan. 1975. An Intro. to Social Anthro. APH, New Delhi.
7. Herskovits, MJ. 1951. Cultural Anthropology. IBM Publications, Delhi.
8. Srinivas, MN. 1966. Caste in Modern India & Other Essays. APH, Bombay.
9. Evans-Pritchard, EE. 1940. The Nuer. Oxford Univ. Press, London.
10. Gurdon, PRT. 1907. The Khasis, London.
11. Das, TC. 1945. The Purum. Calcutta University Press, Calcutta.
12. Mathur, LP. 1068. History of Andaman & Nicobar Island. Sterling Pub. Prvt. Ltd., Delhi.
13. Leber FM. GC. Hckey, JH. Musgrave. 1964. Ethnic Groups of Mainland SE Asia. Human Relation Area File, New Haven.

ANT: H609 Research Methodology and Applied Anthropology

Full Marks: 100

Unit 1: Field-work tradition in Anthropology; pilot survey, observation- participant & non-participant observation, schedule and questionnaire, case study, interview and genealogical method of data collection. (25 marks) 25 periods

Unit 2: Statistics- universe and sample; random and non-random sampling; raw and array data; variables (quantitative and qualitative, discrete and continuous); frequency distribution; measures of central tendency (arithmetic mean, median, mode); measures of dispersion (range, standard deviation, standard error); graphic representation (histogram, polygon and pie chart). (25 marks) 35 periods

Unit 3: Report Writing: Steps of report writing- introduction, methodology, analysis, discussion, summary and conclusion; Footnotes, Reference, Bibliography, and Appendix. (25 marks) 20 periods

Unit 4: Meaning and scope of Applied Anthropology. Concepts and basic postulates of Action Anthropology and Development Anthropology. Use of anthropological knowledge in planning and development. (25 marks) 20 periods

Reading list

1. Young, PV. Scientific Social Survey And Research, Printice Hall International, Delhi.
2. Anderson,Dursion &Poole.1970. Thesis and Assignment Writing. Wiley Eastern Ltd., Delhi.
3. Goode & Hatt, Methods in Social Research. Mc Craw-Hill Book Co., London.
4. Kothari, CR. Reaearch Methodology; Methods and Techniques. Wishwa Prakashan, Delhi.
5. Pelto and Pelto. Anthropological Research Structure of Enquiry.
6. Vidyarthi, LP. 1990. Applied Anthropology in India. Kitab Mahal, Allahabad.
7. Scupin, R. and CR. Decorse. 2005. Anthropology: A Global Perspective. Printice-Hall of India, Pvt. Ltd., New Delhi.
8. Mathur, Hari Mohan. 1995 (2nd enl.ed.) Anthropology and Development in Traditional Societies. Vikas Pub. House Pvt. Ltd., New Delhi.
9. Tylor, EB. 2003. Research Methodology in Anthropology. Goyl Saab, Delhi.

ANT: H610P **PRACTICAL /FIELD WORK**

Full Marks: 100

A**) Museology** (20 marks; 10 hours)

i) Definition and origin of museum in a nutshell; importance of museum; methods of treatment of wood, metal and fabric articles; different methods of display in ethnological museum. 10 marks

ii) Laboratory Note-book: 5 marks

iii) Viva Voce: 5 marks

B) **Field Work** (80 marks, 90 hours)

In a fieldwork programme to be organized by the Department, students are required to stay for a week in the field site selected from time to time. On the basis of the fieldwork, each student shall produce an ethnographic report. Field survey shall consist of:

i) General account of the field site 10 marks

ii) Census survey 10 marks

iii) Anthropometric measurements: Height Vertex, Sitting Height Vertex, Body Weight, Head Length, Head Breadth, Nasal Height, Nasal Breadth. Two indices- Cephalic Index & Nasal Index of at least 30 male and 30 female 20 marks

iv) Material culture: technical drawing, photography and description- house type, agriculture, fishing & hunting implements, dress & ornaments 10 marks

v) Non-material culture: Aspects of social, economic, political, beliefs & practices 10 marks

(Supervisors may assign selected topics to the students. While submitting reports, care should be taken by the Supervisors for not to produce ditto copies by the students.)

Distribution of marks for field report:

i) Field report- (60 marks)

ii) Viva Voce- (20 marks)

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ii. B.Sc. SYLLABUS OF BOTANY

Course structure for Elective and Honours

Semester	Subject-Paper Code*	Paper Name	Full marks/ Pass marks	Time required (Hours)
1	BOT: E101 BOT: E101P	Virus, Bacteria & Cryptogams Practical	75/30 25/10	75 30
2	BOT: E202 BOT: E202P	Gymnosperms, Angiosperms, Applied Botany & Embryology. Practical	75/30 25/10	75 30
3	BOT: E303 BOT: E303P	Plant Geography, Ecology, Plant Practical	75/30 25/10	75 30
	BOT: HSC I (non-credit)	Botany Honours Supportive course I (Theory & Practical)	100/35	80
4	BOT: E404 BOT: E404P	Cytogenetic, Biotechnology and Biometrics Practical	75/30 25/10	75 30
	BOT: HSC II (non-credit)	Botany Honours Supportive course II (Theory & Practical)	100/35	80
5	BOT: H505	Microbial Diversity, Plant Pathology & Embryophyta	100/40	95
	BOT: E506	Advance Plant Taxonomy, Anatomy, Embryology & Palynology	100/40	95
	BOT: H507P	Practical (Based on theory papers of H505 & H506)	100/40	95
	BOT: H608	Ecology, Plant Physiology & Molecular Biology	100/40	95
6	BOT: H609	Cell Biology, Genetics, Plant breeding, Biotechnology & Computer Application	100/40	95
	BOT: H610P	Practical (Based on Theory papers of H608 & H609)	100/40	55
	12 Papers		1200	1120

*E for Elective; H for Honours; P for Practcal; HSC for Honours Supportive Course

SEMESTER- I

Full Mark-100

Objectives of learning:

To enable the students:

i) *To get the knowledge of contents of syllabus*
ii) *To understand the morphology, structure and knowledge of the organism*
iii) *To understand the meaning of scientific terms*
iv) *Differentiate between various groups of bacteria, fungi pathology, lichen, algae, bryophyte, pteridophytes*
v) *Learn about causal organisms of plant diseases*

BOT: E101 Virus, Bacteria and Cryptogams Full Marks: 75

Unit I: Virus –General structure, viral components, classification, nomenclature, viral replication (TMV)Bacteria – General characters, prokaryotic cell organization, brief account of Bergey's classification system, reproduction, brief account on genetic recombination in bacteria, types of nutrition, autotrophism and heterotrophism. 15 marks

Unit II : Fungi – General characters,ecology and significance, classification (John Webther,1977/ Alexopolus,1979)), asexual and sexual reproduction, life cycles of *Saprolegnia* (Mastigomycota), *Mucor* (Zygomycota), *Neurospora* (Ascomycota), *Puccinia* (Basidiomycota) and *Penicillium* (Deuteromycota), economic importance of fungi.Lichens – Thallus structure, reproduction and economic importancePlant Pathology – Concepts and classification of plant diseases, causes of plant disease, principles of plant disease management. 15 marks

Unit III : Algae – General characters, classification (Fritsch/Robert E.Lsee,1999), range of vegetative and reproductive structure of different classes, life cycles of *Oscillatoria* (Cyanophyceae),*Oedogonium*(Chlorophyceae),Chara (Characeae) *Vaucheria* (Xanthophyceae), *Cyclotella* (Bacillariophyceae), *Ectocarpus* (Phaeophyceae) and *Polysiphonia* (Rhodophyceae), economic importance of algae. 15 marks

Unit IV : Bryophytes – General characters, Adaptation to land habit, classification, alternation of generation, range of structural organization of gametophytes and sporophytes, methods of reproduction, life cycles of *Riccia, Marchantia, Anthoceros, Pellia, Porella, Sphagnum* and *Funaria. Ecology and economic importance.* 15 marks

Unit V : Pteridophytes – General characters, classification, anatomy of sporophytes, reproductive methods, life cycles of *Lycopodium, Selaginella, Equisetum, Isoetes, Marsilea* and *Dryopteris.Ecological and Economical importance of pteridophytes.* 15 marks

BOT: E101P (PRACTICAL)

Full Marks: 25

1. Gram staining of bacteria
2. Microscopic study of vegetative and reproductive structures of algal genera included in theory syllabus
3. Microscopic study of vegetative and reproductive structures of fungal genera included in theory syllabus.
4. Study of lichen thalli – crustose, foliose and fructicose, Study of locally important plant diseases
5. Morphology and microscopic study of vegetative and reproductive structures of bryophyte genera included in theory syllabus
6. Morphology and microscopic study of vegetative and reproductive structures of pteridophytes genera included in theory syllabus.

Recommended books:

1. Introduction to Mycology : C.J. Alexopoulos and C.W. MimsWilley Eastern Ltd., New Delhi
2. An Introduction to Mycology : R.S. Mehrotra and K.R. Aneja New Age International (P) Ltd., New Delhi
3. A Text Book of Microbiology : R.C. Dubey and D.K. Meheshwari S. Chand & Company Ltd., New Delhi
4. The Structure and Reproduction of the Algae Vol. I & II : F.E. FritschCambridge University Press, London
5. Introductory Phycology : H.D. Kumar East West Press Pvt. Ltd., New Delhi
6. Introduction to Embryophyta(a) Vol. I. Bryophyta(b) Vol. II. Pteridophyta : N.S. PariharKitab Mahal, Allahabad
7. The Morphology of Pteridophytes: K.R. SporneB.I. Publications, Bombay
8. Studies in Botany Vol. I : J.N. Mitra, D. Mitra & S.K. Chowdhuri Moulik Library, Kolkata
9. College Botany Vol. II : H.C. Gangulee & A.K. KarBook and Allied (P) Ltd., Kolkata
10. A Text Book of Botany – Pteridophyta : B.P. PandeyS. Chand and Company, New Delhi

11. An Introduction to Fungi : H.C. DubeyVikash Publishing House, New Delhi
12. Studies in Botany Vol. - I : J.N. Mitra, D. Mitra & S.K. ChowdhruriMoulik Library, Kolkata
13. College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology Industrial Microbiology and Bryophyta : B.P. PandeyS. Chand Company Ltd. New Delhi
14. Microbiology : Principles and Explorations : J.G. Black John Wiley and Sons, Inc. USA
15. Manual of Microbiology : Kanika SharmaAne Books India, New Delhi
16. Microbiology : P.D. SharmaRastogi Publication, Meerut
17. The Algae : V.J. Chapman and D.J. ChapmanMcmillan India Ltd.
18. Botany for Degree Students: Diversity of Microbes, Cryptogams, Cell Biology and Genetics : B.P. PandeyS. Chand and Company Ltd., New Delhi
19. College Botany Vol. II: Pteridophyta, Gymnosperms and Paleobotany : B.P. PandeyS. Chand and Company Ltd., New Delhi

SEMESTER- II

Full Mark-100

Objectives of learning:

To enable the students:

i) To get the knowledge of contents of syllabus

ii) To understand the morphology, structure and function of various parts of plants

iii) General character of gymnosperms and classification

iv) Difference between angiosperm and gymnosperm

v) Taxonomy terminology

vi) To learn various families and economic importance

vii) Various classification system and reasons behind the same (Linnaeus, Bentham and Hooker, Engler and Prante and Hutchinson

viii) Learn anatomical structure and function of various tissues

ix) Differentiation between the normal and anomalous secondary growth learn about the different meristems and their locations and functions

x) Developmental stages of micro and mega sporangium

xi) To understand the pollen morphology and applications of palynology, basic and applied palynology, pollen allergy and pollen taxonomy

BOT: E202 Gymnosperms, Angiosperms, Applied Botany and Embryology
Full Mark: 75

Unit I: Gymnosperms and Palaeobotany: General characters of Gymnosperms and that Classification; Morphology, Reproduction and Life cycle of *Cycas, Pinus* and *Gnetum.* Economic importance of Gymnosperms. Palaeobotany: Fossil formation, theory and types. Geological time scale and dominant fossil flora of different ages. Study of Rhynia and Psilophyton. 15 marks

Unit II : Angiosperm Taxonomy: Introduction to Plant TaxonomyImportance of field work, observation, herbarium preparation.Concept of species, genus and family. Keys of identification. Rules of nomenclature (validity, effectivity and priority). Classification systems of Linnaeus, Bentham and Hooker, Engler and Prantle and Hutchinson.Taxonomic studies of the following Families: Ranunculaceae, Brassicaceae, Malvaceae, Fabaceae, Rosaceae, Apiaceae, Asteraceae, Solanaceae, Lamiaceae, Euphorbiaceae, Liliaceae and Poaceae 15 marks

Unit III : Applied Botany & Ethnobotany: Origin of cultivated plants, Vavilov's centre of origin.Origin, cultivation and improvement of Rice and Potato.History, cultivation and processing of Tea and coffeeCharacteristics and uses of timber yielding plants:Teak and Pinus.Medicinal plants: *Cinchona*, *Rauwolfia* and *Adhatoda*.Centella asiatica,neem Ethnobotany: Concept, Classification and interdisciplinary approaches 15 marks

Unit IV : Plant Anatomy: Cell structures, cell wall and cell inclusion. Organisantion of apical meristem. Structure and distribution of simple and complex tissues. Primary and Secondary growth in plant. Anomalous growth in *Amaranthus*, *Mirabilis,Nyctanthus* and *Dracaena* stem 15 marks

Unit V : Embryology and Palynology: Plant embryology, Micro and mega sporogenesis, development of male and female gametophytes, fertilization, embryo and endosperm development.Palynology: Pollen and spore morphology. Aerobiology and pollen allergy. 15 marks

BOT: E202P (PRACTICAL) Marks: 25

Gymnosperms and Palaeobotany:1. Temporary stained preparation of the reproductive structures of Gymnosperms included in the theory.2.

Examination of the available specimens/slides of the fossil plants3.
Description and classification of a representative species from each of the angiosperm families mentioned in the theory.
Ranauculaceae: *Ranunculus*
Apiaceae : *Coriandrum*
Asteraceae: *Ageratum, Gynura* & *Spilanthes*
Solanaceae: *Solanum*
Lamiaceae: *Leucas*/*Ocimum*
Enphorbiaceae: Castor
Liliaceae: Onion/*Asparagus*
Poaceae: *Dactyloctenium*/*Cynodon*
Malvaceae: *Sida*/*Urena*
Identification of collected plants from the field4.
Collection and identification of three plants each from cereals, pulses, fiber yielding plants, medicinal plants available in Manipur.5.
To prepare a chart containing the starch contains from five important crop plants and protein contains from five pulses by using internets.6.
Preparation of temporary slides for the study of anomalous secondary growth in plants included in the theory paper.7.
Preparation of stained squashed of pollen motile cells, pollen grains and dissection of endosperm and embryo.8.
Field observation of local vegetation and submission of report is compulsory.

Recommended books

1.	Gymnosperms	:	H.N. SrivastavaPradeep Publications, Jalandhar
2.	Gymnosperms	:	P.C. VashishtaS. Chand and Company Ltd. New Delhi
3.	A Text Book of Botany:Angiosperm	:	V. Singh, P.C. Pandey & D.K. JainRastogi Publication, Meerut
4.	Plant Taxonomy	:	N.B. Saxena & S. SaxenaPragati Prakashan, Meerut
5.	Palaeobotany	:	H.N. SrivastavaPradeep Publications, Jalandhar
6.	Applied Botany	:	P.C. Vasishta & P.S. GillPradeep Publications, Jalandhar
7.	Economic Botany	:	Albert F. HillTATA Mc. GRAW-HILL Publishing Company Ltd. New Delhi
8.	Plant Anatomy	:	M.S. TayalRastogi Publications, Meerut

9.	Plant Anatomy	:	B.P. PandeyS. Chand & Company Ltd. New Delhi
10.	The Embryology of Angiosperms	:	S.S. Bhojwani & S.P. BhatnagarVikas Publishing House Pvt. Ltd. New Delhi
11.	Palynology	:	M.R. SaxenaOxford & IBH Publishing Co. Ltd. New Delhi
12.	Morphology of Gymnosperms	:	J.M. Coultar & C.J. ChamberlainCentral Book Depol, Allahabad
13.	Taxonomy of Vascular Plants	:	G.H.M. LawrenceOxford & IBH Publishing, New Delhi
14.	A handbook of Field and herbarium methods	:	S.K. Jain & R.R. RaoToday & Tomorrows Printers and Publishers, New Delhi
15.	A Text Book of Botany Angiosperm:		B.P. PandeyS. Chand & Company Ltd. New Delhi
16.	A Manual of Ethnobotany	:	S.K. JainScientific Publications, Jodhpur.
17.	Plant Anatomy	:	K. EsauJohn Wiley & Sons Inc. New York.
18.	An Introduction to Palaeobotany	:	C.A. ArnoldTATA, Mc Grew-Hill Book Co. New Delhi
19.	Studies in Botany-I	:	J.N. Mitra, D.Mitra & S.K. ChowdhuriMoulik Library, Kolkata
20.	Studies in Botany – II	:	J. Guha & S.K. ChowdhurMoulik Library, Kolkata
21.	Plant Group	:	H. MukherjeeNew Central Book Agency (P) Ltd. Kolkata
22.	College Botany- II	:	H.C. Gangulee & A.K.KarNew Central Book Agency (P) Ltd. Kolkata
23.	College Botany – III	:	S.K. MukherjiNew Central Book Agency (P) Ltd. Kolkata
24.	General Botany Vol. I – Part I	:	Ganguly, A.K. & Kumar N.C.Emkay Publications, New Delhi
25.	College Botany Practical Vol. II	:	S.C. Santra et.al.Central Book Agency (P) Ltd. Kolkata

SEMESTER- III

Full Mark-100

Objectives of learning:

To enable the students:

i) To learn the Phytogeographical regions of India, factors migration methods and endemism and barrier of distribution.

ii) The interactions taking place in the ecosystem and flow of energy. The role and importance of biotic and abiotic environmental factors in the sustenance of the plant life

iii) Differentiation between light and dark reactions of photosynthesis

iv) The respiratory process in presence of light and difference between C3 , C4 and CAM plants

v) (a)The mechanism of enzyme action (b) the major classes of organic compounds and their synthesis and breakdown in plants

vi) The transport mechanism in plants and differentiate between the physiological processes and their importance

vii) To understand the term molecular biology and importance of biology

viii) To understand gene organization of prokaryotes and eukaryotes

ix) To understand the structure of RNA and DNA, physical properties of DNA and RNA. Biosynthesis of nucleic acids

x) Mechanism of protein synthesis

BOT: E303 Plant Geography, Ecology, Plant Physiology and Molecular Biology

Full Marks: 75

Unit I: Plant Geography- Its scope and importance; phytogeographical regions of India, factors affecting distribution; plant dispersal, migration methods, endemism and barrier of distribution. 15 mark

Unit II : Principles of Ecology: Ecosystem concept, structure and function, ecological pyramids, energy flow and mineral cycling (CNP), hydrological cycle, food chain, food web and trophic levels, structure of plant community, ecological factors (abiotic and biotic factor); ecological adaptation of xerophytes, hydrophytes , Halophytes, ecological succession- hydrosere and xerosere. 15 mark

Unit III : Plant Physiology: Plant water relationship-diffusion, imbibitions, osmosis, water potential and its component; absorption and translocation of water; ascent of sap (theories); transpiration-significance, factors affecting transpiration, mechanism of stomatal movement; Mineral nutrition, Translocation of solutes; Growth and development; concept of photoperiodism and vernalization; Photosynthesis: Photosynthetic pigment system, cyclic and non-cyclic photophosphorylation, C_3, C_4 and CAM pathways, factors affecting photosynthesis; respiration – aerobic, anaerobic, factors affecting respiration; biological Nitrogen fixation-symbiotic and non-symbiotic. 15 mark

Unit IV : Biochemistry: Chemical bonds, pH, buffer; structure, classification and function of biomolecules (carbohydrates, lipids, amino acids, proteins, nucleic acids and vitamins), enzyme-properties, nomenclature and classification as per ECIUB, mechanism of enzyme action, respiration-glycolysis, Kreb's cycle, electron transport system. 15 mark

Unit V : Molecular Biology: Gene organization of prokaryotes and Eukaryotes, structure and physical properties of DNA and RNA; biosynthesis of nucleic acids; DNA – replication; RNA translation, mechanisms of protein synthesis. 15 mark

BOT-E303(P) BOTANY PRACTICAL – III Marks: 25

1. Preparation of map of phytogeographical regions of India
2. Determination of the minimum size of the quadrat by species area curve method
3. Determination of frequency of vegetation in a community by quadrat method.
4. Determination of osmotic potential of vacuolar sap by plasmolytic method using *Rheo*/*Tradescantia* leaf and onion peel.
5. Determination of rate of transpiration by Gangong's potometer
6. Extraction of chlorophyll pigments from leafy plants by paper chromatographic Technique.
7. Study of rate of photosynthesis under different light intensities.
8. Determination of RQ of plant materials having fats, protein.
9. Simple tests for carbohydrate, protein, fats and nucleic acids
10. Preparation of buffer-Phosphate and Tris acetate buffer
11. Isolation of DNA from plant seedlings
12. Field observation of local vegetation and submission of report is compulsory.

Recommended Books

1.	College Botany Vol. II	:	Ganguly and Kar Book & Allied (P) Ltd. Kolkata
2.	Studies in Botany Vo. I	:	Mitra, Mitra & ChaudhuriMoulik Library, Kolkata
3.	A Text book of Plant Ecology	:	Ambasht, R.S.Students friends & Varanasi
4.	Basic Ecology	:	Odum, E.P.Saunder's Philadelphia
5.	Concepts of Ecology (3rd Ed.)	:	Kormondy, E.Prentice Hall of India, New Delhi
6.	Ecology	:	Michael, S.Oxford University Press, London
7.	Fundamentals of Ecology	:	Odum E.P.Prentice Hall of India, New Delhi
8.	Plant Physiology	:	Salis bury F.B. and Ross C.W.Wassworth Publishing Co., Belmonth/CBS Publishers & Dist. Delhi
9.	Plant Physiology	:	Bidwell R.G.S.Macmillan Publication Co. New York.
10.	Plant Physiology	:	Devlin RM & Francis H. WithamFourth Edn. CBS, Shahdara, New Delhi
11.	Outlines of Biochemistry	:	Conn E.E., P.K. Stumpt, G. Bruerning and R.H. DoiJohn Willey & Co., New York
12.	Biochemistry	:	Stryer L. W.I.I. Fueman & Co. New York
13.	Principles of Biochemistry	:	Lehninger A.I., Nelson D.L. & Cox M.M. CBS, Publication
14.	Ecology	:	Odum E.P.Oxford University Publication
15.	Cell and Molecular Biology	:	De Robertis EMF & EDP De RobertisBI Waverly Pvt. Ldt.
16.	Genes	:	Lewin B. Oxford University Press
17.	Cell Biology	:	C.B. Power
18.	Molecular Biology of Cell	:	Bruce – Alberts et. al.Garland Publications
19.	DNA Replication	:	Kornberg A.Freeman & Co.
20.	Cell and Molecular Biology	:	P.K. Gupta Rastogi Publication, Meerut
21.	College Botany Practical Vol. I		S.C. Santra et.al.Central Book Agency (P) Ltd. Kolkata

BOT: HSC I **HONOURS SUPPORTING COURSE I**

Full Mark-100

Unit I: Foundation of Bioinformatics and Basics of Biodiversity of Genetic Evolution (15 marks)

Introduction, Scope of Bioinformatics, importance of Bioinformatics, Biological databases, Genome Sequences, ORES, Genes, Introns, Exons, Protein Sequences, protein synthesis.

What is biodiversity? Why is biodiversity important? Species diversity, ecosystem diversity, genetic diversity and cultural diversity. What is the status of biodiversity? Mendel's laws of inheritance-chemical basis of heredity, molecular biology. Chemical structure of nucleic acid. DNA replication, genetic code, transcription and translation, mutation, PCR, amino acid structure, concept of pH, Pka, buffer.

Unit II: **Food Microbiology, Food Chemistry and Food Commodities** (15 marks)

Micro-organisms: Definition and their role in ecological balance, Disease causing micro-organisms. Fermentation and Pasteurization. Recombinant DNA technology.

General morphology of micro-organisms-bacteria, fungi, virus, protozoa, algae. Contamination on cereals, pulses, vegetables, fruits, meat, fish, milk and canned foods, contamination of foods by pathogenic organisms-symptom and methods of control.

Food commodities- Food consumption and production pattern in Manipur. Study of different food stuffs- cereals, pulses, vegetables, root and tubers, milk products, oil seeds and spices.

Unit III: **Mushroom, Identification and Classification of Mushroom** (15 marks)

Introduction, definition, history of cultivation, present status in India. Different varieties of mushroom cultivation in Manipur- paddy straw mushroom, oyster mushroom, button mushroom, wood ear mushroom, silver mushroom, winter mushroom**.**

Definition of spawn and their types. Types of substrate, substrate preparation and its sterilization, spawning inoculation, mother and planting spawn, post spawning, incubation, cropping and harvesting, identification and classification of mushroom. Important characters for identification of mushrooms, edible and poisonous mushrooms. Diseases and contaminants control measures.

Unit IV: **Principles of computing in Bioinformatics, organisation of digital computer (15 marks)**

Organisation of digital computer-word processor, spread sheet, presentation of software, concept of database, internet and its applications. Communication tools, computer application in plant science. Based principles of computing in bioinformatics, running

computer software, computer operating system, software downloading and installation, database management.

Unit V: Biotechnology, Food Preservation (15 marks)

Definition, history, scope, basic aspect of plant tissue culture. Cellular totipotency, differentiation, organogenesis, embryogenesis. Application of biotechnology in medicine and human welfare, transgenic plants. Food spoilage, causes, principles and methods, dehydration, addition of salt or sugar, high temperature and low temperature, chemical preservations, jellies, squashes and juices, freezing, marmalades.

Unit VI: Practical (25 marks)

1. Demonstration of computer characteristics, protein structure. Application of bioinformatics and biodiversity.
2. Fermentation of soya bean, bamboo shoot and fish.
3. Preparation and preservation of pickles, jams, squashes and juices.
4. Submission of different types of mushrooms found in Manipur.
5. Determination of nutritive content of the following food stuffs- rice, dal, milk, egg, meat, fish, groundnut, butter, mustard oil, potato, onion and amla.
6. Preparation of tissue culture media, sterilization, inoculation of plant material.
7. Demonstration of technique of *in vitro* culture of explants.
8. Field observation:
   i) Food processing unit
   ii) Mushroom cultivation in unit data collection
   iii) Medicinal plants of Manipur

Reference Books:

1. R.L. Kotpal & Dr. N.P. Concept of Ecology, Vishal Publication.
2. P.K. Sinha & P. Sinha (2000) "Foundation of Computing" Finjs Edition, BPB Publication.
3. D. Eaxevanis & I Outette (2000) " Bio-informative" A practical guide to the analysis of genes of proteins widely Indian Edition.
4. S.R. Mundambi & M.V. Rajgopal (1990)- Fundamentals of Food & Nutritions, Wiley eastern Ltd.
5. P.D. Sharma Microbiology- Rastogi.
6. Swaminathan S.I. Advanced Text Book of Food & Nutrition Vol I & II.
7. Banwari G.T. (1978) Basic Food Microbiology C.B.S. Publication.
8. R. Singh & K.C. Singh. Modern Mushroom Cultivation.
9. R.K. Pandey & S.K. Ghosh. A handbook on Mushroom Cultivation.
10. S.S. Bhojwani. Plant tissue culture Application & limitation. Elsevier Science Publishing, New Delhi.
11. E.J. Gauduer, D.P. Smuland & M.I. Simmous. Principles of Genetics.

SEMESTER- IV

Full Mark-100

Objectives of learning:

To enable the students:

i) To understand the structure and function of various cell organelles
ii) To learn the types , structure and function of chromosomes
iii) The mechanism, role s and importance of cell divisions , linkage and crossing over
iv) To understand laws of Mendel , gene interaction, expression, structure of gene and transfer of genetic information, transcription and translation
v) The variousgene mutation ,mutagens and chromosome alterations
vi) Knowledge of sex chromosomes and sex determination in plants, Extranuclear inheritance
vii) To understand breeding behavior, sexual, asexual and apomixis.
viii) Breeding methods, Heterosis
ix) Knowledge of biotechnology. Old and new basic aspects
x) Application of biotechnology in medicine ,agriculture and human welfare, tissue culture and genetic engineering in plant improvement
xi) Knowledge of biometry, scope and application

BOT-E404 Cytogenetics, Biotechnology and Biometrics Full Marks 75

Unit I: Cytology: General accounts of organisation and function of cell and its components: Cell wall; plasmalemma; endoplasmic reticulum; golgi apparatus; ribosomes; mitochondria, plastids and nucleus. Structure and function of chromosome. Mitosis and meiosis – their significance. 15 marks

Unit II : Genetics: Mendelism: Law of segregation and independent assortment; back cross and test cross; Gene interaction; Gene expression; Structure of gene; transfer of genetic information: transcription; translation. Protein synthesis; t-RNA. Linkage and Crossing over; mutation and mutagens: chromosome alterations – deletions, duplications, translocations, inversions; variation in chromosome number: aneuploidy, polyploidy. Extra-nuclear inheritance: Sex chromosome and sex determination in plants. 15 marks

Unit III : Plant Breeding: Principles of plant breeding: breeding behaviour, sexual, asexual, apomixis; polyembryony; breeding methods – conventional; methods of breeding in self and cross pollinated crops; heterosis. 15 marks

Unit IV : Biotechnology: Basic aspects of plant tissue culture; cellular totipotency; differentiation and morphogenesis; Genetic engineering in plant improvement; application of plant biotechnology in medicine, agriculture and human welfare. 15 marks

Unit V : Biometry: Scope and application; collection of data. Sample and sampling – theory and methods; mean, mode, median and standard deviation; probability; chi-square test and analysis. 15 marks

BOT: E404P PRACICAL 25 marks

1. To study cell structure from Onion leaf peel, demonstration of staining and mounting methods
2. Comparative study of Cell structures in Onion cells, *Spirogyra;* Study of Cyclosis in *Tradescantia* staminal Cells.
3. Study of plastids to examine pigment distribution in plants (e.g. *Cassia* and *capsicum*)
4. Examination of electron micrographs of eukaryotic cells with special reference to organelle.
5. Examination of various stages of mitosis and meiosis using appropriate land material (e.g. Onion root tips, Onion flower buds, *Rheoe*, *Tradescantia*).
6. Working out the law of inheritance using seed mixtures.
7. Callus induction, organogenesis and plant regeneration (rice mature embryo)
8. Protoplast isolation e.g. tobacco, proteins
9. Preparation of tissue culture media, sterilization and inoculation of plant material.
10. Analysis of data for mean, mode, median and standard deviation.

Recommended Book

1.	General Botany Vol. II – Part I	:	Ganguly, A.K. & Kumar, N.C.Emkay Publications Delhi
2.	Molecular Biology of Cell	:	Albors, GB., Bray, D., Lewis, J., Raf, M., Roberts, K. & Naten, L.D. Garland Publishing Co., New York,U.SA.
3.	Cell and Molecular Biology	:	Gupta P.K. Rastogi Publication, Meerut, India
4.	Molecular Cell Biology	:	Lodiksh, H., Berk, A., Zipursky, S.L., Maxsudaira,P.Baltipmore, D. & Darnel, J. W.H. Freeman & Co., New York, USA
5.	Genetic	:	The Bejamin Cumajing Publishing Co., Inc., USA

6.	Principle of Genetics	:	Sncestad, D.P. and Simmons S, M.J. John Wiley & Sons, Inc. USA
7.	Molecular Genetics	:	Stent, G.S. CBS Publications
8.	Molecular Cell Biology	:	Nolfe, Sh. Wadswooth Publishing Co, California, USA
9.	Plant tissue culture : Applications & Limitations	:	Bhojwaris Sh. Elsevier Science Pubushing, New York
10.	Elements of Biotechnology	:	Gupta, P.L. Rastogi Publication, Meerut, India
11.	Genetics	:	Gupta, P.K. Rastogi Publication, Meerut, India
12.	Elements of Biostatistics	:	Prasad B. Rastogi Publication, Meerut, India
13.	Principles of Genetics (8^{th} Edition):		Gardaner, J., Simmons, H.J. & Snustad,D.P. John Wiley & Sons New York
14.	Cytogenetics	:	Gupta P.K. Raotogi Publish, Meerut
15.	Breeding Field Crops	:	Pachlmann, J.M. & Sleeper, D.R. Panima Publishing of Crop Important Longman, London & New York
16.	Principles & Practice of Plant Breeding	:	Sharma, J.R. Tata Mc Graw-Hill Publishing Co. Ltd. New Delhi
17.	Textbook of Practical Botany Vol. I & II	:	Bendre A. & Kumar, A.Rastogi Publication, Meerut
18.	Textbook of Practical Botany Vol. I & II	:	Sharma, O.P.Rastogi Prakashan, Meerut
19.	Ecology Work Book	:	Misra, R. Oxford University Press, Calkutta
20.	Plant Microtechnic	:	Johansen, D.A. Mc. Granier Hill Book CompanyMc. New York London
21.	Chromosome Technique (Theory & Practical)	:	Sharma, A. & Sharma, A.Butterworths, London.

BOT: HSC II **HONOURS SUPPORTING COURSE II**

Full Mark-100

Unit I : **Physiology and Biochemistry** **(15 marks)**

Physiological roles of essential elements and their deficiency symptoms. Growth, Phytohormones (auxins, gibberellins and cytokinins). Photosynthesis (Light and Dark reactions), comparative studies of C_3, C_4 and CAM cycles. Biological nitrogen fixation.

Water as universal solvent, weak-interaction in aqueous systems, basic thermodynamic concept (Bioenergetics). Enzyme kinetics. Respiration, glycolysis, Kreb's cycle, fermentation, oxidative phosphorylation, ATP synthesis.

Unit II : Molecular Biology & Cell Biology **(15 marks)**

Introduction to molecular biology, definition, history of molecular biology, classical and new molecular biology.

Molecular biology in life science- Molecular biology and cell biology, molecular biology and evolution, molecular biology and developmental biology. DNA- structure and replication, DNA polymerases, different forms of RNA. Gene- structure, expression and regulation. Operon concept, gene regulation in prokaryotes and eukaryotes.

The cell- historical background, Cell theory, comparative account of prokaryotic and eukaryotic cells. Mitochondria, chloroplast and golgi bodies-ultra structure, origin and function. Nucleus, nucleosome, ribosome and chromosomes- ultra structure and function.

Unit III: **Genetics, Plant Breeding and Biotechnology** **(20 marks)**

Mendel's experiment and principles of inheritance, gene interaction and modified dihybrid ratios- complementary, supplementary, epistatic, duplicate factors, multiple alleles in *Drosophila*, multiple alleles in maize, multiple alleles in cotton, man (blood groups). Plants (self incompatibility). Sex determination in plants.

Types of plant reproduction- vegetative, sexual and apomixis, methods of plant improvement, pure line and mass selection. Plant introduction and acclimatization, hybrid vigour. Technique of plant breeding, hybridization.

Selfing and crossing, pollination, field trial technique

Introduction of Biotechnology- History, definition, scope of biotechnology, old and new biochemistry, cellular totipotency, differentiation, organogenesis, embryogenesis, application of biotechnology in agriculture, medicine and human welfare, transgenic plants, achievement of biotechnology.

Unit IV: Evolution **(10 marks)**

Definition, history of evolution, origin of life. Distinction between origin of life and organic evolution. Origin of life- historical account of origin of earth vs. origin of life. Speciation and isolating mechanisms. Theories of evolution- Lamarck, Darwin theory of natural selection. Mutation theory- Hugo de Vries, synthetic theory of evolution.

Unit V: Bio-statistic and Biometry **(15 marks)**

Introduction and historical perspective, definition, characteristics, scope. Importance and uses of bio-statistic. Sample and sampling, sampling unit, purpose of sampling, process of sampling manually and estimating fruit and seed set (demonstration).

Sampling and non-sampling errors- F-test and analysis of variance, Null hypothesis. Types of analysis of variance. Test of significance, student t test, chi-square test. Probability, correlation, coefficient and regression. Measures of central tendency-types, mean, mode median.

Unit V: Practical **(25 marks)**

1. Seperation of plant pigments by paper chromatography technique.
2. Determination of stomatal frequency using epidermal peeling/impression.
3. Measurement of pH of beet, carrot, potato tuber and *Amaranthus* leaves and sap of water hyacin.
4. Study of various stages of mitosis and meiosis using appropriate plant materials (root tips, flower buds of *Allium cepa*).
5. Study of cell structure from onion leaf peels, demonstration of staining and mounting methods.
6. Estimation of electron micrographs of eukaryotic cells with special reference for organelles.
7. Preparation of chromosome maps from 3-point test cross data.
8. Emasculation and bagging of flowers of Brassicaceae, Poaceae, Papilionaceae, Malvacae, etc, pollinate manually and estimate fruit set, seed set (demonstration).
9. Preparation of tissue culture- media, sterilization and inoculation of plant materials.
10. Demonstration of techniques of *in vitro* culture of various explants.
11. Hybridization experiments- F_1 and available F_2 material analysis for specific character.
12. Determination of mean, mode, median and standard deviation.
13. Field observation of local vegetation and of submission of report is compulsory (Bio-statistics).

SEMESTER – V

BOT: H505 Microbial Diversity, Plant Pathology and Embryophyta

Marks: 100

Unit I : Microbial Diversity – History of microbiology, five kingdom system of classification, Carl Woese's Three Domains of living organism (Archaebacteria, Bacteria and Eukaryotes), microbial forms- viruses (including prions and viroids), archaebacteria, bacteria, algae, fungi and protozoa – their characteristic features, microbiology of soil, air and water. 20 Marks

Unit II : Microbes and Human Welfare – Role of microbes in industry (alcohol, antibiotics, organic acids, enzymes, proteins, vitamins, biofuel), agricultural microbiology (biofertilizers and biopesticides), food microbiology (food spoilage and food preservation,), medical microbiology (microbes as pathogenic organisms). 20 Marks

Unit III : Plant Pathology – History of plant pathology, Koch's postulates of Host pathogen interrelation, classification of plant diseases on the basis of causal organisms and symptoms, studies on symptoms, disease cycles and control measures of the following diseases – damping-off of seedlings, late blight of potato, white rust of crucifers, powdery mildew of pea, blast of rice, stem rust of wheat, leaf blight of paddy, citrus canker and TMV. 20 Marks

Unit IV : Plant Disease Management – Plant quarantine, seed certification, cultural practices, fungicides (classification on the basis of chemical nature and mode of action), biological control, breeding for resistant varieties, genetically modified plants (merits and demerits), concept of integrated pest disease management. 20 Marks

Unit V : Bryology and Pteridology – Bryophytes as the first land plants, evolutionary trend, ecological and economic importance of bryophytes, brief account on the development of Bryology in India. Origin and evolution in pteridophytes, relationship of pteridophytes with bryophytes and gymnosperms, heterospory, seed habit and stellar evolution in pteridophytes, ecological and economic importance of pteridophytes.

20 Marks

Recommended Books

1. Microbiology : M.J. Palezar and R.D. Reid Hill Book Co., New Delhi
2. A Text Book of Microbiology : R.C. Dubey and D.K. Maheshwary S. Chand & Company Ltd., New Delhi
3. Plant Diseases : R.S. Singh Oxford & BM Publishing Co. Pvt. Ltd., New Delhi

4. Introduction to Principles of Plant Pathology
: R.S. Singh, Oxford & BM Publishing Co. Pvt. Ltd., New Delhi

5. Plant Pathology : R.S. Mehrotra Tata Mc Graw-Hill Publishing Co. Ltd., New Delhi

6. The Microbial World : R.Y.Stanier, J.L. Engrahan, M.L. Wheelis, and P.R. Painter Prentice Hall of India, New Delhi

7. Text Book of Microbiology : R. Ananthanarayan & C.K.J. Paniker, Orient Longman, Bombay

8. An Introduction to Embryophyta (Bryophyta)
: N.S. Parihar Kitab Mahal, Allhabad

9. An Introduction to Embryophyta (Pteridophyta)
: N.S. Parihar Kitab Mahal, Allahabad

10. The Morphology of Pteridophyta : K.R. Spome B.I. Publications, Bombay

11. Diseases of Crop Plants in India : G. Rangaswamy Prentice Hall of India, New Delhi

12. Lab Manual of Microbiologist : G. Gunasekaran, New Age Publication

13. Diversity of Microbes and Cryptogams : A.K. Thakur & S.K. Bassi S. Chand and Company, New Delhi

14. A Text Book of Biotechnology : R.C. Dubey S. Chand and Company, New Delhi

15. Industrial Microbiology : A.H. Patel Mc Milan Publishers, New Delhi

16. Botany – Pteridophyta (Vascular cryptogams)
: B.R. Vashishtha, A.K. Sinha & A. Kumar
S. Chand and Company Ltd., New Delhi

17. Botany for Degree Students – Bryophyta
: B.R. Vashishtha, A.K. Sinha and A. Kumar
S. Chand and Company Ltd., New Delhi

18. Frontiers in Microbial Technology : P.S. Bisen CBS Publishers

19. General Microbiology : C.B. Powar & H.F. Daginawala Himalayan Publishing House

BOT: H506 Advanced Plant Taxonomy, Anatomy, Embryology and Palynology

Marks: 100

Unit I: Primitive seed plants and Palaeobotany: Concept of Progymnosperms. Diversity among Gymnosperms and their distribution in Indian sub-continent. Origin and Evolution of Gymnosperms. Salient features and life cycle of *Ginkgo, Taxus* and *Ephedra.*Fossil algae and fungi. Primitive land plants: *Rhyniaf, Lepidodendron, Calamites* and Sphenophyllum. Fossil Gymnosperm orders. Cycadofilicales, Bennettitales and Cordaitales. Fossil Angiosperm: *Palmoxylon, Enigmocarpon, Sahnianthus*. Palaeobotany in the exploration of fossil fuels. 20 Marks

Unit II : Advanced Plant Taxonomy: Objective, Principles and Practices of Plant taxonomy. Methods and techniques of herbarium preparation. Development of chemotaxonomy, Cytotaxonomy and Numerical taxonomy. Biosystematics, Taxonomy on the web: Molecular Taxonomy: Application of DNA hybridization technique in plant Taxonomy; Importance of biochemical markers and DNA markers in taxonomic studies. Role of Botanical survey of India and Taxonomic Literatures. Classical system of Classification: Bentham and Hooker Taxonomic studies affinities and economic importance of the following families: Magnoliaceae, Asteraceae, Rutaceae, Anacardiaceae, Myrtaceae, Cucurbitaceae, Dipteriocarpaceae, Polygonaceae, Moraceae, Rubiaceae, Apocynaceae, Asclepiadaceae, Acanthaceae, Verbinaceae. Arecaceae, Scitaminae (Musaceae, Zingiberaceae, Cannaceae and Marantaceae) Orchidaceae and Cyperaceae. 20 Marks

Unit III : Plant Resources – Management and Utilization, Classification of economic plants, based on their uses. Cyanobacteria: *Spirulina*. Origin, cultivation and improvement of Maize, Mustard, Pea and Banana. History, cultivation and processing of Rubber. Characteristics and uses of timber yielding plants: *Dipterocarpus*, *Phoebe* and *Melanorrhoea*. Medicinal Plant: *Ephedra*, *Carthamus*, *Aloe vera* and *Vinca*. Pharmacognosy: Aims and objects, Collection and preparation of drugs. Importance of ethnobotany in genepool and germplasm conservation. 20 Marks

Unit IV : Anatomy of Angiosperm: Apical meristem and histological theories of shoot and root apices. Vascularization: Primary shoots of monocotyledons and dicotyledons. Formation of internodes, branching pattern, monopodial and sympodial growth. Root-stem transition, Cambium and its function; formation of secondary xylem, characteristics of growth ring, sapwood and heartwood. Secondary phloem, stomata and their types. Anomalous secondary growth in *Bauhinia*, *Bougainvillea* and *Nyctanthus.* 20 Marks

Unit V : Plant Embryology and Palynology: Plant Embryology. Microsporangium and types of pollen tetrad. Megasporangium and types of meganetogenesis. Pollen- pistil interaction, compatibility and incompatibility, syngamy and triple fusion. Development, structure and function of endosperm. Types of haustoria,

Embryogeny- types. Development of monocot and dicot embryos. Suspensor, synergid, polyembryony, apomixes and their role. Pollen production and dispersion in space and time. Role of pollen in taxonomy. Application of palaeopalynology, melisso-palynology and forensic palaeopalynology. 20 Marks

Recommended Books

1. Gymnosperms : H.N. Srivastava Pradeep Publications, Jalandhar
2. Gymnosperms : P.C. Vashishta S. Chand and Company Ltd. New Delhi
3. A Text Book of Botany:Angiosperm : V. Singh, P.C. Pandey & D.K. Jain Rastogi Publication, Meerut
4. Plant Taxonomy : N.B. Saxena & S. SaxenaPragati Prakashan, Meerut
5. Palaeobotany : H.N. SrivastavaPradeep Publications, Jalandhar
6. Applied Botany : P.C. Vasishta & P.S. Gill Pradeep Publications, Jalandhar
7. Economic Botany : Albert F. Hill TATA Mc. GRAW-HILL Publishing Company Ltd. New Delhi
8. Plant Anatomy : M.S. Tayal Rastogi Publications, Meerut
9. Plant Anatomy : B.P. Pandey S. Chand & Company Ltd., New Delhi
10. The Embryology of Angiosperms : S.S. Bhojwani & S.P. BhatnagarVikas Publishing House Pvt. Ltd., New Delhi
11. Palynology : M.R. Saxena Oxford & IBH Publishing Co. Ltd., New Delhi
12. Morphology of Gymnosperms : J.M. Coultar & C.J. Chamberlain Central Book Depol, Allahabad
13. Taxonomy of Vascular Plants : G.H.M. Lawrence Oxford & IBH Publishing, New Delhi
14. A handbook of Field and herbarium methods : S.K. Jain & R.R. RaoToday & Tomorrows Printers and Publishers, New Delhi
15. A Text Book of Botany Angiosperm : B.P. Pandey S. Chand & Company Ltd., New Delhi
16. A Manual of Ethnobotany : S.K. Jain Scientific Publications, Jodhpur.

17. Plant Anatomy : K. EsauJohn Wiley & Sons Inc. New York.
18. An Introduction to Palaeobotany : C.A. Arnold TATA, Mc Grew-Hill Book Co. New Delhi
19. Studies in Botany-I : J.N. Mitra, D.Mitra & S.K. Chowdhuri Moulik Library, Kolkata
20. Studies in Botany – II : J. Guha & S.K. Chowdhur Moulik Library, Kolkata
21. Plant Group : H. Mukherjee New Central Book Agency (P) Ltd. Kolkata
22. College Botany- II : H.C. Gangulee & A.K.Kar New Central Book Agency (P) Ltd. Kolkata
23. College Botany – III : S.K. Mukherji New Central Book Agency (P) Ltd. Kolkata
24. The Morphology of Gymnosperms : K.R. Sporne B.I. Publications, Delhi
25. An Introduction to the Embryology of Angiosperms : P. Maheshwari TATA Mc Grew-Hill Publishing Company Ltd. New Delhi
26. A Text Book of Palynology : K. Bhattacharya New Central Book Agency (P) Ltd. Kolkata
27. Pollen Morphology of Angiosperm : Nair PKKScholar Publishing House, Lucknow
28. A Hand Book of Ethnobotany : Ashalata Drozawo Kalyani Publishers, New Delhi
29. Advanced Plant Taxonomy : A.K. Mondal New Central Book Agency (P) Ltd. Kolkata
30. The Morphology of Angiosperm : K.R. Sporne B.I. Publications, New Delhi
31. The Classification of flowering Plants Volume –I & II : A.B. RendleVikas Publishing House Pvt. Ltd. New Delhi
32. Plant Systematic: Theory and Practical : Gurucharan Singh Oxford & IBH Pub. Co. New Delhi
33. Plant Systematics: An Integrated Approach : Gurucharan Singh Sciences Publication INC(USA) Printed in India

BOT: H507P PRACTICAL

(Based on theory paper BOT-H505 and H506)

Full Marks: 100

1. Preparation of culture media for bacteria and fungi (nutrient agar and PDA).
2. Isolation of microorganisms (bacteria and fungi) from soil/water/air.
3. Pure culture maintenance of bacteria and fungi.
4. Staining of bacteria and fungi.
5. Microscopic study of *Bacillus, Coccus, Staphylococcus, Spirillum, Eschirichia, Nostoc, Anabaena, Saccharomyces, Candida, Aspergillus, Trichoderma.*
6. Morphological and anatomical studies of different types of root nodules (pea, broad bean, *Mimosa*, *Sesbania*).
7. Demonstration of Koch's postulates.
8. Symptoms, causal organisms and microscopic studies of diseased plant specimens included in theory syllabus.
9. Demonstration of commercial fungicides and equipments for field application
10. Comparative studies of thallus and reproductive structures of *Riccia, Anthoceros* and *Polygonum.*
11. Comparative studies of morphological and anatomical structures of *Lycopodium, Selaginella* and *Marsilea* in relation to stellar evolution and heterospory.
12. Gymnosperm and palaeobotany:*Ginkgo* and *Taxus* – Temporary mounts of transverse sections of young and mature stems, radial section and maturation secondary wood; transverse and vertical sections of needle; whole mounts of mature microspores, young and mature embryo.Ephedra – T.S. of node and internode of stem, whole mount of epidermal peel, L.S. of Leaf, microspores and embryos; permanent preparation of anther and ovule.
13. Examination and classification of specimen/slides of the fossil plants as per syllabus.
14. Advance plant Taxonomy: Description and classification up to genus of a representative species from each of the angiosperm families mentioned in the theory.Magnoliaceae: *Michelia*Brassicaeae: *Brassica*/*Cardamine*Rutaceae: *Citrus*Fabaceae: *Crotalaria/Vigna/Cassia/Caesalpinia/Mimosa/Acacia*Myrtaceae: *Callistemon/Eucalyptus,* Ancardaceae*: Mangifera*Cucurbitacea: LuffaRubiaceae: *Mussaenda*Apocynaeceae: *Vinca*Asclepiadaceae: *Calotropis/Asclepias*Acanthaceae: *Justicia/Adhatoda*Verbinaceae *Duranta/ Lantana*Polygonaceae:

*Polygonum*Orchidaceae: *Venda/Dendrobium*Scitaminae: *Musa/Canna/Maranta/ Zingiber*Arecaceae : *Phoenix*Cyperaceae: *Cyprus*

15. Utilizationof plants and Ethnobotany: Collection and identification of five plants each used as a source of carbohydrate, Protein, wood, oil-seed, spice and condiment and drung. Preparation of charts containing the percentage of carbohydrate contain, protein contain, oil contain, from five different species each from internet data.

16. Anatomy: Preparation of permanent/semipermanent slides for the study of anomalous secondary growth in plants included in the theory paper (Double Staining).

17. Embryology and Palynology: Examination of cleared and dissected whole mount permanent preparation of various structures mentioned in theory paper. Preparation of stained slides of endosperm and embryo. To study the germination percentage of pollen grains. Preparation of pollen slides by acetolysis method. Description and illustration of six selected pollen/spore types.

18. Identification and preparation of field notes of 50 plant species in the field.

19. An external field study tour to nationally important botanical gardens/herbaria/ sanctuaries/research laboratories, etc. and submission of the study report is compulsory.

SEMESTER VI

BOT: H608 Ecology, Plant Physiology and Molecular Biology

Marks: 100

Unit I: Vegetation and Natural resources: Detailed study of the vegetation and floristic regions of India-evergreen, deciduous, mangrove forest. Natural resources-forest resources, conservation, aforestation, social forestry, agro forestry-timber extraction, dams and their effects – Mineral resources-water resources-floods, drought, Energy resources-renewable and non-renewable resources. 20 Marks

Unit II : Ecosystems and Pollution: Physical environment; biotic environment; biotic and a biotic interaction, concept of habitat and niche. Ecosystem-basic component of ecosystem. Energy flow in ecosystem, trophic levels, Environmental pollution-Major pollutants-air and water and solid, pollution-control measure; Climate change and Global warming-environmental revolution. Biodiversity-Concept of biodiversity. 20 Marks

Unit III : Plant physiology: Absorption of water, Absorption of mineral elements-roots as absorbing surfaces-passive and active absorption. Physiological role of micro

and macro elements-their deficiency symptoms. Phases of Growth-growth curve, Plant hormones (Auxins, Giberellins, Cytokinins, Ethylene, Abscisic acid) – physiological functions - senescences, photoperiodism, physiology of Flowering - Photomorphogenesis Phytochromes-physiological role. Photosynthesis – Significance-light reactions, Calvin cycle, photorespiration, Laws of limiting factors, chemosynthesis-a brief account. Pentose Phosphate Pathway, Biological Nitrogen fixation-mechanism, elementary knowledge of Nif, Nod, Hup genes and leghaemoglobin Stress plant physiology (Principles and application). **20 Marks**

Unit IV : Biochemistry: Water as universal solvent, weak interactions in aqueous system, Principles of biophysical chemistry (pH, buffer; reaction Kinetics, Thermodynamics and Colligative properties), Bioenergetics, Enzymes and enzyme Kinetics, enzyme regulation, Isozymes; Respiration-glycolysis, Kreb's cycle, Fermentation, Oxidative phosphorylation, ATP synthesis. Biosynthesis of Nucleic acids and Protein synthesis. **20 Marks**

Unit V : Molecular Biology: Gene structures, expression and regulation: Gene organisation in prokaryote and eukaryotes, Operon concept; gene regulation in prokaryotes and eukaryote, positive and negative gene regulation; interrupted genes in eukaryotes; RNA splicing; mRNA stability.Recombinant DNA technology; Restriction endonuclease's prokaryotic and eukaryotic clone vectors; genomic and DNA libraries; various techniques of gene mapping and concept of DNA fingerprinting; polymerase chain reaction; DNA sequencing. Nucleic Acid: Composition of nucleic Acids; DNA structure; A, B and Z forms of DNA; denaturation and renaturation of DNA; Chromatin structure; DNA replication and recombinations; DNA polymerases; different forms of RNA. **20 Marks**

Recommended books

1. Fundamentals of Ecology : Odum E.P., Prentice Hall of India, New Delhi
2. Concepts of Ecology : Kormondy E., Prentice Hall of India, New Delhi
3. Understanding Biodiversity: life, sustainability and equity; tracts for the times : Kothari, A.Orient Longman Ltd. New Delhi
4. A Text of Plant Ecology : Ambasht R.S. & Ambasht N.A. Students' Edition, Friends & Co. Varanasi, India
5. Environmental studies : Chary, S.N. , Mc. Millan India Ltd.
6. Applied Ecology : Newman, E.I. Blackwell Scientific Publications London
7. Plant Physiology : Ting I.P., Addison Wesley Publication Co. Phillippines

8.	Plant Physiology	:	Taiz L. & Zeige E., Sinauer Associates Inc. Pub. Massachuselts
9.	Plant Biochemistry	:	Goodwin TW & Mercer E.I., Pergamon Press, Oxford
10.	Principles of Biochemistry	:	Lehninger A.K., Nelson D.K.&Cox MMCBS Publishers & Dist.
11.	Biochemistry	:	Lupert Stryer, Freeman International Edition
12.	Fundamentals of Biochemistry	:	Jain J.L.,S. Chand & Company, New Delhi
13.	Cell and Molecular Biology	:	De Robertis EMF & EDPDe Pobertis BI Waverly Pvt. Ltd.
14.	Genes	:	Lewin B., Oxford University Press

BOT: H609 Cell Biology; Genetics; Plant breeding, Biotechnology and Computer Application Marks: 100

Unit I : Cell Biology: The Cell: Historical back ground; Cell theory. Kingdomwise cell size and cell structure; Comparative account of prokaryotic and eukaryotic cell; Characteristics of archaebacteria and mycoplasma.Nucleus and ribosomes: Ultrastructure; nuclear envelope and nuclear pore complex; nuclear matrix and nucleoplasm; DNA and Histones; nucleosome and higher level of organisation; centromere and telomere. Ribosome structure; prokaryotic, eukaryotic; organelle ribosomes and their functional significanceMitochondrion and chloroplast: origin, structure and biogenesis; Organelle membrane and organisation of macromolecular complexes; variation in size, shape and number; types of plastids; organelle nuclear interactions; organelle gene organisation. Structure and function of Golgi Complex; endoplasmic reticulum; lysosomes; microbodies peroxysome and glyoxysomes; CytoskeletonCell membrane: Origin, ultrastracture; Chemical constituents and models of cell membrane organisation; roles of various membrane proteins, lipids and carbohydrates; role of ion channels and pumps in cellular transport and signaling. 20 Marks

Unit II : Genetics: Mendels' experiments and principles of inheritance; Back Cross and test Cross; Gene interactions and modified dihybrid ratios- Complementary, Supplementary, epistatic and duplicate factors.Multiple allelism: Multiple alleles in Drosophila (eye colour), man (blood groups), Plants (self-incompatibility)Quantitative genetics: Quantitative traits and quantitative genetics; the multiple factor hypothesis. 20 Marks

Unit III : Plant Breeding:Types of plant reproduction: Vegetative, sexual and apomixis; their effect on generating and fixing genotypic variation.Methods of plant improvement: Pure line and mass selection; hybridization in self-and cross, pollinated Crops; introduction and acclimatization Hybrid vigour.Mutation and Polyploidy as methods of Plant improvement. 20 Marks

Unit IV : Biotechnology: History, definition and scope; Cellular differentiation and totipotency; Organogenesis and embryogenesis; protoplast isolation and culture; Somatic hybridization; clonal propagation; Genetic engineering of plants; Vectors for gene delivery; selectable markers and reporter genes; methods of gene delivery; *Agrobacterium* – the natural genetic engineer; salient achievements in crop biotechnology (with suitable examples) and prospects. 20 Marks

Unit V : Computer application and Bioinformatics Computer organisation programming principles; programming language; Internet and its applications; communication tools – word processing, spread sheet and presentation of software; Concept of database, Applications of Computer in Biological Sciences; introduction to biostatistical analysis of data; Application software for Botany. Bioinformatics – introduction and asses of bioinformatics tools. 20 Marks

Recommended Books

1.	Molecular Biology of Cell	:	Albors, G.B., Bray, D., Lewis, J., Raf, M., Roberts, K. & Naten, L.D. Garland Publishing Co., New York, U.SA.
2.	Cell and Molecular Biology	:	Gupta P.K., Rastogi Publication, Meerut, India
3.	Molecular Cell Biology	:	Lodiksh, H., Berk, A., Zipursky, S.L., Maxsudaira, P.Baltipmore, D. & Darnel, J. W.H. Freeman & Co., New York, USA
4.	Genetic	:	The Bejamin Cumajing Publishing Co., Inc., USA
5.	Principle of Genetics	:	Sncestad, D.P. and Simmons S, M.J. John Wiley & Sons, Inc. USA
6.	Molecular Genetics	:	Stent, G.S., CBS Publications
7.	Molecular Cell Biology	:	Nolfe, Sh., Wadswooth Publishing Co, California, USA
8.	Plant tissue culture: Applications & Limitations	:	Bhojwaris Sh., Elsevier Science Pubushing, New York
9.	Elements of Biotechnology	:	Gupta, P.L., Rastogi Publication, Meerut, India

10. Genetics : Gupta, P.K., Rastogi Publication, Meerut, India
11. Elements of Biostatistics : Prasad B., Rastogi Publication, Meerut, India
12. Principles of Genetics (8th Edition): Gardaner, J., Simmons, H.J. & Snustad, D.P. John Wiley & Sons New York
13. Cytogenetics : Gupta P.K., Rastogi Publish, Meerut
14. Breeding Field Crops : Pachlmann, J.M. & Sleeper, D.R. Panima Publishing of Crop Important Longman, London & New York
15. Principles & Practice of Plant Breeding : Sharma, J.R., Tata Mc Graw-Hill Publishing Co. Ltd. New Delhi
16. Textbook of Practical Botany Vol. I & II : Bendre & Kumar A.,Rastogi Publication, Meerut
17. Textbook of Practical Botany Vol. I & II : Sharma, O.P., Rastogi Prakashan, Meerut
18. Ecology Work Book : Misra, R., Oxford University Press, Calkutta
19. Plant Microtechnic : Johansen, D.A., Mc Graw-Hill Company, Inc. New York, London
20. Chromosome Technique (Theory & Practical) : Sharma, A. & Sharma A., Butterworths, London
21. Bioinformatics: Sequence and structure analysis : David Mount
22. Introduction to Bioinformatics : Attwood, T.K. & Parry. Smith; D.J. Pearson Education Asia
23. Bioinformatics in Biological Science and medicine : Rashidi, H.H. & Buchler K., CRC Press, London.
24. The Cell : Swanson, C.P. and Wetister, P.L.Prentice – Hall of India Pvt. Ltd. New Delhi

BOT: H610P PRACTICAL

(Based on theory papers BOT: H608 and H609**)**

Full Marks: 100

1. Field observation of local vegetation
2. Study of structure of a plant community by random & belt transect methods
3. Determination of Density and Abundance of vegetation in a community by using minimum size of quadrat
4. Determination of physical characteristics of soil like pH, Temperature and moisture content
5. Water analysis (Determination of chlorine, dissolved CO_2 and O_2 in water and measurement of pH)
6. Determination of dissolved oxygen and biochemical oxygen demand (BOD) in unpolluted and polluted water.
7. Determination of stomatal frequently using leaf epidermal peeling/impression
8. Separation of plant pigment by paper chromatography technique and chemical method
9. Isolation of chloroplast and demonstration of Hills activity.
10. Estimation of starch in photosynthesizing leaves
11. Estimation of protein by Bradford method
12. Paper chromatography separation of amino acids
13. Measurement of pH of beet, carrot, potato, tuber, *Amaranthus* leaves and sap of water hyacinth.
14. Study of Cell structure from onion leaf peels; demonstration of staining and mounting methods
15. Comparative study of cell structure in Onion cells, *Hydrilla* and *Spirogyra.* Study of cyclosis in *Tradescanta* stamina/cells haire.
16. Study of plastids to examine pigment distribution in plants (e.g. *Cassia, Lycopersicum, Capsicum*)
17. Examination of electron micrographs of eukaryotic cells with special reference to organelles
18. Study of various stage of mitosis and meiosis using appropriate plant material (e.g. root tips, flower buds of Onion/Pea/Broad been etc.
19. Determination of chromosome counts from dividing pollen mother cells, root tips and pollen grains.

20. Preparation of Karyotypes from dividing root tip cells and pollen grains
21. Detection of aromatics in chromosome pairing and disjunction caused by mutant genes and structural alterations of Chromosome.
22. Preparation of Chromosome maps from 3-point test cross data.
23. Correlation of floral structure with pollination system (e.g. *Salvia, Sesamum, Pisum, Lathyrus, Triticum, Oriza, Zre, Ricinus*).
24. Field exploration for detection of male sterile plants and estimation of their pollen fertility in locally grown crop plants e.g. tomato, *lenum* etc.
25. Estimation of pollen ovule ratios and its bearing on pollination system.
26. Emasculation and bagging of flowers of Brassicaceae, Poaceae, Papilionaceae, Malvaceae etc. pollinating them manually and estimating fruits and seed set.
27. Preparation of tissue culture media, sterilization and inoculation of plant materials
28. Demonstration of techniques of *in vitro* culture of various explants.
29. Isolation of plant protoplasts (e.g. tobacco, petunia) using enzymes available commercially and estimation of their yield
30. Isolation, purification of DNA from plant materials
31. Separation of DNA fragments through gel electrophoresis
32. Isolation of plasmids for *Bacillus/Pseudomonas*
33. Hybridization experiments – F_1 and available F_2 material analysis for specific character.
34. Determination of Mean, Standard Deviation, using MS Excel/SPSS
35. Preparation of presentation of Cell organelles, using Ms Powerpoint or similar packages.
36. Retrieving the botanical articles from internet

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iii. B.Sc. CHEMISTRY SYLLABUS

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	Full Marks/ Pass Marks	Time required (Hours)
1	CHM: E101	Inorganic, Organic and Physical Chemistry	75/30	90
	CHM:E101P	Organic Chemistry Practical	25/10	45
2	CHM: E202	Inorganic, Organic and Physical Chemistry	75/30	90
	CHM:E202P	Inorganic Chemistry Practical	25/10	45
3	CHM: E303	Inorganic, Organic and Physical Chemistry	75/30	90
	CHM:E303P	Physical Chemistry Practical	25/10	45
	CHM: HSC I (non-credit)	Inorganic, Organic and Physical Chemistry	100/35	100
4	CHM: E404	Inorganic, Organic and Physical Chemistry	75/30	90
	CHM:E404P	Analytical Chemistry Practical	25/10	45
	CHM:HSC II (non-credit)	Inorganic, Organic and Physical Chemistry	100/35	100
5	CHM: H505	Inorganic and Physical Chemistry	100/40	135
	CHM: E506	Organic and Physical Chemistry	100/40	135
	CHM:H507P	Practical (Inorganic and Physical Chemistry)	100/40	135
6	CHM: H608	Inorganic and Physical Chemistry	100/40	135
	CHM: H609	Organic and Physical Chemistry	100/40	135
	CHM:H610P	Practical (Organic and Physical Chemistry)	100/40	135
	12 Papers		1200	1550

*E for Elective; H for Honours; P for Practcal; HSC for Honours Supportive Course

SEMESTER – I

CHM: E101 Inorganic, Organic and Physical Chemistry FM-75

SECTION A: INORGANIC CHEMISTRY

(25 marks; 30 Hours)

Unit 1 Atomic Structure 6 Marks

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Heisenberg's uncertainty principle and its significance , Schrodinger wave equation, significance of ψ and $\psi,^2$quantum numbers and their significances, radial and angular wave functions, and probability distribution curves, shapes of s, p, and d orbitals, *variation of energy of atomic orbitals with atomic number.*

Unit 2 Periodic properties 6 Marks

Shielding effect (or screening effect) and effective nuclear charge; atomic and ionic radii; ionization energy, electron affinity, and electronegativity – definition, methods of determination or evaluation, *different scales of electronegativity,* trends in periodic table and applications in predicting and explaining the chemical behaviour.

Unit 3 Chemical Bonding 8 Marks

Covalent bond – Valence bond theory and its limitations, directional characteristics of covalent bond, various types of hybridization and shapes of simple inorganic molecules and ions. Valence shell electron pair repulsion (VSEPR) theory and shapes of simple molecules and ions containing lone pairs and bond pairs of electrons. Molecular orbital theory, homonuclear and heteronuclear diatomic molecules, bond strength and bond energy. Hydrogen bonding, metallic bonding (*VB and band theories*) and van der Waals' interactions, *ionic character in covalent bonds, dipole moment, covalent character in ionic bonds, ion deformation(polarization) and Fajan's rule.*

Unit 4 Acids and Bases 5 Marks

Arrhenius concept, Bronsted-Lowry theory, Lux- flood theory, solvent system concept and Lewis theory of acids and bases (*with merits and demerits*) Hard and soft acid and bases classification, HSAB principle and its applications, *Relative strength of acids and bases (from protonic concept).*

SECTION B: ORGANIC CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Structure and Bonding 5 Marks

Hybridization (sp, sp^2 and sp^3) bond lengths and bond angles *with reference to C in organic compounds*, bond energy, localized and delocalized chemical bond, van der Waals interactions, inclusion compounds, clatherates, charge transfer complexes, *resonance, resonance energy, mesomeric effect* and hyperconjugation, inductive, *electromeric* and field effects, hydrogen bonding.

Unit 2 Mechanism of organic reactions 6 Marks

Curved arrow notation, drawing electron movements with arrows, half-headed and double-headed arrows, homolytic and heterolytic bond breaking. Types of reagents - electrophiles and nucleophiles. Types of organic reactions. Energy considerations. Reactive intermediates - carbocations, carbanions, free radicals, carbenes, arynes and nitrenes

(*structure*,*formation, relative stability and reactions* with examples). Assigning formal charges on intermediates and other ionic species.

Methods of determination of reaction mechanism (product analysis, intermediates, isotope effects, kinetically controlled and thermodynamically controlled reactions and stereochemical studies).

Unit 3 Stereochemistry of organic compounds 9 Marks

Concept of isomerism - elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo- and erythro- diastereomers, meso-compounds.

Relative and absolute configuration, sequence rules, D and L, R and S systems of nomenclature. Geometrical isomerism, E-Z and *syn-anti* systems of nomenclature, geometrical isomerism in oximes and alicyclic compounds.

Conformational isomerism - conformational analysis of ethane and n-butane, conformations of cyclohexane, axial and equatorial bonds, conformation of monosubstituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.

Difference between configuration and conformation.

Unit 4 Cycloalkanes 5 Marks

Nomenclature of monocyclic, bicyclic, tricyclic and *spiro* cycloalkanes. Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strainless rings. The case of cyclopropane ring: banana bonds.

SECTION C: PHYSICAL CHEMISTRY

(25 Marks; 30 hours)

Unit 1 Gaseous state - I 6 Marks

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path*(with calculation*) and *viscosity* including their temperature and pressure dependence. Barometric distribution law and its applications, *qualitative discussion of Maxwell's distribution of molecular velocity of gases* and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy, law of equipartition of energy.

Unit 2 Gaseous state - II 6 Marks

Real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behavior, van der Waals equation of state, its derivation and application in explaining real gas behaviour, mention of other equations of state (Berthelot, Dieterici), Boyle temperature. Continuity of states, critical state, relation between critical constants and van der Waals constants, law of corresponding states.

Unit 3 Liquid state 5 Marks

Nature of liquid state, intermolecular forces, Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity, *cleansing action of detergents*, Temperature variation of viscosity and surface tension of liquids, *parachor and rheochor.*

Unit 4 Solid state 8 Marks

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices *and types of planes*, elementary ideas of symmetry, symmetry elements and symmetry operations, seven crystal systems and fourteen Bravais lattices, X-ray diffraction, Bragg's law. Close packing in crystals, crystal structures of AB and AB_2 type ionic solids (NaCl and TiO_2). A simple account of rotating crystal method and powder pattern method.

CHM: E101P ORGANIC CHEMISTRY PRACTICAL (25 Marks; 45 Hours)

1. Determination of melting point:

Naphthalene 80-82°C, Benzoic acid 121.5-122°C, Urea 133.5-135°C, Succinic acid 184.5-185°, *trans*-Cinnamic acid 133.5-135°C , *cis*-Cinnamic acid 58°C, Salicylic acid 157.5-158°C, Acetanilide 113.5-114°, m-Dinitrobenzene 90°, p-Dichlorobenzene 52°, Aspirin 135°.

2. Determination of boiling point: Ethanol 78°, Cyclohexane 81.4°, Toluene 110.6°C.

3. Systematic qualitative organic analysis of organic compounds possessing monofuntional Groups

Detection of elements - N, S, Cl, Br and I, and functional groups such as alcoholic, phenolic, -COOH, -COOR, aldehydic, ketonic, amide, nitro, amines) and determination of their melting /boiling points.

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SEMESTER- II

CHM: E202 Inorganic, Organic and Physical Chemistry FM-75

SECTION A: INORGANIC CHEMISTRY

(25 marks; 30 Hours)

Unit 1 Theory of quantitative and qualitative analysis 6 Marks

Common ion effect, solubility of precipitates, solubility product. Principles of oxidimetry and reductimetry, iodimetry and iodometry. Gravimetric analysis – its principles, precipitation, coprecipitation, postprecipitation, *ageing*, theory of washing. Error in quantitative analysis.

Unit 2 Non-aqueous solvents 7 Marks

Classification of solvents (based on proton donor and proton acceptor properties), qualities of ionizing solvents, study of reactions in liquid ammonia and liquid sulphur dioxide.

Unit 3 Chemistry of s-block elements 6 Marks

Comparative studies, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems.

Unit 4 Chemistry of p-block elements 6 Marks

Comparative studies, diagonal relationships, salient features of hydrides, oxides, oxyacids and halides, interhalogen compounds, applications of p-block elements (Si, Ge, Se).

SECTION B: ORGANIC CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Alkenes Cycloalkenes, Dienes and Alkynes 10 Marks

Methods of formation (*from alcohols and alkyl halides*) mechanisms of dehydration of alcohols and dehydrohalogenation of alkyl halides, regioselectivity in alcohol dehydration. Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes.

Chemical reactions of alkenes - mechanisms involved in hydrogenation, electrophilic and free radical additions, Markownikoff's rule anti-Markownikoff addition, hydroboration - oxidation, oxymercuration - reduction, epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$. Polymerization of alkenes. Substitution at the allylic and vinylic positions of alkenes.

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions, 1,2- and 1,4- additions, Diels - Alder reaction.

Methods of formation and chemical reactions of alkynes(*by elimination reactions*), acidity of alkynes. Mechanism of electroplilic and nucleophilic addition reactions, hydroboration - oxidation, metal - ammonia reductions, oxidation and polymerization.

Unit 2 Arenes and aromaticity 7 Marks

Structure of benzene: molecular formula and Kekule structure. Stability and carbon-carbon bond lengths in benzene, resonance structure, MO picture.

Aromaticity: Huckel rule, aromatic ions.

Aromatic electrophilic substitution - general pattern of the mechanism, role of δ- and π-complexes and energy profile diagram. Mechanism of nitration, halogenation, sulphonation, mercuration and Friedel - Crafts reaction (*with mechanism*). Activating and deactivating substituents, orientation and ortho/para ratio.

Unit 3 Alkyl halides and aryl halides 4 Marks

Mechanisms of nucleophilic substitution reactions of alkyl halides. S_N2 and S_N1 reactions with energy profile diagrams.

Methods of formation of aryl halides, nuclear and side chain reactions. The addition-elimination and the elimination-addition mechanisms of nucleophilic aromatic substitution reactions.

Unit 4 Alcohols 4 Marks

Synthesis from carbonyl compounds, dihydric alcohols - nomenclature, methods of formation, chemical reactions, oxidative cleavage of vicinal glycols using $Pb(OAc)_4$ and HIO_4.*pinacol-pinacolone rearrangement reaction with mechanism*.

Trihydric alcohols: nomenclature and reactions with $KHSO_4$.

SECTION C: PHYSICAL CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Solutions 6 Marks

Solutions and mixtures, miscible and immiscible liquids, types of solutions, Raoults law and Henry's laws, ideal and nonideal solutions, deviations from ideal behavior, vapour pressure of liquids and liquid mixtures, separation of completely miscible binary liquid solutions by distillation, azeotropic mixtures, solubility of partially miscible liquids (phenol-water, TEA-water and nicotine-water systems), critical solution temperature. Nerst distribution law and its limitations.

Unit 2 Dilute Solutions 6 Marks

Dilute solutions; Colligative properties – lowering of vapour pressure. Clapeyron - Clausius equation,*Concept of chemical potential*, Thermodynamic derivation using chemical potential to derive relations between the four colligative properties (i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure and amount of solute. Applications in calculating molar masses of normal, dissociated and associated solutes in solution.

Unit 3 Colloids and Surface Chemistry 6 Marks

Colloidal state and colloidal systems, characteristics of true solutions, colloidal solutions and suspensions. Classification, preparation and purification of colloidal solutions, properties of colloidal solutions: Tyndal effect, Brownian motion. Adsorption - Physisorption and chemi sorption - Freundlich adsorption isotherm - Langmuir adsorption isotherm.

Unit 4 Chemical equilibrium 7 Marks

Criteria of thermodynamic equilibrium, chemical equilibria in ideal gases, concept of fugacity. Thermodynamic derivation of relation between Gibbs free energy of reaction. Equilibrium constants and their quantitative dependence on temperature, pressure and concentration. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants Kp, Kc and Kx. Le Chatelier principle.

CHM: E202P INORGANIC CHEMISTRY PRACTICAL (25 Marks; 30 Hours)

I Semimicro analysis (4 radicals)

Semimicro analyses of inorganic mixtures containing four radicals/ions from the following list: Silver, lead, mercury, bismuth, copper, cadmium, arsenic, manganese, cobalt, aluminium, iron, nickel, calcium, strontium, barium, magnesium, sodium, potassium, ammonium, chloride, bromide, iodide, fluoride, sulphate, sulphite, thiosulphate, chromate, phosphate, nitrate, nitrite, borate, arsenite, and arsenate.

(N.B.: At least one interfering radical must be present in the composition if there are two acid radicals.)

II Volumetric analysis

a. Estmatiom of Na_2CO_3 and $NaHCO_3$ present in a mixture (solution) of the two.

b. Estimation of Fe(II) ions by tirating it with $K_2Cr_2O_7$ using internal indicator.

c. Estimation of oxalic acid by tirating it with $KMnO_4$.

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SEMESTER - III

CHM: E303 Inorganic, Organic and Physical Chemistry FM-75

SECTION A: INORGANIC CHEMISTRY

(25 marks; 30 Hours)

Unit 1 General properties of d-block elements 6 Marks

Definition, position in periodic table,*detail study of the* characteristic properties of d-block elements including their variable oxidation states, *formation of coloured ions and compounds*, *magnetic properties, catalytic properties* and complex formation tendency.

Unit 2 Metallurgy 6 Marks

Minerals and ores, general principles of metallurgy, extraction of Li, Be, Sn, Cr, Mn and Fe *with refining methods*.

Unit 3 Coordination Chemistry 6 Marks

Werner's coordination theory and its experimental verification, types of ligands, nomenclature of coordination compounds (IUPAC), coordination number and stereochemistry of coordination compounds, isomerism in coordination compounds.

Unit 4 Theories of Coordination Compounds 7 Marks

Theory of coordination bond, Effective atomic number rule, Valence bond theory and its limitations. Crystal field theory and limitations. Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes.*Jahn-Teller effect (distortion)*, Crystal field stabilization energy.

SECTION - B: ORGANIC CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Phenols 5 Marks

Acidic character. Comparative acidic strengths of alcohols and phenols, resonance stabilization of phenoxide ion. Reactions of phenols - electrophilic aromatic substitutiion, acylation and carboxylation, Mechanisms of Fries rearrangement, Claisen rearrangement, Gatterman synthesis, Hauben - Hoesch reaction and Reimer - Tiemann reaction.

Unit 2 Ethers and epoxides 5 Marks

Ethers: Methods of their formation, physical properties. Chemical reactions - cleavage and autoxidation, Ziesel's method.

Synthesis of epoxides. Acid and base-catalyzed ring opening of epoxides, orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.

Unit 3 Aldehydes and ketones 8 Marks

Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehydes and ketones using 1, 3 - dithianes, synthesis of ketones from nitriles and from carboxylic acids. Physical properties.

Mechanism of nucleophilic additions to carbonyl group with particular emphasis on benzoin, aldol, Perkin and Knoevenagel condensations, Condensation with ammonia and derivatives. Wittig reaction, Mannich reaction.

Oxidation of aldehydes, Baeyer - Villiger oxidation of ketones. Cannizzaro reaction, MPV reaction, Clemmensen reduction, Wolff – Kishner reduction, $LiAlH_4$ and $NaBH_4$ reductions. Halogenation of enolizable ketones.

Unit 4 Organic compounds of nitrogen and Sulphur 7 Marks

Preparation of nitroalkanes and nitroarenes, Chemical reactions of nitroalkanes, Mechanisms of nucleophilic substitution in nitroarenes and their reductions in acidic, neutral and alkaline media.

Structure and nomenclature of amines, physical properties, Stereochemistry of amines, Separation of a mixture of primary, secondary and tertiary amines. Structural features effecting basicity of amines. Gabriel-phthalimide reaction, Hofmann bromamide reaction.

Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, sulphonamides.

SECTION C: PHYSICAL CHEMISTRY (25 Marks; 30 Hours)

Unit 1 Thermodynamics-1 7 Marks

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics. First law: Concept of heat (q), work (w), internal energy (U) and statement of first law; enthalpy (H), relation between heat capacities, calculations of q, w, U and H for reversible, irreversible and free expansion of gases (ideal and van der Waals) under isothermal and adiabatic conditions. Joule-Thomson effect and relation between Joule-Thomson coefficient and other thermodynamic parameters; inversion temperature.

Unit 2 Thermochemistry 6 Marks

Heats of reactions: standard states; enthalpy of formation of molecules, and ions and enthalpy of combustion and applications; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data, effect of temperature (Kirchoff's equations) *and pressure on enthalpy of reactions,*

Unit 3 Thermodynamics – II 6 Marks

Carnot cycle and its efficiency, concept of entropy; thermodynamic scale of temperature, statement of the second law of thermodynamics; Calculation of entropy change for reversible and irreversible processes. Free Energy Functions and Gibbs and Helmholtz equation.

Unit 4 Chemical Kinetics – I 6 Marks

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, Zero order reactions and examples - half life period with examples, effect of temperature on the rate of reactions - Arrehenius equation(*no derivation*) and concept of energy of activation. Experimental methods of the determination of rate laws.

CHM: E303P PHYSICAL CHEMISTRY PRACTICAL (25 Marks; 45 Hours)

1. Surface tension measurements

Determine the surface tension by (i) drop number (ii) drop weight method.

2. Viscosity measurement:

(a) Viscosity measurement of given liquids using Ostwald's viscometer (at room temperature)

(b) Study the effect of variation of viscosity of an aqueous solution with the concentration of solute.

3. pH measurements

a) Measurement of pH of different solutions using pH-meter.

b) Preparation of buffer solutions (i) Sodium acetate-acetic acid, and (ii) Ammonium chloride-ammonium hydroxide, and Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

c) pH metric titrations of (i) strong acid and strong base, and(ii) weak acid and strong base.

HONOURS SUPORTIVE COURSE-I

CMH: HSC I Inorganic, Organic and Physical Chemistry FM:100

Section-A (Inorganic Chemistry) 33Marks

1. General characteristic of d block elements, magnetic properties, oxidation state, colour, complex formation and bonding in coordination compound (VBT and CFT) 11 marks

2. Principles of spectroscopy: electromagnetic radiation, wave length, wave number, frequency, quantum theory of electromagnetic radiation and electromagnetic spectrum. 11 marks

3. Environmental chemistry : Environmental segments , atmosphere, compositions of atmosphere, atmospheric structure, pollution, types of pollution, pollutants, types of pollutants, toxic chemical effect of heavy metal like Hg, Pb, in environmental and biological system. 11 marks

Section –B (Organic Chemistry) 34 Marks

1.General concepts of organic reaction intermediates such as carbocations , carbanions, free radicals, carbenes, arynes & nitrene with structures and applications. 12 marks

2. Concept and applications of inductive effect , mesomeric effect, electromeric effect, hyperconjugation, steric effect and types of hydrogen bonding and its effect, electrophilic and nucleophilic addition and substitution reactions with relevant examples. 11 marks

3. Stereochemistry of organic compounds, concepts of chiral, prochiral, molecular chirality, D and L, R and S, E & Z system of nomenclature, configuration and conformations, aliphatic and aromatic characters. 11 marks

Section –C (Physical Chemistry) 33 Marks

1. Mathematics in Chemistry, state function, path function, exact differentials, inexact differentials, partial differential, total differential with examples w.r.to chemistry, cyclic rule, to show that dE,dP, dV, dH, dG, dS,etc. are exact differentials while δW & δQ are inexact differentials. 11 marks

2. Elements of symmetry , line of symmetry (proper axis of symmetry) plane of symmetry, improper or alternating axis of symmetry , centre of symmetry , symmetry operation, point group, assigning point groups to H_2O, NH_3,BF_3, CH_4, C_6H_6, C_6H_5Cl, C_2H_2, C_2H_4 and similar ions/molecules. 11 marks

3. Bohr's model of H atom, its applications and limitation, calculation of radius of H atom and energy of electron in H atom using Bohr's theory, Sommerfeld model of atom, its application and limitations, wave mechanical model of atom, Schrodiger equation (without derivation). 11 marks

SEMESTER - IV

CHM: E404 Inorganic, Organic and Physical Chemistry FM-75

SECTION A: INORGANIC CHEMISTRYY

(25 Marks; 30 Hours)

Unit 1 Chemistry of compounds of non-transition elements 8 Marks

Comparative studies of s - and p - block elements. Preparation and properties of bleaching powder, Portland cement and borazole. Study of solid CO_2 and carbonaceous fuel (solid, liquid and gaseous). Oxides and oxyacids of phosphorous, oxides and hydrides of halogens. Chemical reactivity of chalcogens (halides, oxyacids and peroxyacids of sulphur).

Unit 2 Chemistry of Lanthanides 6 Marks

Position of lanthanides in the periodic table, general properties of lanthanides, electronic structure, oxidation states, ionic radii and lanthanide contraction, consequences of lanthanide contraction,*separation of lanthanides by ion exchange method*, complex formation, uses of lanthanides and their compounds.

Unit 3 Chemistry of Actinides 6 Marks

Position of actinides in the periodic table, general properties of actinides, identification and nuclear synthesis of trans-uranium elements, separation of Np, Pu and Am from U, similarities and dissimilarities between lanthanides and actinides.

Unit 5 Environmental Chemistry 5 Marks

Water pollution: causes, nature of pollutants, treatment of water pollution.Air pollution: causes, remedies to minimize air pollution. Solid waste pollution, treatment and disposal.

SECTION B: ORGANIC CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Carboxylic acids and derivatives 9 Marks

Acidity of carboxylic acids, effects of substituents on acid strength. Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction. Reduction of carboxylic acids. Mechanism of decarboxylation. Synthesis of acid chlorides, esters and amides. Mechanisms of esterification and hydrolysis (acidic and basic).

Physical properties of acid derivatives, relative stability and reactivity of acyl derivatives, interconversion of acid derivatives by nucleophilic acyl substitution.

Unit 2 Organometallic compounds 5 Marks

Organomagnesium compounds: Grignard reagents, formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

Unit 3 Polymers 6 Marks

Natural and synthetic, mechanism of polymerization, condensation and addition polymers, Synthetic plastics, thermosetting and thermoplastic. Urea-formaldehyde, phenol-formaldehyde plastics. Teflon, polystyrene and polyurethanes, natural and synthetic rubbers, synthetic fibres, acrylics, nylon-6 and nylon - 66, terylene, elementary of fibremaking, blended fibres.

Unit 4 Green Chemistry 5 Marks

Principles and applications of green chemistry. Introduction, advantages and disadvantages. Applications in organic synthesis, principles of ultrasound and microwave assisted organic reactions, reactions in ionic liquids.

SECTION C: PHYSICAL CHEMISTRY

(25 Marks; 30 Hours)

Unit 1 Catalysis 6 Marks

Types of catalyst, specificity and selectivity, mechanisms of catalyzed reactions at solid surfaces; effect of particle size and efficiency of the catalysts. Enzyme catalysis, Michaelis-Menten mechanism, acid-base catalysis. Theory of catalysis – adsorption and intermediate compound formation.

Unit 2 Ionic equilibria – I 7 Marks

Electrolytes and non-electrolytes, strong, moderate and weak electrolytes, ionization and ionization constant, factors affecting degree of ionization, ionic product of water. Calculation of pH of dilute solutions of weak acids and bases, common ion effect; dissociation constants of mono- and di-protic acids. Salt hydrolysis and pH for different salts. Buffer solutions; derivation of Henderson equation and its applications; buffer capacity, buffer range, buffer action and applications of buffers in analytical chemistry and biochemical processes in the human body.

Unit 3 Ionic equilibria – II 6 Marks

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid - base titration curves. Theory of acid - base indicators; selection of indicators and their limitations.

Unit 4 Phase equilibria I 6 Marks

Phases, components and degrees of freedom, Gibbs Phase Rule (no derivation) for non-reactive and reactive systems; - Application to one component systems – water, carbon dioxide and sulphur with applications.

CHM: E404P ANALYTICAL CHEMISTRY PRACTICAL

(25 marks; 45 Hours)

1. To measure pH of water using a pH meter
2. To determine hardness of water using EDTA
3. To estimate nickel using DMG

4. To estimate calcium content in chalk by permanganometry

5. To estimate reducing sugar by titration with standard Fehlings solution

6. To determine the equivalent weight of the given acid sample by direct titration method with alkali

7. To determine the saponification value of the given fat or oil sample.

8. To estimate protein in the given sample by Folin Lowry method/biuret method.

9. To estimate a reducing sugar by colorimetric method.

10. To determine the concentration of a given sample by using Lambert-Beer's law.

HONOURS SUPORTIVE COURSE- II

CMH: HSC II Inorganic, Organic and Physical Chemistry FM:100

Section –A (Inorganic Chemistry) 33 Marks

1. General character of d block elements. Complex formation , Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only formula and applications of magnetic moment data in 3d transition metal complexes . theory of coordination bond. Splitting of d-orbital in different stereo-chemistries octahedral, tetrahedral and square planner complexes 11 marks

2. Principles of spectroscopy: Electromagnetic spectrum, molecular vibrations-fundamental, overtone, combination band, Fermi resonance, stretching and bending. Factors influencing vibrational frequencies (elementary treatment only). 11 marks

3. Non stoichiometric compounds:

Solids, types of solids, unit cell and types of unit cell. Radius ratio rules, classification of ionic structure. Lattice energy. Born-harber cycle. Non-stiochiometric defects and stoichiometric defects. Semiconductor and transistors. 11 marks

Section- B (organic Chemistry) **33Marks**

1. Proteins: Amino acids, structure of amino acids, Acid base base behaviour, Peptide bond, peptide structure determination. Level of protein structure. Classification of protein. Protein denaturation and renaturation.

Enzyme: Chemical nature, general characteristics & nomenclature of enzyme activity, active site, enzyme as biocatalyst. 11 marks

2. Acidic nature of carboxylic acid, mechanism of decarboxylation & esterfication, saturated, unsaturated & hydroxyl acids with example. 11 marks

3. Concepts of heterocyclic compounds & the different resonance forms of heterocyclic compounds. 11 marks

Section- C (Physical Chemistry) 34 Marks

1. Electromagnetic radiation, its characterestics, wave length, frequency, wave number. and their units. Relation between wavelength frequency wave no. and energy. Interaction of matter with EMR, spectrum, spectroscopy. 9 marks

2. Specific conductance, equivalent conductance, molar conductance of strong and weak electrolytes, their relationship and units. Electrode potential, standard electrode potential. Electro chemical cells, EMF, Nerst equation, calculation of EMF. 9 marks

3. de- Broglie equation, Heisenberg's uncertainty principle, black body radiation , Planck's theory, photoelectric effect , quantum mechanical operators. 8 marks

4. Phase equilibria, phase, component, degree of freedom, calculation of no. of component, triple point, one component system, two component system, phase diagram. 8 marks

SEMESTER - V

CHM: H505 Inorganic and Physical Chemistry FM-100

SECTION A: INORGANIC CHEMISTRY

(67 marks; 90 Hours)

Unit 1 Nuclear Chemistry and Radioactivity 7 Marks

Discovery of radioactivity, nature of radiations, separation of isotopes, binding energy, mass defect, packing fraction, half-life period, group displacement law, *different types of nuclear reactions, nuclear reactors and nuclear energy*, artificial transmutation of elements, artificial radioactivity, radioactive tracer techniques and their applications.

Unit 2 Chemistry of first, second and third transition element series 18 Marks

General characteristics, comparative studies (ionic radii, oxidation states, complex formation, magnetic behaviour, spectral properties and stereochemistry).

Vertical group and horizontal group relationship of 3d, 4d and 5d elements, oxides and halides of scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper and zinc groups. Role of transition metals in biology.

Unit 3 Thermodynamic and kinetic aspects of metal complexes 6 Marks

A brief outline of thermodynamic and kinetic stability of metal complexes, factors that influence complex formation and stability constants. Substitution reactions of square planar Pt(II) complexes, trans effect.

Unit 4 Alloys and intermetallic compounds 6 Marks

Alloy and types of alloys, rules for the formation of alloys, *their applications,* intermetallic compounds of first transition series*. their applications.*

Unit 5 Interaction of molecules with electromagnetic radiations 6 Marks

Electromagnetic radiation, wave length, wave number and frequency with their units, the electromagnetic spectrum with wave lengths and frequency, absorption of electromagnetic radiation by molecules, elementary idea of different spectroscopic techniques and the information obtainable from each.

Unit 6 Rotational Spectroscopy 6 Marks

Rotational spectra of diatomic molecules: Rigid rotor, moment of inertia, energy levels, selection rules, nature of spectrum, determination of bond length (*with examples)*,. Effect of isotopic substitution on the rotational spectra.

Unit 7 Infrared Spectroscopy 9 Marks

Unit of frequency, wavelength and wavenumber, molecular vibrations – fundamental, overtone, combination tone, Fermi resonance, stretching and bending. Factors influencing vibrational frequencies (elementary treatment only), application to characterization of groups like C=N, C=O, C=C, COOR, N-H and $CONH_2$. Elementary ideas on instrumentation and sample handling.

Unit 8 UV-visible spectroscopy 9 Marks

Fundamental laws of photochemistry (Lambert-Beer's law), molar absorptivity, energy levels of electron transitions of $\sigma \rightarrow \sigma^*$, $\sigma \rightarrow \sigma^*$, $\pi \rightarrow \pi^*$ and $n \rightarrow \pi^*$, and presentation of electronic spectra,

SECTION B: PHYSICAL CHEMISTRY

(33 Marks; 45 Hours)

Unit 1 Mathematics for Chemists 6 Marks

Uncertainty in measurement: types of uncertainties, combining uncertainties. Statistical treatment of uncertainties. Mean, standard deviation, relative error. Data reduction and the propagation of errors. Graphical and numerical data reduction, method of least squares (regression).

Unit 2 Quantum Chemistry – I 6Marks

Black-body radiation, Planck's radiation law, photoelectric effect, Bohr's model of hydrogen atom (no derivation and its defects), De Broglie hypothesis, Heisenberg's uncertainty principle. Quantum mechanical operators – momentum, position, energy (Hamiltonian) operators, postulates of quantum mechanics. Expectation values of dynamical variables.

Unit 3 Quantum Chemistry – II 7 Marks

Schrodinger wave equation (in Cartesian co-ordinates) and its importance, wave function and its physical interpretations, Schrodinger equation for a free particle moving in one dimensional box and its solutions, probability distribution of electrons - radial probability distribution curves.

Unit 4 Introduction to nanomaterials 6 Marks

Definition, classification. Preparation of gold and silver metallic nanoparticles. Self-assembled nanostructures *,carbon nanotubes, inorganic nanowires, bio-inorganic nanomaterials*, – control of nanoarchitecture – one dimensional control. Applications of nanomaterials.

Unit 5 Energetics 8 Marks

Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state. Systems of variable compositions, Partial molar quantities, dependence of thermodynamic parameters on composition; Gibbs-Duhem equation, chemical potential of ideal mixtures, change in thermodynamic functions in mixing of ideal gases. Nernst heat theorem, Third Law: Statement of third law, calculation of absolute entropy of molecules.

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CHM- H506 **Organic and Physical Chemistry** **FM-100**

SECTION-A: ORGANIC CHEMISTRY

(67 Marks; 90 Hours)

Unit 1 Elimination reactions 7 Marks

Elimination Reaction, α-elimination, α-elimination, E2, E1 and E1CB mechanisms, orientation effects in elimination reactions, stereochemistry of E2 reactions. Elimination vs substitution, factors affecting the elimination and substitution reactions.

Unit 2 Carbohydrates 11 Marks

Classification and nomenclature, Monosaccharides, mechanism of osazone formation, constitution of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Formation of glycosides, ethers and esters. Determination of ring size of monosaccharides. Cyclic structure of D(+)- glucose. Mechanism of mutarotaion. Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit 3 Amino acids, Peptides and Proteins 7 Marks

Classification, structure and stereochemistry of amino acids. Acid-base behaviour, isoelectric point and electrophoresis. Preparation and reactions of -amino acids.

Classification of proteins, Peptide structure determination, Classical Levels of protein structure. Protein denaturation/renaturation.

Unit 4 Enzymes 6 Marks

Enzymes as biocatalyst, chemical nature, general characteristics and nomenclature of enzymes, enzyme-activity, active sites, vitamines (B complex group) and elements in enzyme function.

Unit 5 Nucleic acids 5 Marks

Nucleic acids: Introduction. Constituents of nucleic acids. Nucleosides and nucleotides. Double helical structure of DNA.

Unit 6 Fats, Oils, detergents 6 Marks

Natural fats, edible and industrial oils of vegetables origin, common fatty acids, glycerides, hydrogenation of unsaturated oils. Saponification value, iodine value, acid value. Soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit 7 Organic synthesis via enolates 7 Marks

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation Keto-enol tautomerism of ethyl acetoacetate.

Alkylation of 1, 3-dithianes. Alkylation and acylation of enamines

Unit 8 Steroids 7 Marks

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry. Isolation, structure determination and synthesis of Cholesterol, Estrone. Biosynthesis of steroids.

Unit 9 Terpenoids 5 Marks

Occurrence, isolation, classification of terpenes, chemical composition, general methods of determining structure - Isoprene rule, synthesis and structure of citral and limonene.

Unit 10 Alkaloids 6 Marks

Definition, extraction and general methods of determining structure, isolation, structure and synthesis of nicotine, atrophine and cocaine.

SECTION B: PHYSICAL CHEMISTRY

(33 Marks; 45 Hours)

Unit 1 Specific heats of solids 6 Marks

The law of Dulong and Petit, atomic and molar heat capacities, Kopp's law, classical derivation of heat capacity, quantum theory of specific heats- Einstein equation of heat capacity of solids, Debye's equation, Debye's $T^{3.}$ law and characteristic temperatures of solids.

Unit 2 Statistical Thermodynamics – I 6 Marks

Purpose of statistical thermodynamics, probability of distribution, law of multiplication of probabilities, law of addition of probabilities, Sterling approximation, concept of ensembles, canonical ensemble, microcanonical ensemble and grandcanonical ensemble.

Unit 3 Statistical Thermodynamics – II 7Marks

Basic postulates of Maxwell-Boltzmann distribution law, derivation of Maxwell-Boltzmann distribution law, Maxwell-Boltzmann distribution law of velocities, Partition function and its physical significances, types of partition functions (derivation not included).

Unit 4 Macromolecules 6 Marks

Classification of polymers, *nomenclature, molecular forces and chemical bonding in polymers, texture of polymers*,.*Determination of molecular weight of polymers* (Number average molecular weight and weight average molecular weight) by *viscometry,light scattering and osmotic pressure methods*, *polymer solution*,*criteria for solubility*, *thermodynamics of polymer solutions*, Special properties of polymers, *conducting polymers (polyacetylene, polyaniline, polythiophene).*

Unit 5 Conductance 8 Marks

Metallic and electrolytic conductors - specific, equivalent and molar conductances - measurement of conductance - variation of Conductance with dilution for strong and weak electrolytes (qualitative explanation) - Transport number and its determination by Hittorffs and moving boundary method -effect of temperature and concentration - ionic mobility and ionic conductance - Kohlausch's law and its applications.

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CHM: H507P INORGANIC AND PHYSICAL CHEMISTRY PRACTICAL

(Inorganic: 60 marks; Physical: 30 marks: 135 Hours; Field visit: 10 marks)

A. INORGANIC LABORATORY:

I. Preparation of Inorganic complexes

a. Preparation of sodium tris(oxalato)ferrate(III), $Na_3[Fe(C_2O_4)_3].9H_2O$

b. Preparation of hexaamminenickel(II) chloride, $[Ni(NH_3)_6]Cl_2$

c. Preparation of tetraamminecopper(II) sulphate, $[Cu(NH_3)_4]SO_4.H_2O$

d. Preparation of ammonium diamminetetrathiocyanatochromate(III), $NH_4[Cr(NH_3)_2(SCN)_4]$

II. Estimation of two constituents from a binary mixture (one volumetrically and one gravimetrically)

Estimation of the constituents from the following mixture: Iron and calcium, iron and copper, iron and manganese, copper and zinc, silver and copper, calcium and barium, calcium and lead, calcium and magnesium, copper and chloride, copper and sulphate.

III Semimicro analysis

Semimicro analyses of five radicals containing at least one rare element (V, Mo, W , etc.) Silver, lead, mercury, bismuth, copper, cadmium, arsenic, manganese, cobalt, aluminium, iron, nickel, calcium, strontium, barium, magnesium, sodium, potassium, ammonium, chloride, bromide, iodide, fluoride, sulphate, sulphite, thiosulphate, chromate, phosphate, nitrate, nitrite, borate, arsenite, and arsenate.

B. PHYSICAL LABORATORY:

(I) Study the equilibrium of the following reactions by the distribution method:

(i) I_2 in water - Kerosene/CCl_4

(ii) $I_2(aq) + I^- \rightarrow I_3^-(aq)$

(iii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n^{2+}$

(II) Perform the following potentiometric/pH-metric titrations:

(i) strong acid with strong base

(ii) weak acid with strong base and

(iii) dibasic acid with strong base

(III) Potentiometric/pH-metric titration of Mohr's salt with potassium dichromate.

(IV) Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

(V) Phase equilibria: Construction of the phase diagram of

(i) simple eutectic and

(ii) congruently melting systems, using cooling curves and ignition tube methods.

Any other experiment carried out in the class.

C. A STUDY TOUR (AN INDUSTRIAL VISIT, ETC.) :

A report should be submitted at the time of practical examination.

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SEMESTER - VI

CHM: H608 Inorganic and Physical Chemistry Practical FM-100

SECTION A: INORGANIC CHEMISTRY

(67 marks; 90 Hours)

Unit 1 Electronic Spectral properties of transition metal complexes 9 Marks

Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, Orgel-energy level diagram for d^1, d^4, d^6, d^7 and d^9 systems.

Unit 2 Magnetic properties of transition metal complexes 8 Marks

Types of magnetic behaviour, methods of determining magnetic susceptibility, spin only, formula, L-S coupling, and applications of magnetic moment data in 3d transition metal complexes.

Unit 3 Organometallic Chemistry 11 Marks

Definition, nomenclature and classification of organometallic compounds. 18 electron rule, counting of electrons in compounds; bonding and structure of CO, NO and N_2 compounds. Applications of organometallic compounds in homogeneous and heterogeneous catalysis.

Unit 4 Bioinorganic Chemistry 9 Marks

Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin , myoglobin and chlorophyll. Biological role of alkali and alkaline earth metal ions with special reference to Na^+, K^+ and Ca^{2+}, nitrogen fixation.

Unit 5 Inorganic rings and cages 7 Marks

Boron hydrides, diborane and higher boranes, borazine, tetrasulphur, tetranitride, synthesis, structure and their properties.

Unit 6 Inorganic polymers 7 Marks

Silicates and their classifications and structures, phophazenes as inorganic polymers, structure and bonding in triphosphazenes, zeolites and molecular sieves.

Unit 7 Thermoanalytical methods 9 Marks

Thermogravimitric (TGA) and Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) - Basic principles, Instrumentation, Factors affecting to thermoanalytical techniques, Application in soils, organic and inorganic compounds, analytical chemistry.

Unit 8 Non-stoichiometric compounds 7 Marks

Radius ratio rules, classification of ionic structures, layer structures, lattice energy, Born-Harber cycle, non-stoichiometric defects and stoichiometric defects, semiconductor and transistors, photovoltaic cells.

SECTION B: PHYSICAL CHEMISTRY

(33Marks; 45 Hours)

Unit 1 Computer Applications in Chemistry 6 Marks

Introduction to computers and its application in chemistry: Algorithm, Flow charts, basics of FORTRAN, constants, variables, operations, symbols in FORTRAN. Arithmatic expressions, Input and Output statements. FORTRAN Programmes for the determination of molarity, normality and molality of a solution, pH of a solution, viscosity of a solution using Poiseuille's equation, absorbance of a solution on the basis of Lambert-Beer's law.

Unit 2 Symmetry and Point groups 7Marks

Symmetry operations, *point group, assigning point group to molecules and ions like* H_2O, NH_3, CH_4, BF_3, C_5H_5, C_6H_6, *p-dichlorobenzene,* C_2H_4, C_2H_2, *HCN,* NO_3^- *and* ICl_4^-, - products of symmetry operations of various point groups with examples, group multiplicaiton table (C_{2v} ,C_{3v}).

Unit 3 Spectroscopy 8 Marks

Vibrational spectra of diatomic molecules: Harmonic oscillator: energy levels, selection rules, nature of spectrum, determination of force constant. Anharmonic oscillator: energy levels,*Morse potential*, *dissociation energies*, selection rules, nature of spectrum,*fundamental frequencies*, fundamental band, overtones.

Raman Spectroscopy: Raman effect,*vibrational Raman spectra(with theory)*, Raman scattering -Stokes lines and Anti-Stokes' lines. *their intensity difference, rule of mutual exclusion.* Raman shift,

Unit 4 Photochemistry 7 Marks

Grotthus-Drapers and Lambert Beer's Laws(*with limitations*), Stark-Einstien's laws of photochemical equivalence, Quantum yield, *examples of low and high quantum yields with reason*, Photolysis of ammonia, decomposition of Hydrogeniodide and Hydrogenchlorine reactions, Phothsynthesis. Phosophorescence, Fluorescence, Chemiluminescence and photosensitisation – definitions with *examples.*

Unit 5 Surface Active Agents 5 Marks

Hydrophilic and hydrophobic groups, ampiphiles, classification of surfactants, surfactants in solution, formation of micelles and reverse micelles.

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CHM: H609 ORGANIC AND PHYSICAL CHEMISTRY FM-100

SECTION A: ORGANIC CHEMISTRY

(66 Marks; 90 Hours)

Unit 1 Organic photochemistry 5 Marks

Principles of photochemistry, photochemical reactions of carbonyl compounds, olefins and aromatic compounds.

Unit 2 Pericyclic reactions 9 Marks

Definition and classification, electrocyclic reactions (thermal and photo chemical) involving 4 and 6π–electrons and corresponding cyclo reversion reaction, cycloaddition reactions, FMO approach, Diels-Alder Reaction, photochemical [2+2] reactions. Sigmatropic reactions /rearrangements.

Unit 3 Synthetic dyes 5 Marks

Colour and constitution (electronic concept). Classification of dyes. Chemistry and synthesis of Methyl orange, Congo red, Malachite green, Crystal violet, Phenolphthalein, Fluorescein, Alizarin and Indigo.

Unit 4 Heterocyclic compounds 10 Marks

Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution. Mechanism of nucleophilic substitution reactions in pyridine derivatives. Comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six-membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis. Mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

Unit 5 Medicinal chemistry 7 Marks

Drugs and antibiotics - synthesis and structure of the following:

Sulphadrugs - Sulphadiazine – sulphaguanidine, *sulphamethoxazole*

Analgesics - aspirin, phenacetin, *paracetamol*

Antimalarials - Plasmoquin, chloroquine

Antibiotics - chloramphenicol

Unit 6 Chromatography 5 Marks

Principles and application of chromatography- column, thin layer, paper, preparatory thin layer, gas chromatography, elementary ideas of instrumentation of gas chromatography.

Unit 7 Mass spectroscopy 7 Marks

Basic principle, basic components of double focusing instruments, molecular ions, fragmentation of molecular ions, basic rules of fragmentation, fragmentation by -bond rupture in alkane groups, -bond rupture near functional groups, study of the nature of fragmentation and presentation of mass spectra of 2-methylpentane, cyclohexane.

Unit 8 Nuclear Magnetic Resonance Spectroscopy 8 Marks

Qualitative and conceptual treatment of the nmr phenomenon, precessional frequency, energy trasition, theory of reasonance, chemical shift, magnetically non-equivalent protons, shielding and deshielding, spin coupling, analysis of AX type spectra like, trans-cinnamic acid, 1, 1, 2-trichloroethane, ethyl bromide, elementary ideas on instrumentation and sample handling.

Unit 9 Electron Paramagnetic Resonance Spectroscopy 5 Marks

Elementary principle of epr, hyperfine splitting, g values, epr spectra of $C_6H_6^{(.)}$ and $CH_3CHOCH_2CH_3$ and their analysis.

Unit 10 Structural elucidation of organic compounds using different spectral techniques 5 Marks

Characterization of (i) 2-pentanone, (ii) *trans*-cinnamic acid, (iii) *o*-nitrophenol and (iv) acetophenone using IR, UV, ^{1}H NMR and Mass spectroscopic methods.

SECTION B: PHYSICAL CHEMISTRY

(34 Marks; 45 Hours)

Unit 1 Electrochemistry I 8 Marks

Chemical cells, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Nernst equation, Standard electrode potential and its application to different kinds of half-cells. EMF in determination of (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone-hydroquinone, glass electrodes.

Unit 2 Electrochemistry II 9 Marks

Concentration cells with and without transference, liquid junction potential, decomposition potential, electrolytic polarization, overvoltage; determination of activity coefficients and transference numbers. Qualitative discussion of potentiometric titrations (acid-base, redox, precipitation), Theory of strong electrolytes - Debye - Huckel - Onsager theory (without detailed treatment) -

verification of Onsager equation - Wein effect and Debye - Falkenhangen effect - ionic strength - activity and activity coefficients of strong electrolytes and the limiting equation.

Unit 3 Chemical kinetics II 9 Marks

Temperature dependence of reaction rate, Arrhenius equation and its derivation, activation energy,collision theory and transition state theory of reaction rates, Lindemann mechanism, Steady state approximation and reaction mechanism, Kinetics of complex reactions: (i) Opposing reactions (ii) parallel reactions , (iii) consecutive reactions and (iv) chain reactions.

Unit 4 Phase equilibria II 8 Marks

Derivation of Gibbs phase rule, reduced phase rule,Phase equilibria of two component system: solid -liquid equilibria, simple eutectic - Bi-Cd, Pb-Ag systems, desilverisation of lead. Solid solutions: compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCl -$H_2$0), ($FeCl_3$-H_2O) and $CuSO_4$-H_2O system. Freezing mixtures, acetone dry ice.

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CHM: H610P ORGANIC AND PHYSICAL CHEMISTRY PRACTICAL

(Organic: 67, Physical: 33; 135 hours)

Organic Laboratory:

A. Qualitative Analysis: Identification of Organic Compounds; Detection of extra elements(N, S and halogens) and functional groups – phenolic, carboxylic, carbonyl, esters, amines, nitro, anilide, alcohol, halogen derivative of hydrocarbons and hydrochloride in simple organic compounds.

Analysis should include detection of elements, functional group, preparation of a solid derivative. A completely dried sample of the derivative should be submitted to the examiner.

B. Organic Preparation:

(a) Acetylation of salicylic acid, aniline, glucose and hydroquinone. Benzoylation of aniline and phenol.

(b) Aliphatic electrophilic substitution; Preparation of iodoform from ethanol and acetone.

(c) Aromatic electrophilic substitution:

Nitration: Preparation of m-dinitrobenzene, p-nitroacetanilide.

Halogenation: Preparation of p-bromoacetanilide, 2, 4, 6-tribromophenol

(d) Diazotisation/ coupling: Preparation of methyl orange and methyl red.

(e) Oxidation: Preparation of benzoic acid from toluene.

(f) Reduction: Preparation of aniline from nitrobenzene.

Physical Laboratory:

1. To study changes in conductance in the following systems

   (a) strong acid-strong base

   (b) weak acid-strong base and

   (c) mixture of strong acid and weak acid-strong base

2. Study the kinetics of the following reactions.

   (a) Acid hydrolysis of methyl acetate with hydrochloric acid, volumetrically or conductometrically.

   (b) Saponification of ethyl acetate.

3. Verification of Lambert-Beer's Law

4. Determination of pK (indicator) for phenolphthalein or methyl red

5. Study the formation of a complex between ferric and thiocyanate (or salicylate) ions.

Any other experiment carried out in the class.

Reference Books:

Inorganic Chemistry

1. J. D. Lee, New Concise in Inorganic Chemistry.
2. J.E. Huheey, E.A. Ketler and R.L. Ketler, Principles of Structure and Reactivity, Harper Collins College Publishers, 1993.
3. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Academic Press, 3rd Edition, 1976.
4. R. L. Dutta, Inorganic Chemistry - Part I
5. Satya Prakash, A Text Book of Inorganic Chemistry.
6. D.F. Shriver, P.W.Atkins and C.H. Langford, Inorganic Chemistry, Academic Press, 1991.
7. S. Sarkar, General and Inorganic Chemistry, Part II
8. G.L. Miessler and D.A. Tarr, Inorganic Chemistry, Pearson Education, Low price Edition.
9. G. Pass and H. Sutcliffe, Practical Inorganic Chemistry, Chapman & Hill, 2nd Edition. 1974.
10. J.N. Gurtu and Kapoor, Advanced Experimental Inorganic Practical Chemistry, S.Chand and Company, N. Delhi
11. J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, Vogel's Text Book of Quantitative Inorganic Analysis, ELBS.
12. J. Basset, R.C. Denney, G.H. Jeffery and J. Mendham, Vogel's Text Book of Qualitative Inorganic Analysis, ELBS.
13. H.H. Willard, L.L. Merrit and J.A.Dean, Instrumental Methods of Analysis, East-West Press, 4th Edition, 1974.
14. R.L Dutta and A. Syamal, Elements of Magnetochemistry, Affiliated East-West Press, 2nd Edition.
15. G. Friedlander, J.W. Kennedy and J.M. Mill, Nuclear and Radiochemistry, Wiley International, 2nd Edition.
16. K. Nakamato, Infrared and Raman spectra of Inorganic and coordination Compounds, 4th Edition, John Wiley, 1986.
17. R.S. Drago, Physical Methods in chemistry, Saunders College Publishers, 1977.
18. C.N. Banwell. Fundamentals of Molecular Spectroscopy, Tata McGraw Hill.
19. Thermal Methods of Analysis, W.W. Wendlandt, Inter-Science

20. J.W. Moore and E.A. Moore – Environmental Chemistry, Academic Press, London, 1976.
21. A.K. De, Environmental Chemistry, 3rd Edn., New Age International Ltd, New Delhi, 1994.
22. S.E. Manahan, Environmental Chemistry, Willard Grant Press, Boston, 1983.
23. S.S. Dara – A Text Book of Environmental Chemistry and Pollution Control, S. Chand and Co., New Delhi, 1995.
24. G.N. Mukherjee and A Das, Elements of Bio-inorganic Chemistry, 2001
25. H.J. Arnikar, Essentials of Nuclear Chemistry
26. H.J.E. Emeleus and A.G. Sharp, Modern Aspects of Inorganic Chemistry.
27. Day and Selvin, Concise Inorganic Chemistry
28. G.S. Manku, Basic concepts in Inorganic Chemistry
29. S.K. Agarwala and Keemtilal, Advanced Inorganic Analysis, Pragati Prakashan, Meerut, 2011.

Organic Chemistry

1. R. T. Morrision and R.N. Boyd, Organic Chemistry, Allyn and Bacon. Inc.
2. J. March, Advanced Organic Chemistry, Wiley Eastern Ltd
3. S.M. Mukherjee, S. P. Singh and R.P. Kapoor, Organic Chemistry, Vol. I, II, III, Wiley Eastern Ltd.
4. F.A. Cotton, Chemical Applications of Group Theory, WILEY Eastern
5. F.A. Carey, and R.J. Sunberg, Advanced Organic Chemistry, Part A and B, Plenum Press.
6. R. K. Bansal, Organic reaction Mechanism, Wiley-Eastern.
7. A.I. Vogel, Practical Organic Chemistry,
8. R.K. Bansal, Synthetic Approaches in Organic Chemistry, Narosh A Publishing House.
9. W. Kemp and A. Bahl, Experimental Organic Chemistry, S. Chand and Co.
10. R. K. Bansal, Heterocyclic Chemistry, New Age International.
11. R.M. Silverstien, G,C. Bassler and T.C. Morril, Spectroscopic Identification of Organic Compounds.

12. J.R. Dyer, Application of Spectroscopy of Organic Compounds, Prentice Hall.
13. J.M. Hollas, Modern Spectroscopy, John Wiley.
14. V.K. Alluwalia, M. Kidwai, New Trends in Green Chemistry, Anamaya Publishers.
15. D. Nashipuri, Stereochemistry of Organic Compounds, Wiley Eastern.
16. P.S. Khalsi, Stereochemistry, Conformation and Mechanism, New Age International.
17. T.L. Gilchrist and C.W. Rees, Carbon, Nitrenes, Aynes, Netson London Publication.
18. I. L. Finar, Organic Chemistry, Vol. I and II, ELBS Publication.

Physical Chemistry

1. P. W. Atkins, The Elements of Physical Chemistry- (1996) 2nd ed., Oxford University Press, Oxford.
2. G.M. Barrow, Physical Chemistry- 6th ed., Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. K.J .Laidler and J .H. Meiser, Physical Chemistry- 2nd ed.(First Indian ed. 1999) CBS Publishers and Distributors, New Delhi.
4. R.J .Silbey and R.A.Alberty, Physical Chemistry- John Wiley & Sons (Asia) Pvt. Ltd., (Singapore) 3rd ed. (2002).
5. Samuel Glasstone, Thermodynamics for Chemists - Affiliated East-West Press.
6. Samuel Glasstone, An introduction to Electrochemistry - Affiliated East- West Press.
7. P.L. Soni, Text book of Physical Chemistry - Sultan Chand.
8. A.S. Negi and S.C. Anand, Physical Chemistry - New Age International (P).
9. Kundu and Jam, Physical Chemistry, S. Chand.
10. K.L. Kapoor, Physical Chemistry, Macmillan - 4 volumes.
11. Glasstone and Lewis, Elements of Physical Chemistry, Macmillan.
12. S.Glasstone, Text book of Physical Chemistry, Macmillan.
13. Maron and Landor- Colier, Fundamentals of Physical Chemistry, Macmillan.
14. G.W. Castellan, Physical Chemistry, Narosa publishing house.
15. Dogra & Dogra, Physical Chemistry through Problems.

16. Walter J. Moore, Physical Chemistry, Orient Longman.
17. Gashal, Numerical Problems on Physical Chemistry - Books and Allied (P) Ltd.,
18. C.N.R. Rao, Universal General Chemistry, Macmillan.
19. C.H.Hanman, Electrochemistry, John Wiley, 1998.
20. K.J.Laidler, Chemical Kinetics, 3rd ed., Elsevier Publishers.
21. Puri, Sharma, Pathania, Principles of Physical Chemistry, Vishal Publishing Co.
22. Ira N Levine, Physical Chemistry - (1995) 4th ed., McGraw Hill Inc.
23. C.N .Banwell, Fundamentals of Molecular Spectroscopy - 5th ed.
24. Rohatgi Mukherjee, Fundamentals of Photochemistry.
25. M.C. Gupta, Statistical Thermodynamics.
26. D. A. Mc Quarrie, Mathematics for Physical Chemistry- University Science Books (2008).
27. R. Mortimer, Mathematics for Physical Chemistry- 3rd Ed. Elsevier (2005).
28. J. H. Noggle, Physical Chemistry on a Microcomputer- Little Brown & Co. (1985).
29. T. Engel & P. Reid, Thermodynamics, Statistical Thermodynamics, & Kinetics- Pearson Education, Inc: New Delhi (2007).

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iv. B.A. Syllabus of Education

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	Full Marks/ Pass Marks	Time required (Hours)
1	EDN: E101	Education of Philosophical and Sociological Foundations	100/40	75
2	EDN: E202	Educational Psychology and Pedagogy	100/40	75
3	EDN: E303	Development of Education in India	100/40	75
	EDN: HSC I (non-credit)	Peace and Human Rights Education	100/35	75
4	EDN: E404	Issues and Trends in Contemporary Indian Education	100/40	75
	EDN: HSC II (non-credit)	Population and Environmental Education	100/35	75
5	EDN: H505	Educational Evaluation and Statistics in Education	100/40	75
	EDN: E506	Educational Management and Educational Technology	100/40	75
	EDN: H507	Educational Guidance and Curriculum construction	100/40	75
6	EDN: H608	Educational Thought and Practice	100/40	75
	EDN: H609	Child Psychology	100/40	75
	EDN: H610	Experimental Education and Statistics	100/40	75
	12 Papers		1200	900

*E for Elective; H for Honours; HSC for Honours Supportive Course

SEMESTER-I

EDN: E101 **Education of Philosophical and Sociological Foundations**

Full mark-100

Unit 1: Introduction to Education (20 marks)

- Concept, Nature, Scope, Forms, Aims, Functions of Education
- Education as Process, Education as Liberation, Education as Science, Human Resource Development. Four Pillars of Education. Institutional Education

Unit II: Philosophical Foundations of Education (20 marks)

- Meaning of Philosophy and its Relation to Education;
- Philosophical issues and Education- Metaphysical, Epistemological and Axiological Issues in Education;
- Educational Philosophies of Idealism, Naturalism and Pragmatism and their influence in Education

Unit III: Contribution of Educational Thinkers and Philosophers in Education (20 marks)

- Western Educators- Plato, Froebel, J. J. Rousseau and John Dewey;
- Indian Educators- R. N. Tagore, Mahatma Gandhi, Aurobindo Ghose

Unit IV: Sociological Foundations of Education (20 marks)

- Meaning of-Sociology and Educational Sociology
- Education and Social Change, Social Mobility, Social Stratififation
- Education as Social Sub- System, Social Group and Interaction
- Education and Culture

Unit V : Social and Educational Problems (20 marks)

- Freedom, Discipline, Democracy, Secularism
- Education for Equality, Illiteracy and Social Education, Education of Backward Classes
- Social Problems: Poverty, Unemployment, Corruption, Drugs and HIV/ AIDS and Human Security,

SUGGESTED READINGS:

1. Brown RJ : Educational Sociology, Prentice Hall Ind. New York, 1961.
2. Brubacher, J.S. (Ed.) Modern Philosophy of Education, Chicago Press Chicago.
3. Curties, S. J.: Philosophy of Education, Univ. Tutorial Press, London, 1968.
4. Me Iver and Page : Society : An Introductory Analysis, McMillen, madras, 1988.

5. Ross, J.S. : Groundwork of Educational Theory, Oxford University Press, Calcutta, 1972.
6. Ruhela S.P. and Vyas, K.C. : Sociological Foundations of Education in contemporary India, Dhanapetrai and sons, Delhi, 1970.
7. Setharamu, A.S. : Philosophy of Education, Ashish, New Delhi, 1978.

SEMESTER II

EDN: E202 **Educational Psychology and Pedagogy** Full mark-100

Unit 1: Educational Psychology (20 marks)

- Definition of Psychology
- Relationship between Psychology and education
- Nature, scope and methods of educational psychology
- Application of educational psychology in teaching –learning and understanding individual's behavior.
- Psychological basis of mental life.
- Social moral and intellectual development.
- Individual difference and creativity.

Unit II: Personality, its types and traits. (20 marks)

- Definition, meaning and nature
- Theories of personality (Freudian)
- Determinants of personality.
- Types and traits of personality.

Unit III: Learning : Meaning, nature and factors. (20 marks)

- Learning and maturation
- Learning and motivation
- Theories of learning (Thorndike and Skinner)
- Insightful learning.

Unit IV: Pedagogy and its implications (20 marks)

- Science of teaching-relationship between teaching and learning.
- Factors affecting teaching- learning process.
- Input and Output variable.
- General principles of teaching, maxims of teaching, fundamentals of teaching

Unit V: Classroom behavior (20 marks)

- Characteristics of good teacher behavior
- Flander's interaction analysis
- Functions of a teacher.
- Traditional, Macro and Micro- teaching

SUGGESTED READINGS:

1. Bhatia & Bhatia: The principles and methods of teaching, Doaba House, Delhi, 1966
2. Bhamagar, S.: Advanced Educational Psychology, R.Lall Book Depot, Meerut, 1995.
3. Ross.J.S.: Groundwork of Educational Psychology, Oxford Univ. Pres, Calcutta 1972.
4. Chaushans, S.S.: Advanced Educational Psychology, Vikas Publishing House. N.D. 1993.
5. Kuppuswamy, B.: Advanced Educational Psychology, D.U. Publishers Delhi-1964.
6. Saharma, R.A. : Fundamentals of Educational Psychology, R.Lall Book Depot Meerut 1976.
7. Skinner, Charles E: Educational Psychology, Prentice Hall, New Delhi, 1970
8. Yaokam & Simsom: Modern methods and techniques of teaching.

SEMESTER III

EDN: E303 **Development of Education in India** Full mark-100

Unit I: Education in ancient India (20 marks)

- Vedic education: aims of education, process of education, curriculum and organization.
- Buddhist education: aims of education, curriculum and the four eternal truths.

Unit II: Education in Medieval India (20 marks)

- Types of educational institutions, state patronage in educational endeavour.
- Islamic education: its salient features, objectives and curriculum.

Unit III: Education in British India (20 marks)

- Indigenous education in India at the beginning of the 18th century. The Charter Act 1813,
- Macauley's minute 1835, Wood's dispatch 1854, Report of Hunter Commission, 1882,
- Gokhale's bill for compulsory education, University Education Commission 1902.
- Calcutta University Education Commission 1917, Hartong Committee Report 1929.

Unit IV: Development of Indian Education in the Post-independence period. (20 marks)

- Recommendations of University Education Commission 1948-49, Secondary Education Commission 1952- 53, Kothari Commission 1964-66, NPE 1986 and POA 1992.

Unit V: Development of Education in Manipur. (20 marks)

- Education in Manipur during the pre and post-independence periods. Elementary education, Secondary Education, Higher Education and teacher education.

Suggested Readings:

1. Altekar, A.S.: Education in ancient India, Nabakishore & Bros, Banaras, 1948.
2. Devi, Jamini, Ch. : Education in Manipur, Raipravina Bros & Sons, Imphal, 1949

3. Naik, J.P. (et.al): A student's History of Education in India, Macmillan and Co., New Delhi 1974.
4. Mukherjee, S.N. : History of Education in India, Acharya Book Depot, Baroda, 1975.
5. Govt. of Manipur, : Report of the comprehensive survey of Education in Manipur, NCERT, 1973
6. Govt. of Manipur, : Report of the Education Commission Report I & II, Imphal, 1992.
7. Tewari, R.P.: Development and Problems of Education in NER, India, Akashi Depot. , Shillong, 1978.
8. Govt. of India: Vocationalization of First Degree Education, UGC, Sept., 1993, Educational consultants India, New Delhi, 1993.

HONOURS SUPPORTIVE COURSE - I

EDN: HSC I **Peace and Human Rights Education** Marks 100

Unit I: Peace Education (20 marks)

- Concept, Definition, aims, scope
- Perspectives of peace in Christianity, Islam, Hinduism
- Methods of teaching peace education
- Importance of imparting peace education in the curriculum

Unit 2: Commissions and Committees on peace education: (20 marks)

- Delor's Commission, 1996
- UNESCO'S conference for peace and international understanding, Tokyo, 1999
- National Curriculum framework, 2005
- Global Campaign for peace, 1999
- World Council for curriculum and Instruction, 2000

Unit 3: Agencies of peace education and Peace makers in promoting peace in society: (20 marks)

- Mass media
- Civil society organizations

- Non- governmental organizations
- Mahatma Gandhi
- Mother Teresa
- Kailash Satyarthi
- Malala Yausaf Zai

Unit 4: Human rights education: (20 marks)

- Concept of human rights education, aims, scope
- Fundamental rights and fundamental duties in the Indian constitution.
- Directive principles of state policy.
- Role of mass media, NGO's and teachers in promoting human rights literacy in the country

Unit 5: Issues of human rights and Role of education in creating- Legal Awareness of (20 marks)

- Gender discrimination
- Domestic violence
- Sexual harassment
- Communal Conflicts
- Racism
- Mob lynching

Suggested Readings :

1. Agarwal, H.D.: Implementation of Human Rights contents with special reference to India, D.K. Publishers, New Delhi, 1993.
2. Diwan Paras: Human Rights and Law, Universal and Indian. Deep and Deep Publisher's, New Delhi, 1995.
3. NCERT : Peace Education: Self instructional package for teacher education, NCERT, New Delhi, 2004
4. NCERT: National curriculum framework, New Delhi, 2005
5. Prasad, S.N. and Shukla, S (Eds): Democracy, Education and Peace, Associated Publishers, Ambala Cantt, 1995.

SEMESTER IV

EDN: E404 **Issues and trends in Contemporary Indian Education**

Full mark-100

Unit I: Elementary Education (20 marks)

- Aims and Objectives of UEE and SSA. Non- Detention Policy
- Girls' Education and their Problems
- Operation Blackboard (OBB), DPEP
- RTE Act 2009, CWSN and Inclusive Education
- Roles of NCERT, SCERT, DIETs in Elementary Education

Unit II: Secondary and Higher Secondary Education (20 marks)

- Aims and Objectives of General and Vocational Secondary Education
- Universalisation of Secondary Education, RMSA, PPP Model,
- Vocationalisation of Secondary Education at +2Level, Navodaya Vidyalayas
- Functions of NCERT, NCTE, CTEs, IASE, CBSE, BOSEM, COHSEM

Unit III: Higher and University Education (20 marks)

- Objectives and Functions of Higher Education
- Rashtriya Uchchatar Shiksha Abhiyan(RUSA)
- National Knowledge Commission 2006, National Translation Mission
- Role of UGG, AIU, NAAC, AICTE, MCI, ASCs, State Council of Higher Education Commission
- Autonomy, Access, Equity and Excellence Issues in Higher Education, SWOC

Unit IV: Alternative Schooling and ODLS (20 marks)

- Alternative Schooling, Elementary, Non-Formal, Adult and Continuing Education, Saakshar- Bharat Mission 2012, Functional Literacy, NAEP (AEP), NLM, TLC, PLC.
- Open and Distance Learning System, Role of IGNOU and NIOS, Virtual Education.
- Mass media Communication, ICT in Education,
- UGC Programmes for Open Learning System, EMRC

Unit V: Other Issues and Trends in Indian Education (20 marks)

- Population Education and Sex Education
- Adolescent Education and Fundamental Life Skills - Value- Oriented Education and Peace Education - Work Education and Skill Development
- Environmental Education,
- Education for Sustainable Development, LPG in Education.

SUGGESTED READINGS :

1. Dash, B.N. : Principles of Education and Education in Emerging Indian society, Ajanta Prakashan, Delhi 1982.

2. GOI : Environmental Education: A Resource Book for teacher Educators (Level 1, 2 and 3), CEE, Ahmedabad, 2007.

3. GOI: Report of Secondary Education Commission, 1952-53, Controller of Publications, New Delhi, 1973.

4. GOI: National policy and Education 1986 (Modifications made in 1992), Manager of publications, New Delhi, 1986 and 1992.

5. GOI: Programme of Action 1986 and 1992, Manager of publications, New Delhi 1986 and 1992.

6. Rao, V.K.: Population education, APH Publishing Corporation, New Delhi, 2004.

7. Singh, R.P.: Non- formal Education: An Alternative Approach, Steering Publishers, New Delhi, 1987.

8. Talukdat, B.K. : Adult Education: Concepts and Methods, Bina Library Gauhati 1993.

HONOURS SUPPORTIVE COURSE II

EDN: HSC II **Population and Environmental Education** Marks 100

Unit 1: Population Education: (20 marks)

- Concept, Definition, aims, scope
- Population size, growth, sex- age structure, fertility, mortality, migration.
- Significance of imparting population education in the curriculum of schools and colleges.

Unit 2: Population, development and Policies (20 marks)

- Inter- relationship between population growth and development
- Impact of population growth on food supply, safe drinking water, sanitation, housing, employment, health and education.
- Human Development Index
- Gender Development Index
- Population policies: Medical termination of pregnancy, age of marriage, sex determination tests. etc.
- Family welfare programme

Unit 3: Environmental Education (20 marks)

- Concept, Definition, aims, scope
- Relationship of man and environment
- Importance of environment education

Unit 4: Natural resources: renewable and non- renewable resources. (20 marks)

- Forest, water, mineral, food, energy, land resources
- Role of education to the individual or groups in conservation of natural resources for sustainable development
- Ecological balance and its maintenance

Unit 5: Environment pollution, solid waste and disaster management (20 marks)

- Definition, causes, effect and Remedial measurement of air, water, soil, marine, noise, thermal and nuclear pollution
- Solid waste management: Cause, effect and control measures of urban and industrial waste.
- Disaster management: Flood, earthquake, cyclone and landslides.
- Role of education to an individual or groups in prevention of pollution.

Suggested Readings:

1. Mahesh Panday: Pollution dangerous for the future of the earth, Akash Publishing house, New Delhi, 2015
2. Saxena HM : Environment Management, Rawat Publications, New Delhi, 2010.
3. Tej Singh : Disaster Management: approaches and strategies, Akash Publishing House, New Delhi, 2011
4. Unisa, S. : Population health and environment, Rawat Publications, New Delhi, 2016.

SEMESTER-V

EDN: H505 **Educational Evaluation and Statistics in Education** Full mark-100

Unit I: Educational evaluation (20 marks)

- Meaning and scope of educational measurement
- Need for measurement in Education
- Concept of evaluation in Education, relation between measurement and evaluation

Unit II: Types of evaluation (20 marks)

- Formative and summative evaluation.
- Quantitative and qualitative evaluation.
- Principles and techniques of Continuous and Comprehensive Evaluation.

Unit III: Measuring instruments and their classifications. (20 marks)

- Errors in measurement.
- Types of scales in educational measurement.
- Characteristics of good measuring instruments- reliability, validity and objectivity, methods of determination.
- General principles of test construction and standardization.

Unit IV: Statistics in education (20 marks)

- Meaning, Nature and scope of Educational Statistics.
- Measures of central tendency- their uses and limitations.
- Measures of variability- their uses and limitations.
- Concept of normal distributions and their uses.

Unit V: Types of data and bivariate distribution (20 marks)

- Grouped and ungrouped data
- Graphical presentation of data- pie- diagram, histogram, polygon, cumulative frequency graph—ogive and their uses.
- Scatterngram, correlation, computation of co-efficient of correlation by rank difference product movement method, interpretation of coefficient of correlations.
- Application of computer in data processing.

Suggested Readings :

1. Agrawal, R.L. and V. Ashana, Educational Measurement and Evaluation, Vinod Pustak Mandir, Agra, 1983
2. Chakraborty and Chakraborty: Statistics in Educational Psychology and Mental measurement, Book Syndicate, Calcutta, 1978.
3. Ebel, R.L. and Frisbel, D.A.: Essentials of Educational Measurement, Prentice Hall New Delhi, 1981
4. Freeman, F.S.: Theory and practice of psychological testing, Oxford & IBM Publist Company, Calcutta, 1968.
5. Garrett H.E.: Statistics in Psychology and Education, Vikils, Feffer and Simsons, Bombay, 1969.
6. Guilford, J.P.: Fundamental statistics in Psychology and Education, Mc. Graw-Hill Book Co., New York, 1956.

EDN: H506 **Educational Management and Educational Technology**

Full mark-100

Unit I: Educational Management (20 marks)

- Concept of Educational management, meaning, nature, need and scope.
- Types of educational management- Centralised and decentralized, external and internal authoritarian, democratic, dynamic and Laissez- faire.

Unit II: Financial management and Managerial behavior (20 marks)

- Sources of income, pattern of plan and non- plan expenditure and problems of finance.

- Management of educational finance with reference to state Educational finance.
- Factors affecting managerial behavior- personal, social cultural, political and institutional.

Unit III: Educational planning (20 marks)

- Meaning, need and significance of educational planning.
- Types of educational planning, strategies in educational planning.
- Steps in educational planning- centre, state and district.
- Institutional planning and management.

Unit IV: Educational Technology. (20 marks)

- Concept and scope of Educational technology.
- Communication process: theory, concept, nature, process, components.
- Types of communication, mass media approach in educational technology.

Unit V: System approach to instruction (20 marks)

- System approach in educational process.
- Institutional system designing: Concept, components, physical and human resources. Steps.
- Innovations in educational technology, programmed Learning material, personalized system in Instruction, Computer Assisted Instruction, simulated teaching and distance teaching.

Suggested Readings:

1. Allen, Louis: Management and Organisation, Mc Graw Hill Book Co. New York, 1950
2. Chauhan, SS.: A Text-book of programmed Instruction, Sterling publishers, New Delhi, 1982
3. Koontz, H and O'Donnel, C: Principles of Management, MCGraw Hill Book Company, New York, 1979.
4. Mathur, SS: Educational administration, Principles and practices, Krishna Press, Jullunder, 1969.
5. Mukherjee, S..: administration of Education (Theory and Practice), Acharya Book depot, Baroda, 1970.
6. Newman, W.H. et.al.: The patterns of management, Prentice Hall of India, New Delhi, 1976.

EDN: H507 **Educational Guidance and Curriculum Construction**

Full mark-100

Unit I: Educational guidance: (20 marks)

- Meaning, Nature and scope of guidance.
- Need and importance of educational guidance,
- Basic data necessary for educational guidance- abilities, aptitudes, interest, attitude educational attainments and personality traits.
- Construction, administration and interpretations of cumulative record cards and individual inventories.

Unit II: Vocational guidance (20 marks)

- Purpose and functions of vocational guidance, relationship between educational and vocational guidance, vocational guidance and work education.
- Job analysis and occupational information services.

Unit III: Concept of counseling (20 marks)

- Meaning, nature and scope of counseling, different types of counseling.
- Various steps and techniques of counseling
- Necessary personal and professional qualities of a good Counselor.
- Role of Counselor in Secondary schools.
- Relationship between guidance, counseling and teaching.

Unit IV: Curriculum Construction (20 marks)

- Curriculum: concept and nature.
- Traditional and modern concept of curriculum.
- Principles of curriculum construction
- Sociological and psychological foundations of curriculum.

Unit V: Curriculum development and its process (20 marks)

- Role of the local, state and national level agencies in curriculum development.
- National curriculum framework- a critical study.

Suggested readings:

1. Chandra, A : Curriculum Development and Evaluation in Education, 1973.

2. Chauhan, SS.: Principles and techniques of Guidance, Vikas, New Delhi, 1991.
3. GOI, Report of the Secondary Education Commission, 1952-53, Controller of Publications, New Delhi 1973.
4. James, A.: Principles of Guidance, Tata McGraw Hill, New Delhi, 1963
5. Jayaswal, S.R.: Guidance and Counseling, Prakashan Kendra, Lucknow 1985
6. NCTE: Curriculum Framework for quality teacher education, NCTE, New Delhi.

Semester -VI

EDN: H608 **Educational Thought and Practices** Full mark-100

Unit I: Jean Jacques Rousseau. (20 marks)

- His educational ideas, aims of education for the Emile and sophy.
- Methods of teaching and role of the teacher
- Roussiean's contribution in the field of education.

Unit II: John Dewey (20 marks)

- His philosophy, aims of education, democracy and education.
- Scheme of education and methods of teaching
- His contributions in the field of education.

Unit III: Rabindrnath Tagore (20 marks)

- His philosophy of education and teacher-student relationship.
- Methods of teaching, religious and spiritual education.
- Tagore's Shantiniketan and Vishva Bharati.

Unit IV: Swami Vivekananda (20 marks)

- His educational philosophy, - Aims of education and views about the curriculum.
- Methods of teaching and place of the teacher.
- Evaluation of his philosophy of Education.

Unit V: Mahatma Gandhi (20 marks)

- His philosophy of education and aims of education.
- Methods and procedures of education, curriculum and content of education
- Evaluation of his philosophy of education.

Suggested readings:

1. Dash, B.N.: Principles of Education and education in Emerging Indian society, Ajanta Prakashan, Delhi, 1982.
2. Dash, R.: Gandhi in 21st century, Sarup and Sons, New Delhi, 2002.
3. Dewey, John: Democracy and Education, McMillan, New York, 1963.
4. Mani, R.S.: Educational Ideals of Gandhi and Tagore, New Book Society of India, New Delhi, 1966.
5. Mithal, H.C.: Foundations of Educational Thought and Practice, Dhanpat Rai and Sons, Delhi, 1966.
6. Richards, G.: Gandhiji's philosophy of Education, Oxford University Press, New Delhi, 2001.

EDN: H609 **Child Psychology** Full mark-100

Unit I: Nature and scope (20 marks)

- The relevance of child development to educational practice.
- Importance of Early Childhood years.
- Modern approaches to Child study.

Unit II: General nature of Growth and development (20 marks)

- Developmental principles, factors affecting development.
- Development during the pre-natal, post-natal, neo-natal stages.
- Characteristics and needs of new born child and his/ her early experiences.

Unit III: Development upto Pre-adolescence. (20 marks)

- Physical and motor development.
- Speech and language development, perceptual development
- Emotional development, social development and process of socialization.

Unit IV: Development of understanding and intelligence: (20 marks)

- Concept formation, readiness and maturation as related to learning.
- Value of play, types of play, play and child development.
- Individual differences in abilities, interest and their educational implications.

Unit V: Development of self and personality (20 marks)

- Fundamental needs and their satisfaction
- Role of the family, school, peers.
- Problems of adjustment, normal and abnormal patterns of behavior in different stages.

Suggested Readings:

1. Choube, S.P.: Child Psychology, Lakshman Narayan Agrawal, Agra, 1993.
2. Dinkneyer, D.C.: Child Development: The Emerging self, Prentice Hall, 1965
3. Erikson, E.M.: Childhood and society, Norton, New York, 1950
4. Helen, B. & Denise, B.: The developing child, Pearson Education, Delhi, 2004.
5. Hurlock E.B.: Developmental Psychology: A life span approach, Tata McGraw Hill, New Delhi, 1994.

EDN: H610P **Experimental Education and Statistics** Full mark-100

FIRST HALF (50 marks; 30 hours)

Experimental work & Test Administration

Distribution of mark:

i. Experiments and Test Administration : 20 marks

ii. Note Book : 15

iii. Viva voce : 15

List of Experiments:

1. Memory (a) Immediate memory span
   (b) Immediate recall and recognition
2. Learning (a) Maze/ Mirror learning
   (b) Part and whole learning
3. Fatigue (a) Physical Fatigue
   (b) Mental Fatigue

List of Tests:

1. General Mental Ability: (a) Verbal Test
   b) Non- verbal Test
   (c) Performance Test
2. Personality: (a) Inventory/ Checklist
   (b) Thematic Apperception Test/Inkblot Test
   (c) Attitude scale/ values test
3. Achievement: Preparation of an achievement test of 50 items of five types on a school
   subject. This will be an exercise in test construction and standardization.

SECOND HALF

(50 Marks; 40 hours)

Test Development and statistical indices

Distribution of marks:

i. Test construction & standardization : 20 mark
ii. Note Book : 15 mark
iii. Viva voce : 15 mark

Test Development:

1. Item preparation. Item revision and Item analysis – Index of difficulty. Index of discrimination.
2. Test reliability and its determination.
3. Test validity and its determination.

Statistical Measures and Calculation:

1. Norms and their calculation/ computation.
2. Sociometry and its application/ use in classroom management.
3. Determination of association among two variable Rank- difference and product moment coefficients of correlation and their calculation and interpretation.

Note:

1. Students should be prompted to prepare their own test materials/ tools of assessment appraisal and evaluation as far as possible.
2. The record of experiments/practical work/statistical exercises should be maintained in a practical Note-Book prepared by each student which may be regularly/ duly inspected and scanned by the concerned teacher throughout the academic session.
3. The final year- end examination will be conducted by an external examiner in collaboration with the internal examiner, a senior qualified teacher of the subject. Education or Psychology.

Suggested Readings:

1. Agrawal, Y.P.: Statistical methods: Concept, applications and computerization, St. Publishers, New Delhi, 1990.
2. Chkraborty and Chakraborty,: Statistics in Educational Psychology and mental measurement. Book Syndicate, Calcutta, 1978.
3. Kuppuswamy, B. Elementary experiments in Psychology, Wesley press. Mysore.
4. Jalota, S. Students Manual of experimental Psychology. Asia Publication Bombay.
5. Mohsin, S.M. : Experiments in Psychology, Orient Longman, Bombay, 1976.
6. Garrett. HE: Statistics in Psychology & Education, Vakils refer and simson, Bombay.
7. Guilford. J.P. Fundamental Statistics in Psychology and Education, Mc. Graw Hill N. York. 1956.
8. Woodworth R.S. and Schlosberg H: Experimental Psychology, Oxford and IBH Publishers, Calcutta. 1971.

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v. B. A. ECONOMICS SYLLABUS

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	Full Marks/ Pass Marks	Time required (Hours)
1	ECO: E101	Indian Economy	100/40	75
2	ECO: E202	Microeconomics –I	100/40	75
3	ECO: E303	Microeconomics –II	100/40	75
	ECO: HSC I (non-credit)	Elementary Mathematics for Economics	100/35	75
4	ECO: E404	Macroeconomics	100/40	75
	ECO: HSC II (non-credit)	Elementary Statistics	100/35	75
5	ECO: H505	Public Finance	100/40	75
	ECO: E506	Political Economy of Development	100/40	75
	ECO: H507	Quantitative Methods of Economic Analysis	100/40	75
6	ECO: H608	Development Economics	100/40	75
	ECO: H609	Environmental Economics	100/40	75
	ECO: H610	. International Economics	100/40	75
	12 Papers		1200	900

*E for Elective; H for Honours; HSC for Honours Supportive Course

SEMESTER-I

ECO: E101 **Indian Economy** Fullmarks-100

Unit-I: Basic Features of the Indian Economy: Colonial exploitation and its impact on the economy; Changing features of Indian economy from controlled to liberalised economy; India's potential for global economic power- goals, strategy and Challenges; National Income- Trends and structural changes in the Indian Economy.

20 marks 15 periods

Unit-II- Population: Size and growth, Population and development; Demographic Dividend; Problems of overpopulation, causes and remedies.

20 marks 15 periods

Unit-III- Agriculture: Nature and importance; Land Reforms- objective and achievements;

Green revolution, problems of rural credit, agricultural marketing; agrarian crisis in India. 20 marks 15 periods

Unit-IV: Industrialisation: Industrial policy 1956, problems of large scale industries and Policy measures; Role of Micro, Small and Medium Enterprises and its Challenges. Industrial policy 1991, privatisation, liberalisation and disinvestment Policies. 20 marks 15 periods

Unit-V: Planning and Contemporary Issues: Foreign trade, composition and direction of India's foreign trade since independence. Trend in Balance of Payments; Planning- achievements and failures, NITI AAYOG and Planning Commission Problems of unemployment and poverty, employment generation and poverty Alleviation schemes of the Government of India; Black economy in India- concepts, problems and policy measures of the government.
20 marks 15 periods

Reading list:

1. R. Dutta and KPM Sundaram: Indian Economy (latest edition)
2. A.N. Agrawal: Indian Economy- Problems of Development Planning in India
3. C.H. Hanumantha Rao and Hans Lineman (ed.): Economic reforms and poverty alleviation in India. (Sage Publication).
4. Government of India: Economic Survey : Various issues
5. V.M Dandeker: Indian Economy. Vol-I Agriculture& Vol.-II Population and Poverty (Sage Publication).
6. Arun Kumar: The Black Economy in India

SEMESTER- II

ECO: E202 **Microeconomics-I** Full marks-100

Unit- I: Nature and Scope of Economics- The problem of choice, positive and normative Economics, economic model, Demand and supply curves, equilibrium - Changes in market equilibrium. Elasticity of demand- price, income and Cross elasticity.
20 marks 15 periods

Unit-II: Consumer Behaviour- Cardinal utility theory, Indifference curve theory, consumer Equilibrium, substitution effect and price effect- Revealed preference theory.
20 marks 15 periods

Unit-III: Theory of Production and Cost- production function, laws of production, technical Progress and production function, returns to variable factor and return to scale, Isoquants, factor substitution. Different concepts of costs and revenues and their Relationships. 20 marks 15 periods

Unit-IV: Market- Concept of market, competitive and non-competitive markets; Prefect Competition, short –run and long-run equilibrium of firm and industry; Monopoly- Equilibrium of the monopolist, price discrimination, degrees of monopoly power.
20 marks 15 periods

Unit-V: Equilibrium of the firm under monopolistic competition, product differentiation, Selling cost and advertisement; Cournot's duopoly model; Oligopoly- the kinky demand curve model. 20 marks 15 periods

Reading list :

1. A. Koutsoyannis: Modern Micro economics. Macmillan
2. A.W Stonier and Douglas C. Hague: A Textbook of Economic Theory
3. A.L.Ahuja: Advanced Economic Theory
4. Hal.R. Varian: Intermediate Microeconomics- a modern approach.

SEMESTER-III

ECO: E303 **Microeconomics –II** Fullmarks-100

Unit-I: The marginal productivity theory of distribution, price and employment of factor Inputs; competitive factor market – demand for a factor input when one variable /several variables are available. Equilibrium in competitive factor market; factor Markets with monopsony power, market with monopoly power.
20 marks 15 periods

Unit-II: General equilibrium analysis—The Walrasian the two factor two commodity, two Consumer general equilibrium system (2x2x2) model. Static properties of a general Equilibrium State, general equilibrium and allocation of resources, prices of Commodities and factors, factor ownership and income distribution.
20 marks 15 periods

Unit-III: Measuring social welfare— pareto criterion, value judgement, concept of social welfare function , the Bergson social welfare function, Kaldor-Hicks compensation principle, welfare maximization and perfect competition.
20 marks 15 periods

Unit-IV: Externalities and public goods; negative and positive externalities; market failure and ways of correcting market failure, externalities and common property resources, tragedy of commons, public goods and efficiency.
20 marks 15 periods

Unit-V: Market with asymmetric information, quality uncertainty, market for lemons; market signalling, problems of adverse selection, guarantees and warrantees; moral hazard, the principal agent problem in private and public enterprises.
20 marks 15 periods

Reading list:

1. A Koutsoyannis : Modern Microeconomics (Macmillan)
2. A.L. Ahuja : Advanced Economic Theory
3. H.R Varian : Intermediate Microeconomics.

HONOURS SUPPORTIVE COURSE I

ECO: HSC I **Elementary Mathematics for Economics** Fullmarks-100

Unit-I: Basic concepts: Variable, Constant, Co-efficient parameters, Equations, Solution of Simple& Linear equations, Solution of equations having more than one variable, Simultaneous equations. 20 marks (15 periods)

Unit-II: Quadratic equations; roots of equations, equal roots, real and imaginary roots,

Solution of quadratic equations; Logarithms; Common logarithms, use of log table. 20 marks (15 periods)

Unit-III: Interest & Annuities; Principal, Interest, Amount, Simple Interest, compound Interest; Calculation of Simple Interest and Compound Interest, Compound Interest payable every moment. Present Value & Discount of a sum at simple Interest, Present value and Discount at Compound interest.

20 marks (15 periods)

Unit-IV: Set and their representations; Empty Set, Finite& Infinite Sets, Sub-sets, Power sets Universal sets, Venn diagrams, Operation on sets, complement of a set, Intersection of two sets. 20 marks (15 periods)

Unit-V: Permutations & Combinations; Number of permutation of n things r at a time, Binomial Theorem; expansion of $(x + a)^n$ when n is a positive integer.

20 marks (15 periods)

Reading list:

1. Prescribed Text Books of secondary standards (CBSC)
2. H.S. Hall & S.R Knight: Higher Algebra.

SEMESTER -IV

ECO: E 404 **Macroeconomics** Fullmarks-100

Unit –I: Introduction to Macroeconomics – Meaning, Macro vs Microeconomics; National Income Accounting: Concepts- GDP,GNP,NDP,NNP and Per Capita Income. National Income at market price and factor cost. Measurement of National Income- Various approaches and difficulties.

20 marks (15 periods)

Unit-II Money- Evolution of money; quantity theory of money and Keynesian approaches; Concepts of money supply ,components and alternative measures of money supply in India; High powered money.

20 marks (15 periods)

Unit-III: Theories of output and employment: Classical theory- Say's Law of market; Determination of income and employment. Critical evaluation of classical theory. Keynesian Approach. Model of income determination; Consumption function, Saving and investment function. Investment multiplier, Marginal efficiency of Capital. 20 marks (15 periods)

Unit-IV: IS –LM Model: The LM curve and its derivation, the money market equilibrium, The IS curve and its derivation, the product market equilibrium The IS and LM .Curve combined, shifts in the IS and LM schedule.

20 marks (15 periods)

Unit-V: Inflation- cost push and demand pull inflation. Inflation control measures— monetary and fiscal policies and their relative effectiveness; Phillips curve.

20 marks (15 periods)

Reading list:

1. Dornbush, Fisher and Starz: Macroeconomics (Tata Macgraw Hills)
2. S.B Gupta : Monetary Economics
3. G. Ackley : Macroeconomics- theory and policy(Macmillan)
4. Gregory Mankiw : Macroeconomics (Worth Publishers)

HONOURS SUPPORTIVE COURSE II

ECO: HSC II **Elementary Statistics** Fullmark-100

Unit I: Statistics – meaning, relations between statistics and economics. Sources of data— Primary and secondary data sources and its merits and demerits.

20 marks (15 periods)

Unit II: Collection of Data: methods of collection of primary data. Questionnaire— Characteristics of a good questionnaire, Census and Sample survey- its merits and demerits. 20 marks (15 periods)

Unit III: Presentation of data; Frequency table- discrete and continuous frequency distribution. 20 marks (15 periods)

Unit IV: Matrix Algebra; meaning and kinds of matrix, vector matrix, null matrix, identity matrix, square matrix. Matrix operations- addition, subtraction and multiplication. 20 marks (15 periods)

Unit V: Derivatives. Rate of change and derivatives. The derivatives and the slope of a Curve. Derivative of a function of one variable. Partial derivative.

20 marks (15 periods)

Reference Books:

1. D.N. Elhance, Veena Elhance : Fundamentals of Statistics & B.M. Agrawal
2. Alpha C. Chiang : Fundamental Methods of Mathematical Economics
3. Krunt Sydsacter& Peter J.Hammond: Mathematics for Economic Analysis

SEMESTER- V

ECO: H505 **Public Finance** Fullmarks-100

Unit-I: Nature and scope of public finance; the principle of maximum social advantage; Fiscal functions in the developing economy. Externalities and public goods. 20 marks (15 periods)

Unit-II: Budget: meaning ,objectives and classification of government budget – revenue and capital budget, outcome/performance budgeting; Procedure of Preparing government budget. The concepts of deficits in budget and their significance. 20 marks (15 periods)

Unit-III: Taxation: Principles of taxation: equity- horizontal and vertical equity; efficiency in Taxation- tax evasion and avoidance, tax compliance. Taxable capacity- factors affecting taxable capacity, limits of taxable capacity. GST and its features, GST and VAT. 20 marks(15 periods)

Unit-IV: Public Expenditure: Wagner's law of public expenditure and Peacock-Wiseman Hypothesis. Effects of public expenditure on production, distribution and economic stability. Public borrowing: Role of public borrowing in mobilisation of resources for economic development. Sources of public borrowing- internal and external and their burden in the economy. 20 marks(15 periods)

Unit-V: Federal Finance: Centre state financial relations: constitutional provision in India—Finance Commission and its functions, the formulae for devolution of Shareable taxes, grants-in-aids by the latest Finance Commssion. Local Bodies And their financial responsibilities; Fiscal Responsibilities and Budget Management Act(2003) and its implications. 20marks (15 periods)

Reading list:

1. H.L Bhatia : Public Finance (Vikash Bublishing House)
2. R.A Musgrave & P.B. Musgrave : Public Finance in theory and Practice (Asian Student Edition)
3. Govt. of India : Various Reports of the Finance Commission.

ECO: H506 **Political Economy** Fullmarks-100

Unit-I: Introduction: Meaning, scope and subject matter of political economy, the method Of political economy: the classical political economy, Marxian political economy: Marxian concept of mode of production; Correlation between production , Distribution, exchange and consumption. 20 marks (15 periods)

Unit-II: Society and its historical development: Emergence of socio-economic formations And the state. Feudalism as a mode of production – Salient features, class conflicts; theories of the decline and crisis of feudalism.

The concept of primitive accumulation of capital — the role of foreign trade. The relationship between merchant capital and industrial revolution.

20 marks (15 periods)

Unit-III: Capitalism as an Evolving Economic System: Basic features, long run development under capitalism, accumulation process, technical change and crisis. The growth of monopoly capital and MNCs.

20 marks (15 periods)

Unit-IV: New Political economy and Economic Development: The State and economy – Contestation and mutual interdependence. Political Economy of development and underdevelopment. Metropolis – satellite relation and unequal exchange.

20 marks (15 periods)

Unit-V: Globalisation: Meaning, case for and against Globalisation. Globalisation and limits of a welfare state. Globalisation and uneven development, inequality and exclusion, globalisation and structural adjustment programmes and trade reforms in India. 20 marks (15 periods)

Reading list:

1. B.N. Ghosh: Political economy : a Marxist Approach (Macmillan)
2. K.S.Chalam: Reading in political economy (Orient Longman)
3. S.S.M. Desai, Mrs Nirmal: Economic Systems. (Himalaya Publishing House).
4. Soumyen Sikdar: Contemporary Issues in Globalisation (Oxford University Press).

ECO: H607 **Quantitative Methods for Economic Analysis**

Fullmarks-100

Unit-I: Variables, Constants and Parameters; equations and identities; Functions; types of functions; quadratic, polynomial, power and rational functions; Sets and set operations; Matrix algebra; matrix operations : addition, subtraction and multiplication, determinant, rank and inverse of a matrix; Crammer's rule for solution of simultaneous equations. 20 marks (15 periods)

Unit-II : The derivative of a function; techniques of differentiation ; sums, products and Quotients of functions; composite functions and chain rule. Partial differentiation; partial derivatives in economics, total derivative, stationary points; maxima& minima, unconstrained optimisation and constrained optimization (equality constraints) necessary and sufficient conditions for local maxima. The method and interpretation of Lagrange multiplier, application to economic problems.

20 marks(15 periods)

Unit-III : Measures of Central Tendency: Mean, Median and Mode; measures of dispersion: Range, quartile range, mean deviation, standard deviation; probability; sample Sample spaceand events, probability of an event, addition and multiplication Theorems; independent event; mutually exclusive and complementary events, Conditional probability distributions; expected values of random variable, binomial and normal distributions. 20 marks (15 periods)

Unit-IV: Correlation: Karl Pearson's co-efficient of correlation, rank correlation, Regression: Simple Linear regression, techniques of derivation of regression Equations, least square method. Time series: analysis of time series, components Of time series, methods for estimating trend values, semi average, moving average and least square methods. 20 marks (15 periods)

Unit-V: Index number: Kinds of index number, uses of index number, Laysper's, Paasche's and Fisher's index numbers; time reversal, factor reversal and circular reversal test; problems in the construction of an index number; wholesale price index, consumer price index and agricultural production index; splicing; shifting of base index numbers. 20 marks (15 periods)

Reading list:

1. Knut Sydsacter and Peter J. Hammond: Mathematics for Economic Analysis, Pearson Educational Asia, Delhi 2002.
2. Alpha C. Chiang: Fundamental Methods of Mathematical Economics. McGraw Hill.
3. Richard J. Larsen& Morris L. Marx: An Introduction to Mathematical Statistics and its Applications, Prentice Hall.
4. Gupta, S.P.: Statistical Methods. S. Chand, New Delhi.

SEMESTER- VI

ECO: H608 **Development Economics** Fullmarks-100

Unit –I: Nature and Scope of Development Economics: Economic Growth and Development and their measurement. Alternative concepts of economic Development— Human Development Approach and HDI, inclusive growth, Sustainable Development and Sustainable Development Goals (SDGs). Growth theories: Classical approach: Adam Smith, Marx, and Schumpeter, Neo-Classical approach: Solow, Post Keynesian Approach: Harrod-Domar model. 15 marks (15 periods)

Unit-II: Requirement of Economic Development& Strategy: Natural resources, population and Capital Accumulation; Low level of equilibrium trap; Balanced and Unbalanced growth theory. 15marks (15 periods)

Unit- III: Contemporary Economic Issues: Inflation and growth; Unemployment, Poverty and Inequality: concepts and their measurement. 15 marks (15 periods)

Unit-IV: Technology Transfer and Trade Policy: Needs , significance and problems of Technology transfer, Foreign Capital and developing countries; Trade policy— Import –Substitution and Export –Promotion Strategy; WTO and Developing Countries. 15 marks (15 periods)

Unit- V: State, Market and planning: Role of State and Market in the Economy. Planning in a developing economy; Government and market failure. 15 marks (15 periods)

Reading list:

1. M.P. Todaro & S.C. Smith: Economic Development, Pearson Education, Asia
2. M.P Todaro: Economic Development in the Third World (Orient Longman).
3. Debraj Ray: Development Economics (Oxford University Press).

ECO: H609 **Environmental Economics** Fullmarks-100

Unit-I: What is Environmental Economics; Environmental problems; Economic way of thinking about environmental problems; The laws of thermodynamics and Environmental Economics. 20 marks (15 periods)

Unit-II: International Environmental Problems: Trans-boundary Environmental problems; Economics of Climate Change and Global Warming; Environmental Policies; Economic and Non-Economic Policies. 20 marks (15 periods)

Unit-III: Pareto-Optimality and market failure in the presence of Externalities; Common Property Resource and issue of Property rights; Economic solutions of market failure. 20 marks (15 periods)

Unit-IV: Cost benefit analysis of Environmental Policies and Regulations; Renewable resource extraction under monopoly and perfect competition; Non-renewable resource extraction under perfect competition and monopoly. 20 marks (15 periods)

Unit-V: Sustainable Development; concepts and measurement. Environmental Kuznet Curve. 20 marks (15 periods)

Reading list:

1. Kolstad, Charles D.: Environmental Economics, Oxford Univ. Press. 2006.
2. Pearce David and Barbeir, Edward: Blueprint for a Sustainable Economy, Earthscan,2000.
3. Philip E. Graves : A Critique of Benefit –Cost Analysis, Rawat Publications (India).
4. W.W. Norton: Economics of the Environment: Selected Readings, 6th Edition, 2012.

ECO: H610 **INTERNATIONAL ECONOMICS** Fullmarks-100

Unit I: Nature and Significance of International Economics: Importance and evolution, interregional and international trade; need for separate theory of international trade; Classical theory of international trade: Adam smith's absolute advantage theory; Ricardo's comparative advantage theory and Herberler's opportunity cost theory of international trade. 20 marks (15 periods)

Unit II: Heckscher-Ohlin theory of International trade, assumptions, features and limitations Leontief Paradox, Reconciliation between Leontief and Heckcsher-Ohlin theory, Doctrine of reciprocal demand and equilibrium of international trade, Factor price Equalisation theory. 20 marks (15 periods)

Unit III: Balance of Payment: Accounting balance, balance of payment equilibrium, autonomous and accommodating transactions and their relevance to balance of payment equilibrium; concepts of balance of settlement and balance of payment adjustment. Exchange rate determination: mint parity theory, purchasing power parity theory ; fixed and flexible exchange rates. 20 marks (15 periods)

Unit IV: Trade Policies: Free trade vs Protection; Tariffs: types of tariff, effects of tariff Under partial equilibrium and general equilibrium perspectives, Optimum tariff, Tariff vs Quota, theory of Customs union, Globalisation.
20 marks (15 periods)

Unit V: International monetary system: Brettonwoods system, IMF- Objectives, function and achievements; World Bank: functions objectives and principles; World Trade Organisation-- functions of WTO, WTO and developing Countries.
20 marks (15 periods)

Reading list:

1. Bo –Sodersten and Geoffrey Reed: International Economics.
2. Paul R. Krugman and Maurice Obstfeld & Marc Meltiz: International Economics: theory and policy. Pearson education, Indian Edition.
3. K.C. Rana& K.N.Verma: International Economics. Vishal Publishing Co., Jalandhar-Delhi.

vi. B.A. ENGLISH SYLLABUS

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	F. M./ P.M.	Time required (Hours)
1	ESL: E101	English Literature: history, poetry and drama (Old English – the 19th Century)	100/40	70
2	ESL: E202	British Fiction	100/40	70
3	ESL: E303	Western Criticism	100/40	70
	ESL: HSC I (non-credit)	Rhetoric and Prosody, Literary Genres and Major Movements of English Literature	100/35	50
4	ESL: E404	Linguistics and English Language	100/40	70
	ESL: HSC II (non-credit)	Background on North East Literature, Commonwealth and American Literature and European Literature in Translation	100/35	50
5	ESL: H505	20th Century British Literature	100/40	70
	ESL: E506	Indian Writing in English	100/40	70
	ESL: H507	Literary Theory	100/40	70
6	ESL: H608	North-East Literature	100/40	70
	ESL: H609	Commonwealth and American Literature	100/40	70
	ESL: H610	European Literature in Translation	100/40	70
	12 Papers		1200	800

*E for Elective; H for Honours; HSC for Honours Supportive Course

SEMESTER – I

ESL: E101 ENGLISH LITERATURE: HISTORY, POETRY AND DRAMA (Old English – the 19th Century)

Full Marks: 100

Unit I: History of English Literature: 30 marks (10 lecture hours)

A Survey of the Major Periods from Old English to the 19th Century

Unit II: Poetry Section: 40 marks (30 lecture hours)

(i) Sonnets of Shakespeare: (1) *When forty winters shall …*;
(2) *When I do count the clock*;
(3) *That time of year …*

(ii) John Milton: *Lycidas*
(iii) John Donne: *The Good-Morrow*; *A Hymn to God the Father*; *Death Be not Proud*
(iv) Thomas Gray: *An Elegy Written in the Country Churchyard*
(v) William Wordsworth: *Tintern Abbey*
(vi) P.B. Shelley: *Ode to the West Wind*
(vii) John Keats: *To Autumn*
(viii) Lord Byron: *All for Love*
(ix) Alfred Lord Tennyson: *The Lotus Eaters*; *Tears Idle Tears*
(x) Christina Rossetti: Goblin Market
(xi) Robert Browning: *Porphyria's Lovers*

Unit III: Drama Section: 30 marks (10 lecture hours)
(i) William Shakespeare: *Macbeth*
(ii) Christopher Marlowe: *The Jew of Malta*

Books recommended:

i. *An Anthology of Verse*. 2010. Published on behalf of Manipur University.
ii. Francis Turner Palgrave: *The Golden Treasury*. New Delhi: Oxford &IBH Publishing Co. Pvt. Ltd.
iii. William J. Long. *English Literature: Its History, Its Significance*

SEMESTER – II

ESL: E202 BRITISH FICTION Full marks: 100

Unit I: Lectures on Trends in British Fiction – Age-wise (10 marks; 5 lecture hours)

Unit II: (90 marks; 30 lecture hours)
(i) Henry Fielding: *Joseph Andrew*
(ii) Jane Austen: *Sense and Sensibility*
(iii) George Eliot: *Silas Marner*
(iv) Charlotte Bronte: *Jane Eyre*
(v) Charles Dickens: *A Tale of Two Cities*
(vi) Thomas Hardy: *Far from the Madding Crowd*

SEMESTER – III

ESL: E303 WESTERN CRITICISM Full Marks: 100

Unit I: (85 marks; 25 lecture hours)

(i) Aristotle's *Poetics*

(ii) Tragedy and Comedy

(iii) Classicism and Romanticism

(iv) Samuel Johnson: *Preface to the Plays of Shakespeare*

(v) William Wordsworth: *Preface to Lyrical Ballads*

(vi) ST Coleridge: *Biographia Literarial*(Books: XII-XIII)

(vii) Matthew Arnold: *The Study of Poetry*

(viii) T.S. Eliot: *The Function of Critism*

(ix) D.H. Lawrence: *Why the Novel Matters*

Unit II: Practical Criticism (15 marks; 5 lecture hours)

Books recommended:

1. B Das and J.M. Mohanty. *Literary Criticism: A Reading*. Calcutta: OUP, 1998.
2. SM Schreiber. *An Introduction to Literary Criticism*. Oxford.
3. D.J. Enright andChickera. *English Critical Text*.
4. C.B. Cox and A.E. Dyson. *The Practical Criticism of Poetry*. New Delhi: Arnold Heinmann.

HONOURS SUPPORTIVE COURSE I

ESL: HSC I **Rhetoric and Prosody, Literary Genres and Major Movements of English Literature** Full marks:100

UNIT – I (20 marks; 6 lecture hours)

a) Metre and Rhyme in English poetry

b) Rhyme schemes in English poetry

c) Figures of speech

UNIT –II DRAMA (20 marks; 10 lecture hours)

a) Tragedy

b) Comedy

c) Comedy of humour

d) Comedy of manner
e) Absurd drama
f) Problem play

UNIT- III POETRY (20 marks; 6 lecture hours)

a) Metaphysical poetry
b) Sonnet
c) Lyric
d) Epic
e) Mock Epic
f) Ode
g) Elegy
h) Ballad
i) Allegory
j) Dramatic Monologue

UNIT-IV (20 marks; 6 lecture hours)

a) Growth and development of the novel
b) Picaresque Novel
c) Epistolary novel
d) Stream of Consciousness Novel
e) Magic Realism in Postmodern Novels
f) Point of View In Novels

UNIT-V (20 marks; 6 lecture hours)

a) Renaissance
b) Reformation
c) Humanism
d) Enlightenment
e) Neo-Classicism
f) Romanticism
g) Pre-Raphaelite movement
h) Arts for art's sake
i) Modernism in English literature

Books Recommended: *A Glossary of Literary Terms*, M.H. Abrams, OUP: Delhi

SEMESTER – IV

ESL: E404 LINGUISTICS AND ENGLISH LANGUAGE

Full Marks: 100

Unit I: Linguistics: 75 marks (22 lecture hours)

(i) Nature of study: (a) Phonetics: Organs of Speech, the English Vowels and Consonants, Transcriptions, Stress and Intonation Patterns; (b) Phonology: Concepts of Phoneme and Allophone; (c) Morphology: Morpheme and Allomorphs, Morpheme types; Syntax: Traditional and modern approaches to English Grammar, Syntagmatic and Paradigmatic relations, IC Analysis; Semantics

(ii) Scope and branches of Linguistics

(iii) Human Language and animal communication: Different theories of origin and fallacies; characteristics and properties of human language.

Unit II: English Language: 25 marks (5 lecture hours)

(i) A Brief sketch of the origin and history of the English Language

(ii) Changes and influences (Greek, Latin, French, Indian etc.)

Books recommended:

1. AC Gimson: An Introduction to the Pronunciation of English. Edward Arnold.
2. CL Barbr. The Brief History of the English Language.ELBS.
3. Daniel Jones: English Pronouncing Dictionary.ELBS.
4. FT Wood: Outline of the History of English Language. Macmillian
5. George Yule. The Study of Language.2006. Cambridge University Press.
6. JD O'Connor. Better English Pronunciation. New Delhi: Universal Book Stall.
7. John Lyons. Language and Linguistics: An Introduction. Cambridge University Press.

HOUNOURS SUPPORTIVE COUSE II

ESL: HSC II

Background on North East Literature, Commonwealth and American Literature and European Literature in Translation

Fullmark-100

UNIT-I: 30 marks (10 lecture hours)

Background on North East Literature: Books and Authors, Socio – Historical – Literary milieu.

UNIT-II: 40 marks (12 lecture hours)
Background on Commonwealth and American Literature, Books and Authors, Socio – Historical – Literary milieu.

UNIT-III: 30 marks (10 lecture hours)
Background on European Literature in Translation, Books and Authors, Socio – Historical – Literary milieu.

Books Recommended:

1. *An Anthology of Verse.* 2010. Published on behalf of Manipur University.
2. Nongkynrih, Kyanpham Singh, and Robin S Ngangom. (eds.). *Anthology of Contemporary*
Poetry from the Northeast. Shillong: NEHU, 2003.
3. GeetaDharmarajan (ed.). 2004. *The Heart of the Matter*. New Delhi: Katha.
4. Kailash C. Baral (ed.). 2005/2007. *Earth Songs: Stories from Northeast India.*SahityaAkademi.
5. K. Sadananda (ed). *Torrents*. 2005. The Seawaves.
6. *Quarterly Journal*. Manipur State Kala Akademi Pub.
7. An Anthology of Verse. 2010. Published on behalf of Manipur University C.D.
8. Narasimhaiah (ed.). 1990. *An Anthology of Commonwealth Poetry.* Madras: Macmillan.
9. Chinua Achebe. 1971. *Beware, Soul Brother: Poems*. Heinemann.

SEMESTER – V

ESL: H505 20TH CENTURY BRITISH LITERATURE

Fullmarks: 100

Unit I: Poetry Section 25 marks (20 lecture hours)

1. WB Yeast: *Easter 1916; The Second Coming*
2. TS Eliot: *The Hollow Men; Journey of the Magi*
3. DH Lawrence: *Snake*
4. Rupert Brooke: *The Soldier*
5. WH Auden: *Seascape; The Unknown Citizen*
6. Thom Gunn: *Tamer and Hawk*
7. Ted Hughes: *The Thought Fox*

Unit II: Fiction 30 marks (10 lecture hours)

1. Virginia Woolf: *Mrs Dalloway*
2. George Orwell: *The Animal Farm*

Unit III: Drama 45 marks (15 lecture hours)

1. GB Shaw: *Arms and the Man*
2. John Galsworthy: *Strife*
3. Harold Pinter: *The Birthday Party*

Book recommended (Poetry Section):

*An Anthology of Verse.*2010. Published on behalf of Manipur University.

ESL: H506 **INDIAN WRITING IN ENGLISH**

Full Marks: 100

Unit I: Poetry Section 25 marks (22 lecture hours)

1. Henry Derozio: *To the Pupils of Hindu College; Chorus of Brahmins*
2. Toru Dutta: *Our Casuarina Tree; The Lotus*
3. Rabindranath Tagore: *The Child*
4. Nissim Ezekiel: *Night of the Scorpion; In India*
5. AK Ramanujan: *The Striders; Another View of Grace*
6. Kamala Das: *The Dance of the Eunuchs; The Sunshine Cat*

Unit II: Fiction 45 marks (15 lecture hours)

1. Mulk Raj Anand: *Untouchable*
2. Arun Joshi: *The Apprentice*
3. Geeta Hariharan: *The Thousand Faces of Night*

Unit III: Drama 30 marks (10 lecture hours)

1. Girish Karnad: *Tughlaq*
2. Mahesh Dattani: *Where There's a Will*

Books recommended:

1. *An Anthology of Verse*. 2010. Published on behalf of Manipur University.
2. Gokak, V.K. (ed). 1989. *The Golden Treasury of Indo-Anglian Poetry*. New Delhi: Sahitya Akademi.
3. Paranjape, Makarand (ed). 1993. *Indian Poetry in English*. Madras: Macmillan.

ESL: H507 **LITERARY THEORY**

Full Marks: 100

1. Structuralism (Ferdinand de Saussure: Nature of the Linguistic Sign)
2. Post-structuralism (Roland Barthes: ("Work to text"; "The Death of the Author"; MH Abrams"; The Deconstructive Angel")
3. Post-modernism (Linda Hutcheon: Theorizing the Postmodern: Towards a Poetics)
4. Post-colonialism (Edward Said: Introduction to *Orientalism*)
5. Feminism (Elaine Showalter: "Towards a feminist Poetics"; Helen Sixous: "The Laugh of the Medusa")
6. Marxism and Marxist Literary Criticism (Louis Althusser:"Ideology and Ideological State Apparatuses").

(N.B.: *Works cited above within the brackets need not be the only essays to be studied*)

Recommended Books:

1. Peter Berry. 1995. *Beginning Theory*. Manchester: MUP.
2. Bill Ashcroft, Gareth Griffiths, and Helen Tiffin. 1998. *The Empire Writes Back.* London: Routledge.
3. ……. 1997. *The Post-colonial Studies Reader*. London: Routledge.
4. David Lodge (ed). 2003. *Modern Criticism and Theory: A Reader*. Singapore: Pearson.
5. Edward W. Said. 1995. *Orientalism*. London: Penguin.
6. Elleke Boehmer. 1995. *Colonial and Post-colonial Literature*. New York: OUP.
7. Linda Hutcheon. 1988/2003. *Postmodernism: History, Theory, Fiction*. New York: Routledge.
8. M.S. Nagarajan. 2007. *English Literary Criticism and Theory.* Bangalore: Orient Longman.
9. Philip Rice and Patricia Waugh (eds). 1999. *Modern Literary Theory: A Reader*. London: Routledge.
10. Raman Selden, Peter Widdowson, and Peter Brooker. 1997. *A Reader's Guide to Contemporary Theory*. London: Prentice Hall.
11. Simone de Beauvoir. 1949. *The Second Sex*. New York: Virago.

SEMESTER – VI

ESL: H608 **NORTH-EAST LITERATURE**

Full Marks: 100

Unit I: Poetry Section 50 marks (35 lecture hours)

1. Mamang Dai: *The Missing Link; Sky Song*
2. Nilamani Phukan: *Poems; Ecstasy*
3. Yumlembam Ibomcha: *For the Next Birth; Story of a Dream*
4. Thangjam Ibopishak: *Dali, Hussain,* or *Odour of Dream, Colour of Wind; The Land of the Half Humans*
5. Desmond L. Kharmawphlang: *The Conquest*
6. Robin S. Ngangom: *Bad Places; Poems for Joseph*
7. Kynpham Singh Nongkynrih: *Ren; When the Prime Minister Visits Shillong the Bamboos Watch in Silence.*
8. Chandra Kanta Murasingh: *O, Poor Hackukraill; Of a Minister*
9. Hijam Irawat Singh: Hymn to Mother: Factory

Unit II: Fiction 30 marks (10 lecture hours)

1. Lamabam Kamal. *Madhabi*. Trans. RK. Birendra Singh
2. Indira Goswami. *Pages Stained with Blood.* Trans. PradipAchary. New Delhi: Katha, 2002.

Unit III: Short Stories 20 marks (15 lecture hours)

1. Anima Dutta: *The Holy Dip*
2. Harekrishna Deka: *The River Within*
3. LamabamVirmani: *Inspection Report*
4. Vanneihtluanga: *Thunderbird*
5. K. Priyokumar: *Acacia*

Books recommended

1. *An Anthology of Verse.* 2010. Published on behalf of Manipur University.
2. Nongkynrih, Kyanpham Singh, and Robin S Ngangom. (eds.). *Anthology of Contemporary Poetry from the Northeast*. Shillong: NEHU, 2003.
3. Geeta Dharmarajan (ed.). 2004. *The Heart of the Matter*. New Delhi: Katha.
4. Kailash C. Baral (ed.). 2005/2007. *Earth Songs: Stories from Northeast India.*Sahitya Akademi.
5. K. Sadananda (ed). *Torrents*. 2005. The Seawaves.
6. *Quarterly Journal*. Manipur State Kala Akademi Pub.

ESL: H609 **COMMONWEALTH AND AMERICAN LITERATURE**

Full Marks: 100

Unit I: Poetry Section 60 marks (30 lecture hours)

1. Chinua Achebe: *An 'IF' of History; Those Gods are Children*
2. Margaret Atwood: *Journey to the Interior; Animals in that Country*
3. AD Hope: *Australia; The Death of the Bird*
4. David Malouf: *The Year of the Foxes*
5. Derek Walcott: *A Far Cry from Africa*
6. Yasmine Gooneratne: *On an Asian Poet Fallen Among American Translators; There was a Country*
7. Walt Whitman: *Out of the Cradle Endlessly Rocking*
8. Robert Frost: *The Mending Wall; The Road Not Taken*

Unit II: Fiction 40 marks (20 lecture hours)

1. Ernest Hemingway: *The Old Man and the Sea*
2. Ngugi wa Thiong' O: *Devil on the Cross*
3. John Steinbeck: *Of Mice and Men*
4. Margaret Atwood: *The Edible Woman*

Books recommended:

1. *An Anthology of Verse*. 2010. Published on behalf of Manipur University C.D.
2. Narasimhaiah (ed.). 1990. *An Anthology of Commonwealth Poetry.* Madras: Macmillan.
3. Chinua Achebe. 1971. *Beware, Soul Brother: Poems*. Heinemann.

ESL: H610 **EUROPEAN LITERATURE IN TRANSLATION**

Full Marks: 100

Unit I: Poetry Section 15 marks (5 lecture hours)

Homer: *The Odyssey*, Book I

Unit II: Fiction 70 marks (25 lecture hours)

1. Albert Camus: *The Outsider*
2. Franz Kafka: *The Castle*
3. Short stories of Guy de Maupassant:
   a. *The Jewels*
   b. *Mother Savage*
   c. *My Uncle Jules*

4. Short stories of Anton Chekhov:
a. The Grasshopper
b. Gooseberries

Unit III: Drama 15 marks (5 lecture hours)
Sophocles: *Antigone*

Books recommended:

1. Guy De Maupassant. 1971. *Selected Short Stories*. Trans. Roger Colet. Calcutta: Rupa.
2. Anton Chekhov. 1973/1984. *Selected Works.* Vol. I. Moscow: Raduga Publishers.

vii. B.A / B.Sc. SYLLABUS for GEOGRAPHY

Structure of elective and Honours course:

Paper Code	Title	F.M./P.M.	Time (hours)
Semester-I			
GEG: E101	Physical Geography	75/30	60
GEG: E101P	Cartography-I	25/10	30
Semester-II			
GEG: E202	Geographical Thought	75/30	60
GEG: E202P	Cartography-II	25/10	30
Semester-III			
GEG: E303	Human Geography	75/30	60
GEG: E303P	Cartography-III	25/10	30
GEG: HSC I(Non-Credit)	Honours Supportive Course-I	100/35	70
Semester-IV			
GEG: E404	Population& Settlement Geography	75/30	60
GEG: E404P	Cartography-IV	25/10	30
GEG: HSC-II (Non-Credit)	Honours Supportive Course II	100/40	70
Semester-V			
GEG: H505	Geomorphology	100/40	90
GEG: H506	Geography of India	100/40	90
GEG: H507P	Cartography-V	100/40	90
Semester-VI			
GEG: H608	Economic Geography	100/40	90
GEG: H609	World Regional Geography	100/40	90
GEG: H610P	Cartography-VI	100/40	90

SEMESTER-I

GEG: E101 **Physical Geography** (Marks 75)

UNIT-I: (15 marks) 12 periods

Definition of Geography, branches of Geography, Physical Geography Solar system and origin of the Earth, Rocks-their origin and classification, interior of the Earth, Earth movements - Orogenic and Epeirogenic, Earthquakes and Volcanoes, major landforms.

UNIT-II: (15 marks) 10 periods

Weathering, factors affecting weathering, concept of cycle of erosion, works of running water, wind and glaciers, Karst and coastal regions; drainage patterns, lakes and islands.

UNIT-III: (15 marks) 10 periods

Elements of weather and climate, composition and structure of the atmosphere, insolation, heat budget, vertical, horizontal and seasonal distribution of temperature.

UNIT-IV: (15 marks) 10 periods

Atmospheric pressure and winds, planetary, periodic and local winds, evaporation, condensation, Precipitation, cyclones and anticyclones, climatic types and their association with major natural regions.

UNIT-V: (15 marks) 15 periods

Configuration of ocean floor, Temperature and salinity distribution of oceans water, ocean current, marine deposits, coral atolls, global distribution of major plant and animal communities; concept of ecosystem and food chain.

Suggested Reading:

1. Ahmed Enyat: *Geomorphology*, Kalyani Publishers, New Delhi, 2001.
2. Blomm A.L.: *Geomorphology: A Systematic analysis of Late Canezoic landforms*, Prentice Hall Eaglewood Cliffs, N.J. 1978
3. Dayal, P.: *A textbook of Geomorphology*, Sukla Book Depot, Patna 1996.
4. Critchfield,H. *General Climatology*, Prentice Hall, New York, 1975
5. Monkhouse, F.J.: *Principles of Physical Geography*.
6. Sharma,R.C. and Vatal,M. *Oceanography for Geographers*
7. Strahler, A.N. & Strahler,A.E.: *Modern Physical Geography*, John Wiley & Sons revised edition,1992
8. Kale, V.S. and Gupta, A.: *Introduction to Geomorphology*, Orient Longman, Kolkata, 2001

9. Thornbury,W.D, *Principles of Geomorphology*, Wiley Eastern, 1969
10. Wooldridge, S.W. and Morgan, R.S.: *An Outline of Geomorphology*: *The Physical Basis of Geography- An Outline of Geomorphology*, Longman Green &Co., London 1959

GEG: E101P **Cartography-I** (Marks: 25; 30 periods)

UNIT-I

Scale; methods of expressing scales, plain, linear, diagonal, time and comparative scales. (5 marks)

UNIT-II

Representation of relief and elevation by pictorial and mathematical methods. (5 marks)

UNIT-III

Representation of various landforms by contours and drawing of sections or profile, drawing of slopes and their classification by contours. (5 marks)

Record Book **(**5 marks)
Viva Voce (5 marks)

Suggested Readings:

1. Lawrence, G.R.P.: *Cartographic Methods*, Methuen, London, 1968.
2. Monkhouse, F.J.& Wilkinson,H.R.: *Maps and Diagrams,* Methuen London, 1994
3. Robinson, A.H.: *Elements of Cartography*, John Wiley &Sons, New York, 1998 (fifth edition).
4. Singh, R.L.: *Elements of Practical Geography*, Kalyani Publisher, New Delhi.1969.
5. R.P.Mishra: *Fundamentals of Cartography*, Prasaranga, University of Mysore, 1969.
6. Raisz, Erwin: *Principles of Cartography*, McGraw-Hill, New York, 1962.

Semester- II

GEG: E202 **Geographical Thought** (Marks:75)

UNIT-I (15 marks) 15 periods

Emergence of Geography as a subject, Geography and other disciplines, its place in the distribution of sciences, concepts of Geography-distribution, relationships, interactions, area differentiation and spatial organization .

UNIT-II (15 marks) 10 periods

Contributions of Greek, Arab and Indian Geographers, contribution of German and French Geographers.

UNIT-III (15 marks) 10 periods

Geography as the study of environment, man-environment relationship, determinism, possibilism, neo-determinism, dualism in Geography- systematic, regional, branches of Geography.

UNIT-IV (15 marks) 10 periods

Geography of Human Ecology: Areal differentiation and spatial organization: concept of region-macro, meso and micro; recent trends of study of geography in India.

UNIT-V (15 marks) 10 periods

American School-Contribution of Davis, Sample, Huntington: British School-Contribution of Mackinder, Herbertion and L.D. Stamp.

Suggested Readings:

1. Alber, Ronald.F.et.al*: Geography's Inner Worlds: Pervasive themes in Contemporary American Geography* , Routledge, New Jersey, 1992.
2. Dikshit R.D., *The Arts, Science of Geography Integrated Readings*, Prentice Hall of India,New Delhi, 1994.
3. Dikshit R.D., *Geographical Thought-A Contextual History of Ideas*, Prentice Hall of India Pvt. Ltd, 2000
4. Dohrs, F.E.and Sommers, L.W. (eds.) ,*Introduction to Geography*, Thomas CrowellCo., New York,1967
5. Hartshorne, Richard: *Perspective on the Nature of Geography*, Rand McNally and Co, Chicago,1967
6. Harvey, David: *Explanation in Geography*, Edward-Arnold, London, 1972.
7. Holt-Jensen, A.: *Geography: Its History and Concepts*, Longmans, 1980.
8. Hussain, Majid: *Evolution of Geographical Thought*, Rawat Publications, Jaipur, 1984.
9. James, PE.: *All Possible worlds: A History of Geographical Ideas*, Sachin Publication, Jaipur,1980
10. Johnston,R.J. and Claval,P.(eds.): *Geography Since the Second World War*, Croom Helm, London/Bernes and Bable, N.J,1984
11. Jones, P.A.: *Fieldwork in Geography*, Longmans, 1968.

12. Lownsburg, J.F and Aldrich, F.T.: Introduction to Geographical Methods and Techniques, Charles Marrill, Columbus,1979.
13. Minsuhull, R.: The Changing Nature of Geography, Hucthinson University Library, London,1970

GEG: E202P **Cartography-II** (Marks: 25) 30 periods

UNIT-I

Drawing of profiles of an area indicating long and cross profiles, superimposed, projected and composite profiles and their relevance in landform mapping and analysis. (5 marks)

UNIT-II: Identification

1.Fibres- Jute, Cotton, Silk, Cereals-Rice ,Wheat, Jowar, Ragi

2.Rocks –igneous-granite, basalt, dolomite, diorite,

Sedimentary-Shale, limestone, conglomerate, Metamorphic-Slate, Scheist, plyllite, gneiss, quartzite and marble

3. Mineral-Quartz, Feldspar, mica, Hematite, coal, limestone, magnetite, gypsum, bauxite. (5 marks)

UNIT-III

Representation of temperature and rainfall data by lines and bar graphs, drawings of climograph,Hythergraph and Ergograph and their interpretation. Symbols of weather maps, interpretation of Indian daily weather maps for January and July months. Reading of meteorological instruments-maximum and minimum thermometers, wet and dry Barometers, Anemometer. (5 marks)

Record Books (5 marks)
Viva Voce (5marks)

Suggested Readings:

1. Monk house F.J.: *Maps and Diagrams*, Methuen & Co Ltd., London 1971.
2. Raize, Erwin: *Principles of Cartography*: McGraw Hill, New York, 1982.
3. Elhance, D.N.: *Fundamental of Statistics*, Kitab Mahal, Allahabad, 1972.
4. Robinson A.H and Sale R.D.: *Elements of Cartography*, Jon Wiley, New Jersey, 1953.
5. S. Singh R.L: *Elements of Practical Geography*, Kalyani Publishers, New Delli 1979.
6. Birch,T.W.: *Maps: Topographical and Statistical*, Clarendon Press,Oxford,1949.

7. R.P.Mishra: *Maps: Fundamentals of Cartography*, Prasaranga University of Mysore, 1969.
8. Aslam ,Md: *Statistical Method In Geographical Studies*, Rajesh Publication, New Delhi, 1976
9. Pal, S.K.: *Statistics for Geoscientist-Techniques and Applications*, Concept, New Delhi, 1998
10. Gregary, S: *Statistical Methods and the Geographer*, Longman, S. London, 1963.

Semester- III

GEG: E303 **Human Geography** (Marks: 75)

UNIT-I

Nature and scope of Human Geography, branches of Human Geography, approaches to the study of Human Geography, primitive lifestyles of mankind-an environmental study. (15 marks) 12 periods

UNIT-II

Environmental impact on mankind; environmental changes caused by the disposal of waste materials, impact of agricultural development on environment, impact of chemical fertilizers on environment; soil erosion, deforestation.

(15 marks) 15 periods

UNIT-III

Division of mankind; spatial distribution of racial and linguistic groups; human adaptation to the environment (i) Cold region- Eskimo (ii) Hot region- Bushman (iii) Plateau- Gonds (iv) Mountains- Gujjars, nomads and natural hazards.

(15 marks) 15 periods

UNIT-IV

Progress of economic activities of mankind; food gathering, hunting, fishing, vegeculture, shifting cultivation, economic activities in modern societies-industry, transport, agriculture, trade and commerce.

(15 marks) 15 periods

UNIT-V

Migration; causes and consequences, international migration.

(15 marks) 10 periods

Suggested Readings:

1. Bergwan, Edward E: *Human Geography: Culture, Connections and Landscape*, Prentice-Hal, New Jersey, 1995.
2. Carr, M: *Patterns, Process and Change in Human Geography*, McMillan Education, LONDON, 1987.
3. Fellman, J.L: *Human Geography-Landscapes of Human Activities*, Brown and Benchman -Pub, U.S.A, 1997.
4. Deblj, H.J: *Human Geography, Culture Society and Space*, John Wiley, New York 1996.
5. Johnstone, R. J. (editor): *Dictionary of Human Geography*, Blackwell, Oxford 1994.
6. Mc-Bride, HJ: *Human Geography systems, patterns and a change in Human Geography*, Nelson, U.K. and Canada, 1996.
7. Michael, C.: *New Patterns: Process and change in Human Geography*, Nelson, 1997.
8. Peter Daniels, Michael B. Denis S. and James, S.: *Human Geography,* Pearson Education, Delhi 2003.
9. Rubenstein, J.H. and Bacon R.S.: *The Cultural Landscape- an Introduction to Human Geography*, Prentice Hall, India New Delhi 1990.
10. Singh, K. N.: *People of India- an Introduction*, Seagal Books 1992
11. Majid Hussain: *Human Geography*, Rawat Publication, Jaipur, 2003.
12. UNDP: *Human Development Report*, Oxford University Press 2001.

GEG: E303P **Cartography-III** (Marks: 25) 30 periods

UNIT-I

Conventional symbols and their uses in Indian topo-sheets maps, Interpretation of survey maps of India, topo-sheets of an area in respect of (i) relief (ii) drainage (iii) Settlement (iv) communication pattern. (5 marks)

UNIT-II

Diagrammatic and graphical presentation; traffic flow, band graph, line graph, age and sex pyramids, proportional circles, isoplets, cloropleth. (10 marks)

Record Book (5 marks)
Viva Voce (5 marks)

Suggested Readings:

l. Monkhouse, F. J.: *Maps and Diagrams*, Methuen & Co Ltd., London, 1971.
2. Nag. P.: *Thematic Cartography and Remote Sensing*, Concept publication, New Delhi, 1953.
3. Raize, Erwin: *Principles of Cartography*,McGraw Hill, New York 1982.
4. Robinson A.H. and Sale, R. D. :*Elements of Cartography*, Jone Wiley and Sons, New Jersey,1985.
5. Singh. R. L.: *Elements of Practical Geography*, Kalyani Publishers New Delli 1979.
6. R. P. Mishra: *Fundamentals of Cartography*, Prasaranga, University of Mysore, 1969.
7. Gopal Singh*: Map work and Practical Geography*
8. Pal, *S.K. Statistics for Geoscientists-Techniques and Applications*, Concept. New Delhi, 1998.
9. Steers, J.A.: *Map projections*, University of London Press, London.

GEG: HSC I **HONOURS SUPPORTIVE COURSE-I** (Full mark-100)

UNIT-I

India as a geographical unit and its frontiers. Routes into India and its strategic significance. Geological regions and history; lce age in India; Physiographic division-Origin of the Himalayas, Plate Tectonics, Origin of the plain, the plateaus of the Peninsular India, the Coastal Plains. (Marks-25) 20 period

UNIT-II

Natural Hazards and Disaster- Hazards-its definition and types, Disaster- its meaning and classification. Natural Hazards and disaster in India. Causes of earthquake and its prediction. Air pollution and its effects (Marks-25) 20 periods

UNIT-III

Global warming-it's meaning and evidences, Ozone depletion, greenhouse effects and global warming, Remedial measures of greenhouse effect. Climate change-its meaning and concept, Indicators of climatic changes, Causes and theories of climatic changes. (Marks-25) 20 period

UNIT-IV

Applied geomorphology- its meaning and concept; Applied geomorphology to hydrology, engineering projects, mineral exploration, geomorphology and regional planning, geomorphology and hazard management, geomorphology and urbanization. Applied geomorphology in Indian context. (Marks-25) 10 periods

Suggested Readings:

1. J.L. Guha & R.P. Chattoraj: A new approach to Economic Geography- A study of Resources. World Press Pvt.Ltd. Kolkata
2. A Hartshon & W. Alexander: Economic Geography- 3rd Edition, Prentice Hall of India Pvt. Ltd. New Delhi
3. Prithwish Roy: Economic Geography- A study of Resources, New Central Book Agency Pvt. Ltd. Kolkata.
4. Jones & Darkenwald: Economic Geography- Surjeet Publication, New Delhi
5. Tikkha, Bali and Sekhon: World Regional Geography
6. Cole, J.: A Geography of the World's Major Regions
7. Jackson R.HI. and Hudman, L.E: World Regional Geography, Issues for Today.
8. Majid Hussain: World Regional Geography.
9. Majid Hussain: Agricultural Geography

SEMESTER- IV

GEG: E404 **Population and Settlement Geography** (Marks 75)

UNIT-I

Nature and scope of Population Geography, world population geography; world population growth, density and distribution. (15 marks) 15 periods

UNIT-II

Composition of Population; composition, fertility and mortality with reference to India. (15 marks) 15 periods

UNIT-III

Migration -internal, external and international, population problems and policies with reference to India. (15 marks) 15 periods

UNIT-IV

Nature and scope of Settlement Geography, evolution of settlements, spatial distribution and associated factors, settlements of rural and urban.

(15 marks) 15 periods

UNIT-V

Types, pattern, distribution and growth of rural and urban settlement, urbanization trends in the world, functional classifications of towns, urban problems and planning. (15 marks) 15 periods

Suggested Readings:

1. Bose Ashish et al: *Population in India's development (1947-2000*), Vikash, New Delhi 1974.
2. Chandna R.C.: *Geography of Population*, Kalyani Publication, New Delhi, 2000.
3. Chandna R.C: *Geography of Population: Concepts. Determinants and Patterns*, Kalyani New Delhi (2000).
4. Clarke John-I: *Population Geography*, Pergarnon Press, Oxford 1973.
5. Crook, Nigel: *Principle of Population and development*, Pergarnon Press, New York, 1977.
6. Garnier B.J.: *Geography of Population*, Longnan, London, 1970.
7. Mamoria C.B.: *India's Population Problem*, Kitab Mahal New Delhi 1981.
8. Mitra Ashok: *India's Population: Heading towards a billion*, B.R. Pub.Corp.191.
9. Srinivasan K. and M.B. Vlassoff: *Population development Nexus in India: Challenges for the Millennium*, Tata Mc GrawHill, New Delhi 2001 .
10. Sundaram K.V. and Sudeshnangia (Ed): *Population Geography*, Heritage, Delhi 1986.
11. UNDP: *Human development Report*, Oxford University Press, Oxford 2000.
12. Wood. R: *Population Analysis in Geography*, Longman, London 1979.
13. Carter H.: *The Study of Urban Geography*, Edward Arnold, London 1972.
14. Rao, V.L.S. P: *Urbanization in India: Spatial Dimensions*, Concept publication, New Delhi 1996.
5. Singh. R.L and Singh K.N (Eds): *Readings in Rural Settlement,* BHU, Varanasi.
6. Singh, R.Y: *Geography of Settlements,* Rawa1, Jaipur, 1998
7. Singh, R.L and Singh K.N. (Eds): *Readings in Rural Settlements*, BHU, Varanasi.

GEG: E404P **Cartography-IV** (Marks: 25) 30 periods

UNIT-I

Mean, median, mode, standard deviation, correlation of Co-efficient, Quartile deviation. (5 marks)

UNIT-II

Use of line and bar graphs for representing population, agriculture, industry and transport data. (5 marks)

UNIT-III

Drawing of the following maps:

(a) Population distribution of ST/SC population of Manipur; Density and growth map of Manipur and other North-Eastern states by any suitable methods.
(b) Rural and Urban population maps by spheres and multiple dots.
(c) Land use maps, cropping pattern, industries and transport by cartographic techniques other than line and bar graphs. (5 marks)

Record Book (5 marks)
Viva Voce (5 marks)

Suggested Readings:

l. American Society of Photogrammetry: *Manual of Remote Sensing*, ASP, Falls Church, V.A.1983.
2. Baeeett E.C. and Curtis: *Fundamental of Remote Sensing and Air Photo Interpretation*, McMillan, New York, 1992
3. Jeffrey, S and John E.: *Geographic Information System-An Introduction*, Prentice Hall, New Jersey, 1990.
4. Jones, P.A: *Field work in Geography*, Longman, London, 1968.
5. Luder D: *Aerial Photography Interpretation: principles and Applications*, McGraw-Hill, New York 1959.
6. Monkhouse, F.J.: *Maps and Diagrams*, Methuen, London 1967.
7. Nag.P: *Thematic Cartography and Remote Sensing,* Concept, Publication, New Delhi, 1953.
8. Raize I.: *Principles of Cartography*: Mc GrawHill, New York, 1982.
9. Kanitkar, T.P.: *Surveying and Levelling*, Roorkee University, Roorkee, 1965.
10. Robinson A.H. and Sale R.D.: *Elements of Cartography*, John Wiley, New Jersey, 1953.
11. R.L. Singh: *Elements of Practical Geography*.
12. Stoddard R.H.: *Field Techniques and Research Methods in Geography*.
13. R.P. Mishra: *Fundamental of Cartography*.

GEG: HSC II **HONOURS SUPPORTIVE COURSE PAPER-II** (Marks-100)

UNIT-I

Geography of Nepal and Bangladesh: physical, climate, economic and demographic set up. (Marks-25) 20 periods

UNIT-II

Geography of Pakistan and Sri Lanka: physical, climate, economic and demographic set up.

(Marks-25) 20 periods

UNIT-III

Resource: meaning and nature, definition of resource, resource and wealth, resource resistance and neutral stuff, classification of resource, functional theory of resource, resource creative factors and nature, man, culture, recent trends, nature and resource- friend and foe, bountiful and niggardly.

(Marks-25) 20 periods

UNIT- IV

Agriculture: meaning, origin of agriculture; farm mechanization and its relative importance to modern agriculture; major types of agricultural practices- intensive, extensive; humid, irrigation, dry, monoculture, duoculture, oligoculture; primitive, subsistence, sedentary primitive agriculture; commercial grain farming, plantation; Monsoonal agriculture; land use pattern and agriculture, crop concentration and diversification. (Marks-25) 20 periods

Suggested Readings:

1. J.L. Guha & R.P. Chattoraj: A new approach to Economic Geography- A study of Resources. World Press Pvt.Ltd. Kolkata
2. A Hartshon & W. Alexander: Economic Geography- 3rd Edition, Prentice Hall of India Pvt. Ltd. New Delhi
3. Prithwish Roy: Economic Geography- A study of Resources, New Central Book Agency Pvt. Ltd. Kolkata.
4. Jones & Darkenwald: Economic Geography- Surjeet Publication, New Delhi
5. Tikkha, Bali and Sekhon : World Regional Geography
6. Cole, J.: A Geography of the World's Major Regions
7. Jackson R.HI. and Hudman,L.E: World Regional Geography, Issues for Today.
8. Majid Hussain: World Regional Geography.

SEMESTER -V

GEG: H505 **Geomorphology** (Marks: 100)

UNIT-I

The nature, scope and concepts of geomorphology, Relationship of geomorphology with other branches of earth sciences; Geological time scale.

(20 marks) 15 periods

UNIT-II

Earth's interior, Wegener's theory of Continental drift, plate Tectonics; Earth movements-Orogenic and Epeirogenic; types of folds & faults, isostasy, earthquakes and volcanoes, types of mountains.

(20 marks) 20 periods

UNIT-III

Rocks and minerals-origin and composition of rock, classification of rocks, weathering, formation of regolith and soils, rocks and relief.

(20 marks) 15 periods

UNIT-IV

Geomorphic agents and processes, corrosion, transportation and deposition; Mass wasting; Evolution of landscape; concept of cycle of erosion, interruption to cycle of erosion, fluvial, arid, glacial, karst and coastal landscapes.

(20 marks) 20 periods

UNIT-V

Applied geomorphology: settlements, transport, land use, mining, resource evaluation, environmental and assessment. (20 marks) 15 periods

Suggested Readings:

1. Dayal, P: *A Textbook of Geomorphology*, Shukla Book Depot, Patna, 1996.
2. Dury, G.H.: *Essays in Geomorphology*, Heinmann, London, 1966.
3. Ernst, W.G: *Earth systems-Process and Issues*, Cambridge University Press, 2000
4. ICSSR: *A Survey of Research in Physical Geography,* Concept, New Delhi, 1983
5. Kale V. and Gupta, A.: *Element of Geomorphology*, Oxford University Press, Calcutta, 201 .
6. Monkhouse, F.J: *Principles of Physical Geography*, Hodder and Stoughton, London, 1960.
7. Pitty, A.: *Introduction of Geomorphology*, Methuen, London, 1974.
8. Sharma, H.S.: *Tropical Geomorphology,* Concept, New Delhi, 1987.
9. Singh, S. *Geomorphology*, Prayag Pustak Bhawan, Allahabad, 1998.
10. Small, R.J.: *The study of landforms*, McGraw Hill, New York, 1985.
11. Sparks, B.W.: *Geomorphology*, Longmans, London, 1960.
12. Steers, J.A.: *The Unstable Earth. Some Recent Views in Geography*, Kalyani Publishers, 1964
13. Strahler, A.N: *Environmental Geo-Science*, Hamilton Publishing, Santa Barbara, 1973.
14. Strahler, A.N. and Strahler, A.H.: *Modern Physical Geography*, John Wiley & Sons, 1992
15. Summerfield, M.A.: *Global Geomorphology*, Longman, 191.

16. Thornbury, W.D.: *Principles of Geomorphology*, Wiley Eastern, 1969.
17. Wooldridge, S.W. And Morgan, R.D.: *The Physical Basis of Geography-An Outline of Geomorphology*, Longman Green & Co., London, 1959.
18. Wooldridge, S.W.: *The Geographer as Scientist*, Thomas Nelson and Sons Ltd. London, 1956.
19. Holmes ,A: *Principles of Physical Geology*, ELBS/Van Nostrand Reinhold,1978 (third edition)

GEG: H506 **Geography of India** (Marks: 100)

UNIT-I

India in the context of South and South East Asia; India; a land of unity and diversity, Structure and relief, drainage, climate and vegetation, natural regions.

(20 marks) 20 periods

UNIT-II

Agriculture and agricultural development planning, mineral and power resources, the status of their use and need for conservation; location and distribution of iron and steel, textile, petrochemical, cement and forest based industries.

(20 marks) 20 periods

UNIT-III

Transport and communication, trade and commerce, basis of regional divisions of India-macro, meso and micro-regions of India and planning.

(20 marks) 15 periods

UNIT-IV

North East India: structure and relief, climate, soils and natural vegetation, resource utilization, population structure and settlement patterns.

(20 marks) 15 periods

UNIT-V

Manipur: structure and relief, drainage, climate soils and natural vegetation, agriculture, mineral and power resources, population, tribes, settlements.

(20 marks) 15 periods

Suggested Readings:

1. Deshpande C. D: *India-A Regional Interpretation*, Northern Book Centre, New Delhi, 1992.
2. Farmer, B.H.: *An Introduction to South Asia*, Methuen, London, 1983.
3. Govt. of India: *India-Reference Annual*, 2001 pub. Div. New Delhi 2001.
4. Govt. of India: *The National Atlas of India*, NATMO Publication Division, New Delhi, 1965.

5. Govt. of India: *The Gazetteer of India. Vol.-l & Ill*, Publication division, New Delhi, 1965.
6. Lear month, A.T.A.et al (ed): *Man and Land of South Asia, Concept*, New Delhi.
7. Mitra, A.: *Levels of Regional Development of India, Census of India. Vol. -I, Part-l-.A (i) and (ii)* New Delhi, 1967.
8. P.Nag and P.Roy: *Geography of India,* Concept Publication, New Delhi 1998.
9. Shafi, M.: *Geography of South Asia*, McMillan & Co., Calcutta, 2000.
10. Singh, R L. (Eds): *A Regional Geography, National Geographical Society*, India, Varanasi, 1971
11. Spate, O.H.K and Lear month, A.R.A.: *India and Pakistan: Land, People and Economy*, Methuen & Co., London, 1967.
12. Valdiya, K.S.: *Dynamic Himalaya*, University Press, Hyderabad, 1998.
13. Wadia, D.N.: *Geology of India*, McMillan &Co., London, 1967
14. Kullar, D.: *India-A Comprehensive Geography*, Kalyani Publishers, New Delhi, 2000
15. Singh, R.P.: *Geography of Manipur*, NBT, New Delhi
16. Taher, M & Ahmed, P.: *Geography of North East India*, Mani-Manil Prakash, Guwahati, 2000.
17. Ansari S.A.: *Economic Geography of Manipur*, Trio Book House, Imphal.

GEG: H507P **Cartography-V** (Marks: 100)

UNIT-I

Preparation of cross and longitudinal profiles of streams, preparation of average slope map, block diagram, area height curve, hypsometric curve and drainage frequency and density map (20 marks) 15 periods

UNIT-II

Interpretation of geological maps and drawing of geological sections to show the sequence and relationships of structure with relief. (15 marks) 10 periods

UNIT-III

Basic principles of land surveying (i) chain and tape, (ii) prismatic compass and (ii) plane table surveying-radiation, intersection and three point problem.

(20 marks) 20 periods

UNIT-IV

Map projection: general principles, classification; Drawing of Graticules on the following projections by graphical/mathematical methods with suitable outline maps and their properties and uses: Zenithal orthographic, Stereographic, Equal area and Equidistant projections. (15 marks) 20 periods

UNIT-V

Map projection: Conical-Bond's, Polyconic and International projections, Cylindrical-Marcator's, Gall's and Mollweide projections (construction of suitable outline maps by graphical / mathematical methods and properties and uses of the projections). (15 marks) 20 periods

Record Book (7 marks)
Viva Voce (8 marks)

Suggested Readings:

1. Monkhouse, FJ.: *Maps and Diagrams*, Methuen & Co Ltd, London, 1971.
2. Nag.P: *Thematic Cartography and Remote Sensing*, Concept publication, New Delhi, 1953.
3. Raize, Erwin: *Principles of Cartography*, McGraw-Hill, New York, 1982.
4. Robinson .H. and Sale R.D.*: Elements of Cartography*, John Wiley and Sons, New Delhi, 985.
5. Singh, R.L: *Elements of Practical Geography*, Kalyani Publishers, New Delhi, 1979.
6. R.P. Mishra: *Fundamentals of Cartography*, Prasaranga, University of Mysore, 1969
7. Gopal Singh: *Map Work and Practical Geography*, Vikash Publishing House Pvt..Ltd., 1996.
8. Pal, S.K.: *Statistics for Geoscientists-Techniques and Applications*, Concept, New Delhi, 1998
9. Steers, J.A.: *Map Projections*, University of London Press, London.

Semester-VI

GEG: H608 **Economic Geography** (Marks: 100)

UNIT-I

Definition, nature, scope and recent trends in Economic Geography, its relations with economics and allied subjects, sectors of economy-primary, secondary, tertiary and quaternary. (20marks) 15 periods

UNIT-II

Natural resources: Renewable and non-renewable, biotic and abiotic conservation of resources. (20 marks) 15 periods

UNIT-III

Minerals and industries: classification of minerals and their world distribution; Industries: factors of localizations,; Major industries-iron and steel textile,

chemicals, cement, paper, Ship building, small scale and cottage industries.
(20 marks) 20 periods

UNIT-IV

Trade and Transport: geographical factors in their development, water, land and air transport, internal and international trade. (20 marks) 15 periods

UNIT-V

Global distribution and concentration of quaternary activities; Disparity between developed and developing countries; India's position in quaternary sector, Impact of globalization and India's economy,role of multinational companies and rise of IT industries in India. (20 marks) 15 periods

Suggested Readings:

1. Boesch, H.: *A Geography of World Economy*, D.Van Nostrand Co., New York, 1964.
2. Chapman, J.D.: *Geography of Energy*, Longman, London, 1989.
3. Gregor, H.F.: *Geography of Agriculture*, Prentice Hall, New Jersey, USA, 1970.
4. Griggs, D.B.: *The Agricultural Systems of the World*, Cambridge University Press, 1974.
5. Gordon L Clark, Maryann, P. F and Meric, S.G.: *The Oxford Handbook of Economic Geography*, Oxford University Press, New York, 2000.
6. Hartshorne, T.N. and Alexander, J.W.: *Economic Geography*, Prentice Hall, New Delhi, 1986.
7. Ones, C.F. and Darken Wald, G.G.: *Economic Geography*, McMillan Co., New York, 1986.
8. Millar E.: *Geography of Manufacturing*, Prentice Hall, New York, 1962.
9. Raza. M and Agrawal, Y.: Transport Geography of India, Concept, New Delhi, 1986.
10. Smith, D.M.: *Industrial Location-An Economic Geographical Analysis*, John Wiley, New York, 1971.
11. Thomas, R.S: *The Geography of Economic Activities*, McGraw Hill, New York 1962.
12. Alexander, J.W.: *Economic Geography*, Prentice hall, 1974.
13. Berry, BJL, et al: *Global Economy*, Prentice Hall Englewood Cliffs, New York, 1964.
14. Boesch, H.: *A Geography of World Economy*, D.Van Nostrand Co., New Jersey, 1993.
15. Cyson, J.Henry, N. Keeble D. and Martin, R.: The *Economic Geography Reader*, John Wiley and Sons Ltd, Chichester, 2004.
16. Jons, C. F. and Darenwald, G.G.: *Economic Geography*, McMilan Co. New York, 1975.

GEG: H609 World Regional Geography (Mark: 100)

UNIT-I

Asia -Terrain, pattern, drainage, climate, natural vegetation, soils and spatial distribution of population and economic base of the continent in general; Regional studies of South and South East Asia. (35 marks) 20 periods

UNIT-II

Europe- physical, economic and demographic characteristics of the continent; Regional studies of British Isles and European Union. (20 marks) 15 periods

UNIT-III

North and South America- physical, economic and demographic set up; Regional studies of USA and Brazil. (15 marks) 20 periods

UNIT-IV

Australia and New Zealand and Pacific islands-Physical, economic and demographic set up. (15 marks) 15 periods

UNIT-V

Africa- physical, economic and demographic set up. (15 marks) 15 periods

Suggested Readings:

1. Cole,J: *A Geography of the World 's Major Regions*, Routledge, London, 1996.
2. Cole,J.P.: *Latin America-Economic and Social Geography*, Butterworth USA, 1975.
3. Deblij, H. J. *Geography: Regions and Concepts*, John Wiley, New York, 1994.
4. Dickenson, J.P. et al.: *The Geography of the Third World*, Routledge, London, 1996.
5. Dourou, P.: *The Tropical World*, Longman, London, 1980.
6. Jackson, R.H. and Hudman, L.E.: *World Regional Geography: Issues for Today*, John Wiley, New York, 1991.
7. Kohl, A.: *East Asia-Geography of a Cultural Region*, Methuen, London, 1977.
8. Minshull, G.N.: *Western Europe*, Hoddard & Soughton, New York, 1984.
9. Patterson, J.H.: *Geography of Canada and the United States*, Oxford University Press, 1985.
10. Songquiao,Z.: *Geography of China*, John Wiley, New York, 1994.
11. Ward, P.W. and Miller,A.: *World Regional Geography: A Question of place*, John Wiley, New York, 1989.

GEG: H610P **Cartography-VI** (Marks: 100)

UNIT-I

Dumpy level for preparation of road profile and contouring and Theodolite for measurement of heights and distances. (20 marks)

UNIT-II

Remote sensing: orientation of aerial photographs under mirror stereoscope, determination of photo scale, identification of objects from the aerial photographs, preparation of base map from the aerial photographs, visual interpretation of satellite imagery for drainage and land use mapping, introduction to GIS and GPS, Cartography and its history. (25 marks)

UNIT-III

Field work and field report under the guidance of teachers: select any area near the institution or elsewhere, collect toposheets of the area 1:50,000 scale or satellite image, visit the area and identify the land forms, settlement, land use features and compare the same with the topo sheets and/or satellite image, draw sketches and maps of the selected area; conduct field survey and prepare field report. (40 marks)

Record Book (7 marks)
Viva Voce (8 marks)

Suggested Readings:

I. American Society of Photogrammetry: *Manual of Remote Sensing*, ASP, Falls Church, V.A.1983.
2. Baeet E.C. and Curtis: *Fundamental of Remote Sensing and Air Photo Interpretation*, McMillan, New York, 1992.
3. Jeffrey, S and John E.: *Geographic Formation System-An Introduction*, Prentice Hall, New Jersey, 1990.
4. Jones, P.A: *Field work in Geography*, Longman, London, 1968.
5. Luder D: *Aerial Photography Interpretation: Principles and Applications*, McGraw-Hill, New York 1959.
6. Monkhouse, F.J.: *Maps and Diagrams*, Methuen, London 1967
7. Nag.P: *Thematic Cartography and Remote Sensing*, Concept Publication, New Delhi, 1953.
8. Raize ,I: *Principles of Cartography*: Mc GrawHill, New York, 1982.
9. Kanitkar, T.P.: *Surveying and Levelling*, Roorkee University, Roorkee, 1965.
10. Robinson A.H. and Sale R.D.: *Elements of Cartography*, John Wiley, New Jersey, 1953.
11. R.L. Singh: *Elements of Practical Geography*.
12. Stoddard R.H.: *Field Techniques and Research Methods in Geography*.
13. R.P. Mishra: *Fundamental of Cartography*.

viii. B.A. SYLLABUS OF HISTORY

SEMESTER-I

HIS: E101 History of Ancient India

Full mark-100; Pass marks-40

Unit	Topic/Area of Study	Marks allotted & time required
UNIT-I	Sources- Archeological and Literary ; Pre- Historic India- Paleolithic, Mesolithic and Neolithic cultures	20 marks; 15 hours
UNIT-II	Harappan culture and Vedic civilization- Early and Later	20 marks; 15 hours
UNIT-III	India in the 6th century BC: The sixteenth Mahajanapadas and rise of Magadha; Religious Reform Movements –Buddhism and Jainism	20 marks; 15 hours
UNIT-IV	Foreign Invasions-Persian and Greek; Maurya Empire	20 marks; 15 hours
UNIT-V	Gupta Empire-Rulers & their Achievements; Harsha & his times	20 marks; 15 hours

Recommended Reference Books

1. REM Wheeler; The Indus Civilization, Cambridge
2. Romila Thappar; History of India Vol- I
3. R.S. Tripathi; Histoy of Ancient India
4. R.C. Majumdar, H.C. Raichaudhari, K.K. Datta; An Advanced History of India
5. S. N. Sen; Ancient History and Civilization
6. R.C. Majumdar, Ancient India
7. S.N. Sen; Ancient Indian history And civilization

SEMESTER -II

HIS: E202 History of Medieval India

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Sources: Archeological and Literary sources; Early Medieval Indian kingdoms; tripartite Struggle	20 marks; 15 hours
UNIT- II	Early Muslim invasions; Foundation of Delhi Sultanate and Rise of Provincial Kingdoms;	20 marks; 15 hours
UNIT- III	Mughal Empire and Rise of Marathas;	20 marks; 15 hours
UNIT- IV	Rise of Regional States- Rajput states, Bengal, Hyderabad, Mysore and Punjab	20 marks; 15 hours
UNIT- V	Life in Medieval India – Religious Movements (Sufism & Bhakti); Birth of Indo- Islamic Cultures;	20 marks; 15 hours

Recommended Reference Books

1. Habib, Irfan (ed), Medieval India- Research in the History of India 1200-1750 (Delhi 1992)
2. Habib, Md. Politics and Society in the Early Medieval period, Vol. I & II Delhi, pptt, 1974.
3. Habib, Md & K.A.Mizami (ed.) Comprehensive History of India Vol. V, Delhi (pptt. 1987)
4. Moreland, W.H. Agrarian System of Moslem India, Second Edn., Delhi, Oriental Book.
5. Satish Chandra, Medieval India, (Part-I:Delhi Sultanate) Har Anand (publ.), Delhi, 1977.
6. R.P. Tripathi: Some Aspects and Muslim Administration.
7. Yusuf Husain: Some Aspects of Medieval Indian Culture.
8. Satish Chandra: Medieval India, From Sultanate to the Mughal empire;

SEMESTER III

HIS: E303 History of Modern India (1600-1857)

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	European Commercial Interest: A. The Portuguese; B. The Dutch; C. The English & The French.	20 marks; 15 hours
UNIT- II	British Annexation and Consolidation: A. Occupation of Bengal; B. Carnatic Wars; C. Relations with Bengal, Marathas & Sikhs.	20 marks; 15 hours
UNIT- III	British Expansionist Policies: A. Subsidiary Alliance; B. Doctrine of Lapse.	20 marks; 15 hours
UNIT- IV	Structure and Administrative Organization of the Company: A. Regulating Act; Pitts India Act, 1784; Charter Acts (1793, 1813, 1833 & 1853); B. Civil Services, Army & Police; C. Judicial Organization.	20 marks; 15 hours
UNIT- V	Revolt of 1857: A. Causes; B. Courses; C. Impact.	20 marks; 15 hours

Recommended Reference Books

1. H. Dodwell, Cambridge History of India, Vol. V, CUP, London, 1936.
2. B.B. Misra, The Administrative History of India, Oxford, 1970.
3. P.E. Roberts, History of British India, London, 1970.
4. B.L. Grover & S. Grover, A New Look on Modern Indian History, Sultan Chand & Company Ltd., New Delhi, 1990(reprint).

Honours Supportive Course I (Semester III)

HIS: HSC I Selected Topics on History of Ancient & Medieval India

Full marks-100; Pass marks-35

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	India in the 6th century B.C.: Period of Mahajanapadas and Rise of Magadha;	20 marks; 15 hours
UNIT- II	Rise and fall of Mauryan Empire: Chandragupta, Ashoka and decline of Maurya Empire	20 marks; 15 hours
UNIT- III	Gupta Empire: Golden Age and downfall; Harsha's Empire	20 marks; 15 hours
UNIT- IV	Delhi Sultanate: Muhammad Ghori, Alauddin khalji, Muhammad Bin Tughlaq and downfall of Delhi Sultanate	20 marks; 15 hours
UNIT- V	Mughal Empire: Babur, Sher Shah, Akbar and downfall of Mughal Empire	20 marks; 15 hours

Recommended Reference Books

1. R.C. Majumdar, H.C. Raichoudhuri, KK Dutta: An Advance History of India
2. R.S. Tripathi: History of Ancient India
3. R.C. Majumdar: Ancient India
4. Habib, Muhammad and K.A. Nizami (ed.) Comprehension History of India Vol-V
5. R.P. Tripathi: Rise and fall of the Mughal Empire
6. Satish Chandra: Medieval India from Sultanate to the Mughals (Part I & II)

Semester-IV

HIS: E 404 History of Modern India (1789-1945)

Full marks-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	French Revolution: Emergence of Republic; The Reign of Terror; The Directory (1795-1799)	20 marks; 15 hours
UNIT- II	Emergence of Napolean Bonaparte; Expansion, Consolidation & Downfall and Congress of Vienna, 1815.	20 marks; 15 hours
UNIT- III	Social & Political Development (1815-1848): Metternich-Forces of Conservatism, Parties of the old hierarchies, Revolutionary Movements of 1830 and 1848.	20 marks; 15 hours
UNIT- IV	Unification of Italy and Germany; Making of National States, Liberalism and Democracy in Britain.	20 marks; 15 hours
UNIT- V	Europe in the I & II World Wars: Power blocks & Alliance, and World War-I; Fascism and Nazism; Origins of the World War-II.	20 marks; 15 hours

Recommended Reference Books :

1. Hobsbawn, E.F. : Nation and Nationalism
2. Lefeover, George: Coming of the French Revolutions (Princeton University Press, 1989)
3. Locus, Colin: The French Revolution and making of modern political culture Vol.2 (Pergamon, 1988)
4. Evan J.: The Foundation of a modern state in Europe
5. Carlton J.H.Hayes: Modern Europe to 1870
6. Carlton J.H.Hayes: Contemporary Europe Since 1870
7. David Thompson: Europe Since Napolean
8. J.R. Marriot: A History of Europe
9. E. Lipson Europe in the 19th and 20th Centuries (1815-1939), ELBS, 1960
10. Grant and Templary: Europe in the Nineteenth and Twentieth Centuries

Honours Supportive Course II (Semester IV)

HIS: HSC 11 Indian National Movement

Full marks-100; Pass marks-35

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Emergence of Indian Nationalism: Factors of Indian Nationalism, Early Associations	20 marks; 15 hours
UNIT- II	Indian National Congress: Foundation and early phase (1885-1905)	20 marks; 15 hours
UNIT- III	National Movement: Swadeshi Movement, Non-cooperation Movement, Civil Disobedient Movement, Quit India movement	20 marks; 15 hours
UNIT- IV	Communalism in Indian National Movement: Genesis and Muslim League	20 marks; 15 hours
UNIT- V	Independence of India and Partition	20 marks; 15 hours

Recommended Reference Books

1. R.C. Majumdar, H.C. Raichoudhuri, KK Dutta: An Advance History of India
2. Bipin Chandra & others, India's struggle for Independence, New Delhi, 1998
3. B.R. Nanda, Essays in Indian Nationalism, New Delhi, 1978
4. R.P. Dutt, India Today, Calcutta, 1999
5. Sumit Sarkar, Modern India, New Delhi, 1983

SEMESTER V

HIS: H505 **History of Ancient India from the 6th Century B.C. to 12th Century A.D.**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Period of Mahajanapadas: Rise of Magadha, Republics and Monarchies; Iranian and Macedonian invasions and their impact.	20 marks; 15 hours
UNIT- II	Foundation of the Mauryan Empire: Chandragupta Maurya to Ashoka; Dharma of Ashoka; Mauryan Administration; Decline of the Mauryas.	20 marks; 15 hours
UNIT- III	The Kushans; the Sungas and Satavahanas; the Gupta Empire, Harshavardhan.	20 marks; 15 hours
UNIT- IV	Chalukyas, Pallavas, Rastrakutas, Cholas, Gujara Pratihara and Palas.	20 marks; 15 hours
UNIT- V	Arab conquest of Sind	20 marks; 15 hours

Recommended Reference Books :

1. R.S. Sharma, Ancient India's Past
2. Romila Thappar, History of India Vol. I
3. R.S. Tripathi, History of Ancient India
4. S.N. Sen, Ancient India History and Civilization
5. B.G. Gokhale, Ancient Indian History and Cultural, Bombay, 1974
6. S.G. Malik, Indian Civilization, Simla, 1968
7. K.M. Panikar, a Survey of Indian History, Bombay, 1974
8. A.L. Basham, the Wonder that was India, London, 1968
9. H.C. Raychaudhuri, Political History of India, Calcutta, 1965
10. G.P. Singh, Early Indian Historical tradition & Archaeology
11. R.C. Mazumdar, Rigvedic Age
12. R.C. Mazumdar, Ancient India
13. K.A.N. Shastri, A History of south India

HIS: H506 **History of Mughal India 1526-1707**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	A brief survey of source material; Political conditions of North India in 1526; Babur and the establishment of the Mughal Empire; Humayun and his difficulties; Sher Shah and his administration.	20 marks; 15 hours
UNIT- II	Akbar: Early problems and difficulties, regency of Bairam Khan; Rajput Policy; Religious Policy.	20 marks; 15 hours
UNIT- III	Jahangir: Accession, Court Politics, Religious Policy, Relations with Rajputs; Shahjahan: Expansion in the Deccan, relations with Central Asia and Iran.	20 marks; 15 hours
UNIT- IV	Aurangzeb: the War of Succession, Religious policy, Policy towards the Rajputs, the Deccan policy, Rise of the Marathas, Marathas-Mughal Struggle.	20 marks; 15 hours
UNIT- V	Mughal Administration, factors responsible for the decline of the Mughal Empire.	20 marks; 15 hours

Recommended Reference Books :

1. R.P. Tripathi: Rise and fall of the Mughal Empire
2. Anirodha Roy: Some Aspects of Mughal Administration
3. Mohibbul Hasan: Babur, the Founder of Mughal Empire
4. Habib, Irfan: Agrarian System of Mughal India, 1526-1707 (Mumbai, Asia, 1963)
5. V.A. Smith: Akbar the Great
6. K.A.Nizami: Akbar and Religion
7. S.R. Sharma: Religious Policy of the Mughal Emperors
8. Satish Chandra: Medieval India, From Sultanate to the Mughals Part-II, the Mughal (1526-1750), Delhi

HIS: H507 **History of Indian National Movement (1885-1947)**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Emergence of Indian Nationalism: A. Growth of New Ideas; B. Factors of Indian Nationalism C. Growth of Associations	20 marks; 15 hours
UNIT- II	The Early Phase: A. Foundation of Indian National Congress B. The Moderates and the Extremists	20 marks; 15 hours
UNIT- III	Protest and Communalism: A. Partition of Bengal & Swadeshi Movement B. Communalism-its genesis C. Home Rule Movement	20 marks; 15 hours
UNIT- IV	Gandhian Era: A. Khilafat B. Non- Cooperation C. Civil Disobedience	20 marks; 15 hours
UNIT- V	The Last Phase: A. Quit India B. INA C. Partition	20 marks; 15 hours

Recommended Reference Books

1. Bipan Chandra & Others, India's Struggle for Independence, New Delhi, 1998
2. B.R. Nanda, Essays in Indian Nationalism, New Delhi, 1978
3. R.P. Dutt, India Today, Calcutta, 1999
4. Sumit Sarkar, Modern India, New Delhi, 1983

SEMESTER VI

HIS: H608 **History of Manipur From 33 A.D. to 1891 A.D.**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Sources of History: 1. Pre and Proto-History of Manipur 2. Literary Sources 3. Historiography	20 marks; 15 hours
UNIT- II	Evolution and expansion of Kingdom: 1. Nongda Lairen Pakhangba 2. Kiyamba 3. Khagemba	20 marks; 15 hours
UNIT- III	Sanskritization: 1. Garibniwaz 2. Bhaigachandra	20 marks; 15 hours
UNIT- IV	Establishment of relationship with British: 1.Treaty of 1762 2. 7 year Devastation 3. Establishment of Political Agency	20 marks; 15 hours
UNIT- V	Anglo-Manipur War 1891	20 marks; 15 hours

Recommended Reference Books

1. L. Kunjeswori Devi; Archaeology of Manipur
2. Lal Dena Edt.: History of Modern Manipur, 1826-1949
3. Gangmumei Kamei; History of Manipur in Pre-colonial period
4. N. Joykumar Singh; Colonialism to Democracy, History of Manipur-1819-1972
5. R.K. Jhalajit Singh; A Short History of Manipur
6. J.Roy; History of Manipur
7. Lal Dena; British Policy towards Manipur: 1762-1947

HIS: H609 **South-East Asia, 1800-1945**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	Contact with the West: 1. Land and people; 2. European Interests 3. Patterns of European settlement	20 marks; 15 hours
UNIT- II	Anglo-Dutch Imperialism: 1. Dutch colonial interest in Java-culture system and ethical policy 2. British policy in Malaysia; 3. Anglo-Burmese relation	20 marks; 15 hours
UNIT- III	Spanish, USA and French colonial expansion: 1.Philippines: From Spanish to American rule 2. French colonial expansion in Laos, Cambodia and Indo-china (Vietnam) 3. French colonial administration in indo-China	20 marks; 15 hours
UNIT- IV	Thailand's resurgence: 1. Internal developments; 2. Revolution of 1932 and its impact; 3. Modernization and westernization	20 marks; 15 hours
UNIT- V	Growth of nationalist movements: 1. Filipino nationalist movement; 2. Burmese nationalism between the wars 3. Beginnings of nationalist agitation in Indo-China (Vietnam); 4. Political Movements in Indonesia	20 marks; 15 hours

Recommended Reference Books

1. John F. Cody; South Asia: Its historical development
2. D.G.E. Hall; Southeast Asia
3. D.R. Sardesai; Southeast Asia, Past and Present
4. Brian Harrison; A Short History of Southeast Asia
5. D.J.M.; The making of Southeast Asia
6. Mukherjee; Southeast Asia
7. Rich and Allen; An Introduction to the History of Politics of Southeast Asia
8. Housraj; A History of Southeast Asia

9. Cambridge; Cambridge History of Southeast Asia Vol-II
10. Harold C. Vinacke; A History of far east in Modern Times (Relevant Chapters on Southeast Asia)

HIS: H610 **History of America/USA (1776-1945)**

Full mark-100; Pass marks-40

Unit	Topics/Area of study	Marks allotted & time required
UNIT- I	American Revolution: Colonial background sources of conflict, revolutionary groups and ideological basis; and war of Independence	20 marks; 15 hours
UNIT- II	Making of the Constitution	20 marks; 15 hours
UNIT- III	Sectional conflict and civil war: Emancipation of slavery	20 marks; 15 hours
UNIT- IV	Reconstruction: Presidential; Radical and Congressional plans; the emergence of New South	20 marks; 15 hours
UNIT- V	America between I & II World Wars; economic Depression and the New Deal; Entry into world war-II and its consequences	20 marks; 15 hours

Recommended Reference Books

1. Beard, Charles, An economic Interpretation of the Construction of the United State (Free Press 1986)
2. Bojer, Paul, Havand stikoff; Nancy…… Et.al The Enduring Vision: A History of the American people Vol-I and II
3. Hofstadter, Richard, The Age Reform, from Bxyan to FDR (Randeom, 1960)
4. Krisol, Irerny, Godon wood et.al. American continuing Revolution (An Enterprises, 1975)
5. Randall, James et.al. The civil war and Reconstruction (Health and ….)
6. Tripathi, Devijendra and SC, Tiwari, Themes perspective of American History
7. Hick, John, D. The Federal Union: A History of USA since 1865
8. Henry Bamford Parkes: The United States of America.

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ix. B.A./B.Sc. SYLLABUS OF MATHEMATICS

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	Full Marks/ Pass Marks	Time required (Hours)
1	MAT: E101	Algebra - I (Classical Algebra, Modern Algebra), Trigonometry	100/40	75
2	MAT: E202	Calculus and Ordinary Differential Equations	100/40	75
3	MAT: E303	Vector, Geometry and Probability	100/40	75
	MAT: HSC I (non-credit)	Algebra- abstract, linear; real, numerical analysis; logic; C- programming	100/35	65
4	MAT: E404	Mechanics - Dynamics, Statics, Rigid Dynamics	100/40	75
	MAT: HSC II (non-credit)	Partial differential equation, Laplace transform, metric space, complex analysis, spherical trigonometry	100/35	65
5	MAT: H505	Abstract Algebra and Linear Algebra	100/40	75
	MAT: E506	Analysis - I (Real Analysis)	100/40	75
	MAT: H507 MAT: H507P	Numerical Analysis and Computer Programming in C Practical	80/32 20/8	75
6	MAT: H608	Partial Differential Equations, Laplace Transform, Calculus of Variation	100/40	75
	MAT: H609	Analysis – II (Metric Space & Complex Analysis)	100/40	75
	MAT: H610	Optional Papers: Higher Mechanics Fluid Mechanics Probability Theory Cryptography Spherical Trigonometry and Astronomy Computational Mathematics Laboratory Special Theory of Relativity & Tensors	100/40	75
	12 Papers		1200	

*E for Elective; H for Honours; P for Practcal; HSC for Honours Supportive Course

SEMESTER-I

MAT: E101 **Algebra - I (Classical Algebra, Modern Algebra), Trigonometry**

Full Marks: 100

Unit – I: ***Inequalities (10 Marks)***

Geometric Mean and Arithmetic mean, Cauchy-Schwarz, Holder's and Minkowski's inequalities. (6 lectures)

Theory of Equations (15 Marks)

Polynomial, Descartes rule of signs, Fundamental theorem of Algebra (Statement only), Relation between roots and coefficient, Symmetric functions of roots, Transformation of

equations, Solution of cubic equations by Cardan's method and biquadratic equations by Ferrari's method and Euler's method. (12 Lectures)

Unit - II

Convergence of Series (15 Marks)

Infinite series-definitions, Cauchy's general principle for convergence, Geometric series, some useful theorems on series of positive terms, Comparison test of convergence, convergence and divergence of p-series, Cauchy's root test, D'Alembert's ratio test, Raabe's test, Logarithmic test, D'Morgan & Bertrand test, Leibnitz's test for alternating series. Conditional and Absolute convergence. (Ref. Ch. XIV [6], Ch. 4[2]) (12 Lectures)

Unit-III

Abstract Algebra (25 Marks)

Mappings, Equivalence relations and partitions, equivalence classes, Congruence modulo n Group and its elementary properties, Examples of Abelian and Non-abelian groups, Subgroups, Condition for being a subgroup, integral power of an element Order of a group and order of an element of a group, Cyclic groups and generators, Permutation group, product of two permutations Symmetric groups S_1, S_2, S_3, S_n is abelian for and non-abelian for n=3 Cycle notation, Even and odd permutation, Alternating groups, Coset decomposition, Lagrange's theorem Femat's and Wilson's Theorem (Group Theoretic approach), Isomorphism of groups and their elementary properties (i) , (ii) , (iii) is abelian iff G is abelian, (iv) is cyclic iff G is cyclic, (v) is isomorphic if is isomorphic and (vi) (K) is a subgroup if K is a subgroup. Cayley's Theorem (Ref. Ch.2-7[7]), Definition and properties of normal sub-group.

(20 Lectures)

Unit-IV

Matrices (15 Marks)

Some types of Matrices, Elementary operations on matrices, Inverse of a matrix, Linear independence of row and column matrices, Row rank, Column rank and rank of a matrix, Equivalence of column and row ranks, Eigenvalues, eigenvectors and the characteric equation of a matrix, Cayley Hamilton theorem and its use in finding inverse of a matrix. (10 lectures)

Unit-V

Trigonometry (20 Marks)

De Moivre's theorem and its applications, Expansion of trigonometric functions, Exponential values for circular functions, complex argument, Gregory's series, Hyperbolic functions, summation of series including C + iS method, Infinite product. (Sin x and Cosx) (15 Lectures)

RECOMMENDED BOOKS

1. Das and Mukherjee - *Higher Trigonometry,* U.N. Dhur & Sons Pvt. Ltd., Kolkata.
2. Chandrika Prasad - *Algebra and Theory of Equations*, Pothisala Pvt.
3. Burnside and Panton - *The Theory of Equations,* S. Chand & Co., New Delhi.
4. I.N. Herstein - *Topics in Algebra,* John Wiley & Sons, New Delhi.

5. Shanti Narayan & P.K. Mittal : *A Text Book of Matrices*, S. Chand & Co., New Delhi.
6. J,G, Chakravorty & P.R. Ghosh : *Advance Higher Algebra,* U.N. Dhur & Sons Pvt. Ltd., Kolkata.
7. **Joseph A. Gallan :** *Contemporary Abstract Algebra,* Narosa.

REFERENCES

1. John B. Fraleigh - *A First course in Abstract Algebra,* Narosa, Publishing House, New Delhi.
2. Surjeet Singh and Quazi Zameerudin - *Modern Algebra, VIKAS.*
3. K.B. Dutta - *Matix and Linear Algebra,* Prentice Hall of India Pvt. Ltd., New Delhi.
4. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul - *Basic Abstract Algebra,* CUP, Indian Edition.
5. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul - *First Course in Linear Algebra,* Wiley Eastern, New Delhi.
6. H.S. Hall and S.R. Knight - *Higher Algebra,* A.I.T.B.S. Publishers & Distributors,New Delhi.
7. S.L. Loney - *Plane Trigonometry Part I and II,* Macmillan.
8. R.S. Varma and K.S. Shukla - *Text Book on Trigonometry, Pothisala Pvt. Ltd.*
9. S.K. Jain, A. Gunawardena and P.B. Bhattacharya - *Basic Linear Algebra with MATLAB,* Kewy College Publishing (Springer - Verlag), 2001.
10. Frank Ayres (JR) - *Matrices,* Schaum Outline Series.
11. Madhumangal Pal - *U.G. Mathematics,* Asian Books Pvt. Ltd., 2004.
12. S. Bernard & J.M. Child : *Higher Algebra,* A.I.T.B.S., Publishers & Distributors, New Delhi.
13. Pranjal Rajkhowa : *Topics in Degree Mathematics,* Book I and II, Asian Books Pvt. Ltd., New Delhi.
14. Vijay K, Khanna; S.K. Bhambri : *A course in Abstract Algebra,* VIKAS.

SEMESTER-II

MAT: E101 **Calculus and Ordinary Differential Equations** Full Marks: 100

Unit - 1

Differentiation (6 Marks)

Limit and Continuity (using definition) of the functions, Successive differentiation, Leibniz's theorem and its application. (5 Lectures)

Rules of differentiation : (14 Marks)

Rolle's Theorem, Lagrange's and Cauchy's Mean Value theorems, Taylor's and Maclarin's theorem with Lagrange's and Cauchy's form of remainders, Indeterminate forms, L-Hospital's rule, Expansion of standard functions :

e^x , sin x, cos x, log (1+x), $(1+x)^m$, $\sin^{-1}x$, $\cos^{-1}x$, $\tan^{-1}x$. (10 Lectures)

Unit - II

Partial Differentiation : (10 Marks)

Function of Two and three variables, Limit and Continuity for functions of two and three variables, Partial differentiation, succcessive partial differentiations, Euler's theorem on Homogenous functions of two and three variables, Maxima and Minima of functions of two variables. [8 Lectures]

Applications : (10 Marks)

Curvature, radius of curvature for the Cartesian, Parametric, implicit and polar equations, Asymptotes. Length of tangent and normal, sub tangent and sub normal. [10 Lectures]

Unit-III

Integration : (15 Marks)

Integration as the limit of a sum, Fundamental theorem of integral calculus, Definite integrals, Reduction formulae for indefinite and definite integrals, Definition of improper integral, simple properties of Beta and Gamma functions.

Applications : Quadrature and Rectification. [6 Lectures]

Unit -IV

Double Integrals : (15 Marks)

Working knowledge of double integrals, Jacobian, change of variable in double integrals, Application of double integral.

Applications : Volume and surface areas of solid of revolution [15 Lectures]

Unit -V

Equations of First order and First Degree (15 Marks) Exact equations and integrating factors (Rules), Linear equations and equations reducible to linear form, Solutions of simultanous equations of the form , total differential equations of the form : Pdx+Qdy+Rdz=0, method of solutions and their geometrical interpretations, orthogonal trajectory.

Equations of the First order but not of First Degree

Equations solvable for x, y, p and Clairaut's equation, Singular solutions [15 Lectures]

Linear Second Order Differential Equations (15 Marks)

Second order linear differential equations with constant coefficients, Homogeneous linear equations, Complementary functions and particular integrals, Method of variation of parameter Power Series solutions at ordinary and regular singular points.

(10 Lectures)

RECOMMEMDED BOOKS

1. Piaggio - *An Elementary Treatise on Differential Equation and Their Applications,* C.B.S.
   Publishers & Distributors, New Delhi.
2. Das and Mukherjee - *Differential Calculus*, U.N. Dhur & Sons, Kolkata.
3. Das and Mukherjee - *Integral Calculus,* U.N. Dhur & Sons Pvt. Ltd., Kolkata.

REFFERENCES

1. Maity and Bagchi - *Integral Calculus*, *An introduction to Analysis,* New Central-Book Agency, Calcutta.
2. T.M. Apostol - *Calculus, Vulume I and II,* Willey Eastern Ltd., New Delhi.
3. Shanti Narayan - *Integral Calculus*, S. Chand & Co.Pvt. Ltd., New Delhi.
4. Gorakh Prasad - *Integral Calculus,* Pothisala Pvt.Ltd., Allahabad.
5. Gorakh Prasad - *Differential Calculus,* Pothisala Pvt.Ltd., Allahabad.
6. Erwin Kreyszig - *Advanced Engineering Mathematics,* John Wiley *&* Sons.
7. Boyce and Diprima - *Elementary Differential Equations and Boundary Value Problems,* John Wiley & Sons
8. Coddington - *An Introduction to Ordinary Differential Equations and their, Applications, Prentice Hall of India, New Delhi*
9. G.F.Simmons - *Differential Equations,* Tata Mc Graw Hill
10. D.A.Murray,- *Introductory Course in Differential Equations,* Orient Longman(India).
11. Jain and Kaushik - *An Introduction to Real Analysis,* S,Chand & Co. Pvt. Ltd., New Delhi
12. N.Piskunov - *Differential and Integral Calculus,* Peace Publishers, Moscow.
13. Murray R. Spiegel - *Theory and Problems of Advanced Calculus* Schaum's Outline series, Schaum Publishing Co., New York
14. Gabriel Klambaucer - *Mathematical Analysis,* Marcel Dekkar, Inc New York
15. Maity and Gosh - *Integral Calculus,* New Central Book Agency, Kolkata.
16. Pranjal Rajhkowa - *Topics in Degree Mathematics*, Book II, Asian Books Pvt., Ltd., New Delhi.
17. Bhamra KS & Ratna Bala - *Ordinary Differential Equations*, Allied Publishers Delhi.

SEMESTER - III

MAT: E303 **Vector, Geometry and Probability** Full Marks 100

Unit-I

Vector Analysis (20 Marks)

Scalar and vector product of three and four vectors, reciprocal vectors, Differetiation of vectors, Gradient, Divergence and Curl of a vector, vector integration, ordinary integrals of vectors, Line, Surface and Volume integrals, theorems of Gauss, Green, Stokes and related problems. [12 Lectures]

Unit-II

Two dimensional Geometry (30 Marks)

Change of axes: Change of origin without changing the direction of axes. Change of direction of axes of co-ordinates without changing the origin.

Pair of Straight lines: Pair of straight lines, homogeneous equation of second degree, Angle between the pair of lines given by the homogeneous equation, Bisectors of the angles between the pair of lines, Condition for the general equation of second degree represents a pair of straight lines, Point of intersection, Equation of the pair of lines joining the origin to the points of intersection of the line and a curve.

System of Conics: Every general equation of second degree in two variables always represents a conic section, The centre of a conic, Reduction of the general second degree equation into a central and non-central conics, Condition that a line is a tangent to a conic, Chord of contact, pole and polar, Diameter, conjugate diameters, feet of normals, Intersection of two conics, Pair of tangents.

Confocal Conics and their Properties

Polar equation of conics: Polar equation of a conic with respect to focus as pole, equation of a chord, tangent and normal. [21 Lectures]

Unit-III

Three Dimensional Geometry (20 Marks)

Sphere: Equations of sphere, condition for the general equation of second degree to represent a sphere, plane section of sphere, intersection of a plane and a sphere, intersection of two spheres, power of a point, equation of a tangent plane, condition for a plane to be a tangent plane to a sphere, plane of contact, polar plane, pole of a plane.

Cone: Equation of a cone with a conic as guiding curve, enveloping cone of a sphere, quadratic cones with vertex at origin, condition for the general equation of second degree to represent a cone, reciprocal cone, right circular cone.

Cylinder: Equation of cylinder, enveloping cylinder, right circular cylinder.
Central coincoids: Equations and properties of coincoids, intersection of a line with a conicoid, Tangent line and plane, normal, number of normals from a given point, plane of contact. Polar plane of a point, enveloping cone and cylinder, chord, conjugate diameters. *Paraboloids:* Equations and simple properties. *Confocal conicoids:* Equations and simple properties. [18 Lectures]

Unit-IV

Theory of Probability **(30 Marks)**

Random variables, probability distribution,: Binomal distribution, Gamma distribution, Beta distribution, Poisson, Geometric, rectangular, exponential, normal. Expectation and moments, marginal and conditional distributions, characteristic functions, probability inequalities (Tchebychev), Weak and strong convergence of random variables, convergence in probability.

Chebychev's inequality, weak law of large number, Idea of central limit theorem, De moivre's, Laplace theorem, Liapunov's theorem (without proof) and application of CLT. [24 Lectures]

RECOMMENDED BOOKS

1. B. Das-Analytical Geometry with Vector Analysis, Orient Book Company, Kolkata.
2. Shanti Narayan and P.K. Mittal-Analytical Solid Geometry, S. Chand.
3. M.R. Spiegel-Vector analysis and an introduction to tensor analysis-Schaum series.
4. Vector Analysis by Maity & Ghosh.

REFERENCES

1. S.L. Loney: Co-ordinate geometry of two dimensions, Macmillan and Sons Pvt. Ltd.
2. R.J.T. Bell: Co-ordinate geometry of three dimensions, Macmillan and Sons Pvt. Ltd.
3. Ross S.M.(2007): Introduction to Probability Models, 9th edition, Indian Reprint, Academic Press.
4. Goon A.M., Gupta M.K. and Dasgupta B.(2003): An outline of statistical theory, vol.1. 4th edition, World Press, Kolkata.
5. Rohatgi V.K. and Saheh A.M. (2009): An introduction to probability and statitics, 2nd ned, John Wiley and Sons.
6. Hogg K.V., Craig A.T. and Mekean J.N.(2009): Introduction to mathematical statitics, 6h ed, Pearson Education.

7. Johnson N.L., kotz S. and Blakrishna N(1994): Discrete univariates Distributions, John Wiley.
8. Probability and staticstics by D. Biswas.
9. Probability and staticstics by J.N. Kapoor.

MAT: HSC I (Semester III)

Full Mark:100

UNIT-I: Abstract Algebra 20 Marks (15 Lectures)

Cosets (definition : right cosets and left cosets), Normal subgroups, Normalizer, Centralizes, Quotient Groups, Homomorphism and Isomorphism of groups, Kernel of Homomorphism, Conjugate of the element, Self conjugate of elements, Automorphisms of group.

UNIT-II: Linear Algebra 20 Marks (15 Lectures)

Concept of vector space over a field, n-tuple space, subspaces, necessary and sufficient conditions for being a subspace, subspace generated by a subset.

UNIT-III: Fundamentals of Real Analysis 20 Marks (15 Lectures)

Basic properties of real numbers: Field properties, order properties, completeness property, Archimedian property, Dedikind's construction of system of the real number, countable and uncountable sets, bounded sets and their bounds, open sets and closed sets, limits of sequence and Cauchy's criterion for convergence, monotonic sequence, infinite series and power series, limit and continuity of functions (examples), Heine Borel Theorem, Bolzano Weierstrass Theorem, Nested Interval Theorem.

UNIT-III: Elementary Logic 10 Marks (10 Lecture)

Sentences and Statements, Negation of a statement, Truth values of statements and Truth tables, Truth table for q^p, qÅp, q=>p, (q=>p)^(p=>q), Tautology, logically true statement, logically equivalent statement.

UNIT-IV: Numerical Analysis 10 Marks (10 Lecture)

Basic property of finite differences theory, difference formulae, operators E and ", separation of symbols and their properties, method of constructing a difference table, meaning of interpolation and numerical integration.

UNIT-V: Computer C-programming: 10 Marks (15 Lecture)

Basic model of a computer, algorithm, flow chart, data representation, data coding, data types, number systems, conversions, basic input/output statements, simple C-programs.

Recommended Books:

(1) Matrix and linear algebra, K.B. Dutta, Practice Hall of India Pvt. Ltd
(2) Mathematical analysis, S.C Malik and Savita Arora.
(3) Set Theory and number systems by Gupta and Malik, Rastogy Publications, Meerut.
(4) Programming with C by Venugopal and Prasad, Tata Mc Graw Hill.
(5) Topics in Algebra by I.N Herstein, John Wiley & Son's
(6) Kenneth Hoffman and ray Kunze: Linear algebra (Pearson).

Reference Books:

(1) Fundamental of Real analysis: By V.K. Krishna
(2) S. Kumaresan: Linear Algebra
(3) Surjreet Singh and Quazi Zamerudin: Modern Algebra.

SEMESTER-IV

MAT: E404 **Mechanics (Dynamics, Statics, Rigid Dynamics**) Full Marks 100

UNIT-I

DYNAMICS **(35 Marks)**

Components of velocities and accelerations along, radial and transverse, along tagential and normal (Art[1] 48, 49, 87, 88) Simple Harmonic motions (Art[1] 22-25, Art[2]17.1-17.4. 17.6, 17.7) [7 Lectures]

Dynamics of a particle : Motion on smooth and rough plane curves (Art[1] 14.1, 14.2, 15.1, 15.2, 16.1, 16.2) Motion in resisting medium including projectile, Motion of varying mass (Art[1] 104-112) central orbit, Kepler's Law (Art[1] 53-55, 57, 60, 64-67, 69-70)

[15 Lectures]

Acceleration in different Coordinates system (Art[1] 125-127) [4 Lectures]

UNIT-II

Statics **(35 Marks)**

Parallel forces: Resultant of two parallel forces (3-Art 4.2), unlike parallel forces (3-Art. 4.3), moment of a force, Definition (3-Art. 5.1), couples: Definition of moment of couple (3-Art. 6.1), Theorem on moment of forces (3-Art. 6.2), Resultant of a couple and a force (3-Art. 6.8). Equilibrium of three coplaner forces (3-Art 8.1), Any system of coplaner forces (3-Art 8.3). Catenary: Freely suspended thin, perfectly flexible string lines (3-Art 14.2). Geometrical properties of common Catenary (3-Art 14.3), Tension of the Catenary (3-Art 14.4), Finding the parameter of a Catenary for a uniform string (3-Art 14.5).

[14 Lectures]

Forces in 3-dimension (5-Art 14.1), Conditions of equilibrium (5-Art 14.2), Pointsot's central axis (5-Art 14.3), Null points, lines and planes (5-Art. 14.6), Stable, Unstable and Neutral equilibrium (3-Art 11.4). [12 Lectures]

UNIT-III

Dynamics of Rigid Bodies **(Marks 30)**

Moments and products of inertia (Art[1] 144-149), Momental Ellipsoid (Art[1] 151) Equimomental systems, Principal Axis (Art[1] 154, 155) [7 Lectures]

D'Alembert's Principle, Equations of motion of rigid bodies, Motion of centre of inertia, Motion relative to centre of Inertia (Art[1] 162) [7 Lectures]

Motion about a fixed axis (Art[1] 168-171), Compound Pendulum (Art[1] 173-175), Motion in 2 dimension under finite and impulsive forces (Art[1] 187-190), Conservation of momentum and Energy. (Art[1] 235, 236, 238, 239, 242) [9 Lectures]

RECOMMENDED BOOKS

1. S.L. LONEY: An elementary treatise on dynamics of particle and of rigid bodies. Cambridge university press 1956, reprinted by S. Chand & Company (P) Ltd. 1988.
2. DAS & MUKHERJEE: Dynamics published by S. Chand & company (P) Ltd, 2010 ISBN-81-85624-96-8.
3. DAS & MUKHERJEE: Statics published by S. Chand & company (P) Ltd. 2010, ISBN-81-85624-18-6.
4. S.L. LONEY: An Elementary treatise on Statics published by A.I.T.B.S., New Delhi, 2004 ISBN-81-7473-123-7.
5. A.S. RAMSEY: Statics, CBS Publishers and Distribution, Shahdara, New Delhi-110032, India.

REFERENCES

6. M.RAY and G.C. SHARMA: A Textbook of dynamics published by S. Chand & company (p) Ltd., 2008 (Chapter 1, 2, 6, 8, 9, 11, 12), ISBN-81-219-0342-4.
7. R.S. VERNA: A Text Book on Statics Pothishala Pvt Ltd., Allahabad.
8. A.S. RAMSEY: Dynamics Part-I, Cambridge University Press, 1973.

MAT: HSC II (Semester IV)

Full Mark:100

UNIT-I: Partial Differential Equations 20 Marks

Formation of partial differential equations by eliminating arbitrary constants and arbitrary functions.

Concepts of complete integral, particular integral, singular integral and general integral and non-linear partial differential equation of order one.

UNIT-II: Laplace transform: 10 Marks

Concept of transform, definition of Laplace transform, Laplace transform of some elementary functions, definition of inverse Laplace transformation and inverse Laplace transformation of some elementary functions.

Calculus of Variation: 10 Marks

Concepts of variation and its properties, definition of functional, fundamental theorem of calculus of variation, Euler's Equation.

UNIT-III: Metric space: 15 Marks

Definition and examples of a metric space, description of the properties of metric space, open and closed sets in a metric space, neighbourhood, closure, interior and exterior, the Euclidean plane R^2, discrete metric, psedo-metric, distance between two sets, diameter of a set, fundamental inequality, Holder;s Inequality, Cauchy Schwarz Inequality, Minkowski's Inequality (only statements).

UNIT- IV: Complex Analysis: 15 Marks

Limits and continuity, differentiability, construction of a regular function.

UNIT-IV: Spherical Trigonometry Astronomy: 30 Marks

Spherical Triangle, polar triangle, properties of polar and spherical triangle, Sine formula, Cosine Formula, Four park Formula, Sine Cosine Formula, Cotangent Formula, Napier's Analysis.

Recommended Books:

(1) H.T.P. Piaggio: An elementary treaties on Differential equations & Their Applications.

(2) Spiegel: Laplace Transform, Schaum online Series.

(3) P.K. Jain and K. Ahmad: Metric Spaces, Narosa Publishing House, New Delhi P.T.

(4) Spherical Astronomy: M-Ray.

SEMESTER - V

MAT: H505 **Abstract Algebra and Linear Algebra** Full Marks – 100

Unit - I

***GROUPS:* (25 Marks)**

Normal subgroups, Quotient Groups, Homomorphism and Isomorphism of groups, Kernel of a homomorphism, Isomorphism Theorems, Auto-morphisms, Inner Auto-morphism, Auto- morphism groups, Cayley's Theorem, Conjugacy Relation, Conjugate class, Counting Principle and Class Equation of a finite group, Centre of a group, Normalizer, Centralizer and related Theorems, Cauchy's Theorem, Sylow Theorems, p-Sylow subgroups. (Ref. Chapter 2[1]) [20 Lectures]

Unit - II

***RINGS:* (25 Marks)**

Rings, Elementary Properties of Rings, Integral Domains, Division Rings, Fields and related Theorems, Ideals and Quotient Rings, Ideals generated by a subset, Sum of two ideals, Homomorphism and Isomorphism of Rings, Kernel of a homomorphism, Isomorphism Theorems, Maximal Ideal, Principal Ideal, Prime Ideal, Euclidean Rings, Polynomial Rings, Polynomial over the Rational Field, Eisenstein's Irreducibility criterion, Polynomial Rings over Commutative Rings, Unique Factorization Domain.

(Ref. Chapter 3[1]) **[**20 Lectures]

Unit - III

***VECTOR SPACES:* (35 Marks)**

Concept of Vector Space over a Field K, n-tuple space, Subspaces, Necessary and sufficient condition for being a Subspace, Subspace generated by a Subset, Sun as Direct sum of Subspace, Linear Span, Linear Dependence, Linear Independence and their basic properties, Basis, Dimensions, Finite Dimensional Vector Spaces, Existence Theorem for Basis, Complement of a Subspace and Existence of a Complement of a Subspace of a Finite Dimensional Vector Space, Dimension of sum of Subspaces, Quotient Space and its Dimension, Linear Transformation, Kernel of a Linear Transformation, Isomorphism, Isomorphism Theorem, Representation of Linear Transformation as matrices, Algebra of Linear Transformations, Rank and Nullity of a Linear Transformation, Rank-Nullity

Theorem, Change of Basis, Dual Space, Annihilator of a Subspace, Quadratic and Hermitian Forms. (Ref Chapter 4[1], Chapter 9 and 10[3], Chapter 8 and 9[2]

[30 Lectures]

Unit - IV

INNER PRODUCT SPACES: **(15 Marks)**

Inner Product Spaces, Cauchy-Schwarz Inequality, Orthogonal Vectors, Orthogonal Complements, Orthonormal sets and Orthonormal Basis, Bessel's inequality for Finite Dimesnsional Vector Spaces, Gram-Schmidth Orthogonalization process.

Ref. Chapter 9[3]) [10 Lectures]

RECOMMENDED BOOKS

1. I.N.Herstein: Topics in Algebra, John Wiley & Sons, New Delhi.
2. Kenneth Hoffman and Ray Kunze: Linear Algebra, Pearson.
3. V.K. Khanna & S.K. Bhambri: A Course in Abstract Algebra, Vikas Publishing House Pvt. Ltd., New Delhi.

REFERENCES

1. S. Kumaresan: Linear Algebra, Prentice Hall of India.
2. Vivek Sahai and Vikas Bist: Linear Algebra, Narosa Publishing House, New Delhi.
3. Shanti Narayan & P.K. Mittal: A Text Book of Matrices, S. Chand & Co., New Delhi.
4. Joseph A. Gallan: Contemporary Algebra, Narosa Publishing House, New Delhi.
5. Surjeet Singh and Qazi Zameerudin: Modern Algebra, Vikas.
6. P.B. Bhattacharya, S.K. Jain and S.R. Nagpaul: Basic Abstract Algebra, CUP.
7. John F. Fraleigh: A First Course in Abstract Algebra, Addison Wesley.
8. J.G. Chakravorty and P.R. Ghosh: Advanced Higher Algebra, U.N.Dhur & Sons Pvt. Ltd., Kolkata.
9. Michael Artin: Algebra, Prentice Hall of India Ltd.
10. N. Jacobson: Basic Algebra Vol. I & II, Hindustan Publishing Corporation, New Delhi.
11. K.B. Dutta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Lt.
12. I.S. Luthar, I.B. Passi: Algebra Vol-I(Groups), Vol-II(Rings) and Vol-III(Modules), Narosa Publishing House, New Delhi.

13. D.S. Malik, J.N.Moderson & M.K. Sen: Fundamentals of Abstract Algebra, Mc-Graw Hill International Edition.
14. David S. Dummit, Richard M. Foote: Abstract Algebra, John Wiley and Sons(Asia) Pvt., Ltd, Singapore.
15. S.Lipschutz: Theory And Problems of Linear Algebra, SI(metric) edn., Schuam's Out Series, Mc Graw Hill.
16. Frank ayres: Modern Algebra, Schaum Outline Series, Mc Graw Hill.

MAT: H506 **ANALYSIS - I (REAL ANALYSIS)** Full Marks - 100

Unit-I

Real Number System (sets) **(10 Marks)**

Order completeness in R (statement only); Archimedean property [Ref:- Ch - 4- 4.1, 4.2 [1]] ; Bounded sets and their bounds; Limit points; Bolzano-Weierstrass theorem; open and closed sets and related properties/theorems; Concept of compactness; Heine-Borel theorem [Ref :- Ch. 2 - 1, 1.1 to 3.5, Th. 12[1]]; [Ch 4[2]]; [Ch. 2[3]]. [8 Lectures]

Real Sequence **(10 Marks)**

Bounded sequences, Limit points, Bolzano-Weierstrass theorem, Cauchy sequence; Cauchy's general principle of convergence, convergent sequences and their properties , monotonic sequence and their properties.

Subsequences, lim sup., lim inf., Nested interval theorem; [Ref :- Ch. 3[1]]; [Ch.5[2]]; [Ch.3-3.1 to 3.7[3]] [7 Lectures]

Continuity **(10 Marks)**

Types of discontinuities; Properties of continous functions on a closed interval.

Uniform continuity; [Ref :- Ch. 5[1]]; [Ch. 8[2]]; [Ch. 4 - 4.1 to 4.4[3]]. [7 Lectures]

Unit - II

Riemann Integration **(20 Marks)**

Upper and lower Riemann Integrals (R.I.); Darboux's theorems; Integrability conditions, R.I. as a limit of a sum; Properties; Inequalities for Integrals; Integral function; Mean value theorems. [Ref :- Ch. 9 - 1 to 13, th. 23[1]]; [Ch. 8[2]]; [Ch. 6 - 6.1 to 6.9.2[3]]

[14 Lectures]

Unit - III

***Improper Integrals (*15 Marks)**

Different types of improper integrals; Evaluation, convergence of improper integrals; Beta function, Gamma function; Abel's test and Dirichlet's test, Frullani's Integral.

[Ref :- Ch. 11[1]]; [Ch. 11[2]]; [Ch. 9[3]] [13 Lectures]

Unit - IV

***Functions of Several Variables* (15 Marks)**

Differentiability and differential, Partial derivatives of higher order, Young's and Schwarz's theorems, Differentials of higher order, Functions of Functions, Differentials of higher order of a function of functions; Derivation of composite functions (the chain rules); Change of variables, [Ref :- Ch. 15 [1] ; (Ch. 13 - 13.9, 13.10, 13.13[2]] [13 Lectures]

Unit - V

***Multiple Integrals* (20 Marks)**

Concept of line integrals; Double and repeated integrals; Green's theorem in the plane, evaluation of area, Change of order of integration.

Surface areas; surface integrals; Stoke's Theorem; Volume integrals, Triple integrals; Gauss divergence Theorem and its application. [Ref :- Ch. 17 and 18[1]]; [Ch. 20[2]]; [Ch. 16, 17, 18[3]]

RECOMMENDED BOOKS

1. S.C. Malik and Savita Arora - Mathematical Analysis, New Age International (P) Limited; Publishers, New Delhi.
2. K.C. Maity & R.K. Ghosh - An Introduction to Analysis, Differential Calculus Part I & II, Integral Calculus, Books and Allied (P) Ltd., Kolkata 700009.
3. Shanti Narayan and P.K. Mittal - A Course of Mathematical Analysis, S. Chand & Company Ltd. Ram Nagar, New Delhi - 110055.

REFERENCES

1. Shanti Narayan and Md. Raisinghania - Elements of Real Analysis, S. Chand & Company Ltd., Ram Nagar, New Delhi - 110055.
2. S.L. Gupta & N.R. Gupta - Principles of Real Analysis, Pearson Education (Singapore) Pvt. Ltd., Indian Branch, 482 F.I.E. Patparaganj N.D. - 110092.
3. Shanti Narayan and P.K. Mittal - A Course of Mathematical Analysis, S Chand & Company Ltd. Ram Nagar, New Delhi - 110055.
4. S.K. Jain & S.K. Kaushik - Introduction to Real Analysis, S. Chand & Company Ltd., Ram Nagar, N.D. - 110055.
5. S.K. Sinha - Real Analysis, P.C. Dwadash Shreni & Co (P) Ltd. Publisher & Book Seller's, Bara Bazar, Aligarh - 202001.
6. V.K. krishnan - Fundamentals of Real Analysis, Pearson Education (Singapore) Pte. Ltd., Indian Branch.
7. K.K. Jha - Honours Course in Real Analysis and Convergence, Navbharat Prakashan Patna - 4, Delhi - 6.
8. D. Somasundarum & B. Choudhury - A First Course in Mathematical Analysis, Narosa Publishing House, New Delhi.
9. R.G. Bartle & D.R. Sharbert-Introduction to Real Analysis, John Wiley and Sons (Asia) Pte. Ltd., Singapore.
10. R.R. Goldberg - Method of Real Analysis, Oxford and INH Publishing Co.
11. Murray R Spiegel - Theory and Problems of Advanced Calculus, Schaum Out Line Series Mc Graw Hill Book Company.
12. Frak Aryer Jr. - Theory & Problem of Calculus, Schaum Out Line Series Mc Graw Hill Book Company.

MAT: H507 **NUMERICAL ANALYSIS AND COMPUTER PROGRAMMING IN C**

Full Marks – 100

Unit 1 **(Marks 20)**

Finite difference, relation between the operators, ordinary and divided differences, Newton's forward and Backward interpolation formulae, Newton's divided difference formulae and their properties.

Lagrange's and Hermite's interpolation (Osculating) formulae, Least square polynomial approximation. [15 Lectures]

Unit - II **(Marks 20)**

Numerical differentiation, numerical integration, quadrature formulae, Trapezoidal rule, Simpson's rule. Numerical solution of ODEs using Picard, Euler, Euler's modified, Runge-

Kutta methods. Solution of algebric and transcendential equation using method of iteration and Newton - Raphson method. System of linear agebric equation using Gauss elimination method. [15 - Lectures]

Unit – III (Marks - 20)

Introduction to C-programming: Basic model of a computer, Algorithm, Flow Chart, programming language, Compilers and operating system, character set, identifiers and keyword, Constant, variables and data type, operations and expressions, operator precedence and associativity, Basic input/output statements, simple C-programs.

Conditional statements and loops: Decision making with a program, logical and conditional operators, if statement, nested if else statement, loops, while loop, do-while loop, for loop, nested loops, break statement, switch statement, continue statement, goto statement, the comma operator. [15 - Lectures]

Unit – IV (Marks - 20)

Arrays: One dimensional arrays, declaration and initialization of one dimensional arrays, searching, insertion and delation of an element from an array, sorting an array. Two dimensional arrays.

Function: Defining a function, accessing a function, function declaration/prototype, function parameters, return values, passing arguments to a function, call by a reference, call by value, function calls, recursion, passing arrays to function. [15 Lectures]

Unit - V : Practical (Marks - 20)

Programs for Practical

1. To calculate the compound interest accepting the necessary data from the keyboard.
2. To find the value
3. That will read a positive number from the keyboard and check the number is prime or not.
4. To convert octal to decimal number.
5. To generate prime numbers up to n terms.
6. To find GCD of two given numbers.
7. To find GCD of two given numbers using recursion.
8. To arrange numbers in ascending order and decreasing order.
9. To generate Fibonacci series of numbers up to n terms.
10. To implement selection sort.
11. To implement insertion sort.

12. To find the solution of non-linear equation by (i) Bisection (ii) Secant and (iii) Newton-Raphson method.
13. To find the solution of linear equation by Gauss Elimination method.
14. Numerical Integration (i) Trapezoidal rule and (ii) Simpson's 1/3 rule.
15. Ordinary differential equation (i) Euler's method and (ii) Runge-Kutta method.

INSTRUCTIONS FOR PRACTICAL

Duration - One Hour

(a) Program writing- 5 marks, (b) Output- 10 marks, (c) Viva Voce- 5 marks

RECOMMENDED BOOKS

1. M.K. JAIN, S.R.K Iyenger, R.K. Jain - Numerical methods for scientific and engineering computation, New Age international (P) Ltd.
2. James B. Scarborough - Numerical mathematical analysis, Oxford and IBH publishing Co. Ltd.
3. H.C. Saxena - Finite differences and numerical analysis, S Chand & Co. Ltd., New Delhi.
4. Byron Gottfried, Programming with C, Tata McGraw Hill.
5. E. Balaguruswami, Programming with ANSIC, Tata McGraw Hill.
6. RG Dromey, How to solve it by computer, Prentice Hall of India.
7. Venugopal & Prasad, Programming with C, Tata McGraw Hill.

REFERENCES

1. K.E. Atkinson - An introduction to numerical analysis, John Wiley and Sons.
2. M.K. Jain, S.R.K. Iyenger, R.K. Jain - Numerical method for problems and Solutions, New Age international (p) Ltd.
3. R.Y. Robistein - Simulation and Montecarlo method, John Wiley.
4. C.E. Froberg - Introduction to numerical analysis, Addison Wesley, 1979.
5. A. Kamtham - Programming with ANSI & Turbo C, Pearson Education.
6. B.W. Kernighan and D.M. Ritchie, The Programming Language, Prentice Hall of India.
7. V. Rajaraman, Programming in C, Prentice Hall of India.
8. Robert C Hutchison and Steven B. Just, Programming using C language, Tata McGraw Hill.

SEMESTER - VI

MAT: H608 **Partial Differential Equations, Laplace Transform, Calculus of Variation**

Full Marks – 100

Unit - I

***First order PDE:*(20 Marks)**

Origin of 1st order PDE, Formation of PDE by eliminating arbituary constants and arbitrary functions. Cauchy's problem of First order equation [Ref. Ch-2 (1)]. Definitions of (i) Complete Integral (ii) Particular Integral solvable for y (iii) Singular Integral (iv) General Integral. Equations of 1st order but not of 1st degree (i) Solvable for P (iii) Solvable for x [Ref. Ch - V (2)].

Language's method of solving the linear PDE of order one namely $Pp + Qq = R$, where P, Q, R are functions of x, y, z. Its Geometrical Interpretation. Linear equation with n independent variables [Ref. Ch - XII (2)] [15 Lectures]

Unit - II

***Non-linear PDE of order one* (20 Marks)**

Different Standard Forms (i) Only p and q present (ii) Only p, q and z present (iii) f(x,p) = F (y, q) (iv) Analogous to Clairaut's form. [Ref. Ch - XII (2)].

Partial differential equations of 1st order but of any degree (i) Two independent variables. Charpit's Method (ii) Three or more independent variables, Jacobi's method [Ref. Ch - XIII (2)]. [15 Lectures]

Unit - III

***PDE of second order* (20 Marks)**

Introduction to Higher order PDEs (constant coefficients only): Origin of second order equations [Ref. Ch - 3 (1)]. Solution of Linear Homogenous PDE with constant coeffiecients. To find the complete solution of the equations namely (i) $f(D, D^1)z = 0$ and (ii) $f(D, D^1)z = F(x, y)$. Equations reducible to linear form with constant coefficients [Ref. Ch - 2.9 (4)]. Monge's method of integrating (i) $Rr + Ss + Tt = V$ (ii) $Rr + Ss + Tt + U(rt - S^2) = V$ [Ref. Ch - XIV (2)]. [15 Lectures]

Unit - IV

Laplace Transformation **(20 Marks)**

Definition of Laplace Transformations. Kernel of the Integral transformation [Ref. Ch - 6 (3)]. Existence of Laplace Transformation [Ref. Ch - 8.1 (4)]. Transformation of some elementary functions such as $f(t) = e^{-at}$, Cos at, Sin at, Cosh at, Sinh at, t^n etc. [Ref. Ch 6 (3)].

Properties of Laplace Transformation [Ref. Ch - 6 (3)]. First Translation or Shifting Theorem. Second Translation or Heaviside's shifting Theorem [Ref. Ch - 8.5 (4)].

Differentiation property [Ref. Ch - 6 (3)]. Change of scale property with examples [Ref. Ch - 8.5 (4)]. Laplace Transformation of Derivatives of order n with Theorems [Ref. Ch - 13.6 (5)].

Inverse Laplace transformations. Theorems on multiplication by s and 1/s. First and Second Shifting properties wih examples [Ref. Ch - 13.20 (5)]. Convolution Theorem. Properties of Convolution, examples of Convolution [Ref. Ch - 8.16 (4)].

Application of Laplace Transformation in solving PDE [Ref. Ch - 8.19 (4)]

[15 Lectures]

Unit - V

Calculus of Variation **(20 Marks)**

Fundamental Theorem on Calculus of Variation Definition, Euler's equations, particular cases of Euler's equation [Ref. Ch - 17 (5)]. Necessary condition for extremums. Sufficient condition for extremums of higher order variations [Ref. Ch - 10 (4)]. Legendre condition for extremum (Sufficient condition for extremum with problems) [Ref. Ch - 10.7 (4)].

Brachistochron problems. Extension of the variational case (several dependent variables) with examples. [15 Lectures]

RECOMMENDED BOOKS

1. *Elements of partial differential equations by* IAN SNEDDON: Mc-Graw Hill Internarional editions.
2. *An elementary treatise on differential equations and their application* by H.T.H.PIAGGIO.

3. *Introduction to partial differential equations* by K. Krishna Rao.
4. *Advanced partial differential equations (with Boundary value problems)* by Pundir & Pundir.
5. *Advanced engineering Mathematics* by H.K. Dass.
6. *Partial Differential Equations* by KS Bhamra, PHI Learning Pvt. Ltd, New Delhi, 2010.

REFERENCES

1. W.E. Williams: *Partial differential equations,* Oxford.
2. Phoolan Prasad: *Partial differential equations,* Wiley Eastern, New Delhi (and Renuka Ravindran).
3. Spiegel: *Laplace Transform,* Schuam Outlines Series.
4. L.N. Sneddon: *The use of Integral Transform,* Mc-Graw Hill, New York 1972.
5. *An Introduction to Transform Theory,* Academic Press, New York by D.V. Widder.
6. I.N. Sneddon: *Partial differential equations,* Mc-Graw Hill, New York.
7. KS Bharma & Ratna Bala*: Ordinary Differential Equations, Allied Publishers,* Delhi, 2003.

MAT: H609 **ANALYSIS - II (METRIC SPACE & COMPLEX ANALYSIS)**

Full Marks – 100

Unit -I

***Metric Spaces* (25 Marks)**

Definition and example of a metric space, Diameter and boundedness of sets, Distance between two subsets of a Metric space, Fundamental inequalities (Holder and Minkowski), some function spaces, Subspace of a metric space. Open spheres/balls, Open sets and properties, closed sets, neighbourhood of a point, limit points, adherent Point, Interior, Exterior and Frontier points, closure of a set, Dense subsets. **[Ref: CH.2 [1]]**

[18 Lectures]

UNIT -II

***Complete Metric Spaces* (20 Marks)**

Convergent sequences, Cauchy sequences, Convergence of a Cauchy Sequence, Complete spaces, Examples of complete and in-complete metric spaces, Cantor's intersection

theorem. Continous functions: Characterization of continous functions, Uniform Continuity Homeomorphism. **[Ref: CH 3, 4 [1]]** [13 Lectures]

UNIT - III

***Compactness* (20 Marks)**

Compact metric spaces, Sequential Compactness, Bolzano Weirstrass property, Totally boundedness, Finite intersection property, equivalence among the kinds of compactness. Continous functions and compact sets. **[CH: 5 [1]]** [14 Lectures]

UNIT - IV

***Complex Analysis* (20 Marks)**

Limits and Continuity, Differentiability, The necessary and sufficient condition for a function f(z) to be analytic, Method of constructing a regular function, Polar form of Cauchy-Riemann equations, Complex equations of a straight line and circle. **[CH : 2, 5 [2]]** [18 Lectures]

UNIT - V

***Conformal Mappings* (15 Marks)**

Definition, Jacobian of transformation, Necessary and sufficient condition for w = f(z) to represent conformal mapping, Bilinear transformation and fixed points, Types of bilinear transformation, Preservance of cross ratio, Family of circles and straight lines under bilinear transformation. **[CH : 7,8 [2]]** [12 Lectures]

RECOMMENDED BOOKS

1. P.K. Jain and K. Ahmed: metric spaces, Narosa Publishing House, New Delhi.
2. R.V. Churchil & J.W. Brown: Complex variables and Application (5th Edition) Mc Graw Hill International Editions.

REFERENCES

1. G.F. Simmons: Introduction to Topology and Modern analysis, Tata Mc Graw Hill Education Private Limited, New Delhi.
2. S. Lipchutz: General Topology, Schaum's Outline Series, Mc Graw Hill Company.
3. S.C. Malik, Savita Arora: Mathematical Analysis, New Age International (P) Ltd., (Chapter 19)

4. E.T. Copson: Metric Spaces, Universal Book Stall, 5 Ansari Road, New Delhi-11.
5. H.S. Kasana: Complex Variables (Theory and Applications), Prentice Hall of India, Private Ltd., New Delhi
6. John B. Conway: Functions of One Complex Variable, Narosa Publishing House.
7. L.V. Ahlfors: Complex Analysis, Mc Graw Hill Book Company.
8. Murray R. Spiegel: Complex Variables, Schaum's Outline Series, Mc Graw Hill Book company.
9. Shanti Narayan and P.K. Mittal: Theory of Complex Variables: S Chand And Company Ltd., Ram Nagar, New Delhi.
10. R.K. Ghosh & K.C. Maity: Differential Calculus(an introduction to analysis)Part-II(including Metric Spaces and Complex Analysis) New Central Books Agency (p) Ltd. Kolkata.

MAT: H610

[OPTIONAL PAPER- one of the following Papers must be opted]

1. **HIGHER MECHANICS** **Full Marks – 100**

UNIT - 1

System of Particles **(8 Marks)**

Centre of mass, centre of gravity, momentum, conservation of Linear momentum, Angular momentum, kinetic Energy, conservation of Energy for a system of particles.

[6 Lectures]

UNIT - II

Motion of rigid bodies **(30 Marks)**

Generalized coordinates for rigid body, translational and rotational motion Angular momentum, moments and products of Inertia, Kinetic Energy due to rotation, kinetic energy in terms of inertia tensor, principle axes, Principle moments of inertia, Euler's angle, Euler's geometrical equations, rate of change of vector, coriolis forces, Euler's equation of motions. [20 Lectures]

UNIT -III

Lagrangian Mechanics **(25 Marks)**

Generalized Coordinates, degrees of freedom, generalized force, generalized momenta, Holonomic, non-holonomic, Seleronomic and Rheonomic systems, virtual works, D' Alembert's principal, Kinetic Energy as quadratic functions of generalized velocities, Lagrangian of a force system, Lagrange's Equations of motion. Applications to S.H.M. Compound pendulum, projectile, central orbit, motion of a particle on the Earth's surface.

[20 Lectures]

UNIT - IV

Hamiltonian Mechanics **(25 Marks)**

Configuration space, system point, Hamiltonian of a force system, relation between Lagrangian and Hamiltonian of a system. Hamilton's Principle, Physical significiances of Hamiltonian, Derivation of Hamilton's Principle from Lagrange's Equations and Vice-Versa, Derivation from D' Alembert's Principle, Hamilton's Canonical Equation of motion, advantages of Hamiltonian approach over Lagrangian approach, meaning of Action in Hamiltonian sense, Least action Principle. [20 Lectures]

UNIT - V

Canonical Transformation **(12 Marks)**

Meaning and conditions for a transformation to be canonical, Examples, Lagrange's bracket, Poisson's bracket and their properties, equations of motion in Poisson's bracket.

[10 Lectures]

RECOMMENDED BOOKS

1. S.L. Loney : An Elementary treatise on Dynamics of a particles and rigid bodies.
2. G. Aruldhas : Classical Mechanics, Prentice Hall of India, Private Limited, New-Delhi-2008.
3. H. Goldstein : Classical Mechanics Narosa Publishing House, New Delhi-1985.
4. C.R. Mondal : Classical Mechanics, Prentice hall of India New Delhi.

REFERENCES

1. Murray R. Spiegel: Theoretical Mechanics Mc Graw Hill Book Company, New Delhi.
2. K. Shankara Rao : Classical Mechanics Prentice Hall of India.
3. R.G. Takwale and P.S. Puranik : Introduction to Classical Mechanics, Tata Mc Graw Hill Publishing Company, New Delhi.

2. FLUID MECHANICS Full Marks: 100

Unit 1

***Kinetic* (30 Marks)**

Eulerian and Lagrangian description of fluid motion. Concept of local and connective accelerations. Steady and Non-Steady flows. Stream lines and path lines. Equation of continuity in different froms. Irrotional and Rotational flows. Controlled volume analysis for mass, momentum and energy. Velocity potential. [25 Lectures]

Unit II

***Equation of Motion* (30 Marks)**

Equations of motion-Euleria and Lagragian. Pressure equation, Bernoulli's equation and its applications, Cauchy's integrals. Motion under the action of impulsive forces. Sources, Sinks, Doublets and their Images. [25 Lectures]

Unit III

***Dimensional Analysis* (25 Marks)**

Concept of Geometric, Kinematic and Dynamic Similarities, Concept of Fluid rotation, Velocity, Stream function and Potential function, Potential flows, Elementary flow fields and Principle of superposition. [15 Lectures]

Unit IV

***Vortex Motion* (15 Marks)**

General theorem (vortex motion and its properties), Rectilinear vortices, Motion under circular and rectilinear vortices. [10 Lectures]

RECOMMEDED BOOKS

1. G.K. Batchelor, An introduction to Fluid Mechanics, Cambridge Univ. Press 1967.
2. F. Chorlton, Text Book of Fluid Dynamics, CBS Publication, Delhi 1985.

REFERENCES

1. AJ Chorin & JF Mursden, mathematical introduction to Fluid dynamics 1993.
2. L.D. Landu and F.M. Lifshitz, Fluid Mechanics, Pregmon Press 1985.
3. O'Neil and F. Chorlton, Ideal and incompressible Fluid Dynamics, Ellis Horwood. Ltd. 1986.

3. **PROBABILITY THEORY** **FULL MARKS – 100**

Unit - 1

Continous Probability distributions **(22 Marks)**

Continous probability distributions - uniform, exponential, rectangular, beta gamma distributions, probability generating functions. [17 Lectures]

Unit - 2

Generating functions & Convergene **(22 Marks)**

Moment inequalities-Holder, Minkowsky, Schwarz: Weak and strong convergence of random variables, almost sure convergence, Convergence in r'th mean. [16 Lectures]

Unit - 3

Convergence of distribution functions **(18 Marks)**

weak and complete convergence of distribution functions: probability inequalities: Chebychev, Markov and Jensen. [14 Lectures]

Unit - 4

Normal distribution **(18 Marks)**

Normal distribution as limiting case of binomial distribution, properties of normal distribution, normal probability curve, area under normal curve, Characteristic functions and its properties. [15 Lectures]

Unit 5

Central Limit Theorem **(18 Marks)**

Univariate distribution, Transformation, Bivariate normal distribution and its properties. De Moivre Laplace limit theorem, Liapunov theorem (without proof) and applications of central limit theorem. [13 Lectures]

RECOMMENDED BOOKS

1. B.R. Bhatt, Modern Probability Theory, Wiley Eastern Ltd., 1989
2. P. Mukhopadhyay Theory of Probability, New Central Book, Agency, Kolkata, 2002
3. Kai Lai Chung, A Course in Probability Theory, 3/e. Academic Press, 2001

REFERENCES

4. M.H. Degroot, M.J. Schervish : Probability and Statistics, Addison Wesley, 2001
5. Sheldon Ross, A First Course in Probability, Prentice Hall, New Jersey, 2002
6. William Feller, An Introduction to Probability Theory and Its Applications, Volume 1, John Wiley and Sons, Inc., New York, 1971.
7. A.N. Kolmogorov, Foundations of the Theory of Probability, 2nd ed., AMS, 1997
8. Richard Durrett, Probability: Theory and Examples 2/e, Duxbury Press, 1995
9. JN Kapur & HC Saxena, Mathematical Statistics, S. Chand, 1961

4. CRYTOGRAPHY FULL MARKS – 100

Unit - 1

Prerequisites of Number theory **(22 Marks)**

Prime numbers, format's theorem (without proof), Euler's theorem; Primality test- Methods of Native, Fermat, Miller- Rabin Leonard Adleman and Huang, probability, fast deterministic, number theoretic tests. Chinese Remainder Theorem, discrete logarithms.

[17 Lectures]

Unit - 2

Cryptography & Information Security **(18 Marks)**

Information security, security attacks, services and mechanisms, conventional encryption techniques, substitution ciphers and transportation ciphers, cryptanalysis, sterography, stream and block ciphers. [12 Lecture]

Unit - 3

Block Ciphers and DES **(21 Marks)**

Block cipher principles, Data Encryption Standards (DES), strength of DES, differential and linear cyptanalysis of DES, block ciphers models of operation, triple DES, IDEA encryption and decryption, traffic confidentially, key distribution, random number generation. [16 Lectures]

Unit -4

***Public Key Cyptography* (20 Marks)**

Principles of public key cryptography, prime and related prime numbers, modular arithmetic, key management, authentication, key length and encryption strength, RSA algorithm, security of RSA key management. [15 Lectures]

Unit - 5

***DSS & IP Security* (20 Marks)**

Athentication functions, and message authentication codes, digital signatures, authentication protocols, digital signature standards (DSS) digital signature algorithm. IP security and its overview, intruders, viruses and related threads, firewell design principles

[15 Lectures]

RECOMMENDED BOOKS

1. William Stallings, Cryptography and Network Security, Principles and Practice, Prentice Hall of India, New Delhi, 2007
2. V.K Pachghare, Cyptography and Information Security, PHI Learning (P) Ltd, New Delhi, 2009.

REFERENCES

3. Johannes A. Buchman, Introduction to cyptography, Spiringer Verlag.
4. Bruce Schiener, Applied Cryptography, Addition Wesley, 2001

5. **SPHERICAL TRIGONOMETRY AND ASTRONOMY** **Full Mark-100**

Unit I

***Spherical Trigonometry* (30 Marks)**

Spherical triangle, Polar triangle, properties of Polar and Spherical triangles. Sine formula, Cosine formula, Four parts formula, Sine cosine formula, Cotangent formula, Napier's analogies, Delambre's analogies.

Right angled spherical triangle, Formulae relating to the right spherical triangles, Area of a spherical triangle. Area of a spherical polygon. [20 Lectures]

Unit II

Celestial sphere **(20 Marks)**

Three systems of celestial coordinates. Rectangular coordinates. Sidereal time. Rising and setting of stars. Circumpolar stars. Rate of change of zenith distance and azimuth. Twilight. Motion of the Sun. Vernal and Autumnal Equinox. Summer and Winter Solstice. Different kinds of time. Seasons. [17 Lectures]

Unit III

Refraction, Precession and Nutation **(20 Marks)**

Laws of Refraction. Cassini's hypothesis. Simpson's hypothesis. Bradely's formula. Effect of refraction on (1) sunrise and sunset (2) the right ascension and declination of a star (3) in the distance between two neighbouring stars (4) on the shape of the disc of the sun.

Precession on the right ascensions and declination of a star. Nutation in the right ascension and declination of a star. Precession and nutation both on the right ascension declination of a star. [16 Lectures]

Unit IV

Aberration, Parallax **(20 Marks)**

Annual and diurnal aberration. Annual aberration in (1) ecliptic longtitude and latitude (2) right ascension and declination of a star. Diurnal aberration in (1) hour angle and declination (2) zenith distance and azimuth.

Geocentric parallax and Annual parallax. Geocentric parallax in (1) right ascension and declination (2) the distance between two planets (3) azimuth and zenith distance. Annual parallax in (1) latitude and longtitude (2) right ascension and declination. [16 Lectures]

Unit V

Planetary motion **(10 Marks)**

Synodic and orbital Period. Kepler's laws. Deduction of Kepler's laws from Newton's laws of Gravitation.

RECOMMENDED BOOKS

1. M. Ray : *Spherical Trigonometry*

2. M. Ray : *Spherical Astronomy*
3. K.K. De : *Text Book of Astronomy, Books Syndicate Pvt. Ltd., Kolkata.*

REFERENCES

1. W.M. Smart *: Text Book of Spherical Astronomy,* CUP-VIKAS Student's Edition
2. W.M. Smart *: Foundation of Astronomy,* CUP-VIKAS Student's Edition.
3. Gorakh Prasad *: Text Book on Spherical Astronomy ,* Pothisala Pvt. Ltd., Allahabad
4. Standy P. Wyatt *: Principles of Astronomy* : Allyn and Bacon, Inc

6. COMPUTATIONAL MATHEMATICS LABORATORY FULL MARKS 100

[Theory- 50 marks; Practical - 50 marks]

UNIT -I (20 Marks)

Simple arithmetical operations, varables, roundp-off errors, formatting printing, common mathematical functions, script M-files, File Input-Output. Two-dimensional graphics, three-dimensional graphics [15 Lectures]

UNIT – II (10 Marks)

Generating matrices, colon operator, manipulating matrices, simple arithmetical operations, operator procedure, common mathematical functions, data manipulation commands, sparse matrices. [10 Lectures]

UNIT - III (10 Marks)

Solving linear system of equations-square linear system, Catastrophic round-off error, over determined and undetermined linear system, Initial-valued ordinary differential equations. [12 Lectures]

UNIT – IV (10 Marks)

Programming in MATHLAB-Flow control and logic variables, matrix relational operators and logical operators, function M-files.

UNIT – V: PRACTICAL - 50 MARKS (List of practical topics based on MAT Lab)

1. Plotting of functions
2. Matrix operations, vector and matrix manipulation, matrix function

3. Data analysis and curve fitting
4. Use of FFT algorithm
5. Numerical Integration
6. Differential equations
7. 2-D graphics and 3-D graphics-general purpose graphic functions, colour maps and colour functions.
8. Sparse matrices-Iterative methods for sparse linear equations, eigenvalues of sparse matrices.

Instructions for Practical

Two Programs only (a) Program writing- 10 marks**, (**b) Output - 30 marks
(c) Viva Voce - 5 marks **(**d) Note book - 5 marks

RECOMMENDED BOOKS

1. MATHLAB-High performance numeric computation and visualization software: User's guide
2. A MATHLAB Tutorial-Ed Doverman Dept. of Math., Ohio State University.

7. SPECIAL THEORY OF RELATIVITY & TENSORS Full mark-100

Unit - 1

***Basic Aspects of STR* (10 Marks)**

Inertial frames, Galilean tranformation, Michelson - Morley' experiment. The relavistic concept of space and time, Postulates of special theory of relativity, **[10 Lectures]**

Unit - II

***Relativistic Kinematics* (20 Marks)**

Lorentz transformation equations, the general Lorentz transformation equations, Consequences of Lorentz transformation equations like Relativity of simultaneity, Einstein's time distillation or apparent retardation of clocks, Relativity of space - Lorentz - Firzgerald contraction and related problems. **[18 Lectures]**

Unit - III

***Relativistiv Dynamics* (25 Marks)**

Redefined momentum, The relativistic force Law and the Dynamics of a single particle, Equivalence of Mass and Energy, $E=mc^2$ and its consequences.

Unit - IV

***Realitivistic Mechanics* (15 Marks)**

Transformation properties of Momentum, Energy, Mass and Force. **[10 Lectures]**

Unit - V

Tensors (30 Marks)

Space of N-dimension, Transformation of co-ordinates, contravariant and covariant vectors (Tensor of first order), Tensor of second order (or of rank two), Tensor of higher rank (or higher orders), Mixed tensors, Kronecker delta symbol, Invariant or scalar, Algebraic operations with tensors, Addition & subtraction of tensors, contraction, product of tensors, Inner Product, symmetric and Skew symmetric tensor.

[22 Lectures]

RECOMMENDED BOOKS

1. M. Ray : Special Theory of Relativity.
2. A. Das : The Special Theory of relativity.
3. Banerjee and Banerjee : The Special Theory of relativity, Prentice Hall of India, New Delhi.
4. Resnick : Special Theory of relativity, John Wiley.

REFERENCES

1. Dirac : General Theory of Relativity, Prentice Hall of India, New Delhi.
2. S.K. Bose : General Theory of Relativity, Wiley Eastern Ltd.

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x. B.A. SYLLABUS OF POLITICAL SCIENCE

Structure of Elective & Honours Course-

Semester	Subject-Paper Code*	Paper Name	F. M./ P.M.	Time required (Hours)
1	PSC: E101	Political Theory	100/40	75
2	PSC: E202	Western Political Thought	100/40	75
3	PSC: E303	Indian Government and Politics	100/40	75
	PSC: HSC I (non-credit)	United Nations and its Specialised Agencies	100/35	60
4	PSC: E404	Comparative Government and Politics	100/40	75
	PSC: HSC II (non-credit)	Modern Indian Social and Political Thought	100/35	60
5	PSC: H505	International Politics	100/40	75
	PSC: E506	Socialist Thought	100/40	75
	PSC: H507	Public Administration	100/40	75
6	PSC: H608	Government and Politics of North - east India	100/40	75
	PSC: H609	Gandhian Studies	100/40	75
	PSC: H610	. Indian Political Thought	100/40	75
	12 Papers		1200	870

*E for Elective; H for Honours; HSC for Honours Supportive Course

SEMESTER-I

PSC: E101 POLITICAL THEORY Fullmarks-100

UNIT I: Political Theory 20 marks (20 lecture hours)

- Concept, Nature and Scope of Political Science and Political Theory
- Approaches to the study of Political Science : Traditional Approaches: Philosophical, Historical, Institutional and Legal; Contemporary Approaches: Behaviouralism and Post-Behaviouralism

UNIT II : State and Sovereignty 20 marks (15 lecture hours)

- Meaning and significance of the state.
- Perspectives on state : Organic, Mechanistic, Liberal and Marxian.
- Sovereignty: meaning and characteristics.
- Globalization and state sovereignty.

UNIT III : Concept of Power 20 marks (15 lecture hours)

- Meaning of Power, Authority and Legitimacy
- Forms of Power: Political, Economic and Ideological
- Relation between Power, Authority and Legitimacy

UNIT IV : Concept of Ideology 20 marks (15 lecture hours)

- Liberalism
- Socialism and Communism
- Fascism
- End of Ideology Debate.

UNIT V : Democracy 20 marks (10 lecture hours)

- Meaning and principles of democracy, merits and demerits
- Liberty and equality
- Relationship between rights and duties

Reading list:

1. Bhargava, Rajeev & Ashok Acharya(ed.) *Political Theory: An Introduction*, New Delhi:Pearson Education,2008
2. Gauba, O. P. *An Introduction to Political Theory*, New Delhi: Macmillan, 2003
3. Ramaswamy, Sushila, *Political Theory: Ideas and Concepts*, New Delhi: Macmillan, 2003
4. Hacker, Andrew, *Political Theory- Philosophy, Ideology and Science,* Toronto: Macmillan, 1961
5. Laski, Harold J, *The State in Theory and Practice*, London: George Allen & Unwin, 1935
6. Held, David, *Political Theory and the Modern State*, London: Polity, 1994
7. Kapur, A.C, *Principles of Political Science,* S.Chand and Company, 1987
8. Mahajan,V.D, *Political Theory,* S. Chand and Company, 1988
9. Asirvatham, Eddy & Mishra, K.K, *Political Theory,* S.Chand and Company, 2000
10. Barry, Norman P., *An Introduction to Modern Political Theory*, London: Macmillan, 1988

SEMESTER-II

PSC: E202 Western Political Thought Fullmarks-100

Unit I : Plato: Justice, Education, Communism, Philosopher King, Ideal State
20 marks (10 lecture hours)

Unit II: Aristotle: State, Classification of Constitutions, Justice, Citizenship, Slavery and Revolution 20 marks (15 lecture hours)

Unit III: Machiavelli: Influence and Contribution, Statecraft, Separation of politics from ethics and religion. Bodin: State and Sovereignty
20 marks (10 lecture hours)

Unit IV: The contractualists –
Thomas Hobbes: State of Nature, Social Contract, Sovereignty.
John Locke: Liberty, property, state.
J.J. Rousseau: General Will, Social Contract
20 marks (20 lecture hours)

Unit V: Hegel: Dialectics, State. Karl Marx: Dialectical Materialism, Materialistic interpretation of history, Surplus Value, Class Struggle.
Lenin: Theory of Imperialism . 20 marks (20 lecture hours)

Reading list:

1. Rao, V.V, *A History of Political Theories, Ancient and Medieval,* S.Chand, 1967
2. Wayper, C.L., *Political Thought*, English Universities Press, 1969
3. Sabine, George, H, *A History of Political Theory*, Dryden Press, 1973
4. Mukherjee, Subrata & Sushila Ramaswamy, *A History of Political Thought,* PHI Learning,New Delhi, 1999
5. Jha, Shefali, *Western Political Thought from Plato to Marx*, Pearson Publications, Delhi, 2009
6. Barker, Ernest*, The Political Thought of Plato and Aristotle*, Dover Publications, 1959.
7. Bhandari D.R, *History of European Political Philosophy,* BAPCO Publications, 1978

SEMESTER III

PSC: E303 **Indian Government and Politics** Fullmarks-100

Unit I : Socio-historical and political background of the Indian freedom struggle.
20 marks (15 lecture hours)

Unit II : Constitutional Structure: Preamble, Fundamental Rights, Directive Principles of state Policy, Parliament, Executive, Judiciary. 20 marks (20 lecture hours)

Unit III : Nature of the Indian Federation: Centre- state relations, Local self government – Panchayats and Municipalities, Niti Aayog. 20 marks (15 lecture hours)

Unit IV: Party System, Political Behaviour, Caste and politics, Women Empowerment
20 marks (10 lecture hours)

Unit V: Communalism, Regionalism and National integration
20 marks (10 lecture hours)

Reference Books:

1. Granville Austin – Indian Constitution; Cornerstone of a nation
2. Norman D. Palmer – Indian Political System
3. Rajni Kothari – Politics in India
4. Rajni Kothari – Caste in Indian Politics
5. K. Seshadri – Government and Politics in India
6. V.M. Sirsikar – Political behavior in India
7. C.P. Bhambri – Bureaucracy and Politics in India
8. DD Basu – Constitution of India
9. K V Rao- Parliamentary Democracy in India
10. Iqbal Narain (ed) – State Politics in India

HONOURS SUPPORTING COURSE I

PSC: HSC I **United Nations and its Specialized Agencies** Fullmarks-100

Unit I: Origin of the United Nations Organisation, objectives, purpose and principles. 20 marks (10 lecture hours)

Unit II: Principal organs of the United Nations; General Assembly, Security Council, The Economic and Social Council, the Trusteeship Council, the Secretariat and the International Court of Justice. 20 marks (15 lecture hours)

Unit III: Important specialised agencies of the UN- UNESCO, UNICEF, WHO, FAO, ILO 20 marks (15 lecture hours)

Unit IV: Economic development and poverty alleviation under the UN; World Bank Group of financial Institutions, structures and functions. 20 marks (10 lecture hours)

Unit V: Proposals for UN reforms; Security Council and UN Secretariat reforms, suggested reforms in democracy and financing. 20 marks (10 lecture hours)

REFERENCE BOOKS:

1. United Nations Department of Public information, *Basic Facts about the United Nations.* United Nations 2004.
2. Rumki Basu, *The United Nations: Structure and Functions of an International Organisation.*Sterling Publishers, 2004.
3. Ian Hurd, *After Anarchy: Legitimacy and Power in the United nations Security Council,*Princeton University Press, 2007.
4. Kalpana Rajaram*, International Organisations, Conferences and Treaties,* Spectrum Books, 2007.
5. Prakash Chandra and Prem Arora, *Comparative Politics and International Relations,* Cosmos Bookhive, 31st Edition, July 2015.

SEMESTER IV

PSC: E404 **Comparative Government and Politics- U.K., U.S.A, Japan, China & Switzerland** Fullmarks-100

Unit I U.K.: Sources of the Constitution, Parliamentary Government Monarchy, Cabinet, Parliament, Political Parties. 20 marks (15 lecture hours)

Unit II U.S.A: Federal system President, Congress, Supreme Court Separation of Powers and Checks and Balances, Political Parties. 20 marks (15 lecture hours)

Unit III Japan: Emperor, Constitution 1947, Diet, Political Parties, Factional Politics 20 marks (10 lecture hours)

Unit IV People's Republic of China: Cultural Revolution, Nature of the political system, National People's Congress (NPC). 20 marks (15 lecture hours)

Unit V Switzerland: Federal System (Legislature), Referendum, Initiative Recall, Political Parties. 20 marks (15 lecture hours)

REFERENCE BOOKS:-

1. D. Deol - Comparative Government and Politics: A study of Comparative Politics with special Reference to political system of UK, USA, USSR and China, New Delhi, Sterling, 1978.
2. K.R Bombwal ,:- Major Contemporary Constitutional System, Ambala, Modern Publications ,1980
3. S.Banerjee:- The Chinese Government and Politics, Calcutta, K.P Bagchi,1980.
4. J.H Price:- Comparative Government : Four modern Constitutions, New Delhi, I Publications, 1974.
5. R.M Punnet :- Government and Politics in Britain, London, St Paul, 1970.
6. Claudies O. Johnson,- Government of United States, New Delhi, Thomas Growel, 1970.
7. Pritchett, CH .- American Constitution, New Delhi, Metropolitan Book Report 1984.
8. Vishnu Bhagwan & V. Bhushan, World Constitution.

HONOURS SUPPORTIVE COURSE II

PSC: HSC II **Modern Indian Social and Political Thought** Fullmarks-100

Unit 1 : Indian Renaissance 20 marks (12 lecture hours)

(a) Raja Ram Mohan Roy: As a social reformer

(b) Swami Vivekananda: Views on nationalism, democracy and social change

Unit 2 : Hindu nationalism and Muslim thought 20 marks (12 lecture hours)

(a) Savarkar: Hindu nationalism, Social change and social reforms

(b) M.A. Jinnah: Views on Hindu-Muslim unity, Two- Nation theory

Unit 3 : Contribution of Gandhi and Nehru 20 marks (12 lecture hours)

(a) Gandhiji: Satyagraha and Non-violence, Ramrajya, decentralisation

(b) Nehru: Socialism, secularism and Non-alignment

Unit 4 : Socialist thinkers 20 marks (12 lecture hours)

(a) M.N.Roy: Radical humanism

(b) J.P. Narayan: Total Revolution

Unit 5 : 20 marks (12 lecture hours)

(a) Dr. B.R. Ambedkar: Views on social democracy and Hinduism.

(b) Sree Narayana Guru: As a social reformer, views on secularism and universalism.

Books and References:

1. Bipin Chandra: *India's struggle for Independence*, Penguin Books, New Delhi, 2007
2. Verma V.P.: *Modern Indian Political Thought*, Lakshmi Narain Agarwal, Agra. 2000
3. Damodaran. K.: *Indian Thought, A Critical Study*.
4. Appadorai. A. : *Documents in Political Thought in Modern India*, 2 vols, Oxford University Press, Bombay, 1975
5. Appadorai. A.: *Indian Political Thinking through the Ages*, Khanna Publishers, New Delhi, 1992
6. Uma Kaura : *Muslims and Indian Nationalism*, New Delhi, 1977
7. V. Rodrigues (ed): *The essential writings of B.R. Ambedkar*, Oxford University Press, New Delhi, 2002.

SEMESTER-V

PSC: H505 International Politics Fullmarks-100

Unit I Nature and Scope of International Politics; System and Realist Theories of International Politics 20 marks (15 lecture hours)

Unit II National Power: Components and Limitations; Balance of Power: Principles and Methods. 20 marks (15 lecture hours)

Unit III The League of Nations: structures and functions, achievements and failure. The United Nations: structures and functions, achievements and limitations 20 marks (15 lecture hours)

Unit IV Factors Influencing Foreign Policy; Basic Principles of India's Foreign Policy. 20 marks (10 lecture hours)

Unit V Issue of Indian Foreign Policy:

1. Kashmir Issue
2. Causes of Sino-Indian War
3. US Stand on Sino-Indian War of 1962, Indo-Pak Wars of 1965 and 1971
4. Soviet Stand on Sino-Indian War of 1962, Indo-Pak wars of 1965 and 1971

20 marks (15 lecture hours)

Readings:

1. Mahendra Kumar, *Theoretical Aspect of International Politics*. Agra: Shiva Lal Agarwala, 1967.
2. Hans J Morgenthau, *Politics among Nation*. MC Graw Hill, 7th Edition 2005
3. J.A Naik, *A Text Book of International Relations*, MacMillan India, 2nd Edition,2000
4. Palmer and Perkins, *International Relations*. New Delhi: A.I.T.B.S. Publishers 3rd Revised Edition 2002.
5. S.J.R. Bilgrami: *International Organisations* New Delhi; Vikas Publishing
6. Charles Heimsath and Surjit Mansingh, *A diplomatic history of Modern India*, Allied 1971

PSC: H506 **Socialist Thought** Fullmarks-100

Unit I Utopian Socialism: Main Ideas of Robert Owen, Charles Fourier.
20 marks (10 lecture hours)

Unit II The main ideas of Marx, Engels and Lenin : Dialectical materialism, Materialist Conception of History, Class Struggle State, Revolution, Dictatorship of the Proletariat , Imperialism. 20 marks (20 lecture hours)

Unit III Stalin: State and Revolution; National Question
20 marks (10 lecture hours)

Unit IV Mao Theory of Revolution; Cultural Revolution.
20 marks (10 lecture hours)

Unit V Main Principles: Anarchism, Fascism
20 marks (10 lecture hours)

Readings:

1. Cookers, *Recent Political Thought*
2. VD Mahajan, *Recent Political Thought.*
3. Marx and Engels, *Communist Manifesto*
4. F. Engels, *The Origin of the Family, Private Property and the State*
5. F. Engels, *Socialism: Utopian Scientific*.
6. V. Lenin, State and Revolution. *Three Sources and Three Component parts of Marxism, The National Liberation Movement in the East (Selected articles), Imperialism: the highest state of Capitalism.*
7. J.V Stalin, *Problems of Leninism*, Marxism, the National Questions.
8. Mao Ze Dong, *Four Essays on Philosophy*, Peking Foreign Language press 1967
9. Milorad S. Draskatah, *Marxism in the modern World*, Progress Publishers, ABC of Dialectical and Historical, *Moscow Materialism 1977*.
10. GDH Cole, *A History of Socialist Thought*
11. D.R.Bhandari, *History of European Political Philosophy.*

PSC: H507 **Public Administration** Fullmark-100

Unit I Public Administration: Meaning Nature and Scope; differences between Public Administration and Private Administration; Relationship between Politics and Public Administration. 20 marks (15 lecture hours)

Unit II Organisation: Meaning, Bases and Approaches; Problems in the internal working of administrative organization: Hierarchy, Unity of Command, Span of Control and Leadership; Chief Executive: Power, Functions and Responsibilities. 20 marks (15 lecture hours)

Unit III Administrative Units: Line, Staff and Auxiliary agencies. Department and corporation; Centralisation and Decentralisation; Field Headquarters relationship. 20 marks (15 lecture hours)

Unit IV Personnel Administration: Civil service Commission, Recruitment and Training, Administrative accountability. 20 marks (10 lecture hours)

Unit V Agencies of Financial Administration; Financial Committees of India Parliament; Principles of Budget Making; Comptroller and Auditor General of India: Powers and Functions; Planning Commission of India: Origin and Functions. 20 marks (15 lecture hours)

Readings:

1. Amreshwar Avasthi and Shriram Maheshwari, *Public Administration*.
2. Chandra Prakash Bhambri , *Public Administration (Theory and Practice)*
3. Vishnoo Bhagwan and Vidya Bhusan, *A Textbook of Public Administration*
4. Marshall E.Dimock and Gladys O Dimock, *Public Administration*
5. M.P Sharma, *Principles of Public Administration*
6. R.K Arora, *Indian Administration*
7. Mohit Bhattacharya, *Public Administration*
8. Chitra Ramachandran, *Indian Public Administration*
9. Nigro and Nigro, *Modern Public Administration*
10. J.M. Pfiffner and Presthus , *Public Administration*
11. L.D.White, *Introduction to the study of Public Administration*
12. W.F. Willoughby, *Principles of Public Administration*.

SEMESTER VI

PSC: H608 **Government and Politics of North-East India** Fullmark: 100

Unit I Features of North East India- Traditional Political Institutions
20 marks (10 lecture hours)

Unit II Relations between the North East India and the British, Political Status of the States and Hill areas before Independence 20 marks (15 lecture hours)

Unit III Sixth Schedule of the Indian Constitution, Formation of the States: Nagaland, Meghalaya, Mizoram and Arunachal Pradesh 20 marks (15 lecture hours)

Unit IV Political Parties: National and Regional, Their Role in the Politics of North East India 20 marks (15 lecture hours)

Unit V Relation between the Centre and the Region- North Eastern Council, Political Movements 20 marks (15 lecture hours)

Readings:

1. Alemchiba- *History of North East India*
2. V.V Rao- *A Century of Tribal Politics*
3. M.Horam- *Naga Politics*
4. Asoso Yunao- *The Rising Naga*
5. Choudhury. J.N.- *Arunachal Pradesh*
6. Robert Reid- *History of Frontier Areas of Assam*
7. T.C Hudson – *The Naga Tribes of Manipur*
8. J.Roy- *History of Manipur*
9. S.K Chaube- *Hill Politics in North East India*
10. N.N Acharya- *Assam and Neighbouring States*
11. Nari Rustomji – *Enchanted Frontiers*
12. Robert Reid- *History of Frontier Areas Bordering Assam*
13. Machenzie- *North East Frontier*
14. B.G Verghese- *North East Resurgent: ethnicity, insurgency, governance, Development*. Konark Publications, 2004.

PSC: H609 **Gandhian Studies** Fullmark: 100

Unit I Origin of Gandhian Philosophy, his understanding of human nature and his views on spiritualization of politics 20 marks (15 lecture hours)

Unit II Gandhi's concept of Satyagraha, nonviolence, freedom and equality
20 marks (15 lecture hours)

Unit III Gandhi's views on state. Democracy and Socialism
20 marks (15 lecture hours)

Unit IV Gandhi's concept of trusteeship, essentials of Gandhian economics and his views on Science and Technology 20 marks (15 lecture hours)

Unit V Gandhi and World peace, relevance of Gandhi in modern times
20 marks (10 lecture hours)

Readings:

1. M.K Gandhi: *An Autobiography; My Experiment with Truth*, Navajivan Publishing House, Ahemadabad-14
2. V.P Verma: *The Political Philosophy of Gandhi and Sarvodaya*, Luxmi Narayan Agarwal Agra
3. J.B Kripalani: *Gandhi: His life and Thought*, Publications Divisions, Ministry of Information & Broadcasting, Government of India.
4. ,, *The Gandhi's Way*, Vohra & Co, Bombay.
5. Vincent Sheean: *Mahatma Gandhi: A great life in brief*, Publications Division Ministry of Information and Broadcasting, Government of India.
6. Louis Fischer: *The life of Mahatma Gandhi*, Bharatiya Vidya Bhawan Kulapa, KM Munshi Marg Mumbai-07
7. Jayantanuja Bandhyopadhyaya: *Social and Political Thought of Gandhi*, Allied Publishers Calcutta.
8. Budhadev Bhattacharya: *Evolution of the Political Philosophy of Gandhi*, Calcutta Book House Calcutta-12.
9. J.D Sethi: *Gandhi Today*, Vikash Publishing House Pvt. Ltd Ghaziabad, UP.
10. Hiren Mukherji: *Gandhiji: A Study*, Peoples Publishing House New Delhi.
11. V.T Patil: *Studies in Gandhi*, Sterling Publishsers Private Ltd., New Delhi.
12. Gopinath Dhawan: *The Political Philosophy of Mahatma Gandhi*, Naraiyan Publishing House Ahamadabad
13. Raghaven Iyer: *The Moral and Political thought of Mahatma Gandhi*, Oxford University Press, New Delhi.
14. Anil Dutta Mishra: *Fundamentals of Gandhism*, Mittal Publications, New Delhi.

Journals:

1. *Gandhi Marg*, Journal of Gandhi Peace Foundation, New Delhi
2. *Gandhi Vigyan*, A Quaterly Journal of Gandhi, Vigyan Trust, Bangalore.

PSC: H610 **Indian Political Thought** Fullmark-100

Unit I : Ancient Philosophical Traditions of India: Manu and Kautilya
20 marks (10 lecture hours)

Unit II : Raja Ram Mohon Roy; Swami Vivekananda; and Aurobindo Ghosh
20 marks (15 lecture hours)

Unit III : Bal Gangadhar Tilak; Gopal Krishna Gokhale; and M.N.Roy
20 marks (15 lecture hours)

Unit IV : Md Iqbal; Jawaharlal Nehru and Subashchandra Bose
20 marks (15 lecture hours)

Unit V : Dr. B.R. Ambedkar and Jayaprakash Narayan
20 marks (15 lecture hours)

Readings:

1. A.Appadorai: *Indian Political Thinking Through the Ages*, Khama Publishers, New Delhi
2. A.RDesai: *Social Background of Indian Nationalism*, Popular Prakashan, Bombay
3. D.R. Bali: *Modern Indian Political Thought*, Sterling Publishers Pvt. Limited, New Delhi
4. H.H. Das and P.S.N. Patro: *Indian Political Traditions*, Sterling Publishers Pvt. Limited
5. K. Damodaran : *Indian Thought- A critical Review*, Asia Publishing House, New Delhi
6. Ram Ratan and Ruchi Tyagi: *Indian Political Thought*, Mayoor Paperbacks, Delhi
7. V.D. Mahajan: *Modern Indian Political Thought*, S. Chand & Company Pvt. Ltd., Delhi
8. V.P. Verma: *Modern Indian Political Thought*, Lakshmi Narayan Agarwal, Agra.
9. Vishnoo Bhagvan : *Indian Political Thinkers*, Atma Ram and Sons, Delhi
10. B.B. Majumdar: *History of Indian Social and Political Ideas.*
11. U.N. Ghoshal: *A History of Indian Political Ideas.*

xi. B.Sc. PHYSICS SYLLABUS

COURSE STRUCTURE

Semester	Paper Code	Title	F.M./ P.M.	Time allotted (Hours)
I	PHY: E101	Mechanics & Special Theory of Relativity	75/30	70
	PHY: E101P	Practical	25/10	20
II	PHY: E202	Thermal Physics and Optics	75/30	70
	PHY: E202P	Practical	25/10	20
III	PHY: E303	Electricity and Magnetism	75/30	70
	PHY: E303P	Practical	25/10	20
	PHY: HSC I	Classical & Statistical Mechanics	100/35	75
IV	PHY: E404	Atomic and Nuclear Physics	75/30	70
	PHY: E404P	Practical	25/10	20
	PHY: HSC II	Basic application of Physics in dating and radiation	100/35	75
V	PHY: H505	Electronic	100/40	90
	PHY: H506	Mathematical Physics	100/40	90
	PHY: H507P	Practical	100/40	90
VI	PHY: H608	Quantum Mechanics	100/40	90
	PHY: H609	Physics of Materials	100/40	90
	PHY: H610P	Practical	100/40	90

E- Elective; H- Honours; P- Practical; HSC- Honours Supportive Course;

SEMESTER - I

PHY: E101 MECHANICS AND SPECIAL THEORY OF RELATIVITY

Full Marks-75

Objective of the Course

- *This topic gives details about the mechanics of a particle for linear and rotational motion.*
- *It gives details about the gravitational field and briefly discuss about the central force motion.*
- *The last part of the topic deals about the special theory of relativity.*

Unit I: Fundamentals of Dynamics 15 Marks

Dynamics of a single particle, Dynamics of a system of particles, Centre of mass, Equation of motion, Conservation of linear and angular momentum, Idea of conservation of momentum from Newton's third law, Impulse, Momentum of variable mass system; Motion of rocket, single stage and multi stage rockets; Work- energy theorem, Potential energy, Energy diagram, Stable and unstable equilibrium.

Conservative and non- conservative forces, examples, Force fields, Force as gradient of potential energy, Motion in a uniform field, Components of velocity and acceleration in different co-ordinate systems, Uniformly rotating frame, Centripetal acceleration, Coriolis force and its application.

Unit II: Rotational Dynamics 15 Marks

Rigid body motion, Rotational motion- Rotation about a fixed axis, Kinetic energy of rotation, Moment of inertia, Radius of Gyration, Physical interpretation of Moment of Inertia, Parallel axis theorem, Perpendicular axis theorem, calculation of moment of inertia of rigid bodies of regular shapes - rectangular, spherical and cylindrical bodies; Torque and work, torque and angular acceleration, Relation between angular momentum and moment of inertia.

Properties of matter: Hooke's law, Elastic constants and inter-relation amongst them, Surface tension, Surface energy and their relation, Excess pressure on a curved liquid surface, Capillarity and Jurin's law, Streamline and Turbulent flow, Critical velocity and Reynolds number, Equation of continuity, Bernoulli's theorem, Viscosity, Stoke's law, Terminal velocity, Poiseuille's law.

Unit III: Gravitation and Central Force Motion 15 Marks

Gravitation: Newton's Law of gravitation, Inertial and Gravitational mass and their equivalence, Gravitational potential and field, Potential energy and field due to a spherical shell and solid sphere, Self energy, Gauss and Poisson equations for gravitational self energy.

Central force motion: Motion of a particle under central force field, One body problem, Two body problem and its reduction to one body problem and its solution. Kepler's law (Ideas only).

Unit IV: Oscillatory Motion 15 Marks

Motion of Simple, Compound pendulum and Loaded spring, Energy considerations, Time average of energy, Damped harmonic oscillator, Resonance in a lightly damped system, Free oscillations of system with one degree of freedom, Linearity and Superposition Principle, Superposition of (i) two and (ii) N collinear harmonic oscillations; beats.

Unit V: Special theory of relativity 15 Marks

Michelson-Morley experiment and its outcome, Postulates of special theory of relativity, Lorentz transformations, Simultaneity and order of events, Lorentz contraction and Time dilation, Relativistic transformation of velocity, Frequency and wave number, Velocity

dependence of mass and equivalence of mass and energy, Relativistic Doppler effect, Relativistic kinematics, Transformation of energy and momentum.

Suggested books:

1. An introduction to mechanics by Daniel Kleppner, Robert J. Kolenkow (McGraw-Hill, 1973)
2. Mechanics Berkeley Physics Course Vol. 1 by Charles Kittel, Walter Knight, Malvin
3. Introduction to Mechanics-Mahendra K.Verma (University Press)
4. Mechanics by D.S. Mathur (S. Chand and Company Limited, 2000)
5. The properties of matter by D.S. Mathur (S. Chand and Company Limited)
6. The Physics of waves and oscillations by N.K. Bajaj (Tata McGraw-Hill, 1998)
7. Berkeley Physics Course Vol. 3 Waves by Franks Crawford (Tata McGraw-Hill , 2007)
8. Introduction to Special Relativity by R. Resnick (Wiley India Pvt. Ltd)
9. Theoretical Mechanics by M.R. Spiegel, Schaum's outline series.
10. Mechanics part I & II by Naryanamoorthy, S. Chand Publication.

PHY: E101P **PRACTICAL** 25 Marks

1. Determination of 'g' by using a Compound Pendulum (bar with holes).
2. Determination of moment of inertia of a body by using a Torsion Pendulum.
3. Determination of frequency of a Tuning fork by means of a Sonometer.
4. Determination of 'g' by Kater's Pendulum.
5. Determination of surface tension of a given liquid by capillary rise method and verification of Jurin's law.
6. Determination of co-efficient of viscosity of water by Poiseuille's method.
7. Verification of Stoke's law and determination of coefficient of viscosity of a liquid.
8. Determination of Young's modulus by Searle's method.
9. Determination of rigidity modulus by Statistical method.

SEMESTER – II

PHY: E202 THERMAL PHYSICS AND OPTICS Full marks:75

Objective of the Course

- *A thorough knowledge of thermodynamics would create.*
- *The second part of the topic will deals the details of the kinetic theory of gases.*
- *Basic idea of back body radiation and related laws will be study in details.*
- *The topic of optics will study in details about the main phenomenon of optics like interference, diffraction and polarisation.*
- *The last part of the topic deals in details of the mechanism of working LASER.*

Unit I: THERMODYNAMICS 15 Marks

Zeroth law of thermodynamics and temperature; First law and internal energy, Isothermal and Adiabatic processes, Reversible and Irreversible processes,

Second law of thermodynamics, Carnot theorem, Thermodynamic scale of temperature, Entropy, Entropy of a mixture, Third law of thermodynamics, Thermodynamic potentials; Enthalpy, Gibbs and Helmholtz functions, First and second order phase transitions, Chemical potential, Maxwell relations and their applications, Clausius-Clapeyron's equation, Ehrenfest's equation, Joule-Thomson effect and its theory, Magnetic cooling by Adiabatic Demagnetization, approach to absolute zero.

Unit II: Kinetic theory of gases 10 Marks

Derivation of Maxwell's law of distribution of velocities (qualitative discussion) and its experimental verification, Degree of freedom and law of equipartition of energy, Molecular collision and Mean free path, estimates of molecular diameter and mean free path; Transport phenomena,-viscosity, conduction and diffusion, Dependence on temperature and pressure, their relationship, Brownian motion. Equation of state for ideal gases, Equation of state for real gases, Deviations from the ideal gas equation, The virial equation, Van der Waal's equation- derivation of Van-der Waal's equation, Critical constants and law of corresponding states.

Unit III: Interference and Diffraction 20 Marks

Interference in thin films, Fringes of equal thickness and equal inclinations, Theory of Newton's ring, Michelson's interferometer and Fabry- Perot interferometer, measurements of wavelength and thickness of a thin transparent sheet.

Difference between interference and diffraction, Theory of plane diffraction grating, Resolving power and dispersive power of a plane diffraction grating. Fresnel's integrals, Cornu's spiral, Fresnel diffraction pattern at a straight edge.

Unit IV: Polarization 10 Marks

Polarization by reflection, double refraction, wave surfaces as uniaxial crystal, production and detection of elliptically and circularly polarised light, Babinet's compensator- theory and uses, optical activity and polarimeter.

Unit V: Elements of Quantum Optics 10 Marks

Stimulated emission, Population inversion, Mechanism of population inversion, Spontaneous and Stimulated emission, Einstein's coefficients, and Threshold condition for laser action, Ruby laser, application of lasers, Elements of second harmonic generation.

Unit VI: Black body Radiation 10 Marks

Emissive power, Absorptive power of a black body, Kirchhoff's law; total radiation from a black body- Stefan- Boltzmann law; Adiabatic expansion of radiation- Wien's Displacement law; Black body radiation spectrum- Rayleigh-Jeans law and comparison with experiment, the ultraviolet catastrophe, Planck's quantum hypothesis, Planck's law, derivation of Planck's radiation law- Einstein's derivation of Planck's law.

***Suggested books**:*

1. A treatise on heat: including Kinetic theory of gases, Thermodynamics and recent advances in Statistical thermodynamics : Meghanad Saha, B.N. Srivastava (Indian Press, 1958)
2. Heat and Thermodynamics: Zemansky(McGraw Hill)s
3. Thermal physics: P.K. Chakrabarti, New Central Book Agency 2006, Kolkata
4. Fundamentals of optics: Francis Arthur Jenkins and Harvey Elliott White (McGraw Hill, 1981)
5. Optics: Ajoy Ghatak (Tata McGraw Hill, 2008)
6. A text book of light: B. Ghosh and K. G. Mazumdar, (5th edition) Sreedhar publishers, Kolkata
7. Heat, Thermodynamics & Statistical Physics: J.P. Agarwal, Satya Prakash: Pragati Prakashan.
8. A text book of Optics: N. Subrahmanyam, Brij Lal: S. Chand & Company LTD (2006).
9. Optics: P.K. Srivastava, CBS publications and Distributors.

PHY: E202P PRACTICAL 25 Marks

1. To construct a thermocouple with the elements supplied and to determine the melting point of the given substance and the thermoelectric power.
2. Determination of J by Callender and Barne's method.
3. Determination of co-efficient of linear expansion of a metallic rod by optical lever method
4. Verification of Newton's law of cooling.
5. Determination of apparent expansion of a liquid by weight thermometer method.

6. Determination of frequency of a tuning fork by Melde's method.
7. Determination of thermal conductivity of a metallic rod by Searle's method.
8. Determination of the refractive index of the given liquid with the help of a plane mirror, convex and a spherometer.
9. Determination of the refractive index of a given liquid by travelling microscope method.

SEMESTER – III

PHY: E303 **ELECTRICITY AND MAGNETISM** 75 Marks

Objective of the Course

- *The domain of electricity and magnetism extends over the whole of nature.*
- *The concept of different laws of electricity and magnetism will taught through the course.*
- *Theoretical and practical skills developed can be used in industrial application.*

Unit I: Vector and Scalar fields **15 Marks**

Fields - Scalar and Vector, examples, Directional derivative and gradient of a vector field, flux and Divergence of a vector field, circulation and curl of a vector field, algebra of the del operator and Laplacian operator, Gauss's theorem, Stoke's theorem, and Green's theorem.

Unit II: Electric field **20 Marks**

Electric field and electric lines of force, Gauss's law and its applications, electrostatics of conductor, Electric potential, multi-pole moments and multi-pole expansions, force, torque and energy of a dipole in an external electric field, Poisson's and Laplace's equations , Uniqueness theorem, solutions to Laplace's equations in spherical coordinates, Zonal harmonics, Conducting sphere in uniform electric field.

Electrostatic energy, system of point charges, system of continuous charge distribution, Spherically symmetric charge distribution, charged capacitors. Dielectric properties of matter, polarization, electric field caused by polarised matter, Gauss's law in a dielectric, boundary conditions on E and D, capacitors filled with dielectric, dielectric sphere in a uniform electric field, Clausius - Mossoti equation.

Unit III: Magnetic field **20 Marks**

Magnetic field, Magnetic force between currents and definition of B-magnetic field vector, Divergence and Curl of B, Ampere's circuital law, Magnetic scalar and vector potentials, calculation of B for a straight wire, a circular loop and a solenoid, field of a dipole, force,

torque and energy of a dipole in an external field, torque on current loop, magnetic dipole moment, angular momentum, gyro magnetic ratio, Lorentz force, magnetic field energy.

Magnetic properties of matter: magnetization, magnetic field caused by a magnetised matter, field equations in a magnetised matter; Ampere's law in a magnetised matter, boundary conditions on B and H; Magnetic shell, magnetic circuits, hysteresis and B-H curve.

Unit IV: Electromagnetic induction **20 Marks**

Electromagnetic induction, Faraday's laws of induction, curl E, self and mutual inductance, reciprocity theorem, energy stored in a coil.

Alternating current and transient phenomena, A.C. circuit, Mean value of current and voltage, Skin effect, power factor, A.C. in L-R, C-R, L-C-R circuits, Series and Parallel resonance, transient growth and decay of currents in L-R, C-R, L-C-R circuits; Oscillatory discharge.

Maxwell's equations, their physical meaning and respective laws, Equation of continuity; Wave equations for E and B, plane wave solutions, transverse nature of electromagnetic wave, flow of electromagnetic power and the Poynting theorem.

***Suggested books**:*

1. Introduction to Electrodynamics: David J. Griffiths, 3rd edition (Benjamin Cummings, 1998)
2. Elements of electromagnetic: Mathew N. O. Sadiku (Oxford University Press)
3. Electricity and magnetism: D.C. Tayal (Himalaya Publishing House)
4. Electricity and magnetism: D. Chattopadhyay and P. Rakshit
5. Electricity and magnetism: Brijlal and N. Subramaniam, Rratan Prakash Mandir, New Delhi.
6. Modern Electrodynamics: A. Zangwill, Cambridge University Press.
7. Electrodynamics: Robert M. Wald, University of Chicago Press.
8. Electromagnetism: B.B. Laud, Wiley Publication.

PHY: E303P **PRACTICAL** 25 Marks

1. Determination of the Horizontal component of earth's magnetic field and the magnetic moment of the magnet with the help of a deflection magnetometer.
2. Determination of self inductance by Rayleigh's method.
3. Determination of frequency of the A.C. mains with the help of Sonometer.
4. Determination of capacitance by de Sauty's bridge.

5. Determination of refractive index of a prism by using a spectrometer.
6. Determination of capacitance by using ballistic galvanometer.
7. Determination of ECE of copper.
8. To convert a given galvanometer into an ammeter calibrates it with the help of copper Voltmeter.

HONOURS SUPPORTIVE COURSE I

PHY: HSC I CLASSICAL AND STATISTICAL MECHANICS 100 Marks

Objective of the Course

- *The topic will deals in detail about the generalised coordinate and consequently the formulation of Lagrangian and Hamiltonian.*
- *Application of the central force motion and detail of the Kepler's law of planetary motion will be study.*
- *The second part of the topic will deals in detail about the calculation of probability and the derivation of the famous statistics: Maxwell-Boltzmann (M-B) statistics, Bose- Einstein (B-E) statistics and Fermi- Dirac (F-D) statistics.*

Unit 1: Lagrangian and Hamiltonian formulation 40 Marks

Conservative force, potential and the Langrangian function. Recasting of Newton's equation of motion in the Eular- Lanrange form (in Cartesian co-ordinates), Constraints and its classification with examples

Generalised co-ordinates, Generalised velocities and Generalised momenta, Principles of virtual work, D' Alembert's principle and its derivation, Langrangian and Langrange's equation of motion, Hamilton's principle, derivation of Langrange's equation of motion from Hamilton's principle, generalised momenta, conservation laws, special velocity potential, the generalised potential; Lagrangian of a charged particle in an electromagnetic field, Rayleigh dissipation function.

Concept of phase space, Principle of variation, deduction of Hamilton's canonical equations from variational principle. The Hamiltonian function and its physical interpretation, Legendre transformation and the Hamilton's equation of motion, deduction oh Hamilton's principle from D' Alembert's principle, Poisson bracket (P.B), equations of motion in P.B., constants of motion; Fundamental Poisson Bracket, Poisson Bracket algebra of angular momentum.

Unit 2: Central Force Motion 20 Marks

Central force and its example, central potential, particle in a central potential, angular momentum and energy conservation, Langrangian of a particle under central force, reduced mass, two bodies central force problem, equation of motion, and 1st integrals (differential equation of motion of a particle and its solution to inverse square force field), Kepler problem, equivalent one dimensional problem for the radial motion, qualitative discussion on the nature of the orbits, the orbit equation (differential and integral forms), the, inverse square law of force, Kepler's laws of planetary motion, and its deduction.

Unit3: Canonical Transformation: 10 Marks

Generating function, Conditions of canonical transformation and problem

Unit 4: **Fundamental ideas of Statistical Physics** 10 Marks

Distinguishable and indistinguishable particles, microscopic and macroscopic systems with examples, probability and thermodynamic probability, calculation of probabilities, ensembles, principle of equal a priori probability, most probable state, accessible and inaccessible states, probability distribution, Probability and entropy, Boltzmann entropy relation, statistical interpretation of second law of thermodynamics.

Unit 5: Maxwell-Boltzmann (M-B) statistics or Classical statistics 10 Marks

Position space, momentum space, Phase space, Maxwell-Boltzmann (M-B) distribution law, Maxwell's law of velocity distribution, distinction between mean, r.m.s. and most probable speed values, molecular energy in an ideal gas.

Unit 6: Quantum statistics: **10 Marks**

Need of quantum statistics, two types of quantum statistics: Bose- Einstein (B-E) statistics and Fermi- Dirac (F-D) statistics; Distribution law: Bose- Einstein distribution law and its application to photon gas, Fermi- Dirac distribution law and its application to electron gas in metal, Fermi energy, M-B distribution as a limiting case of B-E and F-D distribution, comparison of the three distribution laws.

Recommended Books:

1. Classical Mechanics – H.Goldstein
2. Classical Mechanics – G. Aruhl Das
3. Classical Mechanics – B.D. Gupta and Satya Prakash
4. Introduction to Classical Mechanics – R.G. Takwale and P.S. Puranik
5. Statistical Mechanics- K.K. Huang
6. Thermodynamics, Statistical Physics and kinetics- Satya Prakash

SEMESTER – IV

PHY: E404 ATOMIC AND NUCLEAR PHYSICS 75 Marks

Objective of the Course

- Atomic and Nuclear Physics finds application in Nuclear reactors.
- Nuclear energy has got a great significance in the present scenario.
- This topic will give ideas about the construction and working of different Atomic mass spectrometer.
- The details of spin orbit interaction, Zeeman Effect and ideas of radioactivity will be given to the students.
- The last part of the topic will gives different nuclear model and calculation of Q-value of the nuclear reaction, the details ideas of nuclear fission and fusion reactions and about the release of energy by the Sun will study.

Unit I: Mass spectrograph and X- ray 10 Marks

Atomic masses: Bainbridge and Aston's mass spectrograph, X- rays: Continuous and Characteristic X-rays, Mosley's law, Absorption of X- rays and absorption spectra, X-ray Diffraction and Bragg's law, measurement of wave length of X -ray.

Unit II: Atomic spectra 20 Marks

Hydrogen spectrum, Bohr's theory, Sommerfield's modification of Bohr's theory and relativistic correction, Vector model of atom, electron spin, Pauli's exclusion principle, Periodic table of elements, Spin- Orbit interaction- fine structure of hydrogen, Spectra of alkali elements, Selection rules, L-S and j-j coupling schemes, Zeeman effect.

Unit III: Radioactivity 10 Marks

Law of radioactive decay and half life period, Radioactive series, Theory of successive transformations, Secular and Transient equilibrium, Carbon dating, Artificial radioactivity, Radio isotopes and their uses, Radiation hazards, Theory of alpha decay, Beta decay and Neutrino hypothesis, Gamma decay.

Unit IV: Particle accelerator and Nuclear detectors 10 Marks

Linear accelerator, Cyclotron, Betatron, Synchrotron, Proportional counter, GM counter chamber, Bubble chamber, Scintillation counter, Nuclear emulsion

Unit V: Nuclei and their properties 5 Marks

Rutherford's theory of alpha particle scattering and its experimental verification, Charge, Mass, Size, Constituents, Spin and Parity of nuclei; Nuclear stability and binding energy; Nuclear moments- electric dipole moment, Electric quadrupole moment and magnetic moment, Nuclear forces.

Unit VI: Nuclear models 10 Marks

Liquid drop model, Semi-empirical mass formula and its applications, Shell model.

Unit VII: Nuclear reactions 10 Marks

Q- value of a reaction, kinematics of nuclear reactions, types of nuclear reactions, Cross sections for nuclear reactions; Nuclear fission- elementary theory of nuclear fission, Energy and mass distribution of fission fragments, fission neutrons, four factor formula, Nuclear reactor and its types, Breeder reactor; Nuclear fusion reaction in the Sun, Controlled nuclear fusion.

Suggested books:

1. Concepts of Modern Physics: A Beiser
2. Atomic and Nuclear Physics: Gopalakrishnan (McMillan)
3. Concepts of Nuclear Physics: Bernard L Cohen
4. Nuclear Physics: S N Ghosal
5. Nuclear Physics: D C Tayal
6. Introduction to Nuclear and Particle Physics: A. Das and T. Ferbel: World Scientific Publishing co.pte. Ltd.
7. Nuclear Physics – Kalpan.
8. Atomic Physics: J. Rajam, S. Chand & Co (pvt) LTD.
9. Theory and problem of Modern physics: Ronald Gautreau, W. Savin, Schaum's outline series, Mc Graw-Hill.

PHY: E404P PRACTICAL 25 Marks

1. To draw (i-D) curve for a prism using a spectrometer and to find the minimum deviation using sodium light.
2. To draw (i-D) curve for a prism using a spectrometer and to find the refractive index of the prism using sodium light (angle of prism is given).
3. Determination of radius of curvature of a convex lens by Newton's ring method.
4. Determination of dispersive power of a prism for sodium light using a spectrometer
5. Determination of wavelength of sodium light using a plane transmission grating.
6. Determination of internal resistance of a cell using a potentiometer.
7. To measure current in an external circuit with the help of a potentiometer

HONOURS SUPPORTIVE COURSE II

PHY: HSC-II BASIC APPLICATION OF PHYSICS IN DATING AND RADIATION

100 Marks

Objective of the Course

- *The main objective of the topic is to understand the basic application of physics.*
- *The first part of the topic is study about the carbon dating and its application.*
- *Then the different types dating like luminescence and meteorite dating. .*
- *The application of X-ray and Ultrasound.*
- *The last part of the topic will deal about radiotherapy.*

Unit I: Carbon Dating and its application 15 Marks

Dating, carbon dating, radioactive decay of Carbon, mechanism of carbon dating, ratio of Carbon-12 to Cabon-14 isotopes in plants, important of carbon dating, determination of the history of planet by carbon dating method, Physics of Carbon dating.

Unit II: Luminescence and its application 20 Marks

Introduction of luminescence, mechanism of luminescence, glow curve, different luminescence phenomenon, fluorescence, applications of fluorescence (basic idea), phosphorescence, thermoluminescence (TL), basic application of thermoluminescence in Archaeology, Biology and Biochemistry, Forensic science, Geology , Quality control in Industry, Radiation Dosimetry, Application of TLD in Medicine, Radiotherapy Measurements, Environmental Monitoring, Personal monitoring, Personal monitoring

Unit II: Thermoluminescence Dating 15 Marks

Natural radioactivity and annual dose, gamma irradiation, beta irradiation, alpha irradiation, measurement of thermoluminescence (idea), basic thermoluminescence dating, age equation and evaluation.

Unit III: Meteorite dating 10 Marks

Meteorite, Meteorite in history, determination of the age of the meteorite and its application to the determination of the age of the earth.

Unit IV: Introduction to X-ray and Ultrasound 25 Marks

Introduction of X-ray, production of X-ray, different types of X-ray, applications of X-ray. What is ultrasound, how to prepare for an ultrasound, how an ultrasound is performed, and applications of ultrasound.

Unit V: Introduction to Radiation therapy **15 Marks**

Introduction of radiation and its effects, introduction of radiation therapy, early development in radiation therapy, ionizing radiation, types of radiation therapy, intensity-modulated radiation therapy, particle beam therapy, brachytherapy, targeted radiation therapy, indication for radiation therapy, toxicities of radiation therapy, advantages of radiation therapy in the treatment of cancer.

Suggested Books

1. Thermoluminescence Dating : M. J. Aitken
2. Theory of thermoluminescence and related phenomena : R. Chen and S.W.S. McKeever
3. Radiocarbon dating : M.J. Aitken
4. Handbooks for Archaeologists: No. 3: Radiocarbon Dating. Strasbo. : Mook, W.G.; Waterbolk, H.T. (1985).
5. Introduction to crystallography: Donald E. Sands
6. Dynamic Adaptive Radiation Therapy: A Primer on DART, the Most Comprehensive Solution for Informed Patients, by Michael Dattoli M.D. and Jennifer Cash

SEMESTER - V

PHY: H505 ELECTRONICS 100 Marks

Objective of the Course: This paper deals with

- *The basic concept of physics of semiconductors.*
- *Basic principles of biasing and transistor amplifiers.*
- *The construction of Oscillators.*
- *Fundamental concepts of digital electronics.*
- *Working of special diodes and transistors.*

Unit I: Basic circuit analysis 10 Marks

Circuit models, Kirchhoff's law, single equation loops, Single node pair circuit, Voltage and current divider riles, Principle of superposition, Thevenin and Norton's theorems, Two port analysis of an electrical network.

Unit II: Semiconductor diodes 10 Marks

p-n junction diode, I-V characteristics, application in rectifiers, clippers and limiters, Zener diodes and its application.

Unit III: Bi-polar junction transistors (BJT) 30 Marks

p-n-p and n-p-n structures, active and saturation regions, characteristics of BJT, common emitter configuration, input and output characteristics, z and h parameters, common base configuration, output characteristics, two-port analysis of a transistor using z and h parameters, load line concept, emitter follower, biasing methods, stability factor, low frequency model.

Derivation of current gain, input resistance, voltage gain and output resistance of the CB, CE amplifier configurations (for small signals), the CE configuration with an ammeter resistor (also for small signals), bypassing of the emitter resistor with a bypass capacitor.

Unit IV: Field effect transistor (FET) 10 Marks

Classification of various types of FETS, constructional details of junction field effect transistor, drain characteristics of JFET, biasing of JFET, operating regions, pinch off voltage, idea of metal- oxide-semiconductor-field-effect-transistor (MOSFET).

Unit V: Amplifiers 25 Marks

Resistance-capacitance and transformer coupled amplifiers, power amplifiers- class A, B, AB, and C operations, concept of negative and positive feedback, representation of a single loop negative feedback amplifier, transfer gain with feedback, merits and demerits of negative feedback, Differential amplifiers, principles of operational amplifiers, transfer characteristics, offset parameters, differential gain, CMR, inverting and non-inverting operational amplifier, operational amplifier adder, differentiator, integrator, applications of operational amplifier.

Unit VI: Oscillators 5 Marks

Wave – form generators, Barkhausen criterion, RC oscillator, Wien Bridge oscillator, phase shift oscillator.

Unit VII: Digital circuits 10 Marks

Binary system, Boolean algebra, NOR, NAND gates, half and full adders, minimization of Boolean expressions using K-map.

Suggested books:

1. Digital principles and applications: Donald P. Leach and Albert Paul Malvino (Glencoe, 1995)
2. Basic electronics and linear circuits: N.N. Bhargava, D.C. Kulshreshtha and S.C.Gupta (Tata McGraw Hill, 2006)
3. Integrated Electronics: Millman and Halkias
4. Electronics: D. Chattopadhyay and P.C. Rakshit
5. Principal of electronics: V.K. Mehta, Rohit Mehta, S. Chand & Company.
6. Elements of electronics: M.K. Bagde, S.P. Singh: S.Chand & Company (Pvt) Ltd.

PHY: H506 **MATHEMATICAL PHYSICS** F.M. -100

Objective of the Course

- This paper deals with various Mathematical techniques which are very useful in the study of physics and engineering application.
- Function of Complex variable and Fourier analysis occur frequently in all branches of physics.
- Special functions and partial differential equations deals in details in this paper.

Unit I: Complex variables and functions of a complex variable 35 Marks

Complex numbers and their representation, modulus and argument of a complex number, function of a complex variable, continuity and derivative, Cauchy- Riemann condition, analytic functions, integration of a function of a complex variable, Cauchy's theorem, Cauchy's integral formula, Taylor's series for an analytic function, Laurent series, Singularities and their classification, residue and the residue theorem, evaluation of definite integrals.

Unit II: Special Functions 30 Marks

Gamma functions, recurrence relations, Beta function and recurrence relations, relation between gamma and beta function.

Legendre, Hermite and Laguerre Polynomials, associated Legendre functions, differential equations and series solutions, generating functions, recurrence relations, Orthogonality relations. Bessel Differential equation, generating functions, recurrence relations, zeros of the Bessel function, orthogonality relations, series expansion of a function in terms of a complete set of orthogonal functions.

Unit III: Partial differential equations 20 Marks

Vibrations of stretched string, derivation of the equation and its solution under various initial conditions, vibration of rectangular and circular membranes, heat conduction, derivation of the equation, solution for the temperature in a finite rod, semi- infinite rod, the classical wave equation and the Laplace equation.

Unit IV: Fourier series 15 Marks

Orthogonality of the sine and cosine functions, Fourier series of a function, Fourier series expansion of a periodic function, Parseval's theorem, sine and cosine series.

Suggested books:

1 Advanced Engineering Mathematics : Erwin Kreyzig

2 Mathematical methods for Physicists: G. Arfken and Weber

3 Mathematical Physics: A.K. Ghatak ,I.Goyal and Chu

4 Applied mathematics for Engineers and Physicists: L.A. Pipes and L.R. Harvell

5 Complex variables (Schaum series): M. Spiegel

6 Complex variables and applications: R.V. Churchill, J.W. Brown, R.F. Verhey, McGraw-Hill, Kogakusha, Ltd.

PHY: H507P **PRACTICAL** 100 Marks

List of Experiments:

1. To draw the characteristics of a transistor in the CE and CB configurations
2. To draw the resonance curve of series and parallel LCR circuit and to determine the Q-factor
3. Determination of the constant of a ballistic galvanometer by using a standard capacitor
4. To construct two input OR and logic gates using p-n junction/ transistor and to verify their truth tables.
5. To study the performance of NOT circuit using transistors.
6. To draw the characteristics of a Zener diode and to study its use as a voltage regulator.
7. To study solid state half wave and full wave rectifiers and to determine the ripple factor and p.c. of regulation and different types of filters.
8. To plot the frequency response of an RC coupled amplifier i) without feedback and ii) with negative feedback and to determine the bandwidth in each case
9. Determination of self inductance by Anderson's method.
10. Determination of the band gap of a p-n junction diode (germanium)

SEMESTER VI

PHY: H608 QUANTUM MECHANICS F.M. -100

Objective of the Course

- *This paper is a powerful tool of modern physicist and most of the experimentally observed phenomena in Modern Physics are explained only by Quantum Mechanics.*
- *One cannot imagine now, to do research in Physics, without understanding Quantum mechanics.*
- *This paper will deals with the origin of Quantum theory and its formalism.*
- *The concept of commutator, eigen value, eigen function and Hydrogen energy spectrum etc will be deals in detail.*

Unit I: Origin of the Quantum theory 30 Marks

Failure of classical physics to explain the phenomena such as Black body radiation spectrum and Planck's hypothesis, Planck's radiation law, Einstein's idea and the photo electric

effect, Compton Effect, Franck- Hertz experiment Stability of the atom, Bohr's postulate of angular momentum quantization and the Bohr atom model, Bohr-Sommerfeld quantization rule, limitations of Bohr's theory.

Wave particle duality: De Broglie hypothesis for matter waves, the concept of wave and group velocities, De Broglie's wave and wave particle duality, Davisson Germer experiment, electron diffraction and neutron diffraction

Development of Quantum mechanics: Wave behaviour of matter, two slit experiment with electron (thought experiment), superposition, description in terms of probability and need for probability amplitude, Wave packet, Heisenberg's uncertainty principle (thought experiment and applications), Bohr's complimentary principle, Bohr's correspondence principle.

Unit II: Basic postulates and formalism 30 Marks

Schrodinger wave equation- time dependent and time independent equation, wave function as probability amplitude, normalization of wave function, probability conservation, conditions for physical acceptance of wave function, equation of continuity (differential probability conservation), dynamical variables as operators Eigen values and Eigen function of a dynamical variable, Hermiticity and reality of eigen values, physical meaning of eigen values of a dynamical variable, superposition of wave functions and the expansion postulate, expectation values and Ehrenfest's theorem, the quantum analogue of the classical equation of motion, constants of motion.

The Commutator: The fundamental Commutator and the Commutator algebra; precise definition of uncertainty and the uncertainty relation (statement).

Unit III: 40 Marks

Stationary states and energy Eigen states: Stationary states, time independent Schrodinger equation, the stationary state wave functions, free particle and plane wave

Particle in one dimensional box: Energy eigen values and eigen functions, graphical illustrations, nodes as the energy quantum number, calculation of the expectation values, qualitative estimation of the ground state energy from the uncertainty principle.

Linear harmonic oscillator: Solution of the Schrodinger equation for energy eigen values and eigen functions, Calculation of the expectation values and matrix elements, parity of eigen functions, the virial theorem.

One-dimensional potential barrier: One-dimensional finite potential step, stationary solutions, reflection and transmission coefficients, phenomenon of barrier penetration.

Hydrogen atom: Solution for the energy spectrum and the eigen functions, the quantum numbers n, *l*, m. Degeneracy, expectation values, the viral theorem.

***Suggested books**:*

1. Quantum Mechanics: B.H. Bransden and C.J. Joachain(Pearson, 2008)
2. Quantum Mechanics: E. Merzbacher (John Wiley & Sons, Inc 1997)
3. Quantum Mechanics: Theory and Applications: A. Ghatak & S. Lokanathan (5th edition)
4. Quantum Mechanics: G. Aruldhas (Prentice Hall India)
5. Concepts of modern Physics: Arthur Beiser
6. Modern Physics: R. Murugeshan and K. SivaprasathS(S. Chand & Company Ltd)
7. Quantum Mechanics: L.I. Schiff (McGraw Hill Book Co., New York, 1968)
8. Quantum Mechanics: J.L.Powell & B. Crasemann (Addition-Wesley Pubs. Co., 1965)
9. Introduction to Quantum Mechanics: P.T. Matthews, Tata McGraw-Hill Publishing Com. Ltd.
10. Quantum Physics: R.G. Newton, Springer-Verlag, New York.

PHY: H609 **PHYSICS OF MATERIALS** 100 Marks

Objective of the Course

- *The principles of Physics which are applied to study of solids, the relationship between structure and property is brought out in this paper.*
- *Details of magnetic properties are brought out in this paper also.*
- *This paper serves as pre-requisite to study the burning subjects of physics such as materials science, supercomputer, nano science, etc.*

Unit I: Crystal structure 20 Marks

Crystalline and amorphous materials, lattice and unit cell, lattice translational vectors, lattice with a basis- central and non central unit cell, reciprocal lattice, Bravais lattice types, Brillouin zones of sc, bcc, fcc lattices, X-ray diffraction: Bragg's law, X-ray Scattering, atomic structure factor and geometric structure factor.

Van der Wall London interaction, repulsive interaction and cohesive energy, ionic crystals, Madelung energy, covalent, metallic and hydrogen bonded crystals.

Unit II: Electrical properties of Materials 20 Marks

Free electron model and its limitation, elementary band theory, Bloch theorem, Kronig Penney model, effective mass, concept of hole, band gaps, classification of solids, intrinsic and extrinsic semi conductor, p-type and n- type semiconductors, conductivity of semi conductors, concentration of charge carriers, Fermi level and its temperature dependence, classical Hall effect.

Unit III: Magnetic properties of materials 20 Marks

Types of magnetic materials, classical theory of diamagnetism and Para magnetism, Curie law, Weiss's theory of ferromagnetism, magnetic domains, soft and hard magnetic materials.

Unit IV: Lattice dynamics 15 Marks

Lattice Vibrations, monatomic and diatomic lattice vibrations, acoustic and optic modes, Einstein's theory of specific heat, density of states, Debye's theory of specific heat.

Unit V: Superconductivity 15 Marks

Experimental properties, Meissner effect, London's theory and penetration depth, isotope effect, type I and II superconductors, elementary idea of high T_c Superconductivity.

Unit VI: Physics of low dimension 10 Marks

Density of states in low dimension, different types of nano materials, Blue shifting quantum wells, wires and application of nano-science.

Suggested books:

1 Solid state Physics: A.J. Dekker

2 Introduction to Solid state Physics: C. Kittel

3 Solid state Physics: A. R. Verma and O.N. Srivastava

4 Introduction to Nanoscience: Poole etal

5 Solid state Physics: Keer

6 Solid State Physics: S.O. Pillai, New Age International (P) LTD.

7 Nano Technology: S. Shanmugam, MJP Publishers.

8 The crystal lattice: Arnold M.Kosovich: Wiley-Vch Verlag Gmbh & Co.K GaA

PHY: H610P **PRACTICAL** 100 Marks

List of Experiments:

1. Determination of wave length of monochromatic light by using Fresnel's biprism.
2. To draw the (μ- lambda) curve for the material of a prism by using spectrometer and verification of dispersion formula.
3. To draw the (μ- lambda) curve for the material of a prism by using a Spectrometer and to determine the wave length of the given source.
4. To draw the (D- lambda) curve for a given spectrometer and hence to determine the wave length of the unknown source.
5. Determination of the grating constant by using sodium light and hence to determine the wave length of the unknown radiation.
6. To calibrate a Polarimeter and to determine the concentration of a given solution

7. Determination of electronic charge by Millikan's experiment.
8. Determination of e/m of electron by Thomson's method.
9. To determine Planck's constant using a photocell.

Suggested books:

1. A Handbook of Advanced Practical Physics: C. R. Dasgupta.
2. Advanced practical physics: K.G.Mazumdar
3. Practical physics: D. Chattopadhyay and P. C. Rakshit
4. A Text book of Advanced Practical Physics: S.K.Ghosh.

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xii. ZOOLOGY

Structure of Elective and Honours Course

Semester	Subject-Paper Code*	Paper Name	F. M./ P. M.	Time required (Hours)
1	ZOO: E101	Principles of Classification, Zoogeography	75/30	100
	ZOO: E101P	Practical based on E101	25/10	30
2	ZOO: E202	Functional Anatomy of Non-Chordata	75/30	100
	ZOO: E202P	Practical based on E202	25/10	30
3	ZOO: E303	Functional Anatomy of Chordata	75/30	100
	ZOO: E303P	Practical based on E303	25/10	30
	ZOO: HSC I (non-credit)	Biostatistics, Chordate and Biotechnology	100/35	100
4	ZOO: E404	Environmental Biology, Applied Zoology, Wildlife and Computer Application	75/30	100
	ZOO: E404P	Practical based on E404	25/10	30
	ZOO: HSC II (non-credit)	Bioinformatics, Biodiversity, Environmental changes and Fisheries	100/35	100
5	ZOO: H505	Cell Biology and Genetics	100/40	130
	ZOO: E506	Evolution, Ethology, Biotechnology & Bioinstrumentation	100/40	130
	ZOO: H507P	Practical based on H505 & H506	100/40	130
6	ZOO: H608	Animal Physiology & Endocrinology	100/40	130
	ZOO: H609	Developmental Biology, Histology and Biological Chemistry	100/40	130
	ZOO: H610P	Practical based on H608 & H609	100/40	130
	12 Papers		1200	1500

*E- Elective; H- Honours; P- Practical; HSC- Honours Supportive Course;

SEMESTER-I

ZOO: E101 Principles of Classification, Zoogeography and Palaeozoology

Full mark-75

Unit 1. Classification **20 lecturers; 15 marks**

Classification of animals - historical account. Species concept.
Taxonomy and Systematics, Taxonomic hierarchy.

Unit 2. Code and approaches in Taxonomy **30 lecturers; 20 marks**

International Code of Zoological Nomenclature. Concepts of chemotaxonomy and numerical taxonomy.
Approaches in taxonomy: morphometric and cytological techniques. Basic concept of molecular techniques in taxonomy.

Unit 3 Zoogeography **25 lecturers; 20 marks**

Zoogeographical regions of the world with characteristic fauna. Marine realm and its division and characteristics.
Barriers - types and significance; Continental drift. Discontinuous distribution.

Unit 4. Palaeozoology **25 lecturers; 20 marks**

Fossils and fossilization, types of fossils; trace fossils and living fossils. Dating of fossils, significance of fossils. Geological time scale and associated fauna.

RECOMMENDED BOOKS

1. Darlington, P.J. *The Zoogeography: The geographical distribution of animals*. Wiley Publication, New York.
2. Hubbs, C.L. *Zoogeography.* Ayer Co Publication; Reprint Edition.
   Illies, J. 1974. *Introduction to Zoogeography.* Macmillan.
3. International Commission for Zoological Nomenclature (ICZN). 1999. *International Code of Zoological Nomenclature.* Natural History Museum,Cromwell Road, London SW7 5BD-UK. (available online free: www.iczn.org).
4. Kapoor, V.C. *Theory and Practice of Animal Taxonomy.* Oxford-IBH Publishing Co., N. Delhi, Mumbai & Kolkata.
5. Mayer, E. *Principles of Systematic Zoology.* Mc-Grave Hill Publication, New Delh.
6. Simpson, G.C. *Principles of Animal Taxonomy.* Oxford-IBH Punlishing Co, New Delhi
7. Tiwari, S. *Readings in Indian Zoogeography (vol.1).* Today & Tomorrow Printers & Publishers.

ZOO: E101P PRACTICAL (25 marks)

Taxonomic Procedures 10 marks

Collection of specimens, recording of locality, co-ordinates, altitude, river basin, lake, mountain range etc., method of catch, local name, description of characters, particularly colour in fresh. Labelling/Tagging of specimens and its correlation with field record book. Narcotization, Fixation and Preservation techniques - Wet, Dry, Slide Preparation, Camera-Lucida drawing of specimens. Morphometric and meristic characters, data sheets and data entry. Description of a species. Identification using dichotomous keys.

Zoogeography & Palaeontology 5 marks

Elementary knowledge about origin and evolution of groups of animals in Geological timescale.

Record Books 3 marks
Field Collection & Reports 3 marks
Viva Voce 4 marks

SEMESTER II

ZOO: E202 Functional Anatomy of Non-Chordata (75 marks)

Unit 1. Protozoa, Metazoa 19 lecturers; 15 marks

Protozoa: Distinguishing characters and classification upto classes. Structure. locomotion, osmoregulation, nutrition, reproduction. Life history and pathogenecity of *Entamoeba histolytica, Trypanosome gambiense, Plasmodium vivax.*

Metazoa: Origin of metazoa, metamerism and symmetry.

Unit 2. Porifera and Coelenterata, 14 lecturers; 10 marks

Porifera: Distinguishing characters and classification upto classes. Canal system, skeleton, Economic importance of sponges.

Coelenterata: Distinguishing characters and classification upto classes. Metagenesis (Alternation of Generation) in Obelia, Polymorphism in Coelenterata.

Unit 3: Ctenophore, Platyhelminthes and Nemathelminthes.
19 lecturers; 15marks

Ctenophore: Structural organization.

Platyhelminthes: General structure and classification upto classes. Life cycle and parasitic adaptation in *Fasciola hepatica* and *Taenia solium.*

Nemathelminthes: Distinguishing characters and classification upto classes. Life cycle pathogenecity and prophylaxis of *Ascaris lumbricoides.*

Unit 4. Annelids, Arthropoda, 20 lecturers; 15 marks

Annelids: Distinguishing characters and classification upto classes. Coelom, Digestive, Excretory, Blood vascular system and Nervous system of Neries. Trochophore larva – structure and affinities.

Arthropoda: Distinguishing characters and classification upto classes. Mouth parts of insects, larval forms of Crustacea. Metamorphosis and social life in insects.

Unit 5. Mollusca and Echinodermata 14 lecturers; 10 marks

Mollusca: Distinguishing characters and classification upto classes. Digestive, Respiratiry and Nervous system of *Pila*. Torsion and detorsion in Gastropods, Structure and affinities of *Neopilina.*

Echinodermata: Distinguishing characters and classification upto classes. water vascular system, larval forms.

Unit 6. Minor Phyla 14 lecturers; 10 marks

Distinguishing characters and examples of Nemertinea, Rotifera, Acanthocephala, Sipunculida, Echiurida, Bryozoa (Ectoprocta), Brachyopoda and Phoronida.

RECOMMENDED BOOKS

1. Anderson, D.T. *Invertebrate Zoology.* Oxford University Press.
2. Brooks, W.K. *Handbook ofInvertebrate Zoology.* Kessinger Publishers.
3. Ekambranath, M. & Ananthakrisbnan, T.N. 2000. *Manual of Zoology, Part I & 2.* S. Vishwanathan Printers and Publishers, Chennai.
4. Parker; T.J. & Haswell, W.A. *A Text-book of Zoology, Vol. 1, McMillan* Co.
5. R. L. Kotpal, *A text book of Invertebrata (series of all phyla)*

ZOO: E202P PRACTICAL (25 marks)

Dissections. 7 mark

Nereis: – digestive and nervous systems.

Cockroach: – digestive, reproductive and excretory systems.

Pila: - digestive and nervous Systems.

Study permanenent slides 2 marks

Paramecium entire, conjugation, Monocystis, Euglena, Trypanosome, LS of Sycon, Spongin fibres, Obelia colony, T.S. of Ascaris (male & female), T.S. of Fasciola and Taenia. Cercaria, sporocyst and redia larva of Fasciola. Scolex, mature and gravid segments of Taenia. Mouth parts of Anopheles, Housefly and cockroach, bed bug (W/M), body louse (W/M), T.S. of gill of Pila, TS of arm of Star fish.

Study of specimens 5 marks

Sycon, Spongilla, Physalia, Porpita, Favia, Tubipora, Madrepora, Aurelia, Sea-anemone, Alcyonium, Taenia, Hetronereis, Aphrodite, Chaetopterus, Sabella, Leech, Bonellia, Spider, Limulus, Millepede, Centipede, Crab, Peripatus, Scorpion,

Termite, Daphnia, Cyclops, Balanus, Chiton, Dentallium, Pearl Oyester, Limax, Nautilus, Octopus, Sepia, Loligo, Solen, Aplysia, Antedon, Holothuria, Sea urchin, Starfish, Brittle star.

Temporary mounts **3 marks**

Spongin fibre, Spicules and gemmules of sponge, Obelia colony, ovary and spermatheca and septal nephridia of Earthworm, Parapodia of Nereis. Mouth parts of cockroach, house fly and mosquito. Radula of Pila, Daphnia, Cyclops, Mysis.

Record Books **3 marks**

Viva Voce **5 marks**

SEMESTER-III

ZOO: E303 Functional Anatomy of Chordata 75 marks

Unit 1. General organization of Chordata 12 lecturers; 8 marks

General characters of Chordata and classification upto classes. General characters of Hemichordata, Urochordata and Cephalochordata.

External features, Digestive, Excretory, Sense organs, Reproductive system and Affinities of Amphioxus. Retrogressive metamorphosis of Urochordata.

Unit 2. Agnatha and Pisces 15 lecturers; 10 marks

Petromyzon: external feature, digestive system, respiratory system and reproduction.

Scoliodon: external features; respiratory, circulatory and reproductive systems; brain and cranial nerves.

Air bladder, accessory respiratory organ of fishes. General characters and distribution of Lungfishes.

Unit 3. Amphibia and Reptilia 18 lecturers; 12 marks

Amphibia: origin and evolution, distictive characters and classification upto living orders with examples, metamorphosis and neoteny.

Reptilia: distinctive characters and classification upto living orders with examples; affinities of Sphenodon; distinction between poisonous and non-poisonous snakes; biting mechanism in snakes; Mesozoic reptiles.

Unit 4. Aves 15 lecturers; 12 marks

Aves: origin of birds; distinctive characters and classification upto living orders with examples. Pigeon: feathers; digestive, respiratory, circulatory, urino-genital and skeletal system; brain; distinctive characters of Ratitae & Carinatae with examples; general characters of Archaeopteryx. Perching mechanism in birds.

Unit 5. Mammalia 10 lecturers; 8 marks

Mammal: origin; general characters and classification of Prototheria, Metatheria and Eutheria. Dentition and placentation in mammals. Rabbit: skeletal, excretory and reproductive systems

Unit 5. Comparative anatomy **30 lecturers; 25 marks**

Integumentary system: integument and its derivatives. Digestive system: alimentary canals and associated glands. Circulatory system: heart and aortic arches. Skeletal system: jaw suspension; visceral arches, vertebral column; limbs and girdles. Nervous system: brain; cranial nerves; spinal nerves. Urino-genital system: succession of kidney and evolution of urino-genital ducts. Endocrine glands: pituitary, thyroid, adrenal, pancreas and gonads.

RECOMMENDED BOOKS

1. Ekambranath, M. & Ananthakrishnan, T.N. 2000. *Manual of Zoology, (Chordata) Part I & 2.* S. Vishwanathan Printers and Publishers, Chennai.
2. Kent Jr. G.C. 1969. *Comparative Anatomy of the vertebrates.* The C.V. Mosby Corn. Toppan, Japan.
3. Kingsley, J. S. 1962. *Bulletins of Comparative Anatomy,* Central Book Depot, Allahabad.
4. Parker, T.J. & Haswell, W.A. *A Text-book of Zoology, Volume 2,* McMillan Co, Bombay, Calcutta, Madras.
5. Sedgewicke, A. *A student textbook of Zoology.* Central Book Depot, Allahabad.
6. Wake, M.H. 1992. *Hyman's Comparartive Vertebrate Anatomy, 3rd Edn.,* The University of Chicago Press.
7. Weichert, C.K. *Anatomy of the Chordates*. McGraw Hill Book Inc., New York.
8. Weichert, W.C. & Presch, W. 1997. *Elements of Chordate Anatomy.* Tata-McGraw Hill Publishers Co, Ltd., New Delhi.
9. Young, J.Z. *The Life of Vertebrates.* Oxford University Press, New York.
10. R.L. Kotpal, *Modern text book of zoology, Vertebrates*, Rastogi Publications.
11. E.L. Jordan and P.S. Verma, *Chordate Zoology and Elements of Animal Physiology,* Published by S. Chand & Co. (Pvt.) Ltd.

ZOO: E303P **PRACTICAL** **(**25 marks)

Dissections **6 marks**

Scoliodon afferent and efferent branchial vessels; V, VII, IX and X cranial nerve, internal ear and brain (to be taken out). Frog or toad –V, VII and X cranial nerves. Calotes – arterial, venous and urino-genital systems.

Study of specimems **6 marks**

Amphioxus, Balanoglossus, Ascidian, Petromyzon, Myxine, Electric ray, Sea horse, Saw fish, Sucker fish, Hammer headed shark, Salamander, Hyla, Hemidactylus, Mabuia, Varanus, Turtle, Tortoise, Chameleon, Draco, Cobra, Viper, sea-snake, Krait, Parrot, Cuckoo, Kite, Myna, Flying fox, Duck-billed Platypus, Echidna.

Study of bones **5 marks**

Toad or Frog – skull, lower jaw, pectoral & pelvic girdles, vertebrae. Calotes- skull, lower jaw, pectoral & pelvic girdles, atlas and axis. Pigeon – lower jaw, cervical vertebrae, rib, pectoral and pelvic girdles and pygostyle. Rabbit – skull, lower jaw, pectoral and pelvic girdles.

Record Books **3 marks**

Viva Voce **5 marks**

HONOURS SUPPORTIVE COURSE-I (SEMESTER-III)

ZOO: HSC I **Biostatistics, Chordate and Biotechnology**

100 marks

Unit I (Biostatistics) **20 marks**

Introduction, Purpose and scope, Statistical terms and symbol, Sampling and collection, Tabulation of data, Presentation of data, Measures of central tendency-mean, mode and median; probability, standard errors and standard deviation; Test of significance: Student's T-test, Chi-square test.

Unit 11 (Chordate) **30 marks**

Distinctive and adaptive characteristics of Chordates, Ascidian tadpole and retrogressive metamorphosis, Origin of paired fins in fishes, migration in fishes, Parental care in amphibia, Aortic arches of frog, Snake venom and its importance, Flight adaptation and migration in birds, Races in man (Caucasoid, Mongoloid, Negroid and Australoid.)

Unit III (Biotechnology) **50 marks**

Concept and scope of biotechnology, Cell culture media, Preparation and sterilization, Primary cell culture, Cell line, Plunipotent stem cell, Cryopreservation of cultures.
Concept of recombinant DNA technology, Cloning vectors, Restriction and modifying enzymes, Agarose and polyacrylamide gel electrophoresis, Molecular analysis of DNA, RNA and proteins (Southern, Northern and Western blotting), DNA sequencing (Maxam-Gilbert and Singer method), Polymerase chain reaction. Patenting and Biosafety

Reference books:

1. Text Book of Vertebrate Zoology—S.N. Prasad
2. Chordate Zoology—E.L. Jordan and P.S. Verma
3. Vertebrate Zoology—Vishwanath
4. Zoology of Chordate—Nigam H.C.
5. The Biology of Amphibia—Noble G.K.
6. Snakes of India—Gharpura K.G.
7. Vertebrates—Kotpal R.L

8. Elements of Biostatistics—Satguru Prasad
9. Principles of Statistics—D.N. Ethans
10. Elementary Statistics and Probability—Lalgi Prasad
11. Biomathematics—M.H. Quenouille.
12. Basic Biostatistics and its Application—Animesh K. Dutta.

SEMESTER-IV

ZOO: E404 Environmental Biology, Applied Zoology, Wildlife and Computer Application

(75 Full marks)

Unit 1. Biodiversity **25 lecturers; 20 marks**

Biodiversity: concept; biodiversity hotspots; IUCN Red list category, Wildlife of India with particular reference to Manipur; methods adopted in wildlife census. Concept of wildlife conservation, in-situ & ex-situ conservation, captive breeding, biotechnological intervention. Sanctuaries and National parks of India, Ramsar sites.

Unit 2. Environmental Ecology **15 lecturers; 10 marks**

Concept of Ecosystem. Major ecosystems, man-made ecosystem and ago-ecosystem. Biotic and abiotic factors. Food chain and energy flow, ecological pyramids, ecological niche, habitat, biosphere and biome. Ecological succession, Biogeochemicals cycle: water, oxygen, carbon and nitrogen.

Unit 3. Population and pollution **15 lecturers; 10 marks**

Population. General features, natality, mortality, population density, immigration, emigration, migration, age pyramids, sex ratio, population equilibrium, dispersal and dispersion; Leidig's law of minimum and Shelford's law of tolerance; concept of limiting factors and life table construction method.

Environmental pollution. Types, sources, indicators, causes and control and prevention of pollution. Toxic effects of pesticides and industrial wastes. Biomagnification.

Unit 4. Applied Zoology. **25 lecturers; 20 marks**

Apiculture and Sericulture. Species diversity, life history, rearing methods, diseases and economic utility of bees, tasar worms and mulberry silk worm. Fisheries. Culture and capture fishery. Fishes of commercial value: food and ornamental. Introduction to different pisciculture techniques: extensive and intensive pond fish culture.

Unit 5. Computer Applications. **20 lecturers; 15 marks**

Basic concepts of computer: hardware and software, operating systems. Computer application in Biological sciences. Elementary knowledge of Bioinformatics, E-learning, Networking Programmes used in biostatistics: SPSS, Minitab, phylogenetic, networking modelling etc.

RECOMMENDED BOOKS

1. Alfred, J.R.B. Das, A.K. & Sanyal, A.K. 1998. *Faunal Diversity in India.* Zoological Survey of India, Kolkata.
2. Annanthakrishnan, T.N. 1982. *Bioresources Ecology.* Oxford-11314 Publ Co., Pvt. Ltd, N. Delhi
3. Dandin, S.B., Jayaswal, J. & Giridhar. *Handbook of Sericulture Technologies.* Central Silk Board.(Ministry of Textiles, Govt. of India), CSB Complex, BTM Layout, Madivala, Bangalore-560068.
4. DOEACC. *"CCC" Course on Computer Concepts.* Doeacc Society, Electronics Niketan, 6 CGO Complex, New Delhi-110003.
5. French, C.S. *Data Processing and Information Technology*. BPB Publication.
6. Kormondy, E.J. *Concepts of Ecology.* Patience-Hall, India
7. Krebs, C.J. 1972. *Ecology, the experimental analysis of distribution and abundances.* Harper Intl. Edn., Harper & Row Publ. London.
8. Newman,M.C. *Fundamental of Ecotoxicology.* Lewis Publishers, Washington DC.
9. Odum, E.P. Ecology. *Oxford-IB11 Publishing Co.,* New Delhi, Mumbai & Kolkata.
10. Rajaraman, V. *Fundamentals of Computers.* Prentice Hall, India Ltd., New Delhi. www.iucnredlist.org. (Official website of IUCN).

ZOO: E404P **PRACTICAL** **(**25 marks)

Environmental Biology **5 marks**

Study of ecosystem of a pond. Identification of biotic and abiotic components. Recording of turbidity, temperature and pH. Estimation of Oxygen (Winkler's method) and Carbon dioxide (phenolphthalein method) of pond water. Population study by tagging experiment (to track the movement of animals)- marking, releasing & recapturing method.

Applied Zoology **8 marks**

Study of life history stages of a Honey bee, a Silk moth and a fish. Morphological differences among the different castes of Honey bee.

Wile life **5 marks**

Visit to Wilelife sanctuary/Zoo/National Park/any other worth visiting site and study of the available anikkals.

Record Books **3 marks**

Viva Voce **4 marks**

HONOURS SUPPORTING COURSE II (SEMESTER-IV)

ZOO: HSC II **Bioinformatics, Biodiversity, Environmental Changes and Fisheries**
(100 Full marks)

Unit I (Bioinformatics) **30 marks**

Branches of bioinformatics, Aim and Scope; Introduction to biological Databases Classification and format of Biological Databases (Nucleotide, protein Database and Gene expression Database), Database retrieval system; National center for biotechnology information.

Unit 11 (Biodiversity and environmental changes) **50 marks**

Biodiversity and its conservation: Causes of reduction of Biodiversity, Wildlife conservation acts, Hot spots of biodiversity in India, Census of wildlife with special reference to Sangai.

World heritage sites, Role of organizations like NBPGR< BSI, ZSI, WWF and IUCN, Convention of Biological diversity, Ramsar convention.

Green- house effect and global warming, climate change- shrinking of glaciers and polar caps and consequent effects on river and sea levels, Ozone layer depletion, International controlling forum (Vienna convention, Montreal Protocol, UNFCCC, Kyoto Protocol etc.)

Unit III (Fisheriesy) **20 marks**

Induce breeding; Types of Pisciculture (Monoculture, poly-culture or composite culture and integrated fish farming); Preparation and maintenance of fish pond.

Reference books:

1. Bioinformatics; Principles and Application—Gosh Z. and Bibekanand M. (2008)
2. Bioinformatics and Functional Genomics—Pevsner (2009)
3. B^{i}-odiversity—Agrawal K.C.
4. Environmental Biology—Mukherjee
5. Ecology and Environmental Biology—S. Arora
6. Principles of Systematic Zoology—Mayr and Ashlock
7. Environmental Science—Enger and Smith
8. Fish and Fisheries of India—Jhingran V.G.
9. An Introduction to Fishes—S.S. Khanna

SEMESTER-V

ZOO: H505 **CELL BIOLOGY AND GENETICS**

Full mark-100

Unit 1. Cellular organization. **15 lecturers; 15 marks**

Prokaryotic and eukaryotic cells. Intercellular adhesion and interaction. Various models of plasma membrane, active and passive transport of plasma membrane.

Unit 2. Cytoplasmic organelles. **20 lecturers; 15 marks**

Structure and function of mitochondria, endoplasmic reticulum, ribosomes, lysosomes, cilia, flagella, cell vacuoles, Golgi body, micro bodies.

Unit 3. Nuclear organization. **10 lecturers; 10 marks**

Nucleus: nuclear envelope, nuclear matrix, nucleolus, chromosomes, chromatids, karyotyping, supernumerary chromosomes, chromatin- euchromatin and heterochromatin.

Unit 4. Cell regulatory mechanism **15 lecturers; 15 marks**

Cell cycle, mitotic and meiotic cell division, regulation of cell division. DNA replication: Molecular expression of gene action, protein synthesis and its regulation, Lac Operon and Tryptophan Operon model.

Unit 5. Genetics **35 lecturers; 35 marks**

History of Genetics, Mendelian inheritance patterns: quantitative inheritance, linkage maps. Gene interactions: incomplete dominance, co-dominance, supplementary genes, complementary genes, epistasis, position effect, atavism, lethal gene, multiple alleles hemolytic disease of new born (HDN). Sex determination in Drosophila and man. Genetics of blood group. Modern concept of gene.

Point mutation, chromosomal aberrations, chromosome number, form and rearrangement with reference to speciation in Drosophila, polyploidy (molecular basis of mutations). Non-chromosomal inheritance, human genetics, diseases of single gene inheritance, normal and abnormal karyotypes, genetic counselling.

Unit 6. Molecular Genetics and Tools. **10 lecturers; 10 marks**

RFLP (Restriction Fragment Length Polymorphism) RAPD (Randomly Amplified Polymorphic DNA), AFLP (Amplified Fragment Length Polymorphism), Application of RFLP in DNA fingerprinting. Polymerase Chain Reaction (PCR). Human genome project.

RECOMMENDED BOOKS

1. Barke, J.D.C. *Cell Biology*. Williams & Wilkins Co.
2. deRobertis, E.D.P. & deRobertis, E.M.F. *Cell and Molecular Biology*. Holt-Saunders International Edn.
3. Gardener, E.J. *Principles of Genetics*. John Wiley & Sons Inc., New York.
4. Prescott, D.M. *Methods in Cell Biology*, Bookman Associates, Jaipur.
5. Strickberger, M.W. 2005. *Genetics.* Prentice-Hall of India, New Delhi
6. Swanson, C.P., Mezz, T & Young, W.J. Cytogenetics: *Chromosomes in divisions, Inheritance and Evolution.* Prentice-Hall of India, New Delhi.
7. B.D. Singh, *Genetics.* Kalyani Publishers, B-1/1292, Rajinder Nagar, Ludhiana.

ZOO: H506 Evolution, Ethology, Biotechnology and Bioinstrumentation

Full marks-100

Unit 1. Evolution **30 lectures; 30 marks**

History of evolutionary thought. Origin of life. Evidences of evolution, Modern concept of organic evolution, Hardy-Weinberg law, Sewall-Wright effect.

Role of mutation in evolution. Variation. Natural selection- directional, stabilizing and disruptive types. Isolating mechanism and their role in evolution. Speciation. Evolution of man.

Unit 2. Adaptation. **20 lectures; 15 marks**

Srtuctural adaptations of animals with Cursorial, Aquatic and Volant modes of life. Basic concepts of adaptations of animals to deep sea, desert and cave. Colouration and mimicry in animals. Adaptive radiation and convergence.

Unit 3. Ethology **25 lectures; 20 marks**

Description and types of animal behaviour. Learning in animals. Types of communications in insects. Pheromones and their role. Parental care in fishes. Courtship behaviour in fishes and birds. Biological Rhythm: Circadian rhythm. Migration in insects, fishes and birds.

Unit 4. Biotechnology **15 lectures; 13 marks**

Introduction, history, scope, importance and types of biotechnology. Importance of viruses, bacteria, algae and fungi in biotechnology. Biotechnology of alcohol fermentation and bio-insecticide. Principles and techniques of animal cell cultures.

Unit 5. Human Biotechnology **15 lectures; 12 marks**

Brief idea of health care biotechnology, production of human insulin. Elementary knowledge of genetic engineering. In-vitro fertilization in human and other assisted reproductive technology (ART). Transgenic animals.

Unit 6. Bioinstrumentation **15 lectures; 10 marks**

General principles and brief ideas on the types of Microscopy, Spectrophotometry, Electrophoresis, Chromatography and Centrifugation.

RECOMMENDED BOOKS

1. Alcock, J. *Animal behaviour- an evolutionary approach.* Sinauer Assoociates Inc., Massacheussets
2. Chandrasekharan, M.K. *Biological Rhythm.* Vishwanathan Printers, Chennai.
3. Lull, R.S. 1976. *Organic Evolution.* Light & Life Publisher.
4. Plummer, D.T. *An Introduction to Practical Biochemistry.* Tata-McGraw Hill Publ., New Delhi.
5. Trehan, K. *Biotechnology.* John Willey & Sons.
6. Wilson, K. and Walker, J. 2000. *Practical Biochemistry*, Principles and Techniques, 5th Edn., Cambridge University Press.
7. N. Arumugam, *Organic Evolution.* Saras Publication.

ZOO: H507P **PRACTICAL** **100 marks**

(based on ZOO: H505 & 506)

Cell Biology and Genetics **30 marks**

Squash preparation of onion root tip for the study of mitosis. Temporary and permanent squash preparation of the grasshopper testis for the study of meiosis. Temporary squash preparation of the salivary gland chromosomes of Drosophila and Chironomus.

Study of permanent slides showing autosomes and sex chromosomes of a grasshopper and a mammal.

Karyotyping of chromosomes. Demonstration of Sex Chromatin (Barr body). Demonstration of mitochondria by supra vital staining (Janus green).

Adaptation **10 marks**

Study of mimicry in insects: stick insect, leaf insect, moth, cicada, sea horse, flat fish, remora, flying lizard, bat etc.

Ethology **10 marks**

Tagging (paper/aluminum) of animals and recapture to study patterns of migration. Study of different types of nests of animals. Study of Parental Care

Biotechnology **10 marks**

Demonstration of alcohol fermentation using yeast. Demonstration of soyabean fermentation using starter culture Demonstration of curd making using starter culture

Bioinstrumentation **10 marks**

Preparation of standard curve of amino acid and protein (bovine serum albumin) Measurement of cell/spore size using micrometer. Demonstration of oil emulsion technique in microscopy. Separation of tissue extract using centrifuge. Demonstration of electrophoresis-paper/gel.

Record Books **5 marks**

Slide Submission: Mitosis, Meiosis and Salivary Gland Chromosomes **10 marks**

Viva Voce **15 marks**

SEMESTER VI

ZOO: H608 **Animal Physiology and Endocrinology (with special reference to mammals)**

100 Full marks

Unit 1. Nutrition **15 lectures; 12 marks**

Nutritional requirements-macro and micronutrients, digestion and absorption.

Unit 2. Heart, Blood and Circulation **15 lectures; 12 marks**

Origin, conduction and regulation of heart beat; cardiac cycle, electrocardiogram, composition a function of blood, blood group and Rh factor, haemoglobin and haemopoiesis; peripheral circulation, blood pressure and blood coagulation.

Unit 3. Respiration **15 lectures; 12 marks**

Mechanism and control of breathing. Transport of oxygen and carbon dioxide, oxygen dissociation curves of haemoglobin, Bohr effect, Haldane effect, chloride shift

Unit 4. Excretion **15 lectures; 12 marks**

Physiology of urine formation, mechanism of micturition, role of kidney in water regulation, salt and acid-base balance.

Unit5. Muscle, Nerve and Sense organs **25 lectures; 20 marks**

Ultrastructural, chemical and physiological basis of skeletal muscles, muscle contraction; molecular mechanism of muscle contraction, Cori's cycle. Nerve impulse. Nature, origin and propagation of nerve impulse along a neuron; synapse and myo-neural junction. Integrative functions of central nervous system. Sense organs: functions of organs related with vision, sound perception, taste, smell and touch. Electroencephalogram (EEC).

Unit 6. Endocrinology **25 lectures; 20 marks**

Definitions of endocrine glands, neurosecretory cells.
Functions and hormones 'secreted by the following glands: pineal, hypothalamus, pituitary, thyroid, thymus, parathyroid, islets of Langerhans, adrenal, testis, and ovary. Miscellaneous hormones secreted by gastrointestinal system, kidney, placenta and heart and their functions.

Unit 7. Immunology **15 lectures; 12 marks**

Introduction to immunology, innate immunity and acquired immunity, structure and types of Ig, antigen-antibodies reaction, mechanism of immune responses, brief idea of HIV and AIDS.

RECOMMENDED BOOKS :

1. Bell, G., Davidson, J.N. & Smith, D.E. *Textbook of Physiology and Biochemistry*. ELBS and Churchill Livingstone.
2. Ganong, W.F. *Medical Physiology.* McGraw-Hill Publ., N. Delhi
3. Oiuyton, A.C. & Hall, J.E. *Textbook of Medical Physiology.9th Edn.*, Elsevier, a division of Reed Elsevier India Pvt., Ltd.
4. Keele, C., Neil, E. & Joels, N. *Samson Wright's Applied Physiology.* Oxford University Press, Bombay, Calcutta, Madras.
5. Prossser, C.L. & Brown, F.A. *Comparative Animal Physiology.* W.B. Saunders Cor Philadelphia, Toppan Co. Tokyo, Japan.
6. Rastogi, S.C. *Essentials of Animal Physiology.* Wiley Eastern Ltd.
7. Turner, C.L. *General Endocrinology.* W.B. Saunders, Toppan Co.Ltd.Tokyo

ZOO: H609 Developmental Biology, Histology and Biological Chemistry

(100 marks)

Unit 1. Gametogenesis, Fertilization & Parthenogenesis 20 lectures; 15 marks

Spermatogenesis, oogenesis and vitellogenesis. Egg maturation, egg membranes, polarity of egg Fertilization and Parthenogenesis.

Unit 2. Animal egg, early stages of development, foetal membranes

20 lectures; 15 marks

Types of animal eggs, patterns of cleavage. Blastulation and gastrulation in frog and chick. Germ layers and their derivatives and homologies. Fat maps. Structure and development of extra-embryonic membranes. Placenta and its types.

Unit 3. Organogenesis, Tissue interactions & Metamorphosis

25 lectures; 20 marks

Organogenesis of central nervous system, sense organs, heart and kidney. Metamorphosis:- retrogressive and progressive. Regulation of metamorphosis in Anura and Insects. Organizer concept.

Unit 4. Histology 20 lectures; 15 marks

Basic principles of histological techniques. Microscopic anatomy of the following organs of a mammal: skin, stomach, intestine, pancreas, liver, lung, kidney, spinal chord, nerves, heart, arteries, veins, capillaries, lymph nodule, spleen, testis and ovary.

Unit 5. Biological Chemistry 20 lectures; 15 marks

Biological chemistry, its scope and importance. Chemistry of carbohydrates, proteins, lipids and nucleic acids, enzymes: nature, classification and functions of enzymes. Co-enzymes and prosthetic groups. Enzyme actions.

Unit 5. Intermediary metabolism. **25 lectures; 20 marks**

Carbohydrate: Embden-Meyerhoff pathway, TCA cycle, Glycogenolysis and glycogenesis, gluconeogenesis. Biological oxidations with special reference to the role of the electron transport system. Basic concept of Bioenergetics

Lipid: Oxidation of fatty acids, fate of glycerol, ketone body formation and utilization. Interraction of carbohydrate and lipids.

Proteins: Metabolism of amino acids. Oxidative deamination, trans-amimations, decarboxylation, enzymology of urea cycle. Fate of glucogenic and ketogenic amino acids. Interrelationship of metabolic pathways.

Recommended Books

1. Balinsky, B.I. *Introduction to Embryology.* Saunder College Publishers, Philadelphia.
2. Browder, L.W. *Developmental Biology.* Sauders College Publishing, Fawcelt,
3. D.W. *Bloom & Fawcett- A textbook or histology.* Hodder-Arnold Publication.
4. Jayaraman, J. 1981. *Laboratory Manual in Biochemistry.* New Age International Publishers,New Delhi-110002.

5. Murray, R.K., Granner, D.K., Mayer, P.A. & Rodwell, V.W. *Harper's Biochemistry.* McGraw-Hill Publ.
6. Lelininger, A.L., Nelson, D.L. & Cox, M.M. *Principles of Biochemistry.* CBSD Publishers & Distributors, Delhi.
7. J.L.Jain, *Fundamentals of Biochemistry*. S.Chand &Company Ltd. N.Delhi.

ZOO: H610P **PRACTICAL** (Animal Physiology, Endocrinology, Immunology, Developmental Biology, Histology & Biological Chemistry)
(100 marks)

Animal Physiology **30 marks**

Effects of isotonic, hypotonic and hypertonic solutions on erythrocytes.
Counting of RBC and WBC using Haemocytometer.
Estimation of haemoglobin percentage of a blood sample: amphibia or mammal.
Preparation of haemin crystals.
Coagulation of blood.
Recording of frog's heart beat. Demonstration of the effect of acetylcholine, atropine and epinephrine on the heart beat.

Endoerinology **10 marks**

Dissection of endocrine gland in rat.
Study of permanent slides: sections of pituitary, thyroid, adrenal, pancreas, testis and ovary.

Immunology **10 marks**

Determination of ABO and Rh factor of Blood.

Developmental Biology **6 marks**

Study of developmental stages of frog (permanent slides) WM: cleavage, gastrula and neurula and external gills of frog.
Study of developmental stages of chick (permanent slides) WM:18, 24, 36, 48 and 72 hours of incubation.
Study of permanent slides of sections of blastula and gastrula of chick.

Histology **16 marks**

Microtomy – fixation, embedding, block making, sectioning, staining and mounting of tissues.
Study of permanent slides – sections of oesophagus, stomach, duodenum, ileum, pancreas, lung, kidney and skin of mammal and amphibian.

Biological Chemistry **10 marks**

General test for identification of carbohydrate, lipid and protein.
Separation of amino acid using paper chromatography.
Colorimetric estimation of protein from a calibration curve (provided).

Practical Record **8 marks**
Slide Submission **5 marks**
Viva-Voce **10 marks**

xiii. Syllabus for MANIPURI

Structure of Elective & Honours Course -

Semester	Subject – Paper Code *	Paper Name	Full Mark/ Pass Mark	Time required (Hours)
1	MSL: E101	Poetry, Rhetoric and Prosody	100/35	75
2	MSL: E202	Novel and Short Story	100/35	75
3	MSL: E303	Introduction to Linguistics and Manipuri Language	100/35	75
	MAN: HSC I	Manipuri Language and Literature	100/35	75
4	MSL: E404	Literary Criticism	100/35	75
	MAN: HSC II	Folklore and Culture	100/35	75
5	MAN: H505	Kavy and Drama	100/35	75
	MAN: H506	Indian Literature in Translation	100/35	75
	MAN: H507	History of Manipuri Literature	100/35	75
6	MAN: H608	Old Manipuri Literature	100/35	75
	MAN: H609	Manipuri Culture	100/35	75
	MAN: H610	Folkloristics and Manipuri Folklore	100/35	75

* MSL for Manipuri Second Language; E for Elective; H for Honours; HSC for Honours Supportive Course

SEMESTER-I

BA -101

ENGLISH PAPER-I	Marks 100

a) Medium of Instruction : English

b) Examination Pattern : Semester Pattern

Unit-I : Poetry Marks 40

Author	: Wordsworth
Poem	: Lucy Gray
Theme	: Nature
Central Idea	: Love for Nature
Critical Appreciation	: Short Note
Important Lines	: Explanation

Unit-II : Grammar- Vocabulary Marks 20

I) Descriptive Question Grammar Marks 12

II) Vocabulary Marks 08

a) Antonyms, b) Idioms, c) Phrases, d) Proverbs, e) Abbreviations, f) Homonyms, g) Homophones,

h) Synonyms, i) Affixes, j) One Word Substitution

Question Pattern :

I) Central Idea : Descriptive Question Grammar

II) Important Lines : Explanation, Unit No 1-2

III) ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ ꯂꯥꯏꯔꯤꯛ : ꯑꯦꯜ꯭ꯕꯤꯟ ꯂꯥꯏꯁ꯭ꯔꯝ

IV) ꯗꯥ. ꯀꯃꯜ ꯁꯤꯡꯍ ꯂꯤꯈꯠ : ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯇ꯭ꯌ-ꯁꯥꯗꯨꯕ

V) ꯅꯣꯡꯃꯥꯏꯊꯦꯝ ꯂꯥꯏꯔꯤꯛ : ꯑꯦꯜ꯭ꯕꯤꯟ ꯁꯔꯨꯛ

SEMESTER-II

ꯃ-꯲꯰꯴ : ꯑꯦꯁꯦ ꯑꯃꯁꯨꯡ ꯁꯩꯔꯦꯡ	ꯃꯥꯔꯛ ꯱꯰꯰

ꯁꯔꯨꯛ-꯱: ꯑꯦꯁꯦ ꯃꯥꯔꯛ ꯶꯰

(I) ꯀꯨꯃꯍꯩꯔꯥꯛꯄꯥ ꯁꯤꯡꯍ ꯂꯤꯈꯠ : ꯇꯦꯝꯄꯦꯇꯁ

(II) ꯄꯤꯇꯝ ꯑꯩꯕꯤꯗꯥꯔ ꯂꯤꯈꯠ : ꯇꯄꯥꯡ

(III) ꯇꯣꯝꯕꯥ ꯃꯥꯏꯍꯣꯡ ꯍꯤꯔꯣ : ꯃꯍꯦꯟ ꯑꯍꯟꯅꯕ ꯍꯩꯅꯧ ꯃꯔꯤꯕ ꯂꯩꯔꯣꯡꯄꯒꯤ ꯄꯤꯊꯝ

ꯁꯔꯨꯛ-꯲: ꯁꯩꯔꯦꯡ ꯃꯥꯔꯛ ꯴꯰

ꯇꯝꯒꯗꯕ ꯇꯀꯁꯤꯟꯅꯕꯥ :

(I) ꯑꯅꯧꯕ ꯁꯩꯔꯦꯡ : ꯃꯅꯤꯄꯨꯔꯤ ꯁꯔꯨꯛꯁꯤꯡꯒꯤ

(II) ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ : ꯑ ꯑꯣꯏꯕꯒꯤ ꯄꯥꯝꯕ, ꯃꯅꯤꯄꯨꯔꯤ

ꯇꯝꯒꯗꯕ ꯁꯩꯔꯦꯡꯁꯤꯡ :

꯱ ॥ ꯗꯥ. ꯑꯣ. ꯅꯤꯂꯃꯅꯤ ꯁꯤꯡꯍ : ꯂꯣꯟ ꯂꯩꯅ (ꯑꯅꯧꯕ ꯁꯩꯔꯦꯡ)

꯲ ॥ ꯈꯨꯃꯟꯊꯦꯝ ꯀꯃꯜ ꯂꯤꯈꯠ : ꯑꯇꯣꯞꯄ ꯃꯤꯑꯣꯏ (ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ)

꯳ ॥ ꯗꯤꯇꯣꯝ ꯅꯤꯃꯥꯏ ꯂꯤꯈꯠ : ꯑꯦꯄꯥꯟ ꯀꯥꯡꯂꯥ (ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ)

꯴ ॥ ꯈꯨꯃꯟꯊꯦꯝ ꯀꯃꯜ ꯂꯤꯈꯠ : ꯈꯨꯝꯕ ꯃꯤꯑꯣꯏ ꯍꯩ (ꯑꯅꯧꯕ ꯁꯩꯔꯦꯡ)

꯵ ॥ ꯃꯤꯇꯩ ꯀꯩꯔꯥꯛ ꯂꯤꯈꯠ : ꯑꯦꯃꯥ ꯁꯩꯔꯦꯡꯀꯤ (ꯑꯅꯧꯕ ꯁꯩꯔꯦꯡ)

꯶ ॥ ꯇꯍꯕ ꯅꯤꯡꯊꯧ ꯂꯤꯈꯠ : ꯑꯁꯤꯗꯥꯃꯥ ꯍꯦ ꯑꯁꯤꯗꯥ ꯁꯦꯡꯕꯃꯥ ꯍꯦ ꯁꯦꯡꯕ (ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ)

SEMESTER-III

ꯃ-꯳꯰꯳ : ꯐꯣꯅꯣꯂꯣꯖꯤ ꯑꯃꯁꯨꯡ ꯃꯣꯔꯐꯣꯂꯣꯖꯤ ꯑꯃꯗꯤ ꯃꯅꯤꯄꯨꯔꯤ ꯐꯣꯅꯦꯇꯤꯛꯁ	ꯃꯥꯔꯛ ꯱꯰꯰

ꯁꯔꯨꯛ-꯱ ꯐꯣꯅꯣꯂꯣꯖꯤ ꯑꯃꯁꯨꯡ ꯃꯣꯔꯐꯣꯂꯣꯖꯤ ꯃꯥꯔꯛ ꯶꯰

ꯑ) ꯐꯣꯅꯦꯇꯤꯛꯁ: ꯃꯥꯔꯛ ꯱꯰

(I) ꯗꯦꯐꯤꯅꯤꯁꯟ

(II) ꯑꯥꯔꯇꯤꯀꯨꯂꯦꯇꯔꯤ ꯐꯣꯅꯦꯇꯤꯛꯁ ꯑꯃꯁꯨꯡ ꯐꯣꯅꯦꯇꯤꯛꯁ

(III) ꯑꯥ-ꯁꯦꯒꯃꯦꯟꯇꯦꯜ ꯐꯣꯅꯦꯇꯤꯛꯁ, ꯐꯣꯅꯦꯃꯤꯛ ꯑꯃꯗꯤ ꯁꯨꯞꯔꯥꯁꯦꯒꯃꯦꯟꯇꯦꯜ

ꯈ) ꯃꯣꯔꯐꯣꯂꯣꯖꯤ: ꯃꯥꯔꯛ ꯱꯰

(I) ꯗꯦꯐꯤꯅꯤꯁꯟ

(II) ꯗꯦꯔꯤꯚꯦꯇꯤꯚ ꯃꯣꯔꯐꯣꯂꯣꯖꯤ

(III) [illegible]

(IV) [illegible]

[illegible] [illegible] : [illegible]

(I) [illegible]

(II) [illegible]

(III) [illegible]

(IV) [illegible]

[illegible] [illegible] : [illegible]

(I) [illegible]

(II) [illegible]

(III) [illegible]

[illegible] : [illegible] [illegible]

[illegible]

[illegible] :

1. Charles P. Hockett	: A Course in Modern Linguistics
2. W. Tomchou Singh	: A Study of Meitei Phonology
3. H.D. Sharma	: Language and Phonology
4. Benedict Paul	: Sino-Tibetan A Conspectus
5. Victoria Fronkin	: An introduction to Language
6. P.C. Thoudam	: Remedial Manipuri
7. M.S. Ningomba	: Meitei Lonmit
8. George Yule	: The Study of Language
9. Pushpinder Syal and D.V. Jindal	: An introduction to linguistics, Language, Grammar and Semantics
10. Ch. Yashawanta Singh	: Manipuri Grammar
11. P. Madhubala Devi	: Manipuri Phonology

HONOURS SUPPORTIVE COURSE I (Semester III)

HSC : 101 **Manipuri Language and Literature**

(ꯃꯅꯤꯄꯨꯔꯤ ꯂꯦꯡꯒꯨꯌꯦꯖ ꯑꯦꯟꯗ ꯂꯤꯇꯔꯦꯆꯔ)

Full Mark-100; Pass Mark-35

ꯌꯨꯅꯤꯠ – 1 : ꯃꯅꯤꯄꯨꯔꯤ ꯂꯣꯂꯒꯤ ꯃꯇꯥꯡ : ꯁꯥꯍꯤꯠꯌꯒꯤ ꯃꯔꯨꯑꯣꯏꯕ ꯋꯥꯍꯩ ; – ꯲꯵

ꯌꯨꯅꯤꯠ – ꯲ : ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯃꯇꯥꯡ ; - ꯲꯵

ꯌꯨꯅꯤꯠ – ꯳ : ꯃꯌꯥꯏ ꯀꯌꯥꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯃꯇꯥꯡ ; – ꯲꯵

ꯌꯨꯅꯤꯠ – ꯴ : ꯑꯅꯧꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯃꯇꯥꯡ : ꯁꯩꯔꯦ ꯃꯆꯥ ; – ꯲꯵

ꯌꯨꯅꯤꯠ – ꯵ : ꯃꯇꯦꯡꯕꯤ ꯑꯆꯧꯕꯁꯤꯡꯒꯤ ꯄꯨꯟꯁꯤ ꯑꯃꯁꯨꯡ ꯁꯥꯍꯤꯠꯌ ; – ꯲꯵

ꯃꯔꯨꯑꯣꯏꯕ ꯄꯥꯕꯒꯗꯕ ꯂꯥꯏꯔꯤꯛ :

꯱. ꯑꯦꯟ. ꯈꯦꯂꯆꯟꯗ꯭ꯔ – ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯏꯇꯤꯍꯥꯁ

꯲. ꯑꯦꯟ. ꯇꯣꯝꯕꯤ. ꯁꯤꯡꯍ – ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯁꯤꯡꯍꯥꯋꯂꯣꯟꯀꯟ

꯳. ꯄꯤ. ꯍꯦꯃꯆꯟꯗ꯭ꯔ – ꯇꯥꯝꯂꯥꯏ ꯑꯍꯟꯕ ꯃꯃꯤ

꯴. ꯍꯤꯁ꯭ꯇꯣꯔꯤ ꯁꯥꯍꯤꯠꯌ ꯄꯔꯤꯁꯗ ꯇꯃꯥꯏ – ꯃꯅꯤꯄꯨꯔꯤ ꯇꯥꯍꯤꯠꯌꯒꯤ ꯃꯃꯤ ꯍꯣꯡꯀꯣꯛ

꯵. ꯑꯦꯟ. ꯑꯔꯨꯟ – ꯅꯨꯡꯉꯥꯏꯕ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯃꯅꯤꯄꯨꯔꯤ ꯄꯔꯤꯆꯌꯅ ꯍꯧꯔꯕ

꯶. ꯗꯣ. ꯑꯦꯝ. ꯀꯦ. ꯑꯦꯁ – ꯃꯇꯦꯡꯕꯤ ꯑꯆꯧꯕꯁꯤꯡꯒꯤ ꯈꯣꯡꯊꯥꯡ ꯃꯤꯌꯥꯝ ꯑꯃ

꯷. ꯑꯦꯝ. ꯀꯦ. ꯑꯦꯁ – ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌꯒꯤ ꯇꯥꯡꯀꯦ ꯑꯃ

SEMESTER-IV

[illegible]-404 : [illegible]	[illegible] 100

[illegible]-1 : [illegible] — [illegible] 50

(I) [illegible] : [illegible]

(II) [illegible]

(III) [illegible]

[illegible]-2 : [illegible] — [illegible] 50

(I) [illegible]

(II) [illegible] ([illegible]) : [illegible]

(III) [illegible] ([illegible]) : [illegible]

(IV) [illegible] : [illegible] ([illegible]- XII-XIII)

(V) [illegible] : [illegible]

[illegible] :

1. [illegible] - [illegible]
2. [illegible] - [illegible]
3. [illegible] - [illegible]
4. [illegible] - [illegible]
5. [illegible] - [illegible]
6. [illegible] - [illegible]
7. [illegible] - [illegible]
8. [illegible] - [illegible]

HONOURS SUPPORTIVE COURSE II (Semester IV)

HSC : 202 Folklore and Culture

([illegible])

Full Mark-100; Pass Mark-35

[illegible] – ꯱ : [illegible] ; - ꯲꯵

[illegible] – ꯲ : [illegible] ; – ꯲꯰

[illegible] – ꯳ : [illegible] ; – ꯳꯰

[illegible] – ꯴ : [illegible] -; ꯲꯵

[illegible] :

꯱. [illegible]

꯲. [illegible]

꯳. [illegible]

꯴. [illegible]

꯵. [illegible]

꯶. [illegible] – ꯱

꯷. [illegible]

꯸. [illegible]

꯹. [illegible]

꯱꯰. [illegible]

[illegible]

SEMESTER-V

ꯄꯦꯄꯔ-꯵꯰꯱ : ꯃꯣꯗꯔꯟ ꯄꯍꯦꯡꯒꯥ ꯁꯤꯡꯅꯕ : **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱

ꯀ) ꯑꯔꯤꯕ ꯄꯨꯋꯥꯔꯤ : ꯈꯝꯕ-ꯊꯣꯏꯕꯤꯒꯤ ꯋꯥꯔꯤ (ꯍꯤꯖꯥ ꯍꯥꯡꯕ, ꯀꯥꯎ ꯐꯥꯕ) ꯃꯥꯔꯛ ꯲꯰

ꯈ) ꯗꯥ. ꯈ. ꯆꯥꯎꯕꯥꯒꯤ ꯂꯩꯈꯥꯒꯤ : ꯃꯥꯗꯥꯏꯃ ꯑꯃꯤꯗꯥ ꯃꯥꯔꯛ ꯲꯰

ꯒ) ꯁ. ꯀꯅꯥꯏꯂꯥꯜ ꯁꯤꯡꯍ, ꯃꯔꯤꯀꯨꯜ (ꯁꯤꯡꯍ) : ꯃꯔꯤꯀꯨꯂꯒꯤ ꯒꯔꯤꯇꯃꯁ ꯃꯥꯔꯛ ꯲꯰

ꯑꯍꯥꯅꯕꯅꯤ :

ꯑꯣꯍꯌ - ꯕꯅ ꯅꯨꯑꯣꯗ

ꯀꯥꯡꯂꯦꯏꯒꯕ - ꯑꯍꯔꯒꯏ

ꯌꯨꯅꯤꯠ-꯲

ꯀ) ꯄꯨꯋꯥꯔꯤꯕꯝ ꯅꯃꯥꯏꯒꯤꯁꯨꯡ - ꯒꯒ ꯂꯩꯕꯥꯕꯒꯤ ꯏꯁꯨꯜ ꯃꯥꯔꯛ ꯲꯰

ꯈ) ꯂꯥꯡꯕꯝ ꯑꯣꯍꯕ - ꯑꯣꯍꯒꯦ ꯃꯥꯔꯛ ꯲꯰

ꯄꯦꯄꯔ-꯵꯰꯲ : ꯒꯤꯡꯉꯁꯤꯡꯒꯤ ꯄꯨꯋꯥꯔꯤ ꯂꯩꯁꯥꯕꯨ : **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱ : ꯁꯤꯡꯅꯕ

ꯏ. ꯁꯔꯃꯔꯣ (ꯄꯨꯋꯥꯔꯤ) - ꯏꯁꯤꯡꯒꯤ ꯂꯥꯏꯃ ꯃꯥꯔꯛ ꯳꯰

ꯌꯨꯅꯤꯠ-꯲ : ꯂꯥꯏꯅꯥ

ꯄ. ꯅꯨꯃꯤꯠꯅꯨꯡꯁꯤ ꯅꯨꯡꯁꯥ (ꯄꯨꯋꯥꯔꯤ) -ꯅꯤꯡꯒꯤꯄꯟꯅ (ꯄꯥꯍꯤꯕ ꯅꯨꯄꯥ) ꯃꯥꯔꯛ ꯳꯰

ꯌꯨꯅꯤꯠ-꯳ : ꯌꯦꯡꯃꯤꯁꯦ ꯃꯥꯔꯛ ꯴꯰

ꯀ) ꯗ. ꯄ. ꯑꯣꯍꯕ ꯅꯨꯡꯁꯥ (ꯄꯨꯋꯥꯔꯤ) : ꯒꯤꯡꯉ ꯂꯩꯁꯥꯕꯨꯒꯤ ꯌꯦꯡꯃꯤꯁꯦ:

ꯑꯍꯥꯅꯕꯅꯤ- ꯒꯤꯇꯦꯡꯍꯒꯤ ꯊꯌꯦꯊ, ꯄꯌꯦꯕꯒꯤ ꯃꯨꯒꯥ ꯌꯨꯝꯖꯥꯕ

ꯈ) ꯄ. ꯃꯨꯃꯥ ꯅꯨꯡꯍꯥ (ꯄꯨꯋꯥꯔꯤ) : ꯑꯤꯡꯁꯤ ꯌꯦꯡꯃꯤꯁꯦ:

ꯑꯍꯥꯅꯕꯅꯤ- ꯃꯨꯄꯌꯥꯡ ꯌꯦꯀꯕꯒꯤ ꯁꯡꯁꯤ, ꯃꯤꯊꯊꯤꯕꯒꯤ ꯒꯔ

ꯌꯨꯅꯤꯠ-꯴ : ꯂꯩꯁꯣꯟ ꯃꯥꯔꯛ ꯱꯵

꯱. ꯍꯤꯖꯝ ꯏꯔꯥꯡ, ꯃꯅꯤꯄꯨꯔ (ꯏꯔꯥꯡ) : ꯁꯩꯔꯦꯡꯒꯤ ꯍꯩꯔꯨꯛꯄ ꯂꯩꯁꯣꯟꯁ

ꯑꯦꯛꯁꯥꯡꯄꯂꯁꯤꯡ- ꯑꯍꯥꯟ ꯑꯍꯟꯕꯒꯤ ꯁꯩꯒꯤ ꯂꯩꯔꯛ, ꯃꯨꯂꯩꯁꯦ, ꯄꯣꯀꯤꯂꯁꯤꯡꯁꯤꯡꯒꯤ ꯑꯇꯦꯡ

ꯄꯦꯄꯔ-꯶꯰꯴ : ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯤꯁ꯭ꯇꯔꯤ **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱ : ꯑꯔꯤꯕ, ꯃꯌꯥꯏ ꯀꯥꯏꯕ ꯑꯃꯁꯨꯡ ꯑꯍꯧꯕ ꯃꯇꯝ : ꯃꯥꯔꯛ ꯵꯰

ꯀ) I) ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯑꯔꯤꯕꯒꯤ ꯃꯇꯥꯡ

II) ꯃꯅꯤꯄꯨꯔꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯃꯇꯝ ꯈꯥꯌꯕ

ꯈ) ꯑꯍꯧꯕ ꯃꯇꯝ :

I) ꯑꯍꯧꯕ ꯃꯇꯝꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯃꯇꯥꯡ

II) ꯂꯥꯏꯕꯛ, ꯑꯔꯤꯕ ꯑꯃꯁꯨꯡ ꯍꯧꯖꯤꯛ

ꯌꯨꯅꯤꯠ-꯲ : ꯃꯍꯩ ꯆꯥꯡꯕ ꯑꯃꯁꯨꯡ ꯑꯅꯧꯕ ꯃꯇꯝ ꯃꯥꯔꯛ ꯵꯰

ꯀ) ꯃꯍꯩ ꯆꯥꯡꯕ ꯃꯇꯝ (꯱꯵ ꯑꯃꯁꯨꯡ ꯱꯶ꯁꯨꯕ ꯆꯍꯤ) :

I) ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯇ ꯂꯥꯏꯆꯠꯀꯤ ꯍꯦꯛꯇ

II) ꯂꯥꯏꯔꯤꯛꯀꯤ ꯃꯍꯩ, ꯑꯔꯤꯕ ꯑꯃꯁꯨꯡ ꯍꯧꯖꯤꯛ

ꯈ) ꯑꯅꯧꯕ ꯃꯇꯝ :

I) ꯑꯅꯧꯕ ꯃꯇꯝꯒꯤ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯦꯅꯕ

II) ꯂꯥꯏꯔꯤꯛꯀꯤ ꯃꯁꯛꯂꯣꯏꯁꯤꯡ (ꯑꯣꯏꯕꯂꯣꯏꯁꯤꯡ)

III) ꯁꯩꯔꯦꯡ ꯑꯃꯁꯨꯡ ꯑꯦꯁꯦꯁꯤꯡꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯦꯛꯇ

ꯃꯔꯨꯑꯣꯏ ꯌꯦꯡꯒꯗꯕ ꯂꯥꯏꯔꯤꯛꯁꯤꯡ :

꯱॥ ꯑꯦꯟ. ꯈꯦꯂꯆꯟꯗ꯭ꯔ ꯁꯤꯡꯍ : ꯑꯔꯤꯕ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯤꯁ꯭ꯇꯔꯤ

꯲॥ ꯑꯥꯔ. ꯀꯦ. ꯁꯅꯥꯍꯟꯕ ꯁꯤꯡꯍ : ꯑꯍꯧꯕ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯤꯁ꯭ꯇꯔꯤ

꯳॥ ꯆꯩꯊꯥꯔꯣꯜ ꯀꯨꯝꯕꯥ ꯁꯤꯡꯍ : ꯑꯁꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯑꯍꯟ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯍꯧꯔꯛꯐꯝ

꯴॥ ꯑꯦ.ꯄꯤ. ꯃꯅꯤꯂꯥꯜ ꯁꯤꯡꯍ : ꯑꯁꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯑꯍꯟ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯍꯧꯔꯛꯐꯝ

꯵॥ ꯂꯥꯏꯁ꯭ꯔꯝ ꯂꯥꯏꯔꯤꯛ ꯁꯤꯡꯂꯨꯞ : ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯃꯃꯜ ꯑꯣꯏꯕ

SEMESTER-VI

ꯄꯦꯄꯔ-꯶꯰꯵ : ꯑꯍꯧꯕ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯥꯏꯔꯤꯛ **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱ : ꯑꯦ. ꯁꯣꯃꯣꯔꯖꯤꯠ ꯁꯤꯡꯍ (ꯂꯃꯖꯥ) : ꯌꯥꯏꯔꯦꯜ ꯄꯣꯖꯥ ꯃꯥꯔꯛ ꯲꯵

ꯌꯨꯅꯤꯠ-꯲ : ꯑꯥꯔ. ꯀꯦ. ꯁꯅꯥꯍꯟꯕ (ꯂꯃꯖꯥ) : ꯁꯦꯡꯕ ꯀꯣꯟꯁꯦꯟ ꯖꯣꯏꯟꯕ ꯃꯥꯔꯛ ꯲꯵

ꯌꯨꯅꯤꯠ-꯳ : ꯑꯥꯔ. ꯀꯦ. ꯃꯃꯥꯡꯅꯤꯡꯈ ꯁꯤꯡꯍ (ꯂꯃꯖꯥ) : ꯌꯨꯃꯅꯥꯎꯑꯣꯏ ꯃꯥꯔꯛ ꯲꯵

ꯌꯨꯅꯤꯠ-꯴ : ꯑꯦ. ꯁꯣꯃꯣꯔꯖꯤꯠ ꯁꯤꯡꯍ (ꯂꯃꯖꯥ) : ꯁꯅꯥꯃꯅꯤꯒꯤ ꯑꯣꯏꯕ ꯁꯦꯡ ꯃꯥꯔꯛ ꯲꯵

ꯄꯦꯄꯔ-꯱꯰꯴ : ꯃꯅꯤꯄꯨꯔꯒꯤ ꯖꯒꯣꯏ **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱ : ꯄꯨꯋꯥꯔꯤ ꯃꯇꯝꯗꯥ ꯃꯅꯤꯄꯨꯔꯒꯤ ꯖꯒꯣꯏ-ꯏꯁꯩ ꯑꯣꯏꯕ, ꯂꯥꯏꯍꯔꯥꯎꯕ, ꯅꯨꯡꯉꯥꯏ ꯊꯧꯔꯝ

ꯃꯥꯔꯛ ꯲꯰

ꯌꯨꯅꯤꯠ-꯲ : ꯂꯥꯏ ꯍꯔꯥꯎꯕꯒꯤ ꯖꯒꯣꯏ, ꯇꯨꯝꯕ ꯖꯒꯣꯏ, ꯇꯥꯡꯒꯤ ꯊꯧꯔꯝ, ꯅꯨꯡꯊꯤꯜ ꯅꯨꯡꯂꯩ

ꯃꯥꯔꯛ ꯱꯰

ꯌꯨꯅꯤꯠ-꯳ : ꯆꯍꯤ ꯆꯥꯅꯤꯡ, ꯱꯹-꯲꯰ ꯁꯇꯛ ꯅꯨꯄꯥ-ꯅꯨꯄꯤꯒꯤ ꯃꯅꯤꯄꯨꯔꯒꯤ ꯖꯒꯣꯏꯗꯥ ꯍꯤꯡꯕꯒꯤ ꯃꯔꯤ

ꯃꯥꯔꯛ ꯲꯵

ꯌꯨꯅꯤꯠ-꯴ : ꯆꯍꯤ ꯍꯤꯡꯕ, ꯇꯥꯡꯕ-ꯆꯣꯡ, ꯂꯩꯁꯥ-ꯃꯔꯥꯡ: ꯂꯥꯏꯅꯤꯡ ꯊꯧꯔꯝ, ꯑꯗꯨ, ꯌꯨꯝꯕꯤ ꯆꯥꯡꯗꯣꯛ; ꯍꯤꯡꯕ

ꯃꯥꯔꯛ ꯳꯵

ꯌꯨꯅꯤꯠ-꯵ : ꯏꯁꯩ-ꯇꯥꯡꯕ, ꯌꯨꯝꯂꯦ-ꯄꯣꯜꯂꯦ, ꯅꯨꯡꯉꯥꯏ-ꯃꯔꯥꯡ, ꯃꯅꯤꯄꯨꯔꯒꯤ ꯄꯥꯡꯕꯒꯤ ꯊꯧꯔꯝ

ꯃꯥꯔꯛ ꯱꯰

ꯃꯇꯦꯡ ꯄꯥꯡꯒꯗꯕ ꯂꯥꯏꯔꯤꯛꯁꯤꯡ :

꯱॥ ꯗꯣ. ꯀꯥꯡꯖꯝꯕꯥ	: ꯗꯣ ꯑꯔꯤꯕꯥ ꯂꯥꯏꯔꯤꯛꯀꯤ ꯄꯨꯊꯣꯛ ꯑꯃꯁꯨꯡ ꯃꯅꯤꯄꯨꯔꯒꯤ ꯑꯃꯁꯨꯡ ꯗꯥꯟꯁ ꯑꯃꯁꯨꯡ ꯍꯤꯡꯕ
꯲॥ ꯆꯥꯡꯗꯝ ꯂꯩꯆꯣꯝꯕ(ꯆꯥꯎꯕ)	: ꯃꯅꯤꯄꯨꯔꯤ ꯖꯒꯣꯏ ꯑꯃꯁꯨꯡ ꯏꯁꯩ, ꯚꯣꯜ - ꯲
꯳॥ ꯃꯨꯇꯨꯝ ꯕꯤꯔꯃꯪꯒꯜ	: ꯖꯒꯣꯏ ꯂꯤꯂꯥ ꯑꯃꯁꯨꯡ ꯃꯅꯤꯄꯨꯔꯤ
꯴ ॥ ꯆꯥꯡꯗꯝ ꯆꯥꯎꯕ ꯆꯥꯎꯕꯃꯤ ꯂꯨꯋꯥꯡ	: ꯃꯔꯨ ꯌꯨꯝꯂꯦꯃꯥꯡ
꯵॥ ꯅꯤꯡꯊꯧꯃꯌꯨꯝ ꯕꯨꯝ	: ꯃꯔꯨꯒꯤ ꯃꯍꯩꯂꯥꯡꯒꯤ ꯇꯧꯕꯗꯥꯏꯕ ꯃꯂꯥꯏꯂꯤꯛ
꯶॥ ꯀꯤꯄꯦꯟ. ꯂꯥꯏꯁꯔꯨꯝ ꯂꯩꯃꯥ	: ꯃꯔꯦꯝꯕꯥ
꯷॥ ꯗꯣꯛꯇꯔ.ꯑꯔꯨꯝꯕꯥꯝ ꯂꯤꯡꯍ	: ꯃꯔꯨ ꯆꯍꯤ ꯍꯤꯡꯕ
꯸॥ ꯃꯅꯤ ꯂꯤꯡꯍ ꯗꯃꯨꯗꯥ ꯑꯇꯣꯝꯕꯥ	: ꯑꯗꯨ
꯹॥ ꯑꯣꯄꯦꯟ. ꯖꯤꯇꯦꯟ ꯂꯤꯡꯍ	: ꯑꯗꯨ
꯱꯰॥ ꯗꯣꯛ. ꯆꯥꯎꯕꯍꯤꯡꯕ ꯂꯤꯡꯍ ꯗꯃꯨꯗꯥ	
ꯗꯣꯛ. ꯆꯥꯎꯕꯥꯝ ꯂꯤꯡꯍ (ꯂꯥꯏꯁꯥ)	: ꯅꯤꯡꯊꯧꯖꯥ ꯑꯔꯨꯕꯥ
꯱꯱॥ ꯑꯣꯄꯦꯟ. ꯌꯥꯏꯆꯥ ꯂꯤꯡꯍ	: ꯃꯔꯨ ꯇꯥꯡꯕ
꯱꯲॥ ꯃꯅꯤꯄꯨꯔꯒꯤ ꯂꯥꯏꯍꯔꯥꯎꯕ ꯁꯥꯗꯤꯡ (ꯏꯡꯂꯤꯁ):	ꯃꯅꯤꯄꯨꯔꯒꯤ ꯃꯔꯨꯞ ꯅꯨꯡꯉꯥ
꯱꯳॥ ꯃꯨꯇꯨꯝ ꯕꯤꯔꯃꯪꯒꯜ	: ꯃꯅꯤꯄꯨꯔꯤ ꯄꯣꯡꯕꯒꯤ ꯅꯨꯡꯉꯥ ꯂꯤꯡꯍꯨꯝ

꯱꯴॥ ꯗꯥ. ꯈꯥꯟꯕꯝꯁꯥꯗꯨꯔ ꯅꯤꯁꯥ : ꯆꯥꯏꯗ ꯃꯅꯤꯄꯨꯔꯤ ꯂꯤꯇꯔꯦꯆꯔꯒꯤ ꯍꯤꯁ꯭ꯇꯣꯔꯤ

꯱꯵॥ ꯑꯦꯟꯒꯨꯃꯥꯏ ꯅꯩꯇꯥꯝ ꯄꯨꯅꯥꯁꯤꯡ : ꯃꯥꯏꯊꯣꯏꯕꯒꯤ ꯊꯝ-ꯊꯣꯛꯒꯤ ꯃꯆꯥꯡ

꯱꯶॥ ꯃꯅꯤꯄꯨꯔꯤ ꯂꯥꯏꯆꯤꯡ ꯑꯣꯇꯦ ꯆꯥꯎꯈꯥꯝꯃꯤ (ꯑꯦꯗ) : ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯇꯦꯍ ꯍꯩꯕꯁꯤꯡꯒꯤ ꯏꯇꯤꯍꯥꯁ

꯱꯷॥ ꯑꯦꯟꯒꯨꯃꯥꯏ ꯅꯩꯇꯥꯝ ꯅꯤꯁꯥ : ꯁꯣꯌꯥꯝ ꯊꯣꯏꯕꯥꯁ

꯱꯸॥ ꯗꯥ. ꯈꯥꯟꯕꯝꯁꯥꯗꯨꯔ ꯅꯤꯁꯥ (ꯂꯝꯖꯥ) : ꯏꯃꯦꯇꯥ

꯱꯹॥ ꯑꯣꯗꯥ. ꯁꯥꯗꯨꯔꯂꯥꯈꯥ ꯅꯤꯁꯥ (ꯂꯝꯖꯥ): ꯇꯥꯍꯨꯝꯗ ꯅꯤꯁꯥꯡ

꯲꯰॥ ꯖꯤꯗꯥ. ꯍꯗꯥꯏꯥꯡ ꯂꯥꯃꯃ : ꯃꯤꯊꯣ ꯏꯦꯇꯥꯡ ꯇꯣꯏꯥ

꯲꯱॥ ꯅꯤꯗꯥ. ꯃꯅꯤꯔꯥ ꯅꯤꯁꯥ : ꯗꯥ ꯍꯤꯅꯁꯤꯡꯒꯤ ꯗꯥꯏ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯇꯤꯁꯤꯡꯁꯥ

꯲꯲॥ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯂꯤꯇꯔꯦꯆꯔ ꯖꯥꯂꯤꯅ (ꯑꯦꯗ) : ꯑꯦꯇꯤꯃꯖꯅꯥꯅ ꯗꯥꯏ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯇꯥꯗꯨꯁꯥꯇ,
ꯇꯤꯁꯤꯡꯁꯥ ꯗꯥꯃꯨ ꯑꯣꯕꯁꯥ

꯲꯳॥ ꯗꯥꯅ. ꯑꯥ. ꯁꯥꯌꯁꯥꯇꯤ : ꯑꯤꯗꯥꯌ ꯇꯦꯑꯣꯡꯤꯁꯤ

꯲꯴॥ ꯁꯤ.ꯅꯤ. ꯍꯃꯂꯨ : ꯃ ꯃꯤꯊꯣꯇ

꯲꯵॥ ꯗꯥ. ꯍꯇꯥꯗꯤ ꯅꯤꯁꯥ : ꯃ ꯃꯅꯤꯄꯨꯔꯤ ꯗꯥꯃꯃꯤꯅꯤꯁꯤꯡꯂꯨ

꯲꯶॥ ꯍ. ꯃꯇꯤꯄꯨ. ꯄꯨ : ꯑꯥꯇꯥꯁꯤꯔꯤ ꯗꯥꯏ ꯃꯅꯤꯄꯨꯔꯤ

꯲꯷॥ ꯃꯇꯤꯄꯨ. ꯃꯥꯑꯥꯄꯨꯇꯇꯥ : ꯗꯥꯑꯣꯁꯨꯌ ꯗꯥꯏ ꯃ ꯒꯥꯅꯇꯤ ꯗꯥꯏ ꯃꯅꯤꯄꯨꯔꯤ

ꯄꯦꯄꯔ-꯷꯱꯰ : ꯏꯑꯥꯇꯦꯠꯤꯅꯁꯤꯑꯥꯅ ꯗꯥꯃꯨ ꯃꯅꯤꯄꯨꯔꯤꯒꯤ ꯏꯑꯥꯇꯦꯠ **ꯃꯥꯔꯛ ꯱꯰꯰**

ꯌꯨꯅꯤꯠ-꯱ ꯃꯥꯔꯛ ꯲꯰

ꯏꯑꯥꯇꯦꯠꯤꯅꯁꯤꯑꯥꯅ :

(꯱) ꯏꯑꯥꯇꯦꯠ-ꯃꯤꯏꯤꯁꯤꯂꯨ, ꯁꯥꯌꯠ, ꯂꯥꯑꯥꯖ ꯑꯃꯂꯨꯑꯥ ꯏꯑꯥꯂꯨ

(꯲) ꯏꯑꯥꯇꯦꯠꯒꯤ ꯍꯤꯗꯥꯠꯤꯅꯤ:

(I) ꯃꯤ ꯂꯦꯇꯠ ꯃꯤꯍꯦꯇꯤ ꯍꯤꯗꯥꯠꯤ

(II) ꯃꯤ ꯃꯤꯏꯨꯂꯨ : ꯍꯤꯗꯥꯠꯤ ꯗꯥꯏ ꯊꯥꯠꯍ

(III) ꯃꯤ ꯗꯥꯨꯃꯨꯖꯥꯇꯦꯇꯤꯅꯃ : ꯖꯥꯇꯤꯁꯥꯅꯤ

(꯳) ꯏꯑꯥꯇꯦꯠ ꯏꯤꯇꯃ ꯃꯥꯍꯃ :

(I) ꯖꯠꯤ ꯏꯤꯇꯃ ꯖꯠꯤꯖꯠꯥꯂꯨ, ꯍꯨꯁꯠꯒꯤꯄꯨ ꯃꯥꯍꯃ,
ꯑꯄꯨꯅꯥꯂꯠꯤ ꯃꯥꯍꯃ, ꯗꯥꯊꯇꯠꯊꯥꯂꯨ ꯃꯥꯍꯃ

ꯀꯣꯔꯁꯀꯤ ꯃꯤꯇꯩꯂꯣꯟ

(꯱) ꯀꯤꯁ, ꯂꯣꯂꯣꯡꯒꯤ ꯄꯥꯀꯂꯥ ꯃꯤꯇꯩꯂꯣꯟ (ꯁꯤꯃꯤꯇꯤꯂꯣꯡ, ꯄꯨꯂꯣꯃꯤꯇꯤꯂꯣꯡ ꯄꯥꯀꯂꯥ ꯃꯤꯇꯩꯂꯣꯟ)

(꯲) ꯃꯤꯇꯩꯂꯣꯟ, ꯍꯩꯔꯥꯡꯒꯤ ꯄꯥꯀꯂꯥ ꯑꯣꯏꯕ (ꯁꯤꯃꯤꯇꯤꯂꯣꯡ, ꯄꯨꯂꯣꯃꯤꯇꯤꯂꯣꯡ ꯄꯥꯀꯂꯥ ꯃꯤꯇꯩꯂꯣꯟ)

ꯀꯥꯡꯂꯥ ꯂꯥꯏꯔꯤꯛ ꯂꯥꯏꯔꯤꯛꯁꯤꯡ

꯱॥ ꯄꯤꯑꯣ. ꯄꯥꯀ. ꯁꯤꯡꯍꯣꯡ (ꯁꯝꯄꯥ) : ꯃꯤꯇꯩꯂꯣꯟ ꯄꯥꯡꯒꯜ ꯃꯤꯇꯩꯂꯣꯟ : ꯄꯥꯡ ꯁꯤꯡꯔꯨꯁꯤꯡꯂꯣꯡ, ꯱꯹꯷꯲

꯲॥ ꯄꯥꯂꯩ ꯁꯤꯡꯁꯤꯂ (ꯁꯝꯄꯥ) : ꯁꯤ ꯂꯩꯁꯤ ꯄꯥꯡ ꯃꯤꯇꯩꯂꯣꯟ, ꯱꯹꯹꯵

꯳॥ ꯍꯥꯡꯂꯣꯡ ꯁꯤꯂꯤꯁꯤ ꯄꯨꯂꯩꯍꯥ ꯄꯥꯡꯒꯜ ꯀꯥꯡꯑꯣꯏ ꯁꯤꯂꯤꯁꯤ ꯄꯨꯂꯩꯍꯥ : ꯁꯤꯡꯔꯨꯁꯤꯡꯂꯣꯏ ꯃꯤꯇꯩꯂꯣꯟ, ꯱꯹꯹꯴

꯴॥ ꯂꯤꯇꯔꯦꯆꯔ ꯂꯣꯡꯂꯥ : ꯃꯤꯇꯩꯂꯣꯟ ꯄꯥꯡ ꯁꯤꯡꯔꯨꯁꯤꯡꯂꯣꯡ, ꯱꯹꯹꯶

꯵॥ ꯂꯤꯇꯔꯦꯆꯔ ꯂꯣꯡꯂꯥ : ꯃꯤꯄꯨꯔꯤꯍꯥꯡ ꯄꯥꯂꯣꯂ ꯁꯤ ꯁꯤꯡꯁꯤꯂꯤ ꯃꯤꯇꯩꯂꯣꯟ, ꯲꯰꯰꯰

꯶॥ ꯴ꯤ. ꯁꯤꯡꯍ, ꯄꯥꯡ. ꯂꯤ ꯂꯣꯀꯀ ꯄꯥꯀꯂꯥ ꯍꯤ. ꯂꯤ. ꯁꯤꯂ (ꯁꯝꯄꯥ) : ꯄꯥ ꯂꯣꯡꯁꯤꯂꯥ ꯄꯥꯡ ꯃꯤꯇꯩꯂꯣꯟ ꯀꯥꯡꯑꯣꯏꯔꯤ ꯄꯥꯡ ꯂꯣꯏ ꯁꯤꯂꯣꯏ ꯁꯤꯡꯁꯤꯂꯤ, ꯱꯹꯹꯴

꯷॥ ꯄꯨꯍꯥ. ꯄꯥ. ꯄꯤꯁ. : ꯁꯤ ꯂꯣꯁꯤꯡꯂ ꯄꯥꯡ ꯃꯤꯇꯩꯂꯣꯟ

꯸॥ ꯍꯥꯡꯂꯣꯡ ꯄꯥꯂ. ꯍꯤꯔꯁꯤꯂꯣꯡ : ꯄꯥ ꯍꯤꯁꯤ ꯃꯤꯇ ꯃꯤꯔꯤ ꯁꯤꯄꯨꯄꯂ ꯁꯤ ꯃꯤꯇꯩꯂꯣꯟ

꯹॥ ꯀꯂꯥꯔ ꯁꯂꯂꯀ : ꯃꯤꯇꯩꯂꯣꯟ ꯁꯤ ꯍꯥꯔꯂ ꯄꯥꯡ ꯍꯥꯔꯥꯔꯂ

꯱꯰॥ ꯀꯥꯑꯣꯁꯤ, ꯂꯤꯁ (ꯁꯝꯄꯥ) : ꯂꯣꯡꯁꯤꯡꯁꯤꯂ ꯁꯤꯄꯨꯂꯤꯂꯤ ꯄꯥꯡ ꯃꯤꯇꯩꯂꯣꯟ, ꯀꯤꯁꯤꯂꯤꯂꯤ ꯄꯥꯡꯒꯜ ꯂꯣꯂꯣꯡꯒꯜ

꯱꯱॥ ꯁꯤꯂꯤꯁꯀ ꯄꯤꯑꯣ. ꯴ꯥꯂꯍꯀ : ꯍꯤꯡꯁꯤꯂꯤꯂꯣꯂꯣ ꯁꯤ ꯃꯤꯇꯩꯂꯣꯟꯂꯣꯂꯣ, ꯱꯹꯹꯱

꯱꯲॥ ꯂꯣꯡꯁꯤ ꯁꯤꯀꯂꯣꯡ : ꯁꯤ ꯃꯤꯇꯩꯂꯣꯟ, ꯱꯹꯹꯰

꯱꯳॥ ꯄꯥ. ꯁꯤꯂꯤꯁꯤꯂ ꯂꯤꯂꯥ : ꯃꯤꯇꯩꯂꯣꯟ ꯀꯁꯤꯂꯥ ꯁꯤꯀꯂꯤꯡ ꯍꯤꯂꯤꯡꯂ ꯄꯥꯀꯂꯥ ꯂꯤꯂꯂ

꯱꯴॥ ꯄꯥ. ꯁꯤꯂꯤꯁꯤꯂ ꯂꯤꯂꯥ : ꯃꯤꯇꯩꯂꯣꯟ ꯴ꯤꯁꯤꯂꯤꯡ

3. LANGUAGE AND FOUNDATION COURSES (FC)

Details of Foundation Course (FC) - compulsory non-credit courses for all students of B.A. / B.Sc. Honours courses:

Semester	Name of the Course and Paper Code	Full mark/ Pass mark	Syllabus
I	Paper – I Major Indian Language-Manipuri (MAN I) **OR** General English (GEN I)	100 / 35	The syllabus of Manipur University that has been followed in the college is adopted
II	Paper – II Major Indian Language-Manipuri (MAN II) **OR** General English (GEN II)	100 / 35	The syllabus of Manipur University that has been followed in the college is adopted
III	Regional Development-North-East India (RD)	100 / 35	The syllabus of Manipur University that has been followed in the college is adopted
IV	Environmental Studies (EVS)	100 / 35	The syllabus of Manipur University that has been followed in the college is adopted

SEMESTER-I

i. FOUNDATION COURSE (FC): GENERAL ENGLISH I (GEN I)

Full Marks: 100

Unit I: Grammar 20 marks

Voice: Active/Passive; Speech: Direct and Indirect; Time, Tense and Aspect; Phrasal Verbs; Auxiliary Verbs; Use of Shall, Will, For, Since, Idioms and Phrases; Common Errors; Prepositions; Synonyms and Antonyms; Syntax.

Unit II: Unseen part

(i) Essay: General and Current Topics 20 marks

(ii) Précis writing 10 marks

(iii) Comprehension 10 marks

(iv) Paragraph writing 5 marks

(v) Report writing 5 marks

Unit III: Short Stories 30 marks

(i) Y. Ibomcha Singh: *Water*

(ii) Temsula Ao: *Three Women*

(iii) N. Kunjamohan Singh: *The Taste of an Hilsa*

(iv) MK. Binodini: *A String of Beads*

Books recommended:

1. *Contemporary Indian Short Stories*, Series IV. New Delhi: Sahitya Akacemi.
2. Temsula Ao. *Laburnum for My Head*. 2009. Penguin India.
3. *The Taste of an Hilsa and Other Stories*. New Delhi: Sahitya Akademi.
4. Ch. Jamini Devi. *Malem*. 2007, Leikol.

ii. Foundation Course: Major Indian Language (M.I.L)- MANIPURI (MAN I)

ꯑꯦꯝ. ꯑꯥꯏ. ꯑꯦꯜ - ꯱ :

ꯋꯥꯔꯦꯡ, ꯁꯩꯔꯦꯡ, ꯑꯦꯁꯦ ꯑꯃꯁꯨꯡ ꯄꯥꯝꯕꯩꯗꯤꯕ ꯃꯔꯣꯜ ꯃꯥꯔ꯭ꯛ ꯱꯰꯰

ꯌꯨꯅꯤꯠ-꯱꯫ ꯋꯥꯔꯦꯡ: ꯃꯥꯔ꯭ꯛ ꯲꯵

ꯆꯀꯩꯕꯝ ꯄꯀꯅ	:	ꯁꯦꯃꯨꯡꯍꯦꯅꯤ
ꯑ꯭ꯁꯥꯑꯃꯥꯏꯊꯝ ꯁꯥꯕꯀ	:	ꯅꯤꯡꯊꯧꯈꯃ
ꯑꯦꯆꯤꯡꯕꯝ ꯅꯤꯡꯈꯦꯡꯁ	:	ꯈꯣꯝꯗꯣꯝ ꯆꯝꯕꯤꯂꯤꯕ
ꯆꯥꯏꯂꯨꯝ ꯂꯀꯃꯦꯡꯁꯨ	:	ꯊꯣꯏꯕꯤ ꯅꯥꯡ
ꯂꯨꯏꯕꯤꯃꯦꯡ	:	ꯆꯥꯃꯀꯕꯊꯈꯤ ꯀꯥꯀꯦꯡ ꯀꯤꯅꯥꯊ
ꯑꯃꯤꯀ ꯋꯥꯔꯦꯡ	:	ꯅꯣꯏꯀ

ꯌꯨꯅꯤꯠ-꯲꯫ ꯁꯩꯔꯦꯡ : ꯃꯥꯔ꯭ꯛ ꯲꯵

ꯑ꯭ꯁꯥꯑꯃꯥꯏꯊꯝ ꯁꯥꯕꯀ	:	ꯈꯕꯤ
ꯑꯂꯣꯡꯕꯝ ꯀꯤꯅꯈꯦꯡꯁꯦ	:	ꯑꯦꯡꯁꯨꯃꯣꯡ ꯀꯤ
ꯑꯦ. ꯈꯨꯃꯤꯂꯅꯀꯥꯔꯥꯦ	:	ꯆꯦꯡ
ꯀꯅꯤꯂꯅꯥ ꯂꯝꯕꯨꯃꯤ	:	ꯏꯅꯕ
ꯁꯥꯑꯃꯥ ꯀꯅꯤꯔꯥꯃ ꯂꯤꯑꯔ	:	ꯆꯥ ꯔꯃꯁꯕ
ꯑꯥ. ꯑꯦ. ꯕꯨ	:	ꯕꯨꯃꯤꯡꯊꯕꯡꯑꯤ ꯆꯝꯕꯤꯁ

ꯄꯥꯝꯅꯕ ꯂꯥꯏꯔꯤꯛꯁꯤꯡ :

꯱꯫ ꯀꯣꯡꯁꯤ ꯋꯥꯔꯦꯡ, ꯲꯰꯰꯰, ꯏꯝꯐꯥꯜ, ꯃꯅꯤꯄꯨꯔ ꯌꯨꯅꯤꯚꯔꯁꯤꯇꯤ, ꯀꯥꯟꯆꯤꯄꯨꯔ

꯲꯫ ꯃꯅꯤꯄꯨꯔꯤ ꯋꯥꯔꯦꯡ, ꯱꯹꯹꯹, ꯏꯝꯐꯥꯜ, ꯃꯅꯤꯄꯨꯔꯤ ꯁꯥꯍꯤꯠꯌ ꯄꯔꯤꯁꯗ

꯳꯫ ꯀꯣꯡꯁꯤ ꯁꯩꯔꯦꯡ, ꯱꯹꯹꯹, ꯏꯝꯐꯥꯜ, ꯃꯅꯤꯄꯨꯔ ꯌꯨꯅꯤꯚꯔꯁꯤꯇꯤ, ꯀꯥꯟꯆꯤꯄꯨꯔ

꯴꯫ ꯑꯍꯟꯕ ꯁꯩꯔꯦꯡ, ꯱꯹꯹꯹, ꯏꯝꯐꯥꯜ, ꯃꯅꯤꯄꯨꯔ ꯌꯨꯅꯤꯚꯔꯁꯤꯇꯤ, ꯀꯥꯟꯆꯤꯄꯨꯔ

꯵꯫ ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡ, ꯱꯹꯹꯹ (ꯑꯅꯤꯁꯨꯕ ꯁꯨꯞꯅꯝ), ꯏꯝꯐꯥꯜ, ꯑ ꯀꯥꯡꯁꯦꯡ ꯀꯣꯝ, ꯃꯅꯤꯄꯨꯔ

ꯄꯦꯄꯔ-꯳ ॥ ꯂꯣꯏꯅꯦꯏꯔꯣꯜ ꯃꯥꯔꯛ ꯳꯰

ꯑ) ꯁꯩꯔꯦꯡ : ꯃꯥꯔꯛ ꯱꯰

ꯑ) ꯒꯖꯜ

ꯕ) ꯑꯣꯗ, ꯑꯦꯂꯦꯖꯤ, ꯂꯤꯔꯤꯛ

ꯆ) ꯁꯣꯅꯦꯠ

ꯗ) ꯂꯤꯃꯔꯤꯛ

ꯕ) ꯃꯦꯍꯁꯦꯡꯁꯤ:

ꯑ) ꯃꯦꯍꯁꯤꯟ ꯃꯥꯔꯛ ꯱꯰

ꯕ) ꯈꯨꯟꯂ

ꯆ) ꯋꯥꯔꯤꯂꯣꯜ

ꯗ) ꯁꯩꯔꯦꯡ ꯁꯦꯍꯃꯥꯂꯣꯡ : ꯋꯥꯔꯤꯂꯣꯜ, ꯑꯍꯤꯡꯁꯤꯡ

ꯆ) ꯂꯤꯇꯔꯥꯂ : ꯃꯥꯔꯛ ꯱꯰

ꯑ) ꯑꯣꯜ

ꯆ) ꯑꯆꯦꯆ

ꯗ) ꯂꯤꯇꯔꯥꯂ ꯁꯥꯐꯨꯜ (ꯁꯤꯋꯥꯂꯣꯔ) : ꯑꯣꯏꯕꯂꯣ, ꯐꯤꯔꯦꯡꯁꯤꯡ, ꯐꯤꯁꯥꯡꯁꯤꯡ

ꯄꯦꯄꯔ-꯴ ॥ ꯃꯅꯤꯄꯨꯔꯤ ꯑꯍꯥꯟꯕꯒꯤ : ꯃꯥꯔꯛ ꯲꯰

ꯑ) ꯋꯥꯔꯣꯜ ꯃꯥꯔꯛ ꯱꯰

ꯕ) ꯑꯇꯣꯞꯄꯒꯤ ꯃꯅꯤꯄꯨꯔꯤꯗ ꯍꯟꯗꯣꯛꯄ ꯃꯥꯔꯛ ꯵

ꯆ) ꯑꯍꯥꯟꯕꯒꯤ ꯍꯟꯗꯣꯛꯄ ꯃꯥꯔꯛ ꯵

ꯃꯔꯨꯑꯣꯏꯕ ꯆꯦꯀꯁꯤꯟꯅꯤꯡꯂꯤ :

꯱) ꯗꯣ. ꯂꯤ. ꯁꯤꯟꯍ : ꯀꯥꯏꯔꯦꯡ ꯃꯅꯤꯄꯨꯔꯤ

꯲) ꯁꯤꯂꯣꯏꯃꯄꯨꯝ ꯁꯦꯝꯁꯥ ꯂꯤꯂꯥ : ꯋꯥ ꯂꯨꯃꯥ ꯋꯥꯡ ꯃꯣꯌꯥ ꯁꯩꯔꯦꯡ

꯳) ꯋꯥ. ꯋꯥꯜ. ꯆꯤꯂꯣꯏꯃꯕ : ꯃꯣꯌꯥ ꯆꯦꯍꯃꯤꯔ

꯴) ꯂꯤꯋꯁ. ꯑꯦꯂꯦꯁꯦꯡꯁ ꯂꯤꯂꯥ : ꯃꯅꯤꯄꯨꯔꯤ ꯂꯣꯏꯅꯦꯏ

꯵) ꯗꯣ. ꯃꯨꯕꯆꯥ ꯔꯥꯕꯤ : ꯃꯅꯤꯄꯨꯔꯤ ꯁꯩꯔꯦꯡꯒꯤ

SEMESTER II

(i) FOUNDATION COURSE (FC): GENERAL ENGLISH II (GEN II)

Full Marks: 100

Unit I: William Shakespeare: *Merchant of Venice* 50 marks

Unit II: Poetry 50 marks

(i) William Shakespeare – *All the World's a Stage*
(ii) William Blake – *Tiger*
(iii) William Wordsworth – *To a Skylark*
(iv) ST. Coleridge: *Dejection*
(v) PB Shelley: *To the Skylark*
(vi) Alfred Lord Tennyson – *Crossing the Bar*
(vii) Robert Browning – *Prospice*
(viii) Thomas Hardy – *The Darkling Thrush*
(ix) Rudyard Kipling – *If*
(x) A. E. Housman – *Loveliest of Tree*
(xi) Walt Whitman – *O Captain My Captain!*
(xii) Emile Dickinson: *Because I cannot Stop for Death*
(xiii) Rabindranath Tagore – *Where the Mind is Without Fear*

Books recommended:

1. An Anthology of Verse. 2010. Published on behalf of Manipur University.

2. Th. Ratankumar Singh. *Golden Laurels*. 2009. Foundations.

3. Bhandari D.R, *History of European Political Philosophy,* BAPCO Publications, 1978

(ii) Foundation Course: Major Indian Language (M.I.L)- MANIPURI (MAN II)

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SEMESTER-III

FOUNDATION COURSE (FC): REGIONAL DEVELOPMENT
(NORTH-EAST INDIA)

FC: RD **Full Marks: 100 (45 lecture hours) Pass Marks:35**

Text Book: Regional Development (North-East India) published by the Manipur University, Canchipur, Imphal. (The same is available in the M.U. Website)

SEMESTER IV

FOUNDATION COURSE (FC): ENVIRONMENTAL STUDIES (EVS)

FC: EVS **Full Marks:100 (45 lecture hours) Pass Marks:35**

(Objectives: The core module syllabus for Environmental Studies which aims at imparting knowledge on and attribute towards environment to the undergraduate students, is divided into six units which will be covered in 45 lectures hour based on classroom teaching.)

Unit I: Introduction and Natural Resources **20 marks (8 lecture hours)**

A. Multidisciplinary nature of environmental studies

B. Man and Earth Resources

C. Natural Resources and associated problems

a. Forest resources: use and overexploitation, deforestation, case studies. Timber extraction, mining; dams and their effects on forest and tribal people.

b. Water resources: use and over-utilisation of surface and ground water; floods, draught, conflict over water, dams- benefits and problems.

c. Mineral resources: use and exploitation; environmental effects of extracting and using mineral resources, caes studies.

d. Food resources: world food problems; changes caused by agriculture and over-grazing; effects of modern agriculture, fertilizer, pesticide; water-logging, salinity, case studies.

e. Energy resources: growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, case study.

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

D. Role of an individual in conservation of natural resouces.

Unit II: Ecosystems **15 marks (7 lecture hours)**

A. Concept of an ecosystem

B. Structure and function of an ecosystem

C. Producer, consumer and decomposer

‘ D. Energy flow in the ecosystem, water cycle, carbon cycle, oxygen cycle, nitrogen cycle; energy cycle and integration of cycles in nature.

E. Ecological succession

F. Food chain, food webs and ecological pyramids

G. Characteristic features, structure and function of

a. forest ecosystem

b. grassland ecosystem

c. desert ecosystem

d. aquatic ecosystem- ponds, streams, lakes, rivers, oceans, estuaries

Unit III: Biodiversity **20 marks (8 lecture hours)**

A. Introduction

a. definitions

b. species and ecosystem diversities

B. Bio-geographical classification of India

C. Value of biodiversity: social, ethical, aesthetic and option value

D. Biodiversity at global, national and local levels

E. India as a mega-diversity nation

F. Hot-spots of biodiversity

G. Threats to biodiversity: habitat lost and poaching of wildlife

H. Endangered and endemic species of India- common plant and animal species

I. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity

Unit IV: Environmental Pollution **15 marks (8 lecture hours)**

A. Introduction- definition

B. Cause, effects and control measures of

a. air pollution

b. water pollution

c. soil pollution

d. marine pollution

e. noise pollution

f. thermal pollution

g. nuclear hazards

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

D. Role of individual in prevention of pollution

E. Pollution case studies

F. Disaster management: flood, earthquake, cyclone and landslides

Unit V: Social Issues and the Environment 15 marks (7 lecture hours)

A. From sustainable to unsustainable development

B. Urban problems related to energy

C. Water conservation, rain water harvesting, watershed management

D. Resettlement and rehabilitation of people: problems and concerns with case studies

E. Environmental ethics: issues and possible solutions

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

G. Environment protection Acts

H. Public awareness

Unit VI: Human Population and the Environment 15 marks (8 lecture hours)

A. Population growth variation among nations

B. Population explosion

C. Environment and human health: environmental health, climate and health, infectious diseases, water related diseases risk due to chemicals in food

D. Value education

E. HIV/AIDS

F. Role of information technology in environmental and human health

Suggested reading list:

1. Agarwal K.C. 2001, *Environmental Ecology*. Nidi Publ. Ltd., Bikaner

2. Anjaneyalu Y. 2004, *Intro. to Environmental Science*. BS Publications, Hyderabad
3. Eraco Barucha, 2005, *Text Book of Environmental Studies for Undergraduate Course*, University Grants Commission, New Delhi
4. Gupta P.k. 2004, *Methods in Environmental Analysis- Water, Soil and Air*. Agrobios (India), Jodhpur
5. Hawkins R.E., *Encyclopedia of Indian Natural History*, Bombay Natural History Society, Bombay.
6. Mhaskar A.K., *Matter Hazardous, Techno-Science Publication* (TB) Miller Jr. Environmental Science, Wadsworth Co.
7. Sharma B.K., *Handbook of Environmental Chemistry*, Goel Publ. House, Meerut
8. Vidyasagar & Prabhu Prasadini 2008, *Objective Questions and Glossary in Environmental Science*. BS Publications, Hyderbad

4. VALUE-ADDED COURSES (VAC)

Value- Added Courses- compulsory non-credit courses for all students of B.A. / B.Sc. Honours courses:

Semester	Name of the Course and Paper Code	Full mark/ Pass mark
I	VAC Paper – I : Human Rights & Duties (HRD)	100 / 35
II	VAC Paper – II : Women Empowerment (WEM)	100 / 35

1. VAC: HRD HUMAN RIGHTS AND DUTIES

Fullmark-100

Unit I: Conceptual Background of Human Rights and Duties

(20 marks; 8 lecture hours)

1.1 Rights: Universal, Inherent, Inalienable and Indivisible

1.2 Values: Justice, Liberty, Equality, Dignity, Unity in Diversity

1.3 Relationship: between Rights and Duties; between Freedom and Responsibility.

Unit 2: Philosophical and Historical Perspective (20 marks; 8 lecture hours)

2.1 Origin of concept of human rights.

2.2 Theories of Human Rights

2.3 Human Rights Movements

Unit 3: International Human Rights Standards (20 marks; 8 lecture hours)

3.1 Universal Declaration of Human Rights, 1948

3.2 International Covenant on Civil and Political Rights, 1966

3.3 International Covenant on Economic, Social and Cultural Rights, 1966

Unit 4: **Human Rights and Duties in India (20 marks; 8 lecture hours)**

4.1 Evolution of the concept of Human Rights in India

4.1 Constitution of India – Fundamental Rights, Directive Principles of State Policy and Fundamental Duties

4.2 Enforcement and protection of Human Rights – Judiciary, National Human Rights Commission and other Commissions, Non-Governmental Organisations, role of media

Unit 5: **Core Social Problems (20 marks; 8 lecture hours)**

5.1 Poverty, underdevelopment and illiteracy

5.2 Rights issues concerning women, children and other disadvantaged groups.

REFERENCE BOOKS:

1. Jayapalan N: *Human Rights*. New Delhi, Atlantic Publishers, 2000
2. Bajwa G.S. and D.K. Bajwa: *Human Rights in India- Implementation and Violations.* New Delhi, D.K. Publishers, 1996
3. Mohanti M: *Human Rights Education*. Deep and Deep, New Delhi, 2000
4. National Human Rights Commission: *Human Rights Education for Beginners* (2005)
5. Basu D. D.: *Introduction to the Constitution of India*, 22nd Edition, Lexis Nexis Publications
6. Adil-ul-Yasin and Archana Upadhyay: *Human Rights*. Akansha Publishing House, Delhi, 2004
7. Justice V.R.Krishna Iyer: *Human Rights and Inhuman Wrongs*. B.R.Paperback, Delhi, 2001

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2. VAC: WEM **WOMEN EMPOWERMENT**

Fullmark-100

Unit 1: Concept of women empowerment, status of women (overview of the global and national situation), challenges to women empowerment, benefits of women empowerment. (20 marks; 8 lecture hours)

Unit 2: Women's rights movement (political, economic, social and legal), Meira Paibis, Nupilal, violence against women; The Protection of Women from Domestic Violence Act 2005. (20 marks; 8 lecture hours)

Unit 3: Political empowerment of women; participation of women in decision making bodies; women's participation in grassroots democracy; advocacy groups for women's rights. (20 marks; 8 lecture hours)

Unit 4: Education and women; government schemes and policies related to women; policies for the girl child, women and health. (20 marks; 8 lecture hours)

Unit 5: National Policy for the Empowerment of Women 2001; The United Nations and other international instruments, covenants, conventions related to women empowerment. (20 marks; 8 lecture hours)

Readings:

1. Maithreyi Krishna Raj, *Women's Studies in India: Some Perspectives*. Popular Prakashan, Bombay, 1986.
2. Malla Kullar (ed.), *Writing the Women's Movement: A Reader*. Zuaan, Kali for Women, New Delhi, 2005.
3. Arya Sadhana, *Women Gender Equality and the State*. Deep & Deep, Delhi, 1999.
4. Sushama Sahay, *Women and Empowerment: Approaches and Strategies.* Diacovery Publishing, 1998.
5. Salam Irene, *Women of Manipur: An alternative perspective*. Neha Publications, 2014.

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5. SUPPORTIVE COURSES

Honours Suppoertive Course (HSC)- compulsory non-credit courses for all students of B.A. / B.Sc. Honours courses:

Semester	Name of the Course and Paper Code	Full mark/ Pass mark	Syllabus
III	HSC Paper – I: Honours Supportive Course (HSC I)	100 / 35	HSC-I are included in the syllabi of the different subjects (Ch.3- particular subject)
IV	HSC Paper – II: Honours Supportive Course (HSC II)	100 / 35	HSC-II are included in the syllabi of the different subjects (Ch.3- particular subject)

6. ADD-ON CAREER ORIENTED COURSES (Optional)

(i) COC/COP:

Year	Name	Course	Syllabus
1st	i. Mushroom Cultivation ii. Bioinformatics in Biodiversity iii. Food processing & conservation iv. Communication skill & functional English	Certificate	The syllabus of Manipur University that has been followed in the college is adopted
2nd	i. Mushroom Cultivation ii. Bioinformatics in Biodiversity iii. Food processing & conservation iv. Communication skill & functional English	Diploma	The syllabus of Manipur University that has been followed in the college is adopted
3rd	i. Mushroom Cultivation ii. Bioinformatics in Biodiversity iii. Food processing & conservation iv. Communication skill & functional English	Advance	The syllabus of Manipur University that has been followed in the college is adopted

(ii) Information Technology and Information Technology Enabled Service (IT&ITES) – Certificate and Diploma course run under RUSA 1.0 (SPD, Govt. of Manipur) scheme:

COURSE STRUCTURES OF ITES (QP: DOMESTIC DATA ENTRY OPERATOR)

NSQF LEVEL 4

Paper	Course Code	Course Title/Chapters	Load Allocation (credits)			Marks Distribution			Credits
			L	T	P	Int.	Ext.	Total	
1	**GC-101**	Basic Communication Skill	6	0	0	40	60	100	6
2	**GC-102**	Management Concept & Organisation Behaviour	6	0	0	40	60	100	6
3	**ITSD-103**	Basic Computer Operations, Concept on networking, data storage and retrieval in networked environment. Internet and its uses, Typing tutor. Presentation tools.	3	0	3	40	60	100	6
4	**ITSD-104**	Word Processors in Data entry operations and management, exposing to Microsoft Word/Open Source and its tools,	3	0	3	40	60	100	6
5	**ITSD-105**	Electronic spreadsheet in Data entry operations and its management, exposing to Microsoft Excel/open source office.	3	0	3	40	60	100	6
		Total	**21**	**0**	**9**	**200**	**300**	**500**	**30**

GC–101: Basic Communication Skills

Maximum Marks: 100
Contact Hours: 90 hrs. **External Assessment** : 60
Credit : 6 **Internal Assessment**: 40

Unit 1: Voice and Accent: **1 credit** **12+8 marks**

Pronunciation: Vowels and Consonants sounds, Intonation and Word stress, Business vocabulary, how to neutralize voice and accent?
(Exercise and activity)

Unit 2: Communication: **1 credit** **12+8 marks**

Define communication and its importance, Types of communication, Business communication, Communication Barrier, Listening skills for effective communication, Difference between listening and hearing, Academic listening.
(Exercise and Activity)

Unit 3: Speaking: **1 credit** **12+8marks**

Self introduction, Formal and Informal speaking, Public speaking /Group discussion/ Debate, Presentation skills, Giving instructions and Direction.
(Exercise and Activity)

Unit 4: Professional skills: **2 credit** **12+8 marks**

Telephonic skills, Mock interview and meeting, Dealing with difficult people Reading skill: Guidelines for effective reading and Reading strategies. Writing skill: Writing as a skill, Principle of communicative writing, Email etiquette, Business and Personal writing, Informal and Formal writing, Business and Personal letters, CV/Resume making.
(Exercise and Activity)

Unit 5: Grammar: **1 credit** **12+8** marks

Part of speech, Use of tenses, Phrasal Verbs, Synonyms and Antonyms, Functional grammar, Sentence Construction, (Exercise and Activity)

Recommended books:

1. *Fallowfield, L., & Jenkins, V. (1999). Effective communication skills are the key to good cancer care. European Journal of Cancer, 35(11), 1592-1597.*

GC:102: MANAGEMENT CONCEPT & ORGANIZATIONAL BEHAVIOUR

Maximum Marks: 100
Contact Hours: 90hrs **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I: Nature of Management: **1 Credit** **(12+8) Marks**

Nature of Management, Social Responsibilities of Business, Manager and Environment Levels in Management, Managerial Skills, Planning, Steps in Planning Process, Scope and Limitations, Short Range and Long Range Planning. Flexibility in Planning, Characteristics of a sound Plan - Management by Objectives (MBO), Policies and Strategies, Scope and Formulation, Decision Making - Techniques and Processes.

UNIT II: Nature of **Organization:** **1 Credit** **(12+8) Marks**

Organization Structure and Design, Authority and Responsibility Relationships, Delegation of Authority and Decentralization, Interdepartmental Coordination, Emerging Trends in Corporate Structure, Strategy and Culture. Impact of Technology on Organizational design, Mechanistic vs Adoptive Structures. Formal and Informal Organization.

UNIT III: Group Behaviour & Leadership and Power: 1 Credit (12+8) Marks

Organization structure, Formation of groups in organizations, Influence, Group dynamics, Emergence of informal leaders and working norms, Group decision making techniques, Team building, Interpersonal relations, Communication & Control. Meaning, Importance, Leadership styles, Theories of Leaders Vs Managers, Sources of power, Power centres, Power and Politics.

UNIT IV: Organization & Individual Behavior: 2 Credit (12+8) Marks

Definition, need and importance of organizational behavior, Nature and scope, Frame work of Organizational behavior models. Personality, types, Factors influencing personality, Theories of Learning, Types of learners, The learning process, Learning theories, Organizational behaviour modification. Misbehaviour, Types & Management Intervention, Emotions - Emotional Labour – Emotional Intelligence, Theories. Attitudes, Characteristics, Components, Formation, Measurement & Values. Perceptions, Importance &Factors influencing perception, Interpersonal perception &Impression Management. Motivation, importance, Types & Effects on work behaviour.

UNIT V: Dynamics of Organizational Behaviour: 1 Credit (12+8) Marks

Organizational culture and climate, Factors affecting organizational climate, Importance. Job satisfaction. Organizational change, Importance, Stability Vs Change, Proactive Vs Reaction change, the change process, Resistance to change, Managing change.

***Recommended books**:*

1. *Management and Organisational Behaviour, Author: R B Rudani, Publisher: McGraw Hill Education (27-Jul-2011), ISBN 10 : 0071077936.*
2. *Management and organisational behaviour, Author: Laurie j. Mullins, Publisher Prentice Hall, Seventh Edition.*
3. *Management of organizational behavior: Utilizing human resources, 6th edition, Hersey, Paul; Blanchard, Kenneth H. Englewood Cliffs, NJ, US: Prentice-Hall, Inc*

ITSD:103: BASIC COMPUTER OPERATIONS, CONCEPT ON NETWORKING, DATA STORAGE AND RETRIEVAL SYSTEM IN NETWORKED ENVIRONMENT.

HEALTH AND SAFETY MEASURES IN AN ORGANISATION.

Maximum Marks: 100
Contact Hours: (**42+84=126)Hrs** **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I: Basic Computer Operations: 1 Credit (12+8) Marks

Knowledge of Computer hardware and its peripherals, Input & output devices types and its functions, computer handling on the MS Windows 10 and other open source OS, File management, system maintenance & common trouble shooting**.**

UNIT II: Concept on computer Networking: 1 Credit (12+8) Marks

Networking types and importance, LAN, WAN, types of media used in computer networking (Bounded and unbounded media), Security concepts and measures, etiquettes on the networking environment. Use of internet security for protection of computer, Common data storage and retrieval on the networking environment.

UNIT III: Typing Tutor: 1 Credit (12+8) Marks

Understanding keyboard layout and functions. Typing rules with fingers positions on the keyboard. Typing practice on offline mode using application software for typing practices.

UNIT IV: Introduction to Internet: 2 Credit (12+8) Marks

Concept on internet, applications of internet, e-mail, world wide web (www), data transactions across internet (audio, visual), concept of cloud computing and storage of data and retrieval**.**

UNIT V: Presentation tools: 1 Credit (12+8) Marks

Presentation using MS PowerPoint/open source Office, creating slides and Management, concept of Master slide, Animation tools, transition effects and presentation on a PC or on networking environment.

ITSD-104 : WORD PROCESSORS IN DATA ENTRY OPERATIONS AND MANAGEMENT, EXPOSING TO MICROSOFT WORD/OPEN SOURCE AND ITS TOOLS

Maximum Marks: 100
Contact Hours: **(42+84=126)Hrs** **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I: Create and manage documents: 1 Credit (12+8) Marks

Create a document, Create new blank documents, Create new documents by applying templates, Import files, Open non-native files directly in word, open a pdf in word for editing. Navigate through a document, Search for text within document, insert hyperlinks, Create bookmarks, Demonstrate how to use go to. Format a document, modify page setup, Change document themes, Change document style sets, Insert simple headers and footers, Insert watermarks, Insert page numbers. Customize options and views for documents, Change document views, demonstrate how to use zoom, Customize the quick access toolbar, Customize the ribbon. Split the window, add values to document properties, Demonstrate how to use show/hide. Record simple macros, Assign shortcut keys, Manage macro security. Configure documents to print or save, Configure documents to print, Save documents in alternate file formats. Print document sections, Save files to remote locations, Protect documents with passwords, Set print scaling, Maintain backward compatibility

UNIT II: Format Text , Paragraphs, and Sections : 1 Credit (12+8) MARKS

insert text and paragraphs, append text to documents, find and replace text, Copy and paste text. Insert text via autocorrect, Remove blank paragraphs, Insert built-in fields, Insert special characters, Format text and paragraphs, Change font attributes, Demonstrate how to use find and replace to format text, Demonstrate how to use format painter, Set paragraph spacing, Set line spacing, Clear existing formatting, Set indentation, Highlight text selections, Add styles to text, Change text to Word Art, Modify existing style attributes, order and group text and paragraphs, Prevent paragraph orphans. Insert breaks to create sections, create multiple columns within sections, Add titles to sections, Force page breaks.

UNIT III: **Create tables and lists : 1 Credit (12+8) MARKS**

Create a table, Convert text to tables, Convert tables to text, Define table dimensions, Set auto fit options, Demonstrate how to use quick tables, Set a table title, Modify a table, Apply styles to tables, Modify fonts within tables, Sort table data, Configure cell margins, Demonstrate how to apply formulas to a table, Modify table dimensions,

Merge cells. Create and modify a list, Add numbering or bullets, Create custom bullets, Modify list indentation, Modify line spacing, Increase and decrease list levels, Modify numbering.

UNIT IV: References & Forms: 1 Credit (12+8) MARKS

Create endnotes, footnotes, and citations, Insert endnotes, Manage footnote locations, Configure endnote formats, Modify footnote numbering, Insert citation placeholders, Insert citations, Insert bibliography, Change citation styles. Create captions, Add captions, Set caption positions, Change caption formats, Change caption labels, Exclude labels from captions. Create and manage indexes, Create indexes, Update indexes, Mark index entries, Demonstrate how to use index auto-mark files. Create and manage reference tables, Create a table of contents, Create a table of figures, Format table of contents, Update a table of authorities, Set advanced reference options (captions, footnotes, citations). Manage forms, fields, and mail merge operations, Add custom fields, Modify field properties, Add field controls, Modify field control properties, Perform mail merges, Manage recipient lists, Insert merged fields, Preview results.

UNIT V: Insert and format objects: 1 Credit (12+8) MARKS

Insert and format building blocks, Insert quick parts, Insert textboxes, Demonstrate how to use building blocks organizer, Customize building blocks, Insert and format shapes and SmartArt, Insert simple shapes, Insert SmartArt, Modify SmartArt properties (color, size, shape), Wrap text around shapes, Position shapes, Insert and format images, Insert images, Apply artistic effects, Apply picture effects, Modify image properties (color, size, shape), Add quick styles to images, Wrap text around images, Position images, manage and share documents, Manage multiple documents, Modify existing templates, Merge multiple documents, Manage versions of documents, Copy styles from template to template, demonstrate how to use the style organizer, Copy macros from document to document, link to external data.

Recommended books:

1. *Microsoft Office 2016 Step by Step, Book by Joan Preppernau*
2. *Teach Yourself VISUALLY Word 2013, Book by Elaine J Marmel*

ITSD-105: ELECTRONIC SPREADSHEET IN DATA ENTRY OPERATIONS AND MANAGEMENTS, EXPOSING TO MICROSOFT EXCEL / OPEN SOURCE

Maximum Marks: 100
Contact Hours: **(42+84=126)Hrs** **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I: Create and manage worksheets and workbooks: 2 Credits (12+8)Marks

Create worksheets and workbooks, create new blank workbooks, create new workbooks use templates, Import files, Open non-native files directly in excel, Add worksheets to existing workbooks, Copy and move worksheets, Navigate through worksheets and workbooks, Search for data within a workbook, Insert hyperlinks, Change worksheet order, Demonstrate how to use go to, Demonstrate how to use name box. Format worksheets and workbooks, Change worksheet tab color, Modify page setup, Insert and delete columns and rows, Change workbook themes, Adjust row height and column width, Insert watermarks, Insert headers and footers, Set data validation, Customize options and views for worksheets and workbooks, Hide worksheets, Hide columns and rows, Customize the quick access toolbar, Customize the ribbon, Manage macro security, Change workbook views, Record simple macros, Add values to workbook properties, Demonstrate how to use zoom, Display formulas, Freeze panes, Assign shortcut keys, Split the window, Configure worksheets and workbooks to print or save, Set a print area, Save workbooks in alternate file formats, Print individual worksheets, Set print scaling, Repeat headers and footers, Maintain backward compatibility, Configure workbooks to print, Save files to remote locations. Create cells and ranges, insert data in cells and ranges, Append data to worksheets, Find and replace data, Copy and paste data, Demonstrate how to use autofill tool, Expand data across columns, Insert and delete cells,

UNIT II: T**ables, Charts & Objects in Excel,: 1 Credits (12+8)Marks**

Create a table, Move between tables and ranges, Add and remove cells within tables, Define titles, Modify a table, Apply styles to tables, Band rows and columns, Insert total rows, Remove styles from tables, Filter and sort a table, Filter records, Sort data on multiple columns, Change sort order, Remove duplicates, Apply formulas and functions, Apply cell ranges and references in formulas and functions, Demonstrate how to use references (relative, mixed, absolute), Define order of operations, Reference cell ranges in formulas, Summarize data with functions, Demonstrate how to apply the sum function, Demonstrate how to apply the min

and max functions, Demonstrate how to apply the count function, Demonstrate how to apply the average function, Apply conditional logic in functions, Demonstrate how to apply the SUM-IF function, Demonstrate how to apply the AVERAGE- IF function, Demonstrate how to apply the COUNT-IF function, Format and modify text with functions, Demonstrate how to use the right, left and mid functions, Demonstrate how to use the trim function, Demonstrate how to use the upper and lower functions, Demonstrate how to use the concatenate function. Create a chart, Create charts and graphs, Add additional data series, Switch between rows and columns in source data, Demonstrate how to use quick analysis, Format a chart, Add legends, Resize charts and graphs, Modify chart and graph parameters, Apply chart layouts and styles, Position charts and graphs, Insert and format an object, Insert text boxes, Insert smartart, Insert images, Add borders to objects, Add styles and effects to objects, Change object colors, Modify object properties, Position objects.

UNIT III: **Manage and share workbooks& advance formulas: 1 Credits (12+8)Marks**

Manage multiple workbooks, Modify existing templates, Merge multiple workbooks, Manage versions of a workbook, Copy styles from template to template, Copy macros from workbook to workbook, Link to external data, Prepare a workbook for review, Set tracking options, Limit editors, Create workspaces, Restrict editing, Control recalculation, Protect worksheet structure, Mark as final, Remove workbook metadata, Encrypt workbooks with a password, Manage workbook changes, Track changes, Manage comments, Identify errors, Troubleshoot with tracing, Display all changes, Retain all changes, apply custom formats and layouts, apply custom data formats, Create custom formats (number, time, date), Create custom accounting formats, Demonstrate how to use advanced fill series options, apply advanced conditional formatting and filtering, Write custom conditional formats, Demonstrate how to use functions to format cells, Create advanced filters, Manage conditional format rules, apply custom styles and templates, Create custom color formats, Create and modify cell styles, Create and modify custom templates, Create form fields, prepare a workbook for internationalization and accessibility, Modify tab order among workbook elements and objects, Display data in multiple international formats, Modify worksheets for use with accessibility tools, Demonstrate how to use international symbols, Manage multiple options for +body and +heading fonts, Apply functions in formulas, Demonstrate how to use the if function in conjunction with other functions, Demonstrate how to use and/or functions.

UNIT IV: Advanced Charts & Tables: 1 Credits (12+8)Marks

Create advanced chart elements, Add trend lines to charts, Create dual axis charts, Create custom chart templates, View chart animations, Create and manage pivot tables, Create new pivot tables, Modify field selections and options, Create a slicer, Group records, Utilize calculated fields, Format data, Demonstrate how to use PowerPivot, Manage relationships, Create and manage pivot charts, Create new pivot charts, Manipulate options in existing pivot charts, Apply styles to pivot charts, Charts and chart tools: insert and modify charts, Picture the data: insert and format pictures, Shapes, SmartArt, views: insert and modify shapes and SmartArt, change, views.

UNIT V: Advance Features of Excel: 1 Credits (12+8)Marks

Sound advice: create and use lookup tables, use if functions, Create and modify tables and apply quick styles, Use sort, filter, outline, and goal seeking tools, What happened? (pivot tables) create and modify pivot tables, Create drop-down lists and use data validation, Use and audit formulas from Excel's formula library, Working with macros: create and use macros, Excel in print: use page layout and page set up to modify print settings, 5.1.8 Prepare to share: use reviewing tools and permissions.

Recommended books:

1. *Teach Yourself Visually Excel 2013*
2. *Microsoft Office 2016 Step by Step, Book by Joan Preppernau.*

COURSE STRUCTURES OF ITES (QP: WEB DEVELOPER)

NSQF LEVEL 5

Paper	Course Code	Course Title	Load Allocation			Marks Distribution			Credits
			L	T	P	Int.	Ext.	Total	
6	**GC-201**	Business Correspondence	6	0	0	40	60	100	6
7	**GC-202**	Introduction to IT based accounting and Entrepreneurship	4	0	2	40	60	100	6
8	**ITSD-203**	Graphic Designing tools for website designing using Adobe Photoshop.	3	0	3	40	60	100	6
9	**ITSD-204**	***Understanding HTML, CSS. Programming syntax & Structures, PHP, concept on My- SQL/Maria*** DB.	3	0	3	40	60	100	6
10	**ITSD-205**	Website Development, Deployment and Hoisting	3	0	3	40	60	100	6
		Total	**19**	**0**	**11**	**200**	**300**	**500**	**30**

GC-201: BUSINESS COMMUNICATION AND CORRESPONDENCE

Maximum Marks: 100
Contact Hours: 90 hrs. **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

Unit 1: Assertiveness: 1 credit 12+8 marks

Introduction, Four different life styles, Positive and Negative thinking, Assertive rights, Strategies for assertive behaviour, Indicators of assertive behaviour, Success in relationships, How to say no and Mental locks.

Unit II: Presentation Skills 1 credit 12+8 marks

Effective presentations, Exercising control, Six great helpers and Seven steps to a successful presentation.

Unit III: Meeting Skills 1 credit 12+8 marks

Meeting Agenda, Guidelines, Types of meeting, Purpose of meeting, planning of a meeting, Preparation of a meeting, Problem solving and decision making.

Unit IV: Body Sport and Voice Modulation 1 credit 12+8 marks

Introduction, Positive gestures, Handshakes, The Gazes, Smiles, Hand Movements, Different styles of talking and Voice modulations.

Unit V: Group Discussions and Interviews 2 credit 12+8 marks

Introduction, Dos and don'ts, Body sport for GDs, Pre-planning of Interview, Facing the Interview Board, Body Sport for Interviews and Negotiations.

Recommended books:

1. Chaney, L. H., & Martin, J. S. (2000). *Intercultural business communication*. Prentice Hall.
2. Kaul, A. (2014). *Effective business communication*. PHI Learning Pvt. Ltd.

GC -202: INTRODUCTION TO IT BASED ACCOUNTING AND ENTREPRENEURSHIP

Maximum Marks: 100
Contact Hours:(56+56=112)hrs **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I: Basic computer operations and handlings: 1 Credit (12+8) Marks

Basic computer operations and maintenance using Microsoft Windows 10, Printers, types and printing techniques. Scanners types and scanning techniques. Concept of computer networks, internet and its applications, internet security and its tools**.** Commonly used utility software. Introduction to tally and its applications.

UNIT II: Entrepreneurship: 1 Credit (12+8) Marks

Entrepreneurship, Meaning and importance, Launching Entrepreneurial Ventures, Creativity, Innovations, Methods to Initiate Ventures, Legal Challenges, Search for Entrepreneurial Capital, Business Plan for New Ventures, Meaning and Objectives of a Business Plan, Advantages and cost of preparing a Business Plan, Elements, Critical Assessment Unit III Strategic Perspectives Strategic Growth, Need for Strategic Planning, Understanding the growth stage, Unique managerial Concerns of growing enterprise, Valuation Concerns, Entrepreneurship – Indian Perspective, Historical Perspective, Global Indian Entrepreneurs, Institutions, Modern Entrepreneurs.

UNIT III: Entrepreneurship – Indian Perspective. 1 Credit (12+8) Marks

Project Work Students have to prepare a detailed business plan selecting a product(s), Presentation of such business plans and submission after necessary corrections suggested by subject faculty.

UNIT IV: Financial Accounting: 1 Credit (12+8) Marks

What Is Accounting, Purpose of Accounting, Importance of Accounting, Basic Concept of Financial accounting and its importance in an organisation, Concept of Voucher and its type, Concept of single entry and double, entry system of accounting.

UNIT V: Taxes 1 Credit (12+8) Marks

Value Added Tax (VAT), Central Sales Tax (CST), Service Tax, TDS, Concept on Income Tax and income tax filing, e-filing and requirements. Hands on Practice using Tally ERP, Fundamentals of accounting, Creating Masters in Tally, Voucher entry and Generation of Reports, Tally Vaults and security controls, Export, Import and splitting of data.

Recommended books:

1. *Accounting for Management, Author: Ashok Sehgal, ISBN No.:9789350717516.*
2. *Financial Accounting, Author: Raj K Agrawal Rupesh Agrawal Edition : 2015 Edition, ISBN No.:9789350716960.*
3. *Fundamentals of Accounting and Auditing (CS-FOUNDATION, Author : Aruna Jha S.P OBEROI Edition : 2015 Edition ISBN No.:9789350716427.*
4. *Mastering Tally ERP 9, Author : Asok K. Nadhani, Publisher : BPB Publications (2012), ISBN 10 : 818333475X*

ITSD-203 GRAPHIC DESIGNING TOOLS FOR WEBSITE DESIGNING USING ADOBE PHOTOSHOP

Maximum Marks: 100
Contact Hours: **(42+84=126)Hrs** **External Assessment**: 60
Credit:6 **Internal Assessment**: 40

UNIT I : Introduction to Adobe Photoshop: 1 Credit (12+8) marks

About Photoshop, Navigating Photoshop, Menus and panels, Opening new & existing files, Exploring the Toolbox, The Applications & the Options Bar, Exploring Panels & Menus, Creating & Viewing a New Document, Customizing the Interface & Setting Preferences, Working with Images, Zooming & Panning an Image, Working with Multiple Images, Rulers, Guides & Grids, Adjusting Color with the New Adjustments Panel, The New Masks Panel & Vibrance of Colour & Correction Command, The New Note Tool & the Save for Web & Devices Interface.

UNIT II: Manipulating Image using Photoshop: 1 Credit (12+8) marks

Resizing & Cropping Images, Understanding Pixels & Resolution, The Image Size Command, Interpolation Options & Resizing for Print & Web, Cropping & Straightening an Image, Adjusting Canvas Size & Canvas Rotation, selecting with the Elliptical Marquee Tool, Using the Magic Wand & Free Transform Tool, selecting with the Regular, Polygonal Lasso Tools & the Magnetic Lasso Tool, Combining Selections, Using the Quick Selection Tool & Refine Edge & Modifying Selections.

UNIT III: Getting Started with Layers: 1 Credit (12+8) marks

Understanding the Background Layer, Creating, Selecting, Linking & Deleting Layers, Locking & Merging Layers, Copying Layers, Using Perspective & Layer Styles, Filling & Grouping Layers, Introduction to Blending Modes, Blending Modes, Opacity & Fill, Creating & Modifying Text.

UNIT IV: Painting in Photoshop & Colour Correction: 1 Credit (12+8) marks

Using the Brush Tool, Working with Colors & Swatches, Creating & Using Gradients, Creating & Working with Brushes, Using the Pencil & Eraser Tools, Painting with Selections, Color Spaces & Color Modes, The Variations Command, The Auto Commands, Adjusting Levels, Adjust Curves, Non-Destructively, with Adjustment Layers.

UNIT V: Photo Retouching, Pen Tool, Special Effects & Exporting File Formats: 2 Credit (12+8) marks

The Red Eye Tool, The Clone Stamp Tool, The Patch Tool & the Healing Brush Tool, The Spot Healing Brush Tool, The Color Replacement Tool, The Toning & Focus Tools, Painting with History, Quick Mask Options, Painting a Selection, Saving & Removing a Selection from the Background, Understanding Paths & the Pen Tool, Creating Straight & Curved Paths, Creating Combo Paths & Creating a Clipping Path, Smart Filters, Creating Text Effects, Applying Gradients to Text, Saving with Different File Formats, Saving for Web & Devices, Printing Options.

Recommended books:

1. *The Photoshop CS Book for Digital Photographers, Book by Scott Kelby*
2. *Adobe Photoshop CS6 Classroom in a Book, Book by Brie Gyncild*
3. *The Photoshop Elements 14 Book for Digital Photographers, Book by Scott Kelby*

ITSD-204: Understanding HTML, CSS, Programming Syntax & Structures based on PHP, JavaScript.

Maximum Marks: 100

Contact Hours: **(42+84=126)Hrs** **External Assessment**: 60

Credit:6 **Internal Assessment**: 40

UNIT I: HTML **1Credit** **(12+8) marks**

The World Wide Web (WWW) and history of HTML, Why HTML, Prerequisites HTML Documents, Dividing the document into 2 parts, Headers tags, Body tags. Paragraphs, Formatting. Elements of an HTML Document, Text Elements, Tag Elements, Special Character elements. Image tags, HTML Table tags, Lists ordered & unordered list Anchor tag, Name tag.

UNIT II: Advance HTML **1Credit** **(12+8) marks**

Hyperlinks - FTP/HTTP/HTTPS, Links with images and buttons, Links to send email messages, Text fonts and styles, background colors/images, Marquee Behavior, Forms elements , button and its types, Text Box, Text area, List Box, Combo box, related tags (action, method, name, input, submit etc.), HTML Media Tags.

UNIT III: CSS (Cascading Style Sheet): **1Credit** **(12+8) marks**

Concept of CSS, Creating Style Sheet, CSS Properties, CSS Styling (Background, Text , Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model(Introduction, Border properties, Padding Properties, Margin properties).

UNIT IV: Advance CSS **1Credit** **(12+8) marks**

CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align,Pseudo class, Navigation Bar, Image Sprites, Attribute sector), CSS Color,, Creating page Layout and Site Designs

UNIT V: Introduction to SQL **1Credit** **(12+8) marks**

Concept of Database, DBMS, What is SQL (Structured Query Language), Types DDL (Data Definition Language), DML (Data Manipulation Language), DQL (Data Query Language) & DCL (Data Control Language) function and sytax. Hands on practical to MYSQL/MariaDB.

Recommended Books:

HTML & CSS: Design and Build Web Sites, Book by Jon Duckett
Sams Teach Yourself SQL in 10 Minutes, Book by Ben Forta

ITSD-205: WEBSITE DEVELOPMENT, DEPLOYMENT AND HOSTING

Maximum Marks: 100

Contact Hours: **(42+84=126)Hrs**
Credit:6

External Assessment: 60
Internal Assessment: 40

UNIT I: Scripting Language in web developing-1 2 Credit (12+8) Marks

Overview of PHP, PHP installation and Introduction, PHP Basics, Variables, Arrays in PHP with Attributes, Loops, String Functions in PHP, PHP Email Function, Date & Time, Image Uploading, File handling in PHP, Functions in PHP.

UNIT II: Scripting Language in web developing-2 1 Credit (12+8) Marks

Errors handling in PHP, Sending Emails using Classes, Class, Object, Inheritance, Inheritance types, Object cloning, Constructor and Destructor, Access specifiers, Scope resolution operator, Class constant, This operator, Abstract class and interface

UNIT III: Developing Web application 1 Credit (12+8) Marks

Understanding SRS (System Requirement Specification), BRS(Business Requirement Specification), URS (Users Reuirement specification), HLD (High Level Design), LLD (Low Level Design), Developing Dynamic Website on NetBeans with PHP as scripting language.

UNIT IV: 1 Credit (12+8) Marks

Overview of IIS & Apache and hoisting the website/web application on IIS & Apache web server at the local intranet

UNIT V: 1 Credit (12+8) Marks

Overview of IIS & Apache and hoisting the website/web application on IIS & Apache web server at commercial hoisting sever through internet.

Recommended Books:

PHP and MySQL Web Development, Book by Luke Welling
Professional Microsoft IIS 8, Book by Benjamin Perkins, Dennis Glendenning, Jeff Cochran, Kenneth Schaefer, and Scott Forsyth
Apache Cookbook, Book by Ken Coar and Rich Bowen.

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