

NATIONAL UNIVERSITY



Syllabus Subject: **Botany**

Three Years B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Subject: Botany
Syllabus for Three Year B.Sc. (Pass) Course
Effective from the Session: 2013-2014

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113001	Paper-I	Microbiology, Physiology, Mycology	100	4
113003	Paper-II	Higher Cryptogams, Gymnosperms, Plant Pathology	100	4
Second Year				
123001	Paper-III	Angiosperms, Economic Botany, Anatomy, Embryology, Paleobotany	100	4
123003	Paper-IV	Biodiversity, Conservation, Ecology, Environmental science & Cytology	100	4
Third Year				
133001	Paper-V	Plant Physiology, Phytochemistry Agronomy and Horticulture	100	4
133003	Paper-VI	Genetics, plant Breeding, Evolution, Biotechnology and Biostatistics.	100	4
133004	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
113001	Paper-I	Microbiology, Physiology, Mycology	100	4

A. Microbiology

Marks: 40

- (i) Introduction, contribution of eminent scientists in the field Microbiology.
- (ii) Introduction, characteristics and reproduction of Prions, Viroids, Rickettsia and Mycoplasma.
- (iii) Viruses: Definition, biological nature, physical and chemical structure, multiplication, transmission and economic importance.
- (iv) Bacteria: Introduction, classification, structure, multiplication and economic importance.

B. Phycology

Marks: 30

- (i) Habit and habitats, classification, general structures, reproduction and economic importance of Algae.
- (ii) Salient feature of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae.
- (iii) Life histories of *Anabaena*, *Oedogonium*, *Vaucheria*, *Sargassum* and *Polysiphonia*.

C. Mycology:

Marks: 30

- (i) Introduction, general characteristics, classification, structure and economic importance of Fungi.
- (ii) Life histories of *Synchytrium*, *Pythium*, *Saccharomyces*, *Penicillium*, *Puccinia*, *Agaricus* and *Fusarium*.
- (iii) Lichens: Habit and habitats, classification, structure and importance.

Paper Code	Paper	Paper Title	Marks	Credits
113003	Paper-II	Higher Cryptogams, Gymnosperms, Plant Pathology	100	4

A. Higher Cryptogams

Marks: 40

Bryophyta

- (i) Introduction, salient features of Hepaticopsida, Anthoceropsida and Bryopsida with examples.
- (ii) Life history of *Marchantia*, *Pelia*, *Anthoceros* and *Sphagnum*.

Pteridophyta

- (i) Introduction, salient features of Psilopsida, Lycopsida, Sphanopsida and Pteropsida with examples.
- (ii) Life histories of *Lycopodium*, *Selaginella*, *Ophioglossum* and *Marsilea*.

B. Gymnosperms**Marks : 20**

- (i) Introduction, general characteristics, modern classification and economic importance.
- (ii) Life histories of *Cycas* and *Gnetum*

C. Plant Pathology:**Marks: 40**

- (i) Introduction, scope and importance of plant diseases.
- (ii) Classification of plant diseases.
- (iii) Stages in the development of plant diseases: Inoculation, penetration, infection, growth and reproduction, dissemination, overwintering and oversummering of the pathogens.
- (iv) Causal organisms, symptoms, etiology and control measures of the following plant diseases:
 - a) Brown spot of rice, b) Late light of potato, c) Stem rust of wheat, d) Stem rot of jute e) Tikka disease of ground nut.

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123001	Paper-III	Angiosperms, Economic Botany, Anatomy, Embryology, Paleobotany	100	4

Angiosperms**Marks: 40**

- b) Morphology of flowers, types of inflorescence and fruits.
- c) Definition, scope, units of Classification, nomenclature, preparation of herbarium sheets; Artificial (Linnaeus), natural (Benthum and Hooker.) and phylogenetic. (Engler and Prantle) systems of classification, merits and demerits of these systems.
- d) Magnoliopsida (Dicot): Nymphaeaceae, Rutaceae, Cucurbitaceae, Apocynaceae, Rubiaceae and Lamiaceae.
- e) Liliopsida (Monocot): Amaryllidaceae and Aracaceae

Economic botany**Marks: 20**

- a) Scientific and local names, parts used and importance of 10 plants of each of the following group: food grains, pulses, medicines, rubber, oil, spices and timber yielding plants.
- b) Tea and rubber: Cultivation and processing.

Anatomy**Marks: 15**

- a) Origin and differentiation of apical meristem, tissues and tissue systems.
- b) Distribution of mechanical tissues, normal secondary growth in dicot stem and dicot root and root-stem transition.

Embryology**Marks: 15**

- a) Introduction, sporogenesis and gametogenesis, fertilization.
- b) Development of embryo and endosperm in dicot plant, seed and fruit formation.

Palaeobotany**Marks: 10**

- (a) Definitions and scope of Palaeobotany,
- (b) Types of fossils and fossilization processes.
- (c) Geological era; appearance and extinctions of the life forms in different geological periods.

Paper Code	Paper	Paper Title	Marks	Credits
123003	Paper-IV	Biodiversity, Conservation, Ecology, Environmental science & Cytology	100	4

Biodiversity and Conservation**Marks: 20**

- (i) Definition and elements of biodiversity; causes and losses of biodiversity; rare, vulnerable, threatened and endangered species of Bangladesh.
- (ii) Definition and types of conservation, principles of conservation, advantages and disadvantages of *in situ* and *ex-situ* conservation; conservation in botanic gardens and seed banks; role and activity of IUCN, WWF and CITES.

Ecology**Marks: 40**

- (i) Definition and scope of ecology, climatic, topographic and biotic factors.
- (ii) Salient features of hydrophytes, xerophytes and halophytes.
- (iii) Plant succession: Causes and types, hydrosere, xerosere.
- (iv) Structure and function of ecosystems (Sundarban forest).
- (v) Food chain, food web and ecological pyramids.
- (vi) Phytogeographical regions of Bangladesh.

Environmental Science**Marks: 20**

- i) Definition and components of the environment
- ii) Pollution: Air, water and sound pollution, causes and effects of pollution on plants and animals and their remedies.
- iii) Green house effect: Sources and effects of green house gases, ozone layer depletions.
- iv) Population growth and its impact on nature

Cytology**Marks 20**

- (i) Introduction, definition and scope of Cytology, concept of prokaryotic and eukaryotic cells.
- (ii) Ultra structure of eukaryotic cell; detailed structure and function of cell organelles (chloroplast, mitochondria, ribosome, endoplasmic reticulum and nucleus).
- (iii) Physical and chemical structure of chromosome.
- (iv) Meiotic cell division and its significance.

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133001	Paper-V	Plant Physiology, Phytochemistry Agronomy and Horticulture	100	4

Plant Physiology

Marks: 40

- (i) Absorption of water: Mechanism of absorption of water and nutrients by roots and ascent of sap.
- (ii) Essential mineral elements: Essential elements, deficiency symptoms in plants.
- (iii) Photosynthesis: Pigment systems, photophosphorylation and the fixation of CO₂ through C₃ and C₄ pathways, factors affecting the rate of photosynthesis.
- (iv) Respiration: Mechanism of aerobic and anaerobic respiration and fermentation, respiratory quotient, factors affecting respiration.
- (v) Plant growth regulators: Classification with examples, application of plant growth regulators
- (vi) Physiology of flowering: Photoperiodism and vernalization.
- (vii) Dormancy of seeds: Nature, causes and removal of seed dormancy, viability of seeds.

Phytochemistry

Marks: 30

- (i) Nitrogen metabolism: Nitrogen fixation and nitrogen cycle.
- (ii) Carbohydrates: Classification, common carbohydrates found in plants.
- (iii) Amino acids: Classification, structure and synthesis of amino acids.
- (iv) Vitamins: Definition, origin, types and deficiency diseases caused by Vitamin-A, B, B₂ and C
- (v) Enzymes: Definition, nomenclature, classification with examples, mechanism of action.

Agronomy and Horticulture

Marks: 30

- (i) Definition and scope of Agronomy and Horticultures, classification of field crops.
- (ii) Seeds: Characteristics of a good seed, procurement, quality of seeds, seed treatment.
- (iii) Fertilizers: Definition, classification of fertilizers, composition, dosage, application time and procedure.
- (iv) Crop rotation: Significance, common weeds and their control.
- (v) Preparation of seed bed, sowing and seedling growth; pre-and post-transplanting care.
- (vi) Cultivation of tomato, mango and rose.

Paper Code	Paper	Paper Title	Marks	Credits
133003	Paper-VI	Genetics, plant Breeding, Evolution, Biotechnology and Biostatistics.	100	4

Genetics

Marks: 30

- (i) Mendelism, exceptions of Mendel's laws.
- (ii) Linkage and crossing over; Linked genes and recombination of linked gene.
- (iii) Biochemical structure of DNA and RNA; replication of DNA
- (iv) Mutation: Definition, types of mutation and mutagens, detection of mutation in *Drosophila* by CLB method.

- (v) Sex determination: Different methods of sex determination with examples (XX-XO type, XX-XY type)
- (vi) Polyploids and their economic importance plant breeding and evolution

Plant Breeding and Evolution

Marks: 30

- (i) Introduction: Definition, scope and objectives of Plant Breeding.
- (ii) Hybridization: Objectives and techniques of artificial hybridization.
- (iii) Breeding techniques in self pollinated crops: Methods, merits and demerits of pure line selection and pedigree method.
- (v) Theories of evolution, Darwins theory, Lamarck's theory and mutation theory of evolution.

Biotechnology

Marks: 20

- (i) Definition, scope, importance and achievements of biotechnology.
- (ii) Plant tissue culture: Direct and indirect methods of *in vitro* culture, culture medium, production of disease free plants and commercial aspects of tissue culture.
- (iii) Biogas technology: Production methods and uses.
- (iv) Biofertilizers: Definition, production methods and uses.

Biostatistics

Marks: 20

- (i) Definition and scope of biostatistics, idea of continuous and discontinuous variables, concept of population and sample.
- (ii) Parameters of measures of central tendency (mean, mode, medium) and dispersion (range, variance, standard deviation and co-efficient of variation).

Books Recommended:

Microbiology:

1. Brock, T.D., W.S. David and T.M. Michael : 1984. Biology of Microorganisms. Prentice-Hall Engle Wood, Cliffs, New Jersey.
2. Dubey, R. C. and D. K. Maheshwari : 1999. A text book of Microbiology. S. Chand and Co. Ltd.
3. Frobisher, M., R.D. Hinsdill, K. T. Grabtree and C.R. Goodheart: 1947. Fundamentals of Microbiology (9th ed.). W.B. Saunders Co. London.
4. Pelczer, M.J., E.C. Chan and N.R. Krieg: 1993. Microbiology: Concepts and Application. McGraw Hill Book Co. Inc. New York.
5. Tortora, G.J., B.R. Funke and C. L. Case: 1997. Microbiology (6th ed.) Addison Wesley Longman, Inc., California.
6. ইসলাম, এম. রফিকুল,
মিহির লাল সাহা এবং
এম. এ. বাসার : ২০০৪. অনুজীব বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।
7. খান. এ. এ. : ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Phycology:

1. Bold, H.C. and M.J. Wynne : 1978. Introduction to the Algae, Prentice Hall, India.
2. Chapman, V. J. and D. J. Chapman: 1983. The Algae, Macmillan, London.
3. Fritsch, F.E. : 1946. The Structure and Reproduction in Algae. Vol. I, Cambridge Univ. Press, London.
4. Lee, R.R. : 1989. Phycology, Cambridge Univ. Press, U.K.
5. Prescott. C.W. : 1968. The Algae: A review. Thomas Nelson, London.

6. Smith, G.W. : 1950. The Fresh Water Algae of the United States. McGraw Hill Book Co. Inc., New York.
7. Van dan Hoek, C.D.G. Mann and H. M. Johns: 1966. Algae: An Introduction to Phycology, Cambridge Univ. Press.
8. খান. এ. এ. : ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Mycology:

1. Alexopoulos, C.J., C.W. Mims and M. Blackwell : 1996. Introductory Mycology (4th ed.), Wiley, Eastern Ltd. Calcutta, India.
2. Hawker, Liliam, E : 1967. Fungi, Hutchinson Univ. Library, Cambridge Univ. Press, London.
3. Moore-Landecker, Elizabeth : 1982. Fundamentals of the Fungi. Prentice-Hall. Inc., New Jersey, USA.
4. Webster, J. : 1980. Introduction to Fungi. Cambridge Univ. Press, London, UK.
5. খান. এ. এ. : ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Bryophyta and Pteridophyta:

1. Eams, A. J. : 1964. Morphology of Vascular Plants. Tata McGraw-Hill Pub. Co. Ltd. Bombay.
2. Parihar, N. S. : 1955. An Introduction to Embryophyta, Vol. I & II, Central Book Depot, Allahabad.
3. Smith, G. M. : 1955. Cryptogamic Botany. Vol. II McGraw-Hill Co. Inc., New York, London.
4. Vashista, P. C. : 1993. Botany for Degree Students: Pteridophyta. S. C. Chand & Co. Ltd. Ramnagar, New Delhi.

Gymnosperms:

1. Arnold, C. R. : 1977. An Introduction to Palaeobotany. Tata McGraw Hill Pub. House, New Delhi.
2. Biswas, C. and B. M. Johri: 1997. The Gymnosperms. Norasa Pub. House, New Delhi.
3. Coulterm, J. M and C. J. Chamberlain: 1964. Morphology of Gymnosperms. Central Book Depot, Allahabad, India.
4. Mukherji, H. : 1997. Plant Groups. New Central Book Agency, Ltd. Calcutta.
5. Parihar, N. S. : 1995. An Introduction to Embryophyta Vol. I & II. Central Book Depot. Allahabad
6. Sharma, O. P. : 1980. Gymnosperms – A treatise, Progati Parkashan, Meerut, India.
7. Smith, G.M. : 1955. Cryptogamic Botany. Vol. II. Bryophyta & Pteridophyta, McGraw Hill Co. London.
8. Vashishta, P.C. : 1994. Botany for Degree Students. Vol. V. Gymnosperms. S. Chand and Co. Ltd. Ramnagar, New Delhi.

Plant Pathology:

1. Agrios, G.N. : 1997. Plant Pathology (4th ed.) Academic Press, London.
2. Fahy, P. C. and G.J. Persley : 1983. Plant bacterial disease. A diagnostic guide, Academic Press, London.
3. Mehrotra, R.S. : 1980. Plant Pathology. Tata McGraw-Hill Pub. Co., Ltd.

- New, Delhi.
4. Rangaswami, G. : 1972. Diseases of crop plants in India. Prentice-Hall of India Private Ltd., New Delhi.
 5. Singh, R.S. : 1978. Plant Diseases. Oxford & IBH Pub. Co., New Delhi.
 6. খান, এ. এ. : ২০০০. মাইক্রোবায়োলজি, দোলন চাপা, কাজী প্রকাশনী, ঢাকা।

Angiosperms:

1. Davis, P. H and V.H. Heywood : 1963. Principles of Angiosperm Taxonomy. Oliver Boyd, Edinburgh and London.
2. Hooker, J.D. : 1887-1897. Flora of British India, Vols. 1-7.
3. Jeffrey, C. : 1986. An Introduction to Plant Taxonomy (2nd edition), Cambridge Univ. Press.
4. Kapoor-Vijay, P. and James White (ed.): 1992. Conservation Biology: The Commonwealth Sciences Council.
5. Khan. M.S. and M. Halim : 1967. Aquatic Angiosperms of Bangladesh, BARC, Dhaka.
6. Khan. M.S. (ed.). : 1973-1993. Flora of Bangladesh; fascicles 1-51, BARC, Dhaka.
7. Lawrence, G.H.M. : 1951. Taxonomy of Vascular Plants. The Macmillan Co. New York.
8. Prain, D. : 1903. Bengal Plants. Vols. 1-2, Botanical Survey of India, Calcutta.
9. হাসান, এম.এ. এবং এম. কে. আলম : ১৯৯৭. উদ্ভিদ শ্রেণী বিন্যাস তত্ত্ব (৩য় সংস্করণ), হাসান বুক হাউজ, ঢাকা।

Plant Anatomy and Embryology:

1. Cutter, E.G : 1969. Plant Anatomy. Part I & II. Edward Arnold Pub., UK.
2. Eames, A.J. and L.H. MacDaniels : 1947. An Introduction to Plant Anatomy. McGraw Hill Pub. Co., New York.
3. Esau, K. : 1953. Plant Anatomy, John Wiley & Sons, Inc., New York.
4. Fahn, A. : 1969. Plant Anatomy, Pergamon Press.
5. Maheswari, P. : 1950. An Introduction to the Embryology of Angiosperms. Tata McGraw-Hill Pub. Co. Ltd. Bombay, New Delhi.

Economic Botany:

1. Albert, F. H. : 1972. Economic Botany. Tata McGraw Hill Pub. Co. Ltd., New Delhi.
2. Cotton, C.M. : 1990. Ethnobotany – Principles & Application.
3. Hill, A. F. : 1951. Economic Botany, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
4. Jain, S. K. : 1997. Indian Ethnobotany, Tata McGraw Hill Pub. Co. Ltd., New Delhi.
5. Pandey, B. P : 1978. Economic Botany, S. Chand and Co., New Delhi.
6. হাসান, এম. এ. : ১৯৯৬. বাংলাদেশের ভেষজ উদ্ভিদ, আশরাফিয়া বই ঘর, বাংলাবাজার, ঢাকা।
7. আহমেদ, সামসুদ্দিন : ১৯৯৬. বাংলাদেশের লোকজ বনৌষধি, হাসান বুক হাউজ, বাংলা বাজার, ঢাকা।

Plant Ecology & Environmental Science:

1. Bannister, P. : 1976. Introduction of Physiological Plant Ecology. Black well Scientific Publications.

2. Kershaw, K.A. : 1973. Quantitative and dynamic Plant Ecology, Edward Arnold Ltd.
3. Kumar, H.D. : 1995. General Ecology, Vikash Pub. House, India.
4. Kumar, H.D. : 1995. Modern concepts of Ecology, Vikash Pub. House, India.
5. Odum, E.P. : 1971. Fundamentals of Ecology, Toppan Co. Ltd. Japan.
6. Poole, R.W. : 1974. An Introduction of Quantitative Ecology, McGraw-Hill Book Co., New York.
7. Sharma, P.D. : 1995. Ecology and Environment, Rastogi Pub.
8. Shukla and P.S. Chandel : 1991. Plant Ecology and Soil Science, S.Chand & Co., India.

Cytology:

1. Dupraw E. J. : 1970. DNA and Chromosomes, Holt, Rinehart and Winston, New York.
2. Gupta, M.L. and M.L. Jangir : 1998. Cell Biology: Fundamentals and Applications, Agro Botnika, New Delhi.
3. Sharma, A. : 1976. The Chromosomes. Oxford & IBH Pub. Co., New Delhi.
4. Wilson, G. B. and J. H. Morrison: 1966. Cytology, Litton Educational Pub. Inc., New York.
5. জামান, এম. এ. : ১৯৭৫. কোষবিদ্যা, বাংলা একাডেমী, ঢাকা।
6. সুহিত গুহ : ১৯৭৮. সাইটোলজি, পশ্চিম বঙ্গ রাজ্য পুস্তক পর্ষদ।

Plant Physiology:

1. Goodwin, T.W. and E. I. Mereer: 1983. Introduction to Plant Biochemistry (2nd ed.). Pergamon Press.
2. Hess, D. : 1975. Plant Physiology. Springer International Student Edition.
3. Pandey, S.N. and B.L Sinha: 1990. Plant Physiology (2nd ed.) Vikash Pub House Pvt. Ltd.
4. Salisbury, F. B. and C. Ross : 1969. Plant Physiology. Wardsworth Pub. Co. Inc., Belmont, California.
5. কর্মকার : ২০০০. উদ্ভিদ শরীর বিজ্ঞান, হাসান বুক হাউজ, ঢাকা।

Phytochemistry:

1. Goodwin, T. W. and E. I. Mereer : 1983. Introduction to Plant Biochemistry (2nd ed.). Pergamon Press.
2. Jain, J.L and Chand : 1983. Fundamentals of Biochemistry (2nd ed.). S. and Co. Ltd. New Delhi.
3. Srivastava, H.S. : 1990. Elements of Biochemistry. Rastogi Publication Meerut.
4. Varner, J.E. and J. Bonner : 1965. Plant Biochemistry. Acad. Press, New York, London.

Genetics:

1. Benjamin Lewin : 2000. Gene 2000. Oxford University Press and Cell Press.
2. Gordner, E. J. : 1960. Principles of Genetics. John Wiley and Sons, Inc. New York, London.

3. Singleton, W.R. : 1967. Elementary Genetics. D. Von Nostrand Co., Inc., Canada.
4. Sinnot, E. W., L.C. Dunn and Th. Dobzlaansky: 1985. Principles of Genetics. (5th ed.). McGraw-Hill Book Co. Inc., New York, London.
5. Snustad, D.P. et al. : Principles of Genetics, John Willey & Son, Inc.
6. Strickberger, M.W. : 1996. Genetics. MacMillan Pub. Co. Inc., New York, London.
7. Whilehouse, H. L. K. : Towards an Understanding of the Mechanism of Heredity, Edward Arnold. England.
8. ইসলাম, এ. এস. : ১৯৮৪. বংশগতি বিদ্যার মূল কথা, বাংলা একাডেমী, ঢাকা।
9. আখতার জামান : বংশগতি বিদ্যা, বাংলা একাডেমী, ঢাকা।

Plant Breeding:

1. Allard, R.W. : 1999. Principles of Plant Breeding. (3rd ed.). John Wiley & Sons. Inc., New York.
2. Chaudhury, H.K : 1978. Elementary Principles of Plant Breeding. Oxford & IBH Pub. Co., New Delhi.
3. Dana, S. : 2001. Plant Breeding, Naya Udyog, Calcutta.
4. Simonds, N.W. : 1979. Principles of Plant Improvement, Longman Group Ltd. London
5. Singh, B.D. : 1995. Plant Breeding-Principles and Methods, (5th ed.). Kalyani Publishers, New Delhi.
6. Sinha, U. and S. Sinha: 1977. Cytogenetics, Plant Breeding and Evolution, Vikas Publ. House, Pvt. Ltd. New Delhi.
7. ভূইয়া, এম. এস. রশীদ: ১৯৯২. উদ্ভিদ প্রজনন, বাংলা একাডেমী, ঢাকা।

Practical

Marks: 100

1. Morphological and microscopic examination of Bacteria, Algae and Fungi included in the syllabus.
2. Morphological and microscopic examination of Bryophytes, Pteridophytes and Gymnosperms included in the syllabus.
3. Anatomy of root, stem (primary and secondary) with single staining technique.
4. T.S. of Anther and ovary.
5. Preparation of root tip squash using acetocarmine to observe and identify different stages of mitosis.
6. Morphological and anatomical adaptations of plants in different ecological conditions.
7. Preparation of lactophenol and cotton blue. Working out of the plant diseases included in the syllabus.
8. Working out of locally available angiosperms and members of the angiospermic families included in the syllabus. Technique of preparation of herbarium sheets.
9. Preparation of compost and seed bed. Raising seedling, vegetative propagation by cutting, budding and layering. Practices of pruning and training in garden plants. Transplantation of rice and vegetables.
10. Setting up of the physiological experiments on osmosis, photosynthesis and respiration in order to know the working principles and expected results.
11. Determination of emasculation and crossing technique.
12. Study of plant population by quadrat method.
13. i) Identification: fertilizers, seeds, vegetables and fruits.
ii) Museum specimens and permanent slides.
iii) Botanical names of available local plants.

- iv) Economic products included in the syllabus.
- v) Plants of morphological and ecological interest
- 14. Excursion shall be performed in order to study and collect plants from natural habitats, records of field trips should be maintained properly.
- 15. Practical note book should be maintained properly and regularly signed by course teacher.
- 16. Practical class records duly signed by course teacher and herbarium sheets as well as other collections have to be submitted on the day of practical examination.
- 17. Viva-voce will be held during the practical examination.

Paper Code	Paper	Paper Title	Marks	Credits
133004	Paper-VII	Practical	100	4

01.	Bacteria/Algae/Fungi/Plant Pathology	10
02.	Bryophytes/Pteridophytes/Gymnosperms	10
03.	Taxonomy	12
04.	Anatomy (Secondary growth of dicot stem and root)	12
05.	Cytology/Plant Breeding/Physiological experiments	10
06.	Ecological adaptations (two specimens)	04
07.	(i) Identification: (5 specimens)	10
	(ii) Botanical names of 2 angiosperms	02
08.	Collections	05
09.	Practical Note Book and Excursion report	10
10.	Viva-voce	15

NATIONAL UNIVERSITY



Syllabus

Subject: Chemistry

Three Year B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Chemistry
Session: 2013-2014

Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
112801	Paper-I	Physical Chemistry	100	4
112803	Paper-II	Organic Chemistry	100	4
Second Year				
122801	Paper-III	Inorganic Chemistry	100	4
122803	Paper-IV	Synthetic Organic Polymers	100	4
Third Year				
132801	Paper-V	Industrial Chemistry	100	4
132803	Paper-VI	Analytical Chemistry	100	4
132804	Paper- VII	Practical	100	4
		Total =	700	28

**Detailed Syllabus
First Year**

Paper Code	Paper	Paper Title	Marks	Credits
112801	Paper-I	Physical Chemistry	100	4

1. State of aggregation of matter: General discussion.
2. **Gaseous state:** The gas laws. kinetic theory of gases, deviation from ideal behaviour. Amagat's curves. Van der Waals equation. Andrew's isotherms. Iequification of gases. Joule-Thompson effect. critical phenomena. molecular weights from gas density, abnormal molecular weights, thermal dissolution.
3. **The Liquid state:** The vapour pressure of liquids, intermolecular forces, surface tension and viscosity of liquids, molecular structure and its relationship with surface tension, viscosity, optical rotation and dipole moment.
4. **Thermodynamics:** Work, energy and heat; first law of Thermodynamics, internal energy, enthalpy, laws of Thermochemistry. heat of reaction formation etc, heat capacities of substances. Kirchoffs equation.
Reversible and irreversible process, isothermal and adiabatic processes; second law of thermodynamics, Carnot cycle, entropy, free energy, Gibb's-Helmholtz equation, Clausius-Clayron equation.
5. **Solution properties:** Dalton's law of partial pressure, Henry's law and distribution law and their simple applications (association dissociation and solvent extraction).
6. **Colligative properties:** Raouit's laws of lowering of vapour pressure, elevation of boiling point and depression of freezing point, osmotic pressure, their experimental determination.

7. **Homogeneous equilibrium:** Law of mass action, its enunciation and mathematical formulation of equilibrium constant and its application to chemical reactions, principle of mobile equilibrium and its application to industrial reactions.
8. **Phase rule:** Simple one component systems, simple two component system with and without compound formation, partly miscible liquid pairs, principles of fractional distillation.
9. **Surface chemistry and colloids:** Different types of adsorption: Langmuir adsorption isotherm, classification of colloids, importance of colloids.
10. **Chemical kinetics:** First and second order reactions and their simple treatment, determination of order of reaction, simple theories of reaction rate (Only outline of Arrhenius). Catalysis (elementary treatment).

Books Recommended:

- | | |
|----------------------------|--|
| 1. Afinolley | : <i>An Introduction to Physical Chemistry</i> |
| 2. Daniels and Alberty | : <i>Physical Chemistry</i> |
| 3. A. R. Chowdhury | : <i>Chemistry Fundamentals</i> |
| 4. M. Haque & Y. A. Mollah | : <i>Principles of Physical Chemistry</i> |
| 5. নুরুল হক ও মহির উদ্দিন | : <i>ভৌত রসায়ন পরিচিতি</i> |
| 6. সিরাজুল ইসলাম | : <i>প্রাথমিক ভৌত রসায়ন</i> |
| 7. পাল ও চক্রবর্তী | : <i>ভৌত রসায়ন</i> |
| 8. পালিত | : <i>ভৌত রসায়ন</i> |

Paper Code	Paper	Paper Title	Marks	Credits
112803	Paper-II	Organic Chemistry	100	4

1. **Fundamentals:** Purification and analysis of organic compounds, hybridization, nomenclature and structure of organic compounds.
2. **Aliphatic compounds:**
 - 2.1 **General knowledge of the following terms:** Free radicals, inductive effects, tautomerism, resonance, carbonium ions and carbanion.
 - 2.2 **Isomerism:** A general knowledge of isomerism including optical isomerism of substances containing one and two asymmetric carbon atoms and geometrical isomerism of carbon compounds.
 - 2.3. **Aliphatic compounds:** A general study, nomenclature, general methods of preparations, physical properties, reactions with special reference to functional groups and characteristic reactions and important uses of alkanes, alkynes, alkenes, alkylhalides, hydroxy compounds, ethers, amines, aldehydes, ketones, carboxylic acids and their esters halides, anhydrides and amides.
3. **Aromatic compounds:** A general study of the hybridization and structure of benzene; resonance and delocalization. isomerism in benzene substitution, preparation & reactions of benzene, aromatic halides, phenols. aldehydes, ketones, carboxylic acids, nitro, amino and diazonium compounds. polynuclear aromatic hydrocarbons with special reference to the chemistry of naphthalene.
6. **Important reactions:** General principles and applications of some important reactions: Wurtz-Fittig. Williamson synthesis, Malonic and acetoacetic ester synthesis, Grignard

reaction. Sandmeyer reaction. Friedel-Crafts reaction. Aldol condensation, Cannizzaro reaction. Perkin reaction.

7. **Heterocyclic compounds:** Furan, pyrrole, thiophene and pyridine- their preparation and properties.
8. **Study of Carbohydrates:** With special reference to glucose, fructose, mutarotation, Kiliani reaction and Ruff's degradation.

Books Recommended:

- | | |
|------------------------------------|---|
| 1. I. L. Finar | : <i>Organic Chemistry (Vol.I)</i> |
| 2. J. Conant | : <i>The Text Book of Organic Chemistry</i> |
| 3. Ahmad & Miah | : <i>Organic Chemistry</i> |
| 4. English & Cassidy | : <i>Principles of Organic Chemistry</i> |
| 5. A. Khaleque | : <i>Organic Chemistry</i> |
| 6. মফিজুদ্দিন আহমেদ ও জব্বার মিয়া | : <i>জৈব রসায়ন</i> |
| 7. পাল ও চক্রবর্তী | : <i>জৈব রসায়ন</i> |
| 8. রবীন্দ্রনাথ ঘোষ | : <i>জৈব রসায়ন</i> |
| 9. নুরুল হক ও মহির উদ্দিন | : <i>জৈব রসায়ন পরিচিতি</i> |

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
122801	Paper-III	Inorganic Chemistry	100	4

1. Atomic structure: General study of the modern concept of the structure of atom. Rutherford atom model, Bohr's atom model; quantum numbers, Pauli's exclusion principle, electronic configurations of elements; elementary ideas about the wave nature of electrons; atomic orbitals.

2. Periodic classification: General survey of the classification of elements; periodic nature as related to the atomic structure. modern periodic table: its constitution; s-block, p-block, d-block & f-block elements, change of properties of elements in periods & groups.

3. Sizes of atoms and ions: Atomic and ionic radii-ionization potential, electron affinity, electronegativity and their influences on the properties of molecules.

4. Bonding: Elementary ideas about the electronic theory of bonding, different bonds; hybridization of orbital, bond length, bond strength and bond angles, shapes of molecules.

5. Transition metals: General chemistry of transition elements with reference to the elements of the first transition series (3d elements).

6. Acids and bases: Modern views about acids and bases, theories and their applications and limitations. strength of acids.

7. Group chemistry: Brief general study of the following groups of elements in the periodic table with reference to properties and uses of elements and their important compounds with special emphasis to comparative chemistry.

i) Inert gases ii) Alkali and coinage metals iii) Alkaline earth metals iv) Group-III v) Group-IV vi) Group-V vii) Group-VI viii) Group-VII. Elements.

8. Radio-activity: Discovery of radioactivity, concepts of half life, and disintegration constant of radioelements, uses of radioisotopes. Typical examples and elementary idea about artificial radio-activity and nuclear reactions.

9. Co-ordination compounds: Classification; Werner's theory and electronic interpretation of the structure and isomerism in 6-coordinated complexes (elementary treatment only).

10. Principles of analytical chemistry: Theoretical principles of qualitative and quantitative analysis.

Books Recommended:

- | | |
|---------------------------|---|
| 1. S. Z. Haider | : <i>Introduction to Modern Inorganic Chemistry</i> |
| 2. G. S. Gilreath | : <i>Fundamental Concept of Inorganic Chemistry</i> |
| 3. T. Moellar | : <i>Inorganic Chemistry</i> |
| 4. এ কে এস আহমদ | : <i>অজৈব রসায়ন</i> |
| 5. সায়েম এ লতিফ | : <i>অজৈব রসায়ন</i> |
| 6. নুরুল হক ও মহির উদ্দিন | : <i>জৈব রসায়ন পরিচিতি</i> |
| 7. রবীন্দ্রনাথ ঘোষ | : <i>অজৈব রসায়ন</i> |

Paper Code	Paper	Paper Title	Marks	Credits
122803	Paper-IV	Synthetic Organic Polymers	100	4

1. Classification of Polymers & Polymerization Process: Addition (chain reaction) and condensation (step reaction) polymerizations

2. Fundamental concept of the Following Polymer: Homopolymers and heteropolymers. low density and high density polymers and their properties. Copolymers, alternating, random, block and graft copolymers. elastomer, thermoplastic and thermosetting polymers and their properties. fiber and elastomer.

3. Mechanism of polymerization: Radical, cationic and anionic polymerization, and their kinetics, chain termination, chain transfer, chain retardation and chain inhibition.

4. Co-ordination polymerization: Fluid-bed process, Ziegler-Natta catalysis, mechanism of co-ordination polymerization and its kinetics, metal oxide catalyzed and olefin polymerizations. ring opening polymerization.

5. Configuration of polymers: Syndiotactic, isotactic, atactic polymers.

6. Some important polymers: Production of monomer unit, physical properties and important uses of polythene, polyvinylchloride (PVC), polystyrene, polybutylene, polybutadiene-styrene, neoprene, polymethylmethacrylate, polyacrylonitrile, polyvinylacetate, polyamides: Nylon 6, Nylon 66, Nylon 11 and Nylon 12, silk and wool.

8. Thermosetting resins: Phenol-formaldehyde, phenol-urea, melamine-formaldehyde polymers, their preparation and uses. Epoxy resins and polyurethanes.

Books Recommended:

- | | |
|--|--------------------------------|
| 1. R.T. Morrison and RN Boyd Fifth edition | : Organic Chemistry |
| 2. F.W. Billmeyer, JR | : Text book of polymer science |

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
132801	Paper-V	Industrial Chemistry	100	4

- Fundamentals to the development of a chemical industry:** Future prospect of different types of chemical industries in Bangladesh. general ideas regarding unit processes and unit operations.
- Natural gas and urea fertilizer industries:** Composition of natural gas and its survey in Bangladesh, Purification of natural gas, manufacture of ammonia and urea from natural gas.
- Phosphoric and sulfuric acids:** Manufacture of phosphoric and sulfuric acids, triple super phosphate, calcium phosphate.
- Cement industry:** Raw materials, composition, methods of manufacture of portland cement, types of cement, setting and hardening of cement.
- Glass industry:** Basic raw materials and manufacturing processes of glass, their composition and users.
- Oils, fats, waxes, soap, and detergent:** Manufacturing of soap and detergent. concept of soap and detergents and their action.
- Pulp and paper industry:** Concept of cellulose structure. natural sources of cellulose and their composition. different processes for the manufacturing of paper from pulp.
- Synthetic fibres:** Rayon, nylon and cellulose acetate.

Books recommended:

- R. N. Shreve and J. A. Brink, Jr., McGraw-Hill Inc. : Chemical Process Industries
- B. K. Sharma, Geol Publishing House. : Industrial Chemistry
- J. A. Kent edited, Van Nostrand. : Reagent's Hand Book of Industrial Chemistry
- G. T. Austin edited, McGraw-Hill. : Chemical Process Industries
- W. D. Callister, Jr., John Wiley & Sons, Inc. : Materials Science and Engineering – An Introduction
- J. H. Block and E. B. Roche, Lea and Febiger Pub. : Inorganic Medicinal and Pharmaceutical Chemistry
- H. J. M. Bowen, The Royal Society of Chemistry. : Environmental Chemistry Vol. I - III

Paper Code	Paper	Paper Title	Marks	Credits
132803	Paper-VI	Analytical Chemistry	100	4

- Basic concepts in analytical chemistry and statistical treatment of data:** Analytical detection and quantification, sensitivity, selectivity, specificity, concentration limit, dilution limit etc. of chemical reactions, sample containers, sample preservation, sampling, sample dissolution, wet ashing and dry ashing, reagents and reactions, population and sample mean, standard deviation, relative standard deviation, coefficient of variation, variance, confidence limit, Gaussian distribution, statistical tests – the F test, the T test, the Q test, regression lines, least square method, coefficient of correlation.
- Volumetric analysis:** Principle, apparatus, end point, indicator, general factors influencing volumetric method, advantages, acid-base titrations, redox titrations, complexometric titrations – complexing agents, influence of $[H^+]$ on complexation.

3. **Gravimetric analysis:** Introduction, general requirements of a gravimetric method, precipitation from homogeneous solution.
4. **Spectrophotometric analysis:** Ultraviolet and visible radiation, absorbance, transmittance, absorptivity, the Beer-Lambert's law, limitations of Beer-Lambert's law, basic components of a spectrophotometer, qualitative and quantitative analysis.
5. **Thermal analysis:** Thermogravimetry (TG), types of TG, instrumentation, application of TG, differential thermal analysis (DTA): working principle, instrumentation, factors affecting DTA, applications, differential scanning calorimetry (DSC): working principle, instrumentation and applications.
6. **Atomic spectrometric methods:** Atomic absorption and atomic emission, absorption line width, choice of absorption line, flame emission spectrometry: instrumentation, flame emission analysis, atomic absorption spectrophotometry: principles, instrumentation and interferences, hydride vapour generation technique, cold vapour technique, advantages and disadvantages of AAS.
7. **Voltammetric analysis:** Diffusion current, half wave potential, oxygen interference, cyclic voltammetry(Cv), quantitative applications.

Books Recommended:

1. D. A. Skoog, D. M. West, F. J. Holler : Fundamentals of Analytical Chemistry
and S. R. Crouch, Saunders College
Publishing.
2. G. D. Christian, John Wiley & Sons. : Analytical Chemistry
3. D. Harvey, McGraw-Hill Higher Education : Modern Analytical Chemistry
4. A. I. Vogel, Longman, Green and Co. Ltd : A Text Book of Quantitative

Paper Code	Paper	Paper Title	Marks	Credits
132804	Paper- VII	Practical	100	4

For B.Sc (Pass) Course (Two days of 6 hours duration each day)

Marks distribution:

- | | |
|--|------------------|
| 1. Inorganic qualitative analysis | 30 Marks |
| 2. Organic qualitative analysis | 25 Marks |
| 3. Inorganic quantitative/Physical chemistry | 20 Marks |
| 4. Lab note book | 10 Marks |
| 5. Viva-voce | 15 Marks |
| Total = | 100 Marks |

Experiments:

- A. **Inorganic Qualitative Analysis:** Qualitative analysis of mixture of inorganic compounds containing three radicals, two basic and one acid (including interfering radicals by classical or semi-micro methods).
- B. **Inorganic qualitative Analysis:**
 - i) Acidimetry and Alkalimetry: Preparation of N/10 HCl, H₂SO₄ and CH₃, COOH solutions and their standardisation.

- ii) Determination of Na_2CO_3 content in washing soda.
- iii) Determination of mixture of carbonate and caustic soda
- iv) Oxidation-reduction titration's involving.
 - a) Preparation and standardization of N/10 KMnO_4 sodium oxalate solution.
 - b) Determination of ferrous iron using standard KMnO_4 solution.
 - c) Determination of Ca in CaCO_3 by standard KMnO_4 solution.
 - d) Preparation of standard N/10 $\text{K}_2\text{Cr}_2\text{O}_7$ solution and determination of ferrous iron by using internal indicators.
 - e) Determination of Cu iodometrically.

Physical Chemistry:

1. Determination of molecular weight by
 - a) Vapour density method
 - b) Depression of freezing point or elevation of boiling point.
 2. Thermochemical measurements; heat of neutralization and heat of solution calorimetrically.
 3. Rate of inversion of sucrose to be followed by a polarimeter.
 4. Experiment involving distribution law: Determination of partition co-efficient, molecular association and equilibrium constant.
 5. Measurements of electrolytic conductance and two typical conductometric titrations of strong acid-strong base and weak acid-strong base.
 6. Determination of solubility of a solid at various temperatures and calculation of its heat of solution.
- C. Organic qualitative analysis: analysis of organic compounds, such as amine (primary, secondary and tertiary), aldehydes, ketones, carboxylic acids, phenols and nitrocompounds (containing only one functional group).

The analysis should include the following:

- i) Elemental analysis (N.S. and halogen).
- ii) Solubility tests with the following solvents.
 - a) Water
 - b) 5% Solution of sodium bicarbonate, sodium hydroxide and hydrochloric acid
 - c) Concentrated sulphuric acid
- iii) Functional group analysis

Book Recommended:

1. A. I. Vogel : *A. Text Book of Quantitative Inorganic Analysis*
2. A. I. Vogel : *A. Text Book of Qualitative Inorganic Analysis*
3. Jabbar & Haque : *Practical Chemistry*
4. Shriner & Fuson : *Systematic Identification of Organic compounds*
5. নরুল হক ও মহির উদ্দিন : ব্যবহারিক রসায়ন
6. হাজারী, গুপ্ত ও দে. : স্নাতক জৈব রসায়ন

NATIONAL UNIVERSITY



Syllabus

Subject: Geography and Environment

Three Year B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Geography and Environment
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113201	Paper-I	Physical Geography & Environment	100	4
113203	Paper-II	Economic Geography	100	4
Second Year				
123201	Paper-III	Population and Cultural Geography	100	4
123203	Paper-IV	Geography of Bangladesh	100	4
Third Year				
133201	Paper-V	Regional Geography of South Asia (Excluding Bangladesh)	100	4
133203	Paper-VI	Geography of Human Settlements	100	4
133204	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus
First Year

Paper Code	Paper	Paper Title	Marks	Credits
113201	Paper-I	Physical Geography & Environment	100	4

- a) Physical Environment (1 Question out of 2 to be answered)
- b) Geomorphology (2 Questions out of 4 to be answered)
- c) Climatology (1 Question out of 2 to be answered)
- d) Oceanography (1 Question out of 2 to be answered)

a) Physical Environment:

1. Elements and Components of Physical Environment
2. Global Cycles and Systems of the Earth's Environment
3. The Sources of Energy for the Earth's Environment
4. Major Energy Systems of Earth and Interrelation in Environmental systems
5. The Hydrologic Cycle, Water Budget, Water Resources
6. Scope and contents of Physical Geography and Environment

b) Geomorphology:

1. Size and Shape of the Earth
2. Materials of the Earth's Crust, Rocks and Minerals
3. Sculpturing of the Land Surface: Weathering, Erosion, Transportation and Deposition
4. Tectonic Processes in the Earth's Crust
5. Earthquakes and features produced in the Earth's Surface
6. Volcanoes: Types and Features in the Earth surface
7. Works of Rivers, Wind and Glacier.

c) Climatology:

1. Composition of the atmosphere
2. Elements and Factors of Weather and Climate
3. Insolation and Temperature, Horizontal and Vertical Distribution of Temperature
4. Atmospheric Pressure and Wind System
5. Humidity, Condensation and Precipitation: Formation of Clouds, Fogs, Dews, Frosts, Snows and Hails, Types and Distribution of Rainfall
6. Tropical and Temperate Cyclones
7. Study of the Climatic Types: Equatorial, Monsoon and Mediterranean

d) Oceanography:

1. Distribution of Land and Water
2. Relief of the Ocean Floors
3. Ocean Deposits
4. Salinity of the Oceans and Seas
5. Tides and Currents of the Oceans

Books Recommended:

1. Strahler A. H. and Strahler A. N. 1992: Modern Physical Geography, 4th edition, Wiley: Singapore.
2. Blij H. J. de and Muller P. O. 1996: Physical Geography of the Global Environment, Wiley: New York.
3. Singh Savindra, 2007: Climatology, Prayag pustak Bhawan: Allahabad, India.
4. Singh Savindra, 2003: Physical Geography, Prayag pustak Bhawan: Allahabad, India.
5. আহমেদ, রফিক, ২০০০: আবহাওয়া ও জলবায়ু বিজ্ঞান, ঢাকা।
6. দাস, সুভাস চন্দ্র, ২০০২: আধুনিক সমুদ্র বিজ্ঞান, ঢাকা ।

Paper Code	Paper	Paper Title	Marks	Credits
113203	Paper-II	Economic Geography	100	4

1. Introduction to Economic Geography

- a) Definition, Concept, Scope and Objective of Economic Geography
- b) Relation between Geography and Economics
- c) Classification of Economic Activities

2. Economic Geography of Production

2.1 Primary Activities

- a) Gathering, Hunting, Lumbering, Fishing, Mining and Nomadic Herding /Livestock Ranching
- b) Agriculture: General characteristics of various agricultural systems and case studies of selected commodities such as Rice, Wheat, Cotton, Jute, Sugarcane, Rubber and Tea

2.2 Secondary Activities

- a) Development and Distribution of Power and Energy Resources of the World
- b) Manufacturing; Characteristics; Physical and Socio-economic Factors for growth of Industries
- c) Major Industrial and Manufacturing regions of the world
- d) Case Studies of some Industrial Complexes: Iron and Steel Industry, Apparel Industry, Textile Industry, Dairying and Mixed Farming Industries

2.3 Tertiary Activities

- a) Transportation and Trade: Regional and International Pattern
- b) Trade and its effect on the economy of the region

2.4 Quaternary Activities: Professional, Administrative Services and Entertainment

3. National Income and Product: GDP, GNP composition and change, financial institution and their role in sectoral and overall development with respect to Bangladesh.

Books Recommended:

- 1. Coe, N., Kelly, P. and Yeung, HWC, 2012. Economic Geography: A Contemporary Introduction, 2nd edition, Wiley-Blackwell: Singapore.
- 2. Wood, A. and Roberts, SM, 2011. Economic Geography- Places, Networks, and Flow. Routledge: New York.
- 3. Alexander, JW, 1988: Economic Geography, Prentice-Hall, New Delhi.
- 4. চৌধুরী, সিই, ১৯৯৫: আর্থনীতিক ভূগোল: বিশ্ব ও বাংলাদেশ, ঢাকা বিশ্ববিদ্যালয়, ঢাকা।

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123201	Paper-III	Population and Cultural Geography	100	4

- 1. **Introduction to Population Geography:** Definition and concept, development of Population Geography, Population and Demography

2. Sources of population data:

- i) Population census
- ii) Sample survey
- iii) Registration

3. Population Distribution:

- i) Population Density
- ii) Factors Affecting Population Distribution/Determinants

4. Population Composition

- i) Biological: Size, Age, Sex
- ii) Social: Marital Status, Language, Religion, Education

5. Population Dynamics

- i) Fertility
- ii) Mortality
- iii) Migration and its Determinants
- iv)

6. Introduction to Cultural Geography: Definition, Scope and Methods

6. Evolution of Human Races and Mankind

8. Processes of Culture Change: Invention/Innovation; Diffusion and Integration
Assimilation and Acculturation

Books Recommended:

1. Jones, H.R. 1990. Population Geography, Guilford Press.
2. Clarke, J.I. 1978: Population Geography, London: Oxford Series
3. Zilensky, W. I. 1984: A Prologue to Population Geography. U.K.
4. Demko, C.J., H.M. Rose, and A.A. Schnell 1986: Population Geography: A Reader, NY.
5. Bogue, D.J. 1978: Principles of Demography. NY.
6. Spencer, J.E. & Thomas (Jr.), W. L., 1969. *Introduction to Cultural Geography N.Y.*
6. তাহা, আ. ২০০০. জনসংখ্যা ও জনপদ ভূগোল, রাজশাহী বিশ্ববিদ্যালয়, রাজশাহী।
৭. বাকী, আ হ ম, ২০০৬। সাংস্কৃতিক ভূগোল, বঙ্গ প্রকাশনীঃ ঢাকা।

Paper Code	Paper	Paper Title	Marks	Credits
123203	Paper-IV	Geography of Bangladesh	100	4

1. Location and Boundary; Administrative divisions and geographic regions

2. The Natural Environment

- 2.1 Geological Structure & Physiography
- 2.2 Climate and Soil
- 2.3 River Systems

3. Natural Resource Base

- 3.1 Natural Vegetation and Forest
- 3.2 Minerals and Energy Resources

4. Economic Base

- 4.1 Agriculture, Fisheries and Livestock
- 4.2 Industry: Nature, Growth, Location and Distribution
- 4.3 Trade and Commerce
- 4.4 Transport and Communication

5. Population

- 5.1 Size, Growth, Age and Sex Structure
- 5.2 Density and distribution
- 5.3 Population characteristics, Problems

6. Hazards and disasters: Floods, cyclones, droughts, and river bank erosion.

Books Recommended:

1. Rashid, H. 1995 : *Geography of Bangladesh, UPL, Dhaka.*
2. Rahman, A. Atiq. et al. : *Environment and Development in Bangladesh Vol: 1-2, UPL, Dhaka.*
3. Islam, M.A. 1995 : *Environment; Land use and Natural Hazards in Bangladesh, University of Dhaka, Dhaka.*
4. Islam, N and Choudhury S. I. 1992 (edited) : *Bangladesh Bhougolic Shomikhaya, Department of Geography, University of Dhaka (in Bangla), Dhaka.*
5. Nizamuddin, K. (ed.), (2000), *Disaster in Bangladesh: Selected Readings, Disaster Research Training and Management Centre, University of Dhaka.*
৬. হাসান , এম. ও অন্যান্য : *বাংলাদেশ প্রাকৃতিক ভূগোল ও পরিবেশ, বাংলা একাডেমী, ঢাকা।*
৭. ঈমাম, বি. : *বাংলাদেশের খনিজ সম্পদ, বাংলা একাডেমী, ঢাকা।*
৮. চৌধুরী, সিরাজুল ইসলাম, ১৯৯৫ : *আর্থনীতিক ভূগোল: বিশ্ব ও বাংলাদেশ, ঢাকা বিশ্ববিদ্যালয়, ঢাকা।*

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133201	Paper-V	Regional Geography of South Asia (Excluding Bangladesh)	100	4

1. Introduction to South Asia

- 1.1 Geographical Location
- 1.2 Member Countries: National Boundaries, Socio-economic Database

2. Physical Environment of South Asia

- 2.1 Physiography
- 2.2 Climate
- 2.3 Drainage Systems
- 2.4 Vegetation
- 2.5 Mineral and Energy Resources

3. Cultural Environment of South Asia

- 3.1 Population: Growth, Distribution and Characteristics
- 3.2 Economic:
 - a) Major Crops (Rice, Wheat, Cotton, Sugarcane and Tea) Productions and Distributions
 - b) Major Industry (Iron and steel, Textile power and Energy) Production and Distributions
 - c) Transportation: Roads, Railways, Waterways and Airways.
 - d) Trade and Commerce: Internal and External Trade

4. Introduction to SAARC

- 4.1 Formation of SAARC
- 4.2 Aims and Objectives
- 4.3 Major Problems in regional Co-operations

Books Recommended:

1. Abbasi, Bushra Afza, 1991 : *Geography of South Asia, Sang-e-Meel Publication, Lahore*
2. Davis, K. 1951 : *The Population of India & Pakistan, University Press, London*
3. Spate O.H.K & A.T.A. : *India, Pakistan and Ceylon, The Regions, Methuen & Learmonth. 1967 Co., London*
৪. রউফ , কাআ ও বিল্লাহ, মো ২০০৬ : *দক্ষিণ এশিয়া, সুজনেষু প্রকাশনী, ঢাকা ।*

Paper Code	Paper	Paper Title	Marks	Credits
133203	Paper-VI	Geography of Human Settlements	100	4

1. Definition, Scope, types and approaches of the study of human Settlement

2. Rural Settlement:

- a) Rural Settlements: Types, Forms and Characteristics
- b) Rural Periodic Markets: Origin, Growth, Characteristics and their role in Development

3. Urban Settlements:

- a) Definition, Scope, classification (types) of Urban Settlement,

4. Origin and History of Urban Centers:

- a) Factors of Urban Growth

b) Urbanization process

5. Internal Structure of the City and Urban Land Use

- a. Concentric Zones
- b. Multiple Nuclei
- c. Sector Theory

6. Urban Environment

- a) Urban utility services
- c) Environmental Degradation

7. Urbanization in Bangladesh:

- a. Development, Problem and Prospects
- b. Rural- Urban Migration

Books Recommended:

- | | |
|--|---|
| 1. Carter, Harold, 2000 | The Study of Urban Geography, London: Edward Arnold. |
| 2. Singh, R.L. (et.al.),1998 | Geographic Dimensions of Rural Settlements |
| 3. Daniel, P.1990 | The Geography of Settlement |
| ৪. বাকী, আবদুল, ২০০২ | পৌর বসতিঃ কাঠামো, জনগোষ্ঠী ও পরিকল্পনা গ্রন্থ, সুবঙ্গ প্রকাশ, ঢাকা |
| ৫. ইলাহী, ম. ও রুমী,সৈ.র.আ. ২০০৫ | নগর ভূগোল-সাম্প্রতিক ধারা, ঢাকা: সুজনেষু প্রকাশনী |
| ৬. ইসলাম, এন. ও বাকী, আবদুল, ১৯৯৬ (সম্পাদিত) | নগরায়ন বাংলাদেশ, আরবান স্টাডিজ প্রোগ্রাম, নগর গবেষণা কেন্দ্র, ঢাকা । |

Paper Code	Paper	Paper Title	Marks	Credits
133204	Paper-VII	Practical	100	4

Section A: Maps and Element of Maps Marks- 25

Marks distribution:

Written Examination = 15,

Laboratory Book=5,

Viva-Voce=5

- 1. Scales: Simple, Diagonal and Comparative
- 2. Drawing of Contours and Profiles
- 3. Cartographic Representation of Geographical Data: Dot, Shade and Isopleth methods
- 4. Introduction to use of Geographic Information Systems (GIS), Remote Sensing (RS), Geographic positioning system (GPS)

Section B: Elementary Surveying: Marks- 25

Marks distribution:

Written Examination (Fieldwork & Drafting Map) = 15,

Laboratory Book=5,

Viva-Voice=5

1. Principles of Surveying
2. Definition of Surveying: Types of Surveying: Geodetic, Plane
3. Methods of Surveying: Chain and Tape Surveying: Equipments, Recording of field data, open and closed Traverse surveying, Drawing procedure, Advantage and disadvantages.
Plane Table Surveying: Equipments Drawing procedure, Advantage and disadvantages.

Section C. Map Projection Marks- 25

Marks distribution:

Written Examination= 15

Laboratory Book=5,

Viva-Voice=5

1. Definition and Classification of Projections.
2. Construction of the following Projections.
 - 2.1 Cylindrical Projection: Simple Cylindrical and Cylindrical Equal Area projection
 - 2.2 Simple Conical Projection with One Standard Parallel
 - 2.3 Zenithal Equal Area projections (polar case)
3. Identification, Use, Merits & Demerits of Projections.

Section D. Quantitative Techniques in Geography: Marks- 25

Marks distribution:

Written Examination=15,

Laboratory Book=5,

Viva-Voice=5

1. Use of statistics in Geography
2. Sources of Geographic Data
3. Collection and Processing of Geographic data
4. Scales of Measurement
5. Frequency Distribution and Graphical Representation
6. Measures of Central Tendency: Mean, Median and Mode
7. Measures of Dispersion and measures of Association/ Relation

Books Recommended:

- | | | |
|----------------------|---|---|
| 1. Singh R.L, 1994 | : | <i>Elements of Practical Geography, India.</i> |
| 2 Singh, Gopal, 2005 | : | <i>Practical Geography, India</i> |
| 3. Aziz & Shahjahan | : | <i>Surveying, Dhaka.</i> |
| ৪. রউফ, কা. আ. ২০০৬ | : | ফলিত ও ব্যবহারিক ভূগোল, সুজনেষু প্রকাশনী, ঢাকা। |
| ৫. ইলাহী, ম. ২০০৪ | : | পরিসংখ্যান ভূগোল, বাংলা একাডেমী, ঢাকা। |

NATIONAL UNIVERSITY



Syllabus

Subject: Home Economics

Three Years B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Subject: Home Economics
Syllabus for Three Year B.Sc. Pass Course
Session: 2013-2014

Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113501	Paper-I	Home Management and Housing	100	4
113503	Paper-II	Child Development and Family Relations	100	4
Second Year				
123501	Paper-III	Food and Nutrition and Institutional Food Management	100	4
123503	Paper-IV	Clothing, Textile and Applied Art	100	4
Third Year				
133501	Paper-V	Textile Weaving and Design of Art	100	4
133503	Paper-VI	Food Science and Technology	100	4
133504	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus
First Year

Paper Code	Paper	Paper Title	Marks	Credits
113501	Paper-I	Home Management and Housing	100	4

1. Definition of home management, Philosophy and objectives.

- a) Role-Philosophy of management, definition
- b) Subjects of home management
- c) Relation of home management to other areas of home economics.
- d) Role of successful home maker
- e) Methods of home management
- f) Definition, importance and methods of making decision.

2. Motivation creating factors in home management

- a) Definition and classification of values.
- b) Importance and development of values.
- c) Importance and types of goals.
- d) Definition & types of standard-measurement of living and standard of living

3. Resources:

- a) Definition of resources and classification.
- b) Characteristics of resources.

- c) Indicators/influencing factors of using resources.
- d) Principles in the use of time and energy.

4. Money management:

- a) Family income-types of income.
- b) Means of increasing income.
- c) Family budget-characteristics of budget, advantages & disadvantages.
- d) Rules of making a family budget and factors influencing it.
- e) Savings-importance, means of increasing small savings.

5. Energy management:

- a) Conservation of energy-definition of fatigue and causes.
- b) Means of reducing fatigue.
- c) Methods of work simplification, methodical analysis of work- design plan methods, relaxing method etc.

6. Housing:

- a) Definition-need and principles of site and area selection for house.
- b) Factors to consider in planning a house-house plan in relation to money and family requirements, principles of light & colour, selection of equipments & their uses.

7. Materials for constructing houses:

- a) Concept of the availability of easily obtainable building materials in Bangladesh & their characteristics.
- b) Suitability of building materials in weather and location.

8. Furniture and materials for home decoration:

- a) Need, standard, suitability and beauty in selecting furniture.
- b) Concept of furniture and their arrangement, other materials for home decoration.

9. Reserving healthy environment in house:

- a) Definition of environment; causes and prevention of environmental pollution.
- b) Causes & harmful effect of pollution in homes.
- c) Means & roles of family member in preserving healthy environment.

Books Recommended:

- | | |
|--------------------------------|------------------------------------|
| 1. Nickeel, Rice and Toker | : Management in Family Living |
| 2. Gidbreeth Thomas and Clymer | : Management in the Home |
| 3. Goodyear and Klobor | : Managing for Effective Living |
| 4. অধ্যাপক মমতাজ খান | : পারিবারিক জীবন ও গৃহ ব্যবস্থাপনা |
| 5. অধ্যাপক মমতাজ খান | : পারিবারিক সম্পদের ব্যবস্থাপনা |
| 6. ড. ফিরোজ সুলতানা | : গৃহ ব্যবস্থাপনা ও বাসস্থান |

Paper Code	Paper	Paper Title	Marks	Credits
113503	Paper-II	Child Development and Family Relations	100	4

1. Child's growth and development

- a) Definition of growth and development; stages of growth and development.
- b) Characteristics of different stages of development; infancy, childhood, preadolescence and adolescence.

- c) Developmental tasks of different stages.
- d) Stage of prenatal development.
- e) Importance and effect of maturation and learning in child's development.

2. Importance & effect of family relations in child's development.

- a) Child and Parents relationship and factors influencing it.
- b) Principles of child guidance; effect of discipline and care & Love of parents on child's behaviour.
- c) Juvenile delinquency-causes and preventive measures. Role of family & society in eliminating juvenile delinquency.

3. Family life cycle:

- a) Stage of family life cycle-developmental task & effects of each stage of development.
- b) Responsibility of family in the development of intelligence & pursuing a future career & profession of children.

4. Family crisis:

- a) Family crisis-definition & types. Effect of family crisis on child's development. Reactions of crisis-unemployment, long term illness, desertion, madness, physical abuse, divorce, death.
- b) Meaning of preserving family stability & resolving conflict.

5. Drug addiction and mental retardation:

- a) Causes of drug addiction-prevention and remedial measures.
- b) Causes & types of mental retardation.
- c) Role of family & society in rehabilitating the mentally retarded.

6. Child welfare in Bangladesh:

- a) Child homes-day care center, rehabilitation centre, children's village etc.
- b) Government and nongovernment efforts in child welfare in Bangladesh.

7. Importance & methods of child observation:

- a) Importance of child observation.
- b) Description of the methods of child observation-running, selective, anecdotal record, quick method & case study.

Book Recommended:

- | | |
|-------------------------------------|---|
| 1. Mussen P.H. Conger J J and Kagan | : Child Development and Personality |
| 2. Smart S. and Smart R.C. | : Children Relationship and Development |
| 3. Crow and Crow | : Child Development and Adjustment |
| 4. Strong R | : Introduction to child Study |
| 5. Breckendige and Smith | : Child Study |
| 6. দরিয়ানুর বেগম | : শিশুর আচরণ ও ক্রমবিকাশ, বাংলা একাডেমি |
| 7. দরিয়ানুর বেগম | : শিশু পালন |
| 8. মোঃ আলী আযম | : শিশু মন |
| 9. সুলতানা বানু | : বিকাশ মনোবিজ্ঞান ১ম ও ২য় খণ্ড |
| 10. সুলতানা সারওয়ার্জা জামান | : মানব বিকাশে মনোবিজ্ঞান |
| 11. শাহীন আহমেদ | : শিশু বর্ধন বিকাশ ও পরিচালনা |
| 12. উত্তম কুমার দাস | : মানবীয় বিকাশ আচরণ ও সামাজিক পরিবেশ |
| 13. মোঃ আতিকুর রহমান ও সালমা জোহরা | : মানবীয় বিকাশ আচরণ ও সামাজিক পরিবেশ |

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123501	Paper-III	Food and Nutrition and Institutional Food Management	100	4

1. Food and Nutrition:

Relation of food and nutrition to health; Functions of food in maintaining health; classification of nutrients- their characteristics, functions, food sources and requirements- carbohydrates, lipids, protein, vitamins, mineral elements and water.

2. Determining energy requirements of the body:

Measurement of energy, methods for determining energy requirement, factors influencing energy requirement. Determining energy value of foods.

3. Assessment of nutritional status and nutritional requirements at different ages:

Different methods for determining nutritional states of the body; height and weight, mid-arm circumference, biochemical tests and evaluation of clinical tests, concept of nutritional requirements of different ages-infants, children, adults, pregnancy, lactation and old age-relation of requirements to physiological changes.

4. Basic Food group and planning of balanced diet:

Concept and importance of balanced diets; Principles of planning balanced diets-Factors to consider sample of meal plan for different ages. Meal planning for institutions-planning menu and serving-hostels, hospitals, school tiffin etc.

5. Buying, Storage and preservation of foods:

General rules for buying foods, process of storage of perishable and non-perishable foods. Causes of food spoilage-concept of different methods of food preservation.

6. Diet planning for different diseases and Physiological conditions:

Importance and types of diet, principles of diet planning. Principles of diet planning in different diseases-diabetes, high blood pressure, heart diseases, jaundice, kidney diseases, diarrhoea, typhoid etc. Pregnancy and lactation.

Book Recommended:

- | | |
|---|---|
| 1. Bogarl Briggess and Callouay | : Nutrition and Physical Fitness |
| 2. Davidson and Passmore | : Human Nutrition and Dietetics |
| 3. Cooper, Barbers, Mitchell Rynbergen and greene | : Nutrition in Health and Disease |
| 4. ড. মুহাম্মদ আবদুর রহমান | : শিশুর আচরণ ও ক্রমবিকাশ, বাংলা একাডেমি |
| 5. দেবজ্যোতি দাস | : পারিবারিক বিপাক ও পুষ্টি |
| 6. সৈয়দা হালিমা রহমান | : খাদ্য ও পুষ্টি |
| 7. সৈয়দা হালিমা রহমান | : খাদ্য ও পুষ্টি |
| 8. শাহীন আহমেদ | : খাদ্য ও পুষ্টি বিজ্ঞান |
| 9. সিদ্দিকা কবীর | : খাদ্য ও পুষ্টি |
| 10. সিদ্দিকা কবীর | : খাদ্য ও পুষ্টি ব্যবস্থা |
| 11. সৈয়দা হালিমা রহমান | : বিপাক ও পুষ্টি বিজ্ঞান |

Paper Code	Paper	Paper Title	Marks	Credits
123503	Paper-IV	Clothing, Textile and Applied Art	100	4

Clothing and Textile:

1. Introduction:

- a) Definition of cloth.
- b) Definition of dress.
- c) Classification of fibre.
- d) Study of textile fibre-Making cotton, Linen, Wool, Silk, Asbestos, Nylon, Rayon, Polyester.
- e) Identification of fibre: Physical, Chemical & Microscopic Test.

2. Selection of Clothing for the family:

- a) Economic factors.
- b) Physiological factors.
- c) Psychological factors.
- d) Social factors.

3. Decision making in selecting Clothing:

- a) process of decision making.
- b) Influencing factors in decision making.
- c) Steps of decision making.

4. Social significance of fashion on clothing:

- a) Fashion concept
- b) Change in fashion.
- c) Factors influencing fashion.
- d) Fashion cycle.
- e) Effect of fashion and advertisement in the development of garments industry.

5. Development of Garments and textile Industry of Bangladesh.

- a) Historical Background of textile industry of Bangladesh from ancient time till now.
- b) Hand loom industry in Bangladesh Economy.

6. Cultural and regional textile background of Bangladesh

- a) Monipuri Textile.
- b) Zamdhani Saree.
- c) Saree of Tangail.
- d) Silk and Benarashi Saree
- e) Rajshahi Bank.
- f) Comilla Khaddar.

7. Consumer Technique (Shopping practices & Consumer ethics)

- a) Study of market & price.
- b) Effective shopping practice.
- c) Problems of buyer.
- d) Ways of problem solution for the buyer.
- e) Study of labels and their uses.

Applied Art:

8. Introduction:

- a) Definition, Classification and Sources of Art.
- b) Importance of Art in Human life.

9. Study of art elements and principles.

10. Use of art elements and principles in architecture and home decoration.

11. Applied art as a significant factor in economic development and fruitful leisuretime activity.

a) Self employment.

b) Female employment.

12. Indigenous materials used in applied art-Jute, Clay fabric, Bamboo and Cane, Shell and Cone, Wood etc.

13. Overview of traditional craft of Bangladesh.

a) Nakshi Kantha

b) Shikha

c) Pottery Painting and clay toys.

d) Wooden toys and wood craft.

14. Making decorations on fabrics and dresses.

a) Methods of decoration-Embroidery, Dyeing, Printing, Painting etc.

b) Dyeing- Definition, Elements, Methods, Use of etc.

c) Printing- Definition, Elements, Methods, Use of etc.

d) Printing- Definition, Elements, Methods, Use of etc.

e) Painting- Definition, Elements, Methods, Use of etc.

15. Problems and its solution of the art of Bangladesh.

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133501	Paper-V	Textile Weaving and Design of Art	100	4

1. Weaving:

- a) History of Weaving
- b) Steps of Weaving

2. Basic weaves and their characteristics:

- i) Simple ii) Twill iii) Satin and Sateen

3. Decorative weaves:
Basket, Rib, Herring bone, Broken twill, Dobby weaves, Jaquard weaves, leno weaves, Stop weaves, Lappet weaves, Swivel weaves and pile weaves.
4. a) Definitions of design, Classification of design, Sources decorative
b) Source of design, functions of design, Evaluation of design.
5. Role of design in enriching the life of individual
6. Factors of responsible for the change of design
7. Time, money and energy saving characteristics of design
8. Use of design in everyday life – Health and food, clothing, housing and home decoration, education, recreation, Social welfare, Physically and mentally retarded people.

Books Recommended:

1. Essentials of Textiles – Marjory L. Joshep
2. Textile fibers and their use – Hes'S
3. Fibre to Fabric – Patter and Corbman
4. Meaning of crafts – Edward L. Muttall
5. Creative hands – Dorris and CoxBardara
6. বস্ত্র ও পরিচ্ছদ - তাহমিনা জামান

Paper Code	Paper	Paper Title	Marks	Credits
133503	Paper-VI	Food Science and Technology	100	4

1. Introduction to food science – Definition and scope of food science. Functions of food.
2. Cereals – Structure of grains (rice and wheat) and their composition. Changes in processing.
3. Meat, fish – Structure of muscle, composition, postmortem changes and tenderness of meat, Changes in meat on cooking.
4. Eggs – structure of egg, composition and nutritive value of egg. Uses of egg in food preparation.
5. Milk – Composition of milk, chemical analysis of milk and checks for purity.
6. Pulses and legumes & oil seeds – composition, chemical and physical changes during cooking, toxic constituents in legumes.
7. Vegetables and fruits – Classification, composition, structure and changes occurring during cooking. Nutritive value of fruits.
8. Food borne illness – bacterial, food borne poisonings, infections and nonbacterial intoxications.
9. Food adulterations – Common adulterants & their ill effects, Simple tests to detect adulterations.

Reference:

1. Shakuntalas Manay, N. and Shadaksharas Wamy, M. 2005. Food Facts and Principles. 2nd edition. New Age International Publishers.
2. Potter N. Norman. 2003 Food Science. 3rd edition. New Age International (P) Limited.
3. Mudambi, Sumati R. and Rao, Shalini M. Food Science.
4. William, Frazier C. 1997. Food Microbiology. Tata MC Graw – Hill Publishing Company Limited.
5. Srilakshami. Food Science
6. Parker, Rick. 2003. Introduction to food Science. Thomson Learning, Inc.
7. Food chemistry – L.H. Meyar
8. Food Science and Tecnology – M. Puke
9. উচ্চতর পুষ্টিবিজ্ঞান শাহীন আহমেদ

Paper Code	Paper	Paper Title	Marks	Credits
133504	Paper-VII	Practical	100	4

1. Drawing, making & evaluating a house plane.
2. Drawing & constructing a storage unit & evaluating it.
3. Furniture arrangement (room wise)
4. Child observation – recording child's observation following any one methods.
5. Presenting a research repord on mentally retarded.
6. Food preservation by different methods: Pickles using vinegar, fruit jelly, achar, squash etc.
7. Planning menu and making food list for different ages. Diet planning for different diseases. Planning menus for hostels.
8. Simple tests to detect adulteration in milk, tea, oil and spices.
9. Drafting & construction of blouse and petticote.
10. Textile printing – Prepare usable clothes with the method of block printing, batik and tie-dye.
11. Preparing craft work by using decorative stitch.
12. Preparing craft work by using indigenous raw material.

NATIONAL UNIVERSITY



Syllabus

Subject: Mathematics

Three Years B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Subject: Mathematics
Syllabus for Three Year B.Sc. Pass Course
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113701	Paper-I	Fundamentals of Mathematics	100	4
113703	Paper-II	Coordinate Geometry and Vector Analysis	100	4
Second Year				
123701	Paper-III	Calculus	100	4
123703	Paper-IV	Linear Algebra	100	4
Third Year				
133701	Paper-V	Computer Programming and Numerical Analysis	100	4
133703	Paper-VI	Ordinary Differential Equations	100	4
133704	Paper-VII	Math Lab	100	4
		Total =	700	28

Detailed Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
113701	Paper-I	Fundamentals of Mathematics	100	4

Elements of logic: Mathematical statements, Logical connectives, Conditional and bi-conditional statements. Truth tables and tautologies, Quantifiers, Logical implication and equivalence, Deductive reasoning. Methods of proof (direct, indirect and Method of Induction.)

Set Theory: Sets and subsets, Set operations, Cartesian product of two sets, De Morgan's laws.

Relations and functions: Relation and Functions, Order relation, Equivalence relations. Functions. Images and inverse images of sets Injective, surjective and bijective functions. Inverse functions.

The Real Number System: Field and order properties, Natural numbers, integers and rational numbers, Absolute value and their properties. Basic inequalities.(Including inequalities of means, powers; inequalities of Cauchy, Chebyshev, Weierstrass).

The Complex Number System: Field of Complex numbers, De Moivre's theorem and its applications.

Theory of equations: Number of roots of polynomial equation. Relations between roots and coefficients, Symmetric functions of roots, Sum of the powers of roots, Synthetic division, Des Cartes rule of signs, Multiplicity of roots, Transformation of equations.

Elementary number theory: Divisibility, Fundamental theorem of arithmetic, Congruences (basic properties only)

Summation of Series: Summation of algebraic and trigonometric series, Arithmetic-geometric series.

Books Recommended:

1. Schaums Outline Series- *Theory and problems on set theory and related topics*.
2. S. Bernard & J M Child – *Higher algebra*.
3. Md. Abdur Rahman – *Basic Algebra*
4. Fazlur Rahman & Hafizur Rahman – *Fundamentals of Mathematics*.

Paper Code	Paper	Paper Title	Marks	Credits
113703	Paper-II	Coordinate Geometry and Vector Analysis	100	4

Two-dimensional Geometry: Transformation of coordinates, Pair of straight lines (homogeneous second degree equations, general second degree equations representing pair of straight lines, angle between pair of straight lines, bisectors of angle between pair of straight lines), General equations of second degree (reduction to standard forms, identifications, properties and tracing of conics).

Three-dimensional Geometry: Coordinates, Distance, Direction cosines and direction ratios, Planes (equation of plane, angle between two planes, distance of a point from a plane), Straight lines (equation of lines relationship between planes and lines, shortest distance) Spheres.

Vector Analysis: Vectors in plane and space. Algebra of vectors. Rectangular Components. Scalar and Vector products. Triple scalar product. Applications of vector to geometry (vector equations of straight lines and planes, areas and volumes). The gradient, divergence and curl of a vector function.

Book Recommended:

1. H. H. Askwith – *Analytic Geometry of Conic Section*
2. J. A. Hummel – *Vector Geometry*
3. Fazlur Rahman & Hafizur Rahman – *Analytic and Vector Geometry*.

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123701	Paper-III	Calculus	100	4

Functions & their graphs (Polynomial and rational functions, logarithmic and exponential functions, trigonometric functions and their inverses, hyperbolic functions and their inverses, combinations of such functions). Limit and continuity: Definitions and basic theorems on limit and continuity. limit at infinity and infinite limits Computation of limits.

Differentiation: Tangent lines and rates of change. Definition of derivative. One-sided derivatives. Rules of differentiation (proofs and applications). Successive differentiation. Leibnitz theorem (proofs and application). Related rates. Linear approximations and differentials.

Applications of Differentiation: Rolle's theorem, mean value theorem. Maximum and minimum values of functions. Concavity and points of inflection. Optimization problems, Curvature.

Function of several variables: Limit and continuity. Partial derivatives Defferentiability. linerarization and differentials. The chain rule. Partial derivatives with constrained variables Derictional variables. Lagrange multipliers, Taylor's formula.

Integration: Antiderivatives and indefinite integrals. Techniques of integration. Definite integration using antiderivatives. Definite integration using Riemann sums. Fundamental theorems of calculus (proofs and applications). Basic properties of integration. Integration reduction.

Applications of Integration: Arc length. Plane areas. Surfaces of revolution. Volumes of solids of revolution.

Graphing in polar coordinates. Tangents to polar curves. Areas in polar coordinates. Arc length in polar coordinates.

Multiple Integration: Double integrals and iterated integrals. Double integrals over nonrectangular regions. Double integrals in polar coordinates. Area by double integral. Triple integrals and iterated integrals. Volume as a triple integrals.

Improper integrals. Tests of convergence and their applications. Gamma and Beta functions.

Indeterminate forms, L' Hospital's rule.

Approximation and Series: Taylor polynomials and series. Convergence of series. Taylor's series. Taylor's theorem and remainders. Differentiation and integration of series. Validity of Tailor expansions and computations with series.

Book Recommended:

1. Howard Anton : *Calculus*
2. Mohammad and Bhattacharjee : *Text Book on Differential Calculus*
3. : *Text Book on Integral Calculus*
4. Matin and Chakrabarty : *Differential Calculus*
5. Abu Yusuf : *Differential Calculus*
: *Integral Calculus*

Paper Code	Paper	Paper Title	Marks	Credits
123703	Paper-IV	Linear Algebra	100	4

Matrices and Determinants:

Notion of matrix. Type of matrices. Algebra of matrices. Determinant function. Properties of determinants. Minors, Cofactors, expansion and evaluation of determinants. Elementary row and column operations and row reduced echelon matrices. Invertible matrices. Different types of matrices, Rank of matrices.

Vectors in R^n and C^n : Review of geometric vectors in R^2 and R^3 spaces. Vectors in R^n and C^n . Inner product. Norm and distance in R^n and C^n .

System of Linear Equations: System of linear equations (homogeneous and non-homogeneous) and their solutions. Application of matrices and determinants for solving system of linear equations. Applications of system of equations in real life problems.

Vector Space: Notion of groups and fields. Vector spaces. Subspaces. Linear combination of vectors. Linear dependence of vectors. Basis and dimension of vector spaces. Row and column space of matrix. Rank of matrices. Solution spaces of systems of linear equations.

Linear Transformation: Linear transformations. Kernel and image of linear transformation and their properties. Matrix representation of linear transformations. Change of bases.

Eigenvalues and Eigenvectors: Eigenvalues and Eigenvectors. Diagonalization. Cayley-Hamilton theorem and its application.

Book Recommended:

1. Howard Anton & Chris Rorres – *Elementary Linear Algebra with Application*
2. Seymour Lipschutz (Schaum's Outline Series) – *Linear Algebra*
3. Md. Abdur Rahman - *Linear Algebra*
4. Fazlur Rahman & Hafizur Rahman - *Linear Algebra*

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133701	Paper-V	Computer Programming and Numerical Analysis	100	4

Part-I: Computer Programming

Algorithm and programs: Problem analysis and development of algorithms. Program coding, execution, design, validation and refinement.

Basic FORTRAN: Data type, operations functions, assignment statement, input-output, stop and end statement.

Control structure: Logical data type, logical if and block if, do and continue, Go to statement, While statement.

Input-output: formatted input and output, File processing.

Dimensional arrays: Arrays and subscripted variables, dimension statement, parameter and data statement, examples average group data, sorting and searching.

Multidimensional arrays: Matrix operations, Solving linear system, Functions and subroutines: Library functions and statement functions, function subprogram, subroutine, subprogram, Common statement.

Part-II: Numerical Analysis

Solutions of equations of one variable: Bisection method, Fixed point iteration, Newton-Raphson method, Error analysis for iterative method.

Interpolation and polynomial approximation: Taylor polynomials, Interpolation and Lagrange polynomial, Iterated interpolation.

Numerical differentiation & integration: Numerical differentiation with backward – difference formula, forward difference formula, Adaptive quadrature method, Trapezium method, Simpson method, Matrix algebra and system of equations. Matrix operations, Gauss-Jordan elimination method. SOR Method. (Successive over-Relaxation method).

Books Recommended:

- | | | |
|--------------------------------|---|---|
| 1. Schaum's Outline Series | : | Fortram 77 |
| 2. V. Rajaraman | : | Fortram 90/95 |
| 3. S. S. Kuo | : | <i>Numerical methods & Computers</i> |
| 4. Burdin & J. D. Faires | : | <i>Numerical Analysis</i> |
| 5. S. S. Shastri | : | <i>Introductory Methods of Numerical Analysis</i> |
| 6. হোসাইন, ডট্টাচার্য, ইলিয়াস | : | সাংখ্যিক বিশ্লেষণ |

Paper Code	Paper	Paper Title	Marks	Credits
133703	Paper-VI	Ordinary Differential Equations	100	4

- Ordinary differential equations and their solutions:** Definition and formation of differential equations. Classification of differential equations. Solutions. Implicit solutions. Singular solutions. Initial value problems. Boundary value problems. Basic existence and uniqueness theorems (statement and illustration only). Direction fields. Phase line.
- Solution of first order Differential equations :** Separable equations. Linear equations. Exact equations. Special integrating factors. Substitutions and transformations. Homogeneous equations. Bernoulli equation. Riccati equation. First order higher degree equation-solvable for x, y and p . Clairaut's equation.
- Modelling with first order differential equations:** Construction of differential equations as mathematical models (exponential growth and decay, heating and cooling, mixture of solution. Series circuit, logistic growth, chemical reaction, falling bodies). Model solutions . and interpretation of results. Orthogonal trajectories.
- Solution of higher order linear equations:** Linear differential operators. Basic theory of linear differential equations. Solution space of homogeneous linear equations. Fundamental solutions of homogeneous solutions. Reduction of orders, Homogeneous linear equations with constant coefficients. Non-homogeneous equation. Method of undetermined coefficients. Variation of

parameters. Euler-Cauchy differential equation.

5. **Series solutions of second order linear equations** : Taylor series solutions. Frobenius series solutions. Series solutions of Legendre, Bessel, Laguerre and Hermite equations and their solutions.

Books Recommended:

1. S.L. Ross- *Differential Equations*.
2. Denis Gill-*Introduction to Differential Equations*.
3. Frank Ayres, J R. *Theory and Problems of Differential Equations*.
4. Martin Braun. *An introduction to Differential Equations and their Applications*.
5. কুদ্দুস, আওয়াল, হাফিজ - *Ordinary differential Equation*

Paper Code	Paper	Paper Title	Marks	Credits
133704	Paper-VII	Math Lab	100	4

Problem-solving using Mathematica: Running the package. Numerical computation. Algebraic computation. Mathematical functions. Derivatives and integrals. Limits and series. Determinants and matrices. Graphics. Standard packages. Solving problems in Algebra, Geometry, Calculus, differential equations and Computing. Problems will be selected from courses studied in the first and second years.

Students are required to work on their assignments in the sessions.

Evaluation: Internal Assessment (Laboratory works): 30 marks. Final Exam (Lab) (4 hours): 70 marks.

Books Recommended:

1. Schaum's Outline Series – *Mathematica*
2. Worlfarm's Research (Student edition) – *Mathematica*

NATIONAL UNIVERSITY



Syllabus Subject: Physics

Three Year B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Physics
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
112701	Paper-I	Mathematical Methods, Waves and Optics	100	4
112703	Paper-II	Mechanics, Properties of Matter and Relativity	100	4
Second Year				
122701	Paper-III	Thermodynamics and Statistical Mechanics	100	4
122703	Paper-IV	Electromagnetism and Basic Electronics	100	4
Third Year				
132701	Paper-V	Atomic Physics and Quantum Mechanics	100	4
132703	Paper-VI	Nuclear Physics and Solid State Physics	100	4
132704	Paper-VII	Physics Practical	100	4
		Total =	700	28

Detail Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
112701	Paper-I	Mathematical Methods, Waves and Optics	100	4

A. MATHEMATICAL METHODS

1. Vector Analysis

Transformation properties of vectors; Differentiation and integration of vectors; Line integral, volume integral and surface integral involving vector fields; Gradient, divergence and curl of a vector field; Gauss' divergence theorem, Stokes' theorem, Green's theorem - application to simple problems; Orthogonal curvilinear co-ordinate systems, unit vectors in such systems, illustration by plane, spherical and cylindrical co-ordinate systems only.

2. Matrices

Hermitian adjoint and inverse of a matrix; Hermitian, orthogonal, and unitary matrices; Eigenvalue and eigenvector (for both degenerate and non-degenerate cases); Similarity transformation; diagonalization of real symmetric matrices.

3. Ordinary Differential Equations

Solution of second order linear differential equations with constant coefficients and variable coefficients by Frobenius' method (singularity analysis not required); Solution of Legendre and Hermite equations about $x=0$; Legendre and Hermite polynomials - orthonormality properties.

4. Partial Differential Equations

Solution by the method of separation of variables; Laplace's equation and its solution in Cartesian, spherical polar (axially symmetric problems), and cylindrical polar ('infinite cylinder' problems) coordinate systems.

5. Fourier Series

Fourier expansion – statement of Dirichlet's condition, analysis of simple waveforms with Fourier series. Introduction to Fourier transforms; the Dirac-delta function and its Fourier transform; other simple examples. Vibration of stretched strings- plucked and struck cases.

B. WAVES AND OPTICS

1. Linear Harmonic Oscillator (LHO)

LHO. Free and forced vibrations. Damping. Resonance. Sharpness of resonance. Acoustic, optical, and electrical resonances: LCR circuit as an example of the resonance condition. A pair of linearly coupled harmonic oscillators --- eigenfrequencies and normal modes.

2. Waves

Plane progressive wave in 1-d and 3-d. Plane wave and spherical wave solutions. Dispersion: phase velocity and group velocity.

3. Fermat's principle

Fermat's principle and its application on plane and curved surfaces.

4. Cardinal points of an optical system

Two thin lenses separated by a distance, equivalent lens, different types of magnification, Helmholtz and Lagrange's equations, paraxial approximation, introduction to matrix methods in paraxial optics – simple application.

5. Wave theory of light

Huygen's principle; deduction of law of reflection and refraction.

6. Interference of Light

Condition of sustained interference by analytical treatment, Division amplitude and division of wave front, methods for production of interference fringes by biprism and determination of wavelength, measurement of thickness of thin films, colour of a thin film in reflected and

transmitted light, Haidinger's fringe, Theory of Newton's rings. Determination of wavelength and refractive index using Newton Ring apparatus .

7. Interferometer

Michelson's interferometer and its theory relating to the formation of circular fringe's, Determination of wavelength of a source and small difference of wave lengths in D lines by Michelson's interferometer, standardization of a meter by Michelson's interferometer.

8. Diffraction of light

Fresnel and Fraunhofer class of diffraction, Fresnel's half period zones, zone plate its similarity with convex lens. Diffraction at straight edge, circular aperture.

9. Elements of fiber optics

Construction of optical fibers, image formation, numerical aperture, structure--step index, graded index, uses.

Books & References:

Mathematical Physics

1. Introduction to Mathematical Physics - C. Harper (Prentice-Hall of India).
2. Mathematical Methods - M. C. Potter and J. Goldberg (Prentice-Hall of India).
3. Vector Analysis - M. R. Spiegel, (Schaum's Outline Series) (Tata McGraw-Hill).
4. Tatwiya Padartha Bidyar Bhumika – S. Sengupta, Asok Ghosh and D. P. Roychaudhuri (W.B. State Book Board (WBSBB)).
5. Mathematical Physics – P.K. Chattopadhyay (Wiley Eastern)

Waves and Optics

1. Waves and Oscillations - Rathin N. Chaudhury (New Age Publ.).
2. Waves- J R Crawford (Tata McGraw Hill)
3. Fundamentals of Optics - F. A. Jenkins and H. E. White (Mc Graw Hill, Kogakusha).
4. Geometrical and Physical Optics - B. S. Longhurst (Orient Longmans).
5. Optics – A. K. Ghatak (Tata Mc Graw Hill).
6. Optics – Hecht and Zajac (Addison-Wesley)

Paper Code	Paper	Paper Title	Marks	Credits
112703	Paper-II	Mechanics, Properties of Matter and Relativity	100	4

A. MECHANICS

1. Mechanics of a Single Particle

Velocity and acceleration of a particle in (i) plane polar coordinates - radial and cross-radial components (ii) spherical polar and (iii) cylindrical polar co-ordinate system; Time and path

integral of force; work and energy; Conservative force and concept of potential; Dissipative forces; Conservation of linear and angular momentum.

2. Mechanics of a System of Particles

Centre of mass, centre of mass frame, centre of moving systems, Collision: elastic and inelastic collision, coefficient of restitution. Expression of velocities of two bodies after elastic and inelastic collision in laboratory frame. Elastic collision in centre of mass frame. Relationship between angle of scatterings in laboratory frame and centre of mass frame. Motion of a rigid body about a fixed axis. Angular momentum and expression of angular momentum of a system of rotating bodies. Relationship of angular momentum of a system of bodies with angular momentum in centre of mass frame. Principle of conservation of angular momentum.

3. Rotational Motion

Moment of inertia, radius of gyration; Energy and angular momentum of rotating systems of particles; Parallel and perpendicular axes theorems of moment of inertia; Calculation of moment of inertia for simple symmetric systems; Ellipsoid of inertia and inertia tensor; Setting up of principal axes in simple symmetric cases. Rotating frames of reference - Coriolis and centrifugal forces, simple examples. Force free motion of rigid bodies - free spherical top and free symmetric top.

B. PROPERTIES OF MATTER

1. Gravitation

Gravitational potential and intensity, calculation of gravitational potential and intensity due to thin spherical shell, thick spherical shell, sphere, circular disc etc. Compound pendulum, measurement of 'g' by bar and Kater's pendulum.

2. Elasticity

Hooke's law, work done in strain, elongation strain, volume strain, shearing strain, Young's modulus, Bulk modulus and rigidity modulus and their inter-relationship, Poisson's ratio, torsion in a cylinder, twisting couple, variation of strain along its length. Bending of beams and cantilevers in different cases: loaded at free end, loaded uniformly, bending moments.

3. Viscosity

Equation of continuity, Energy of a liquid in flow, Bernoulli's theorem, critical velocity, Reynold's number, Poiseuille's equation, motion in a viscous medium: Stoke's law, streamline and turbulent flow.

4. Surface tension

Surface tension as a molecular phenomenon, surface tension and surface energy. Excess pressure on curved liquid surface (spherical bubble and drop). Theory and experimental determination of surface tension of liquid by ripple method.

C. RELATIVITY

1. Introduction

Galilean transformation and invariance of Newton's laws of motion, non-invariance of Maxwell's equations. Michelson-Morley experiment and explanation of the null result.

2. Special Theory of Relativity

Concept of inertial frame. Postulates of special theory; simultaneity; Lorentz transformation along one of the axes – length contraction, time dilatation and velocity addition theorem, Fizeau's experiment. Four vectors. Relativistic dynamics : variation of mass with velocity; energy momentum relationship.

3. Vectors and Tensors

Covariant and contravariant vectors. Contraction. Covariant, contravariant, and mixed tensors of rank-2, transformation properties. The metric tensor (flat space-time only). Raising and lowering of indices with metric tensors. (Consistent use of any one convention --- $\text{diag}(-1,1,1,1)$ or $\text{diag}(1,-1,-1,-1)$.) Example of common four-vectors: position, momentum, derivative, current density, four-velocity.

Books & References:

Mechanics & Properties of Matter

1. Theoretical Mechanics - M. R. Spiegel, (Schaum's Outline Series) (McGraw-Hill).
2. Mechanics - K. R. Symon (Addison-Wesley).
3. Introduction to Classical Mechanics - R. G. Takwale and P. S. Puranik (Tata McGraw-Hill).
4. Classical Mechanics – N. C. Rana and P. S. Joag (Tata McGraw-Hill).
5. Physics-I - D. Halliday and R. Resnick (Wiley India Pvt Ltd).
6. Padarth Dharma - D. P. Ray Chaudhuri (West Bengal State Book Board).
7. The Feynman Lectures on Physics – Vol I (Addison-Wesley).
8. An Introduction to Mechanics – D. Keppner and R.J. Kolenkow (Tata McGraw-Hill).
9. Mechanics – H. S. Hans and S. P. Puri (Tata McGraw-Hill).
10. Classical Mechanics – J. Goldstein (Narosa Publ. House).
11. Classical Mechanics – A. K. Roychoudhuri (O. U. P., Calcutta).

Relativity

1. Concepts of Modern Physics, Arthur Beiser, (Tata McGraw-Hill)
2. Modern Physics, K. S. Krane, (Wiley India Pvt Ltd)
3. Modern Physics, Murugesan & Sivaprasath, (S. Chand & Company Ltd)
4. Introduction to Mechanics, Mahendra K. Verma, (Universities Press)

References:

1. Introduction to Special Relativity, R. Resnick, (Wiley India Pvt Ltd)
2. Elements of Properties of Matter, D. S. Mathur, (S. Chand & Company)
3. General Theory of Relativity, P. A. M. Dirac, (Prentice-Hall of India)

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
122701	Paper-III	Thermodynamics and Statistical Mechanics	100	4

A. THERMODYNAMICS***1. Kinetic Theory of Gases***

Basic assumptions of kinetic theory, Ideal gas approximation, deduction of perfect gas laws. Maxwell's distribution law (both in terms of velocity and energy), root mean square and most probable speeds. Finite size of molecules : Collision probability, Distribution of free paths and mean free path from Maxwell's distribution. Degrees of freedom, equipartition of energy (detailed derivation not required).

2. Real Gases

Nature of intermolecular interaction : isotherms of real gases. Van der-Waals equation of state, Other equations of state (mention only), critical constants of a gas, law of corresponding states; Virial Coefficients, Boyle temperature.

3. Heat transfer

Thermal conductivity, diffusivity, Fourier equation for heat conduction –its solution (steady state) for rectilinear and radial (spherical and cylindrical) flow of heat, Determination of thermal conductivity of solids by Searle's method, Forbe's method and Lee's disc method(for bad conductors).

4. Radiation

Nature of radiant heat, emissive and absorptive power, prevost's theory of heat exchange, Kirchhoff's law (simple deduction), Black body radiation, Stefan-Boltzmann law, Planck's formula for black body radiation (elementary idea).

5. Basic Concepts of Thermodynamics

Microscopic and macroscopic points of view : thermodynamic variables of a system, State function, exact and inexact differentials.

6. First Law of Thermodynamics

Thermal equilibrium, Zeroth law and the concept of temperature. Thermodynamic equilibrium, internal energy, external work, quasi-static process, first law of thermodynamics and

applications including magnetic systems, specific heats and their ratio, isothermal and adiabatic changes in perfect and real gases.

7. Second Law of Thermodynamics

Reversible and irreversible processes, indicator diagram. Carnot's cycles-efficiency, Carnot's theorem. Kelvin's scale of temperature, relation to perfect gas scale, second law of thermodynamics – different formulations and their equivalence, Clausius inequality, entropy, change of entropy in simple reversible and irreversible processes, entropy and disorder; equilibrium and entropy principle, principle of degradation of energy.

8. Thermodynamic Functions

Enthalpy, Helmholtz and Gibbs' free energies; Legendre transformations, Maxwell's relations and simple deductions using these relations; thermodynamic equilibrium and free energies.

9. Change of State

Equilibrium between phases, triple point : Gibbs' phase rule (statement only) and simple applications. First and higher order phase transitions, Ehrenfest criterion. Clausius-Clapeyron's equation. Joule-Thomson effect.

B. STATISTICAL MECHANICS

1. Phase space

Concept of Microstates and macro states, Basic postulates - equal priori probability and ergodic hypothesis, Liouville theorem and conservation of density in phase space, Statistical ensemble - Micro-canonical, Canonical and Grand canonical ensemble and their partition functions, Relation of statistical mechanics with thermodynamics - Expressions of different thermodynamical quantities (e.g. Free energy, pressure, average energy, entropy, Specific heat) in terms of partition function;

2. Classical statistics

Maxwell-Boltzmann distribution function, Calculation of thermodynamical quantities for ideal gas, Maxwell-Boltzmann velocity distribution law, (Average, most probable velocity and root mean square speed and their relation; Principle of equipartition of energy.)

3. Quantum statistics

Concept of indistinguishability, Entropy of mixing and Gibbs' paradox, Resolution of Gibbs' paradox introducing indistinguishability; Bose-Einstein distribution function and its behaviour with temperature, Basic idea of phenomenon Bose-Einstein condensation (Qualitative description), Calculation of various thermodynamical quantities of photon gas (black body radiation); Fermi-Dirac distribution function and its behaviour with temperature, Basic idea of Fermi surface and Fermi energy, Calculation of various thermodynamical quantities of free electron gas; Classical limits and distinguishing features of classical and quantum statistics.

Books & References:

Heat & Thermodynamics

1. Heat and thermodynamics - Zemansky and Ditman (Mc Graw Hill, Kugakusha).
2. Kinetic theory of gases - Loeb (Radha Publ. House).
3. Thermodynamics – F. Fermi (Dover)
4. Tapgatividya – Asoke Ghosh (W.B.S.B.B).
5. A Treatise on Heat - Saha and Sribastava (The Indian Press Ltd).
6. Gaser Anabik Tattwa- Pratip Kumar Chaudhuri (W. B. S. B. B).
7. Thermal Physics – S. Garg, R. M. Bansal, C. K. Ghosh (Tata Mc Graw Hill).
8. Heat and Thermodynamics – H. P. Roy and A. B. Gupta (New Central Book Agency).

Statistical Mechanics

1. Statistical Physics, F. Mandle (ELBS).
2. Fundamentals of Statistical and Thermal Physics, F. Reif, (Mc Graw Hill).

Paper Code	Paper	Paper Title	Marks	Credits
122703	Paper-IV	Electromagnetism and Basic Electronics	100	4

A. ELECTROMAGNETISM

1. Electrostatics

Quantisation of charge and Millikan's oil-drop experiment, Coulomb's law, intensity and potential --- example of point charge, Gauss' theorem --- simple applications, potential and field due to an electric dipole, mechanical force on the surface of a charged conductor. Dielectric medium, polarization, electric displacement.

2. Capacitor

Parallel-plates and cylindrical, energy stored in parallel plate capacitor.

3. Steady Current

Network analysis --- Kirchoff's laws, Thevnin and Norton's theorem, Wheatstone bridge, potentiometer.

4. Thermoelectricity

Seebeck, Peltier, and Thomson effects, laws of thermoelectricity, thermoelectric curve --- neutral and inversion temperature, thermoelectric power.

5. Magnetic effect of current

Biot and Savart's law, Ampere's circuital law (statement only), magnetic field due to a straight conductor, circular coil, solenoid, endless solenoid, Magnetic field due to a small current loop -- - concept of magnetic dipole, Ampere's equivalence theorem.

6. Lorentz force

Force on a moving charge in simultaneous electric and magnetic fields, force on a current carrying conductor in a magnetic field.

7. Magnetic materials

Intensity of magnetization, relation between **B**, **H**, and **M** --- illustration in the case of bar magnet, magnetic susceptibility --- dia, para and ferromagnetic materials, statement of Curie's law. Hysteresis in a ferromagnetic material, hysteresis loss.

8. Electromagnetic induction

Self and mutual inductances in simple cases, energy stored in inductance.

9. Varying currents

Growth and decay of currents in L-R circuit; charging and discharging of capacitor in C-R circuit.

10. Alternating current

Mean and r.m.s. values of current and emf with sinusoidal wave form; LR, CR and series LCR circuits, reactance, impedance, phase-angle, power dissipation in AC circuit --- power factor, vector diagram, resonance in a series LCR circuit, Q-factor, principle of ideal transformer.

B. BASIC ELECTRONICS

1. Thermo-ionic emission

classical deduction of Richardson's equation, characteristic curve of a vacuum diode, space charge, temperature and space charge limited current, Child Langmuir law, Triode and its characteristics curves, parameters from these curves. Triode as an amplifier, graphical analysis with load line. Semiconductors : junction diode, zener diode & their applications.

2. Basic concepts of Transistor

PNP & NPN transistors operation, characteristics curves of a transistor in common emitter and common base mode - current amplification factor, input & output resistance. Transistor as an amplifier (simple Mathematical treatment) in CE mode, d.c and a.c load line, graphical analysis of the amplifier.

3. Feed back in amplifiers

conditions of oscillation, Barkhausen criteria ; Working principle & description of Tuned collector and Hartley oscillators mentioning frequency of oscillation.

4. Logic gates

Logic gates: OR, AND, NOT, NAND, NOR, XOR, their circuit realization & truth tables.
Boolean algebra, de Morgan's theorem, flip-flop circuit.

Books & References:

Electricity & Magnetism

1. Introduction to Electrodynamics – D. J. Griffith, (Prentice Hall, India Pvt. Ltd).
2. Berkeley Series Vol II (Electricity and Magnetism) E.M. Purcell (Tata McGraw-Hill).
3. The Feynman Lectures on Physics – Vol. II (Addison – Wesley).
4. Electricity and Magnetism - J. H. Fewkes and J. Yarwood (Oxford Univ. Press, Calcutta).
5. Physics-II - D. Halliday and R. Resnick (Wiley India Pvt Ltd).
6. Classical Electrodynamics – J.D> Jackson (Wiley India)

Electronics

1. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
2. Electronic Fundamentals and Applications – D. Chattopadhyay and P. C. Rakshit (New Age International)
3. Electronics Fundamentals and Applications – J. D. Ryder (PHI Pvt. Ltd).
4. Electronic Device and Circuit Theory – R. Boylestad and L. Nashelsky (Prentice – Hall).
5. Integrated Electronics – J. Millman and C. C. Halkias (Mc Graw Hill).
6. Digital Logic and Computer Design – M. Moris Mano, (PHI (Pvt.) Ltd.).
7. Electronics – R.K. Kar (**Books and Allied (P) Ltd.**).
8. Digital Electronics – D. Ray Chaudhuri (Platinum Publishers)

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
132701	Paper-V	Atomic Physics and Quantum Mechanics	100	4

1. Atomic Spectrum:

Good quantum numbers, and selection rules. Stern-Gerlach experiment and spin as an intrinsic quantum number. Incompatibility of spin with classical ideas. Bohr-Sommerfeld model. Fine structure. Study of fine structure by Michelson interferometer.

2. Vector model of atom:

Magnetic moment of the electron, Lande g factor. Vector model – space quantization. Zeeman effect. Explanation from vector atom model.

3. Bohr's hydrogen atom

Theory of hydrogen atom, expression of radii of electrons, expression of energies and hydrogen atom spectrum. Effect of nuclear motion on atomic spectra, reduced mass, modified Rydberg constant and wave number, Evidences in favour of Bohr's theory, correspondence principle, fine structure of spectral lines and Sommerfeld's relativistic atom model.

4. Uncertainty principle

Uncertainty principle - Its deduction and application to simple problems, viz, Non-existence of electron within nucleus, Ground state energy of Hydrogen atom, Radius of Bohr orbit.

5. Molecular spectroscopy

Diatomic molecules – rotational and vibrational energy levels. Basic ideas about molecular spectra. Raman effect and its application to molecular spectroscopy (qualitative discussion only).

B. QUANTUM MECHANICS

1. Old quantum theory

Planck's formula of black-body radiation. Photoelectric effect. Quantization of energy levels.

2. Basic quantum mechanics

de Broglie hypothesis. Electron double-slit experiment. Compton effect, Davisson-Germer experiment, Heisenberg's uncertainty principle (statement) with illustrations. Concept of wave function as describing the dynamical state of a single particle. Group and phase velocities, classical velocity of a particle and the group velocity of the wave representing the particle. Principle of superposition. Schrödinger equation. Probabilistic interpretation; equation of continuity, probability current density. Boundary conditions on the wave function.

3. Basic postulates of quantum mechanics

Dynamical variables as linear hermitian operators and eigenvalue equations, Momentum, energy and angular momentum operators. Measurement of observables, expectation values. Commutation relations between operators. Compatible observables and simultaneous measurements, Ehrenfest theorem.

Books & References:

Atomic Physics

1. Mani H.S. and Mehta G.K. : Introduction to Modern Physics
2. Beiser A. : Perspectives of Modern Physics
3. White A.E. : Introduction to Atomic Physics
4. Barrow H., : Introduction to Molecular Physics
5. Feynmann R.P. Et al : The Feynmann Lectures in Physics, B.I. Publication
6. Hertzberg G. : Atomic Spectra and Atomic Structure
7. Hertzberg G. : Molecular spectra and Molecular Structure
8. Herchiaf : Fluorescence and phosphorescence Olon,

Quantum Mechanics

1. Quantum Mechanics – J. L. Powell and B. Crasemonn, (Oxford, Delhi).
2. Quantum Mechanics – F. Schwabl (Narosa).

3. Quantum Mechanics – A. K. Ghatak and S. Lokenathan (Macmillan, Delhi).
4. Introductory Quantum Mechanics - S. N. Ghoshal (Calcutta Book House).
5. A Textbook of Quantum Mechanics – P. M. Mathews and K. Venkatesan (Tata Mc Graw Hill).
6. Modern Quantum Mechanics – Sakurai (Persian Education)

Paper Code	Paper	Paper Title	Marks	Credits
132703	Paper-VI	Nuclear Physics and Solid State Physics	100	4

A. NUCLEAR PHYSICS

1. Bulk properties of nuclei

Nuclear mass, charge, size, binding energy, spin and magnetic moment. Isobars, isotopes and isotones; mass spectrometer (Bainbridge).

2. Nuclear structure

Nature of forces between nucleons, nuclear stability and nuclear binding, the liquid drop model (descriptive) and the Bethe-Weizsacker mass formula, application to stability considerations, extreme single particle shell model (qualitative discussion with emphasis on phenomenology with examples).

3. Unstable nuclei

- (a) Alpha decay : alpha particle spectra – velocity and energy of alpha particles. Geiger-Nuttall law.
- (b) Beta decay : nature of beta ray spectra, the neutrino, energy levels and decay schemes, positron emission and electron capture, selection rules, beta absorption and range of beta particles, Kurie plot.
- (c) Gamma decay : gamma ray spectra and nuclear energy levels, isomeric states. Gamma absorption in matter, photoelectric process, Compton scattering, pair production (qualitative).

4. Nuclear fission and fusion

Discovery and characteristics, fission products and energy release, spontaneous and induced fission, transuranic elements. Chain reaction and basic principle of nuclear reactors. Nuclear fusion: energetics in terms of liquid drop model.

B. SOLID STATE PHYSICS

1. Crystal Geometry

Amorphous and crystalline materials, glassy forms periodic lattice, basis, translation vectors, primitive and non-primitive Crystal Axis, Unit Cell, Primitive and Conventional Bravais lattice,

Miller indices, symmetry, point groups and space groups. Body centered and face centered lattices, interplanar spacing. Indices of lattice planes.

2. Crystallography

Bragg's law, diffraction of X –ray, measurement of lattice parameter for cubic lattices. Theory of Laue Spots.

3. Bonding in Solids

Types of bonding in solids, covalent, Ionic bindings, energy of bonding, transition between covalent and ionic bonding, metallic bonding, Vander waal's bonding, hydrogen bond.

4. Lattice Vibrations

Linear monatomic chains, Acoustical and optical phonons, Qualitative description of the phonon spectrum, Brillouin Zones, Einstein and Debye theories of specific heat of solid T^3 Law. Qualitative description of free electron theory and its inadequacies with reference to Hall effect and specific heat of electrons in metals.

Books & References:

Nuclear Physics

1. Littlefield T.A. and Thorley N. : Atomic and Nuclear Physics E.L.B.S.
2. Enge H.A. : Introduction to Nuclear Physics, Addison-Wesley
3. Meyroff : Element of Nuclear Physics
4. Kaplan : Nuclear Physics
5. Cohen : Concepts of Nuclear Physics
6. Segre : Nuclei and particles. B1n'Cham : Nuclear Physics 31

Solid State Physics

1. Introduction to Solid State Physics, C. Kittel (Wiley Eastern).
2. Elementary Solid State Physics – M. Ali Omar (Pearson Education)
4. Solid State Physics – A. J. Dekker (Mc. Millan)
4. Solid State Physics – S. O. Pillai (New Age International)
5. Elements of Solid State Physics – J. P. Srivastava (Prentice Hall)
6. An Introduction to Solid State Physics and Application – R.J. Elliot and A.F. Gibson (McMillan)
7. Solid State Physics – D.W. Snoke (Person Education)

Paper Code	Paper	Paper Title	Marks	Credits
132704	Paper-VII	Physics Practical	100	4

LABORATORY CLASSES: At least 30 Experiments are to be performed during 3 years.

(Two Experiments, one from each group are to be performed in six (6) hours during final examination)

Distribution of Marks

Distribution of Marks			Distribution of Marks on each Experiment		
i)	Two Experiments (One from each group)	2×35=70	i)	Theory	5
ii)	Laboratory Note Book	15	ii)	Procedure & Data Collection	15
iii)	Viva-voce on Experiment	15	iii)	Calculations & Results	10
			iv)	Discussions	5
	Total	100		Total	35

Laboratory Teaching Classes

One laboratory class (of 3 periods duration) per week should be devoted to teach the following topics during the three years course. These lectures should be taken in laboratory and should be of interactive type so that students also participate in the learning process. As the course on physics practical will be taught in early months of first year, students will get sufficient time to use apparatus in practical classes.

Laboratory Teaching

1. Demonstration lectures on use of Vernier, Micrometer, Spherometer, Barometer, common balance ,etc.; graph plotting -2 Lab-class.
2. (i) Basic ideas of Probability & Statistics
(ii) Error analysis, significant figures, limits of accuracy of an Experiment-associated choice of equipments. -3 Lab-class
3. Measuring instruments (e.g. Galvanometer, Multimeter & CRO) to be used in the laboratory – 2 Lab-class.

GROUP –A

1. Determination of the value of acceleration due to gravity by using bar Pendulum.
2. Determination of moment of inertia of a metallic cylinder/rectangular bar about an axis passing through its centre of gravity.
3. To determine the modulus of rigidity of the form of a cylindrical rod by statical method.
4. Determination of young's modulus of the material of the given wire by Searle's method.
5. To determine the focal length of two given convex lenses and their combination in contact by displacement method.

6. Determination of refractive index of the given liquid with the help of plane mirror, convex lens & spherometer.
7. To determine the focal length of two given convex lenses and their combination in contact by displacement method.
8. Determination of the refractive index of the material of a prism by drawing the i - δ curve using spectrometer.
9. To calibrate a polarimeter and hence to determine the concentration of sugar solution.
10. Determination of the surface tension of water by capillary rise method.
11. Determination of the co-efficient of viscosity of water by flow through a capillary tube
12. Determination of the frequency of a tuning fork with the help of a sonometer (Either by using the relevant formula or by using the n - l curve).
13. To determine refractive index of water using travelling microscope.
14. To determine the boiling point of a given liquid by platinum resistance thermometer.
15. Determination of thermal conductivity of the given rod by Searle's apparatus.
16. Determination of thermal conductivity of a bad conductor of heat by Lee's and Chorlton's method.
17. Determination of specific heat of the given liquid by the method of cooling.
18. To determine the boiling point of a given liquid by platinum resistance thermometer.
19. To determine the melting point of a solid with the help of a thermocouple.
20. To determine the wavelength of monochromatic source by Fresnel's biprism.
21. Determination of the width of a single slit by the Spectrometer with diffraction method.
22. To determine the wave length of monochromatic light by Newton's ring experiment.

GROUP –B

1. To determine the ballistic constant of a ballistic galvanometer.
2. Determination of specific resistance of the material of a given wire by meterbridge.
3. Verification of the laws of series and parallel resistance by a Post Office box.
4. Determination of E.C.E. of copper by using an ammeter and a copper voltameter.
5. Determination of EMF of a cell by potentiometer.
6. Comparison of the magnetic moments of two given bar magnets by deflection magnetometer.
7. Determination of the value of the given low resistance by drop of potential method with the help of metre-bridge.

8. Determination of internal resistance of a cell with the help of potentiometer.
9. Conversion of the given galvanometer into an ammeter & its calibration using copper voltmeter.
10. Determination of resistance of a galvanometer by half-deflection method.
11. Determination of the reduction factor of a tangent galvanometer with copper voltmeter and hence to determine the value of H, the horizontal component of earth's magnetic field.
12. Convert a given galvanometer into voltmeter and calibrate it.
13. To draw the forward characteristic curves of a semiconductor diode and hence calculate the dc resistance (r_{dc}).
14. To draw the dynamic characteristic curve of a triode for three different loads and to calculate the voltage gain for the load and to compare it with the theoretically calculated value.
15. To draw input, out put and mutual characteristics curve of a transistor in CE mode and hence to calculate its h-parameters.
16. To measure the resistance, reactance and self inductance of a choked coil in an L-R circuit using an A.C. Voltmeter.
17. To determine the ripple factor of a full wave rectifier with a shunt capacitor filter using a D.C. voltmeter and to study the variation of ripple factor with load.
18. To study a full wave rectifier with a shunt capacitor as filter circuit and hence to determine the values of ripple factor using CRO at the different frequency loads.
19. To study the frequency response curve of a series LCR circuit and determine the resonance frequency.
20. Determination of J (mechanical equivalent of heat) by Joule's electrical calorimeter.
21. To study the variation of mutual inductance of a given pair of co-axial coils by using a ballistic galvanometer.
22. To measure the self inductance of two coils by Anderson bridge. To find the total inductance of the above two coils connected in series and hence estimate the coefficient of coupling between the coils.

Books & References:

1. *BSc Practical Physics*, C. L. Arora, (S. Chand)
2. *An Advanced Course in Practical Physics*, D. Chattopadhyay and P. C. Rakshit, (New Central Book Agency)
3. *A Text Book of Advanced Practical Physics*, S. Ghosh, (New Central Book Agency)
4. ব্যবহারিক পদার্থবিজ্ঞান- অরুণ বসাক ও ছদরুদ্দিন আহমেদ চৌধুরী
5. ব্যবহারিক পদার্থবিজ্ঞান (১ম ও ২য় খণ্ড) - মফিজুল মান্নান

NATIONAL UNIVERSITY



Syllabus

Subject: Psychology

Three Years B.Sc. Pass Course

Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Psychology
Session: 2013-2014

Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113401	Paper-I	General Psychology	100	4
113403	Paper-II	Experimental Psychology	100	4
Second Year				
123401	Paper-III	Developmental Psychology	100	4
123403	Paper-IV	Social Psychology	100	4
Third Year				
133401	Paper-V	Industrial Psychology	100	4
133403	Paper-VI	Measurement & Statistics in Psychology	100	4
133404	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
113401	Paper-I	General Psychology	100	4

- 1. Introduction:** Definition and nature of Psychology; Psychology as a science; Fields of Psychology: Experimental, Physiological, Clinical, Counseling, Industrial, Engineering, Educational, Social and Developmental Psychology; Methods of Psychology: Experimental, observational. Clinical, Case histories, Survey method.
- 2. Sensation and Perception:** The nature of sensation and perception; Selectivity in perception: Selective attention; Determinants of stimulus selection; Form perception: Figure and ground, contour, perceptual organization, Perceptual constancy: Size and Brightness constancy; Depth perception: Monocular and Binocular cues to depth perception; perception of movement; Illusion and hallucination.
- 3. Learning:** Definition and nature of learning; Factors of learning; Classical conditioning, Operant conditioning, Cognitive learning: Cognitive mapping, Latent learning, Insightful learning; Principles of reinforcement: Primary and secondary reinforcement, Schedule of reinforcement.
- 4. Memory and forgetting:** Defining Memory and forgetting; Information processing approach-Sensory memory, short-term memory and long term memory; Ways of measuring memory;
- 5. Motivation:** Defining Motivation; Motivational cycle; Characteristics of motivated behavior;
- 6. Personality:** Definition of personality; Nature and determinants of personality: Observation, Rating Inventories and Projective tests.

7. **Intelligence:** Definition of intelligence; Concept of I.Q.; Measurement of intelligence; Verbal and non-verbal tests, Individual and group tests;

References:

1. আফসার উদ্দীন (২০০২). সাধারণ মনোবিজ্ঞান। রাজশাহী : রাজশাহী বিশ্ববিদ্যালয় প্রকাশনা বোর্ড।
2. Crider, A.B., Goethals, G.R. Robert D. Kavanaugh.R.D. Solomon, P.R. Psychology, Scott Foresman (1993), Psychology (4th ed.) New York; Harper Collins College publishers.
3. Feldman, R.S. (2002), Understanding Psychology (6th ed.) New York; Mc Graw Hill; Hisher education.
4. Hilgrad, E.R., Alkimson, R., and Alkinson. (R.C.) Introduction to Psychology. New York; Harcourf Brace, Latested.
5. Huffman K. (2004) Psychology in Action (7th ed.) U.S.A.; John Wiley and Sons Inc.
6. যোগেন্দ্র কুমার মন্ডল (২০০৮): সাধারণ মনোবিজ্ঞান; হাসান বুক হাউজ, ঢাকা।
7. Morgan, C.T. and King, R.A Wisz, J.R. and Shoopier C. (1966) Introduction to Psychology. New York: Mc Graw Hill.
8. Munn. N.L. (1969). Introduction to Psychology; D Boston, Houghton Mifflin Co.
9. Newman, P.R. and Newman, B.M. (1983) Principles of Psychology; Illionis Homewood: The Dorsey Press, Latested.
10. Zimbardo, P.G (1979), Psychology and life: Scott, Foresman and Co. Latested.
11. কাজী সাইফুদ্দীন (২০১০), সাধারণ মনোবিজ্ঞান, আলোয়া পাবলিকেশন, ঢাকা।
12. নীহার রঞ্জন সরকার, মনোবিজ্ঞান ও জীবন।
13. এম. আর. আলী, মনোবিজ্ঞান।

Paper Code	Paper	Paper Title	Marks	Credits
113403	Paper-II	Experimental Psychology	100	4

1. **Introduction:** Definition and scope of experimental psychology, stimuli and responses, Forms of behavior studied in experimental psychology.
2. **Variables:** Definition; Types of variables; control of variables; experimental variable and controlled variable. Relationship between variables.
3. **Experimentation:** Experimental method, characteristics of experimental method, Experimental method vs Scientific method. Types of experiment, Experimental group and control group.
4. **The Problem:** Selecting the problem, necessity of defining a problem, technique involved in defining a problem.
5. **Hypothesis:** Definition and Types of hypothesis, sources of hypothesis, function of hypothesis, Characteristics of a good hypothesis.
6. **Designing and conducting experiment:** Essential characteristics of good experimental design, Types of experimental design: Simple Randomized Design, Two Matched Groups Design, More than Two Randomized Groups Design, Repeated Measurement Design, Within Group Design, Factorial Design, Steps in experimentation.
7. **Writing Report of Experiments- steps.**

References:

1. মীর ফখরুজ্জামান. পরীক্ষন মনোবিজ্ঞান
2. নীহার রঞ্জন সরকার, মনোবৈজ্ঞানিক পরিমাপন ও পরিসংখ্যান
3. McGuigan, F. T. - Experimental Psychology, Prentice Hall Inc.
4. Postman, L & Egan, J.P. - Experimental Psychology: An Introduction, Harper & Row.NY.
5. Woodworth & Schlosberg – Experimental Psychology.
6. কাজী সাইফুদ্দীন (২০০৭), পরীক্ষন মনোবিজ্ঞান ও গবেষণা পদ্ধতি, আবীর প্রকাশনি, ঢাকা।
7. নীহার রঞ্জন সরকার, পরীক্ষন মনোবিজ্ঞান।

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123401	Paper-III	Developmental Psychology	100	4

- 1. Introduction:** Definition of Developmental Psychology, Meaning of developmental change, Types and rate of change, Division of life cycle, Principles of development.
- 2. Methods for the study of development:** Observational method Experimental method, Longitudinal & cross-sectional method, Case Study, Interview, Questionnaires.
- 3. Prenatal development:** How life begins, three stages of prenatal development, Factors influencing prenatal development, Maternal factors & environmental factors.
- 4. Birth and Neonate:** The birth process, Types of birth, Birth complications, Adjustment of Neonate, characteristics of a Neonate, Physiological functioning.
- 5. Infancy:** Characteristics, Physical development, Developmental tasks, Reflex actions.
- 6. Babyhood:** Characteristics, Physical development, Motor development, Language development, Social development.
- 7. Childhood:** Characteristics, Physical development, Language development, Emotional development, Social development, Childhood play and its importance.
- 1. Adolescence:** Physical changes during adolescence, Stages of puberty, Primary sex characteristics, Secondary sex characteristics, mental tasks of adolescence.

Book recommended:

1. Alison, e, s; Susan F. and Joanne, C.(1958): Child Development: A Topical Approach; John wiley.
2. Ambron, J. R. and Brodzinsky, D. (1979): Life span Human Development; Holt, Rinehart and Winston.
3. সুলতানা বানু, (১৯৯২): বিকাশ মনোবিজ্ঞান (১ম খণ্ড); বাংলা একাডেমি, ঢাকা।
4. মোঃ আমিনুল হক, (২০০৪): বিকাশ মনোবিজ্ঞান; হাসান বুক হাউস, ঢাকা।
5. Hurlock, E. B. (1978): Child Development; N.Y.; Mc Groaw Hill Book Co.
6. Hurlock, E. B. (1987): Development Psychology; N.Y.; Mc Groaw Hill Book Co.
7. সুলতানা জামান এবং সুলতানা বানু, (১৯৯৮): মানব বিকাশে মনোবিজ্ঞান; লেখকদ্বয় কর্তৃক প্রকাশিত, ঢাকা।
8. Sarafino, E.Armstrong, J.W.(1980) : Child and Adolescent Development; London; Scott. Foresman and company.

Paper Code	Paper	Paper Title	Marks	Credits
123403	Paper-IV	Social Psychology	100	4

- 1. Introduction:** Defining Social Psychology; Subject matter of Social Psychology; Social Psychology and its relation to Psychology, Sociology and Anthropology; Research

Methods used in Social Psychology.

2. **Socialization:** Socialization as a learning process; Agents of Socialization; Cultural Influences on Socialization.
3. **Attitude:** Defining Attitude; Formation of Attitude; Change of Attitude.
4. **Human Communication:** Process of Human Communication; Verbal and Nonverbal Communication.
5. **Leadership:** Definition of Leadership; Characteristics of a Good Leader; Types of Leader.
6. **Collective Behavior:** Public Opinion; Crowding; Rumour; Propagation; Prejudice
7. **Social Group:** Defining Group; Types of Group; Group and Public Perception.

Reference:

1. হামিদ আখতার বেগম, আধুনিক সমাজ মনোবিজ্ঞান: রাফায়েল শাহরিয়ার প্রকাশনা, ঢাকা।
2. জহিরুল হক, সমাজ মনোবিজ্ঞান; আলোর প্রকাশনি, ঢাকা।
3. মীর কখরুজ্জামান, সমাজ মনোবিজ্ঞান; ঢাকা বইবিতান, ঢাকা।
4. Krech, D. Crutchfield R.S. and Ballachey Z. L., Individual in Society; Mc. Graw Hill Co. Ltd.
5. Lindgren, H.C. An Introduction to Social Psychology. Wiley and Sonsl.
6. Myers D.G. Social Psychology. Mc. Graw Hill, Inc.
7. Second P.F. and Backman, C.W. Social Psychology. Mc. Graw Hill.

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133401	Paper-V	Industrial Psychology	100	4

1. Introduction:

- 1.1. Definition of Industrial Psychology
- 1.2. Scope of Industrial Psychology
- 1.3. Industrial Psychology as an applied Science
- 1.4. History of Industrial Psychology

2. Job Analysis:

- 2.1. Definition of Job Analysis
- 2.2. Purposes of Job Analysis
- 2.3. Methods of Job Analysis

3. Personnel Selection Procedures:

- 3.1. Psychological tests
- 3.2. Biographical Information
- 3.3. Interviews
- 3.4. References

4. Personnel Training:

- 4.1. Assessment of training needs
- 4.2. Training Methods
- 4.3. Evaluation of training programs

5. Accident and Safety:

- 5.1. Definition of Accident
- 5.2. Causes of Accident: Situational and Personal factors

5.3. Prevention of accident

5.4. Safety Provisions

6. Job Satisfaction:

6.1. Nature of Job Satisfaction

6.2. Determinants of Job Satisfaction

6.3. Assessment of Job Satisfaction

Books Recommended:

1. Anastasia, A.(1979) Fields of Applied Psychology. New York; Mc Graw Hill.
2. Blum. M.L. and Naylor, J.C. (1968) Industrial Psychology CSB Publication, New Delhi, India.
3. Ghiseli E.N. & Browa C.W. Personal and Industrial Psychology. Mc Grow Hill New York.
4. রওশন জাহান, (১৯৯০) শিল্পে মনোবিজ্ঞান: কর্মবিজ্ঞান; ঢাকা বিশ্ববিদ্যালয়।
৫. আব্দুল খালেক, (২০০৫) শিল্প মনোবিজ্ঞান, (৪র্থ সংস্করণ), হাসান বুক হাউস, ঢাকা।
6. Sual, F.E. and Knight, P.a. (1995) Industrial/Organization Psychology. Brooks /Cale Publication Company. California U.S.A.

Paper Code	Paper	Paper Title	Marks	Credits
133403	Paper-VI	Measurement & Statistics in Psychology	100	4

1. Introduction:

1.1. Measurement in the Physical Science

1.2. Measurement in the Social and Psychological Science

1.3. Properties of number

1.4. Levels of measurement

1.5. Basic postulates in measurement

2. Psychological Test:

2.1. Definition of Psychological Test

2.2. Current uses of Psychological Tests

2.3. Types of Psychological Test

2.4. Characteristics of a Psychological Test

3. Steps in Constructing a Psychological Test:

3.1. Designing & Writing items

3.2. Designing & Scoring Responses

3.3. Collecting Data

3.4. Analyzing Items

3.5. Assessing Reliability

3.6. Assessing Validity

3.7. Establishing Norm

4. Statistics:

What is Statistics? Classification of Statistics, Nature and Scope, uses of Statistics in Psychology, The idea of quantification.

5. Frequency Distribution:

5.1. Grouping of Data

5.2. Choosing Class intervals

5.3. Apparent and true limits of class intervals

5.4. Frequency and cumulative frequency distribution.

5.5. Graphical representation of data

6. Measures of Central Tendency:

- 6.1. Computing mean, median and mode
- 6.2. When to apply mean, median, mode
- 6.3. Mathematical Properties of the mean

7. Measures of Variability/dispersion:

- 7.1. Need to measure variability
- 7.2. The range, interquartile range, Semi-interquartile range, Mean deviation, Standard deviation, Variance.

Suggested Readings:

1. নীহার রঞ্জন সরকার (২০১০), পরিসংখ্যান ও পরিমাপন।
2. Kline, T. J.B. (2005), Psychological Testing. New Delhi: Vistaar Publications.
3. Anastasi, A., Urbine, S.(1997), Psychological Testing and Assessment. New York; Mc Grow Hill Co.
4. Ferguson, G. S. Statistical Analysis in Psychology and Education, Longmans Green & Co. Ltd; London.

Paper Code	Paper	Paper Title	Marks	Credits
133404	Paper-VII	Practical (4-Experiment +2-Test)	100	4

Any Six:

1. To investigate the phenomenon of bilateral transfer of training.
2. To investigate the phenomenon of Muller-Lyer illusion.
3. To Study the effect of division of attention.
4. To investigate the associative reaction time under free VS controlled situation.
5. To study the immediate memory span for auditory stimuli.
6. To compare incidental and intentional learning.
7. To study the effect of retro-active inhibition on paired-associate learning.
8. To measure retention as a function of time.
9. To measure intelligence by administering Alexander Pass Along Test.
10. To Study the basic concept of the child by Boehm Test of Basic Concept (BTBC)
11. To measure intelligence by Koh's Block Design Test

Marks distribution:

(A) Experiment (One day)

Laboratory note book	10
Experiment/Test	
Conduction	15
Report	15
Viva-voce	10
Total =	50

(B) Test (One day)

Lab. Note	10
Conduction	15
Report	15
Viva	10
Total =	50

NATIONAL UNIVERSITY



Syllabus

Department of Statistics

Three Year B.Sc. Pass Course
Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Statistics
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113601	Paper-I	Descriptive Statistics	100	4
113603	Paper-II	Probability and Probability Distributions	100	4
Second Year				
123601	Paper-III	Methods of Statistics	100	4
123603	Paper-IV	Numerical Mathematics & Linear Algebra	100	4
Third Year				
133601	Paper-V	Applied Statistics-I	100	4
133603	Paper-VI	Applied Statistics-II	100	4
133604	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus
First Year

Paper Code	Paper	Paper Title	Marks	Credits
113601	Paper-I	Descriptive Statistics	100	4

Descriptive Statistics: History of statistics, its definitions, nature and characteristics, Methods of statistics, Scope, applications and Limitations of statistics. Sources of statistical data, Primary and secondary data. Variables, Attributes, Classification, Tabulation, Different types of tables, Frequency distribution. Graphical presentation of data, Detailed study of different types of graphs and charts with their relative merits and demerits.

Measures of central tendency, Measures of dispersion, Moments, Skewness & Kurtosis and their properties. Bivariate data. Scatter diagram, Simple correlation, Rank correlation, Correlation ratio, Simple regression analysis, Principles of least squares, Lines of best fit, Standard error of estimators of regression coefficients & their properties. Multiple correlation, Partial correlation, Multiple regression, Estimation of multiple regression coefficients.

Books Recommended:

- 1 Islam, M.Nurul : An Introduction to Statistics and Probability, 4th Edition, Mullick & Brothers, Dhaka New Market
- 2 Mostafa, M.G : Methods of Statistics
- 3 Simpson G.& Kaafka, F. : Basic Statistics

- 4 Yule and Kendall, M.G. : An Introduction to the Theory of Statistics
- 5 Jalil A. & Ferdous, R : Basic Statistics: Methods Applications

Paper Code	Paper	Paper Title	Marks	Credits
113603	Paper-II	Probability and Probability Distributions	100	4

Probability: Elements of set theory. Experiment, Random Experiment Sample Space, Events, Union and Intersection of Events, Different types of events. Meaning of probability, Scope of probability, Different approaches of defining probability. Elementary theorems of probability, Additive & multiplication rule, permutation & combination. Conditional probability, Theorems on conditional probability, Theorem of total probability, Bayes' theorem and its uses and importance in statistics.

Random variable and its Probability Distributions: Discrete and continuous random variables, Probability density function, Distribution function, Function of random variable and its distribution, Joint distribution, marginal and conditional distributions, Independence of random variables, Mathematical expectation, Expectations of sum and products of random variables, Conditional expectation and conditional variance. Moments and moment generating functions, Characteristic function, Cumulants and cumulant generating functions, Relation between moments and cumulants.

Probability Distributions: Details study of Binomial, Negative Binomial, Geometric, Hypergeometric, Uniform, Normal, Exponential, Beta, Gamma, Lognormal, Cauchy, Pareto distributions and their properties.

Books Recommended:

- 1 Islam, M.Nurul : An Introduction to Statistics and Probability, 4th Edition, Mullick & Brothers, Dhaka New Market
- 2 Roy, M.K. : Fundamentals of Probability & Probability Distribution
- 3 Mosteller, Rourket : Probability with Statistical Applications.
Thomas
- 4 Hoq, M. S. : Probability : An Introduction
- 5 Ross : A First Course in Probability, Collier –McMillan, N.Y.
- 6 Feller, W. : Introduction to the Probability Theory and its Applications

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123601	Paper-III	Methods of Statistics	100	4

Sampling Distributions

Distribution of sample mean and variance and their independence, Detailed study of χ^2 , t and F distributions, Standard errors of statistics and their large sample approximations. Fisher's Z transformation, Distribution of sample correlation coefficient when population correlation coefficient is zero.

Estimation

Concept of Estimation and problem of estimation, Estimator and Estimate. Properties of a good estimator: Unbiasedness, Consistency, Efficiency, Sufficiency, Minimum Variance, Best asymptotically normal, Consistent asymptotically normal. UMVUE, Rao-Black Well Theorem, Cramer-Rao Inequality, MVB estimator, Use of Cramer-Rao inequality in finding UMVUE.

Point Estimation: ML method of estimation, Method of moments, method of Least Square, Method of minimum chi-square, Bayesian Method of Estimation.

Interval Estimation: Concept of interval estimation, Confidence interval, Confidence limit, Confidence bound, Confidence coefficients, Methods for finding confidence interval, Confidence interval for mean, variance, difference of means, ratio of variance.

Test of Hypothesis

Concept: Test of hypothesis, Logic behind tests of hypothesis, Neyman-Pearson's approach of testing hypothesis.

Preliminaries of tests: Hypothesis, simple and composite hypotheses, Null and alternative hypotheses, Concept of test of significance, procedures of testing a hypothesis, Test errors, Level of significance, One-tailed and two-tailed tests, P-value. Concept of test Statistics: Normal, T^2 , t and F statistics. Testing the significance of a single mean, Single variance, Single proportion, Difference of two means and proportions, Ratio of two variances and their confidence intervals. Paired t-test. Testing the homogeneity of several population means, Variance and proportions. Test of goodness of fit.

Books Recommended:

- 1 Mood, Graybill & Boes : Introduction to the Theory of Statistics 3rd ed. McGraw- Hill
- 2 Ashraf Ali : Methods of Statistics, Vol. II
- 3 Rao, C.R. : Linear Statistical Inference & its Applications, Wiley.
- 4 Islam, M, N. : An Introduction to Statistics and Probability, 4th Edition, Mullick & Brothers, Dhaka New Market
- 4 Mostafa, M.G. : Methods of Statistics
- 5 Hogg R.Y. and Craig, A.T : Introduction to mathematical statistics. McMillan- Collierm, N.Y.

Paper Code	Paper	Paper Title	Marks	Credits
123603	Paper-IV	Numerical Mathematics & Linear Algebra	100	4

Numerical Mathematics: Differences of a polynomial, Finite difference operator, Factorial notation. Newton's and backward interpolation formula. Central difference formula. Gauss, Stirling's and Lagrange's interpolation formulas. Interpolation with unequal interval of the argument. Numerical differentiation. Numerical integration by different formulae. Numerical solution of equations by various methods.

Linear Algebra: Vector space, Subspace, Linear independence, Basis & Dimension, Inner product, Length, Orthogonal Length, Orthogonal basis, Orthogonalisation process, Matrices & their properties, Matrix operations and their uses in Statistics. Inverse of matrices and their properties. Orthogonal, Idempotent, Patterned matrices and their properties and uses in Statistics.

Books Recommended:

- 1 Scarborough : Numerical Mathematical Analysis
- 2 Freeman, H : Finite differences for Actuarial Students
- 3 Mallick S.A. & M. E. : Numerical Mathematics, Mullick & Brothers, Dhaka New Market
- 3 Searle, S.R. : Matrix Algebra useful for Statistics
- 4 Rao, C.R. & Mitra : Generalized Inverses and its Applications
- 4 Mostafa, M.G. : Methods of Statistics
- 5 Rahman, A : College Degree Algebra

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133601	Paper-V	Applied Statistics-I	100	4

Index number

Concept of index number, Problems in the construction of index number, Construction of simple and weighted indices, cost of living index number.

Time Series Analysis

Different components of time series data. Measurement of secular trend, seasonal, cyclical and irregular components by different methods. Test of randomness of a time series data. Effect of moving average on cyclical and irregular components.

Demography

Definition, nature and scope of demography. Sources of demographic data: Vital registration, Survey and Census. Rates, ratios, and proportions. Age-Sex composition, Errors in age-sex data, detecting errors in age data. Population pyramid. Concept of population change, Population growth, Measurement of population growth with special reference to Bangladesh.

Concept of fertility, Reproduction. Measures of fertility and reproduction, Cohort fertility. Concepts of mortality and morbidity, Measures of mortality, Trends of mortality, of morbidity.

Definition, use and functions of life tables, different types of life table, construction of life tables. Actuarial life table, its construction and application

Industrial and Official statistics

Nature and scope of industrial & official statistics, Concept & importance of quality control. Quality control measures. Statistical quality control techniques, its uses and usefulness. Product

control and process control. Assignable and Non-assignable causes of variation. Control charts. Construction of control charts. Acceptance sampling. Sources and limitations of official statistics, Education Statistics, Different types of scores, I.Q. Construction of tests.

Books Recommended:

- | | | | |
|----|--|---|--|
| 1 | Chatfield | : | The Analysis of Time Series: An Introduction |
| 2 | Box and Jenkins | : | Time Series Analysis |
| 3 | Shryock, H.S. Siegel, J.S. et al. | : | The Methods and Materials of Demography |
| 4 | Barclay, G.W. | : | Techniques of Population Analysis |
| 5 | Chiang, C.L. | : | The Life Table and its Application |
| 6 | Speigelman | : | Introduction to Demography |
| 7 | Pollard, S.H. Farhat, Y.& Pollard, G.N | : | Demographic Technique |
| 8 | Biswas, S. | : | Stochastic Process in Demography and Application, Wiley Eastern Ltd. |
| 9 | Duncan, A.J. | : | Quality Control and Industrial statistics |
| 10 | Gupta and Kapoor | : | Applied Statistics |
| 11 | Grant, E.L | : | Statistical Quality Control |

Paper Code	Paper	Paper Title	Marks	Credits
133603	Paper-VI	Applied Statistics-II	100	4

Analysis of Variance

Concepts, Definitions & Assumptions. One way, Two way & Three way classifications, Experimental Design & Sample Design, Principles of design. Basic designs: CRD, RBD, LSD, their relative efficiency, Analysis with missing values, ANOVA in Different designs. Basic concepts of factorial experiments, 2^2 , 2^3 , Analysis, interpretation and uses of above mentioned factorial experiments.

Sample Survey

Basic concept to sample survey, relative advantages, disadvantages and suitability of complete and sample enumeration. Uses of sample survey. Role of sampling theory. Requirements of a good sample design. Population, Sampling units, Sampling frame and related problems. Basic principles of sample survey. Various steps involved in a sample survey. Pilot survey. Random or probability sampling and Non-random or purposive sampling. Mixed sampling.

Different types of errors associated with sampling such as sampling errors & Non sampling errors and complete enumeration. Various methods of data collection. Questionnaire and schedule. Preparation of questionnaire. Different types of random sampling. Details study of Simple random sampling, Stratified random sampling and Systematic sampling.

Books Recommended:

- 1 Montgomery, D.C. : Design and Analysis of Experiments (2nd ed.), Wiley
- 2 Kempthorne : Design and Analysis of Experiments, Wiley
- 3 Scheffe, H. : Analysis of Variance, Wiley
- 4 S.A Mallick : Parikhaner Design
- 5 Cochran, W.G. : Sampling Techniques
- 6 Hansen, Hurwitz and Madow : Sampling Techniques

Paper Code	Paper	Paper Title	Marks	Credits
133604	Paper-VII	Practical	100	4

Condensation and tabulation of data, Frequency distribution, Graphical representation of data, Measures of location and dispersion. Measures moments, Skewness and kurtosis. Simple correlation co – efficient and fitting of regression lines. Rank correlation & Correlation ratio.

Drawing of commonly used curves: Binomial, Poisson & Normal. Exercises of fittings of Different probability distributions with standard Errors. Common tests of significance of Mean, Variance, Proportion, Correlation coefficient and Regression coefficient. Fitting of theoretical distributions and testing of goodness of fit. Tests of large samples, contingency table test, Exact test, Approximate test. Tests of homogeneity.

Analysis of CRD, RBD & LSD. Missing plot estimation with analysis. Drawing of SRS, Estimation of parameters (mean & Variance).

Computing different types of index number. Cost of living index number. Determination of trend and seasonal variation by different methods from time series data. Measurement of fertility and mortality, Calculation of rates and ratios, Construction of life table.

Uses of interpolation formulae for equal and unequal interval. Use of Solution of equation. Numerical integrations.

NATIONAL UNIVERSITY



Syllabus Department of Zoology

Three Year B.Sc. (Pass) Course
Effective from the Session: 2013–2014

National University
Syllabus for Three Year B.Sc. Pass Course
Subject: Zoology
Session: 2013-2014
Course content and marks distribution

Paper Code	Paper	Paper Title	Marks	Credits
First Year				
113101	Paper-I	Nonchordate	100	4
113103	Paper-II	Chordata	100	4
Second Year				
123101	Paper-III	Cytology & Histology, Ecology and Molecular biology.	100	4
123103	Paper-IV	Embryology, Physiology, Animal adaptation, Evolution, Palaeontology and Zoogeography	100	4
Third Year				
133101	Paper-V	Ethology and Animal Genetics	100	4
133103	Paper-VI	Economic Zoology and Systematics	100	4
133104	Paper-VII	Practical	100	4
		Total =	700	28

Detailed Syllabus

First Year

Paper Code	Paper	Paper Title	Marks	Credits
113101	Paper-I	Nonchordate	100	4

- Broad classification of the following phyla up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh:

Sarcomastigophora, Apicomplexa, Ciliophora, Porifera, Coelenterata, Platyhelminthes, Nematoda, Mollusca, Annelida, Onychophora, Arthropoda, Echinodermata and Hemichordata.
- Type study of the followings with their systematic position, habitats, external morphology, organ systems, such as digestion, movement, circulation, respiration, excretion, nervous, reproduction; food and feeding habits, mode of life and development
 - Phylum Sarcomastigophora: Euglena, Entamoeba

- b. Phylum Apicomplexa: *Plasmodium*
- c. Phylum Ciliophora: *Paramecium*
- d. Phylum Porifera: *Scypha*,
- e. Phylum Coelenterata; *Obelia*
- f. Phylum Ctenophora: *Hormiphora*
- g. Phylum Platyhelminthes: *Fasciola*, *Taenia*
- h. Phylum Nematoda: *Ascaris*
- i. Phylum Rotifera: Any rotifer
- j. Phylum Mollusca; *Pila*
- k. Phylum Annelida: *Neanthes*
- l. Phylum Onychophora: *Peripatus*
- m. Phylum Arthropoda; Prawn
- n. Phylum Phoronida: *Phoronis*
- o. Phylum Echinodermata; *Astropecten*
- p. Phylum Hemichordata: *Balanoglossus*

3. Special study of the following:

- a. Protozoa: nuclear apparatus and nutrition
- b. Porifera: canal systems
- c. Coelenterata: polymorphism, Coral reef and reef formation
- d. Platyhelminthes: parasitic adaptations
- e. Annelida: segmental organs
- f. Arthropoda: crustacean larvae
- g. Echinodermata: larval forms

Books Recommended:

- 1. C. P. Hickman and L. S. Roberts. 199: Animal Diversity. Wm. C. Brown
- 2. J. W. Nybakken and J. McClintock. 1996: The Diversity of Invertebrates: Gulf of Mexico Version. Wm. C. Brown

3. L. S. Dillon. 1976: Animal variety; An Evolutionary Account. Wm. C. Brown Company Publisher Dubuque, Iowa
4. E. E. Ruppert and R. D. Barnes. 1994: Invertebrate Zoology (6" edition). Saunders College Publishing- Harcourt Brace College Publishers, New York, London
5. A. J. Marshal, W. D. William: Text Book of Zoology- Invertebrates. (Edited the edition of Text Book of Zoology, Vol. I, T. J. Parker and W. A. Haswell)
6. M. Sleigh. 1989: Protozoa and other Protists. Chapman and Hall Inc., New York

Paper Code	Paper	Paper Title	Marks	Credits
113103	Paper-II	Chordata	100	4

1. Broad classification of the followings up to orders with general and diagnostic characteristics of each taxonomic category with examples, particular reference to Bangladesh-
 Urochordata, Cephalochordata, Cyclostomata, Chondrichthyes,
 Osteichthyes, Amphibia, Reptilia, Aves and Mammalia
2. Type study of the followings with their systematic position, habitats, external morphology, anatomy including skeletal, digestive, circulatory, respiratory, excretory, nervous, reproductive and endocrine systems; food and feeding habits, mode of life and development
 - a. Urochordata: *Ascidia*
 - b. Cephalochordata: *Branchiostoma*
 - c. Cyclostomata: *Petromyzon*
 - d. Chondrichthyes: *Scoliodon*
 - e. Osteichthyes: *Labeo*
 - f. Amphibia: *Bufo/Rana*
 - g. Reptilia: *Hemidactylus*
 - h. Aves: *Columba*
 - i. Mammalia: *Cavia*
3. **Special study of the following:**
 - i. Poisonous and non poisonous snakes; snake venom and biting mechanism
 - ii. Mesozoic reptiles

- iii. Migration of birds
- iv. Flying mammals and marsupials
- v. Aquatic adaptations of mammals
- vi. Integument and its derivatives: fish fins and scales; feathers, beak, bills and claw of birds; nails, hooves and horns of mammals; dentition, teeth and their development, types of dentition, dental formula of mammals
- vii. Skeletal system: axial and appendicular skeletons of vertebrates
- viii. Digestive system: modification of the alimentary canal in different chordates
- ix. Circulatory system: modification of aortic arches and heart in reptiles, birds and mammals
- X. Urinogenital system: excretory system; pro-, meso-, and metanephridic kidneys; reproductive system.

Books Recommended:

1. M. Hildebrand. 1994: Analysis of Vertebrate Structure. John Wiley & Sons. Inc., New York
2. G. C. Kent and L. Miller. 1997: Comparative Anatomy of the Vertebrates. McGraw Hill
3. J. Young, 1981: Life of Vertebrates. OUP, USA
4. F. H. Pough, J. B. Heiser and W. N. McFarland. 1997: Vertebrate Life. Prentice Hall
5. K. V. Kardong. 1997: Vertebrates: Comparative Anatomy, Function, Evolution. Wm. C. Brown
6. R. M. Alexander. 1977: The Chordates. Vikas Publishing House Pvt. Ltd., New Delhi
7. R. Pearson and J. N. Ball. 1981: Lecture Notes on Vertebrate Zoology. Blackwell Science.
8. T. J. Parker and W. A. Haswell: A Text Book of Zoology. Vol. II. Macmillan & Co., London
9. C. K. Weichert: Anatomy of the Chordates

Second Year

Paper Code	Paper	Paper Title	Marks	Credits
123101	Paper-III	Cytology & Histology, Ecology and Molecular biology.	100	4

Cytology & Histology

1. Definition of cytology and histology
2. History of cytology
3. Ultra-structures of cell; cell divisions; morphology of sperm and ovum
4. Tissue: types and functions

Books Recommended:

1. G. B. Wilson and J. H. Morrison: Cytology. Affiliated East-West Press Pvt. Ltd., New Delhi
2. J. R. Baker. 1966: Cytological Technique. John Wiley & Sons

Ecology:

1. Definition, structure, component and function of ecosystem; Energy and its flow in Ecosystem; Biogeochemical cycles: carbon, nitrogen and carbon dioxide; Aquatic Ecosystem of a pond
2. Definition of population; population growth forms: J and S- shaped growth forms
Concept of carrying capacity
3. Major biomes of the world
4. Environmental pollution: air, water, soil and noise- their sources, effects and remedial measures
5. Conservation of natural resources; concept and classification of resources; renewable and non-renewable resources and their management
6. Consequences of the loss of natural resources
7. Concept of biodiversity.

Books Recommended:

1. R. L. Smith. 1998: Elements of Ecology. Longman
2. M. Begon, J. L. Harper and C. R. Townsend. 1996: Ecology: Individuals, Populations and Communities. Blackwell Science

3. C. J. Krebs. 1993: Ecology- The Experimental Analysis of Distribution and Abundance. Harper Collins, New York
4. E. A. Laws. 2000: Aquatic Pollution: An Introductory Text. Wiley
5. A. Dobson. 1996: Conservation and Biodiversity. Scientific American
6. J. Turk, J. Wittes, R. Wittes and A. Turk: Ecosystems Energy, Population. W.B. Saunders Company, Philadelphia, London
7. B. Groombridge and M.D. Jenkins. 1996: Assessing Biodiversity Status and Sustainability. WCWC
8. K. J. Gaston and J. I. Spicer. 1998: Biodiversity: An Introduction. Blackwell Science
9. M. Jeffries. 1997: Biodiversity and Conservation. Routledge
10. E. P. Odum: Fundamentals of Ecology. W. B. Saunders Com. London

Molecular biology:

1. Gene: nature, chemical composition and functions
2. Chemistry and function of nucleic acids; DNA and RNA
3. Replication of DNA; Transcription of RNA
4. Types of RNA
5. Genetic engineering; concept and techniques; gene cloning
6. Biotechnology: concept, techniques and its scope in Bangladesh

Books Recommended:

1. A. Bruce, D. Brey and J.D. Watson. 1994: Molecular Biology of the Cell. (3rd Ed.) Garland Publ. Inc.
2. J. D. Watson et al. Modern Biology of the Gene. Benjamin Inc., California, London
3. S. M. Kingsman and A. J. Kingsman Genetic Engineering
4. A. Wiseman. Principles of Biotechnology
5. S. B. Primrose Modern Biotechnology
6. S. B. Primrose Principles of Gene Manipulation
7. J. Bullock and B. Kristiansen Basic Biotechnology
8. D. M. Glover Principles of Gene Cloning

9. J. M. Walker and E. B. Gingold Molecular Biology and Biotechnology
10. E. De Robertis and E. M. De Robertis, Jr. 1981: Essentials of Cell and Molecular Biology. Saunders College Publishing, New York

Paper Code	Paper	Paper Title	Marks	Credits
123103	Paper-IV	Embryology, Physiology, Animal adaptation, Evolution, Palaeontology and Zoogeography	100	4

Palaeontology and Zoogeography.

Embryology:

1. Gametogenesis- spermatogenesis and oogenesis in mammals
2. Types of eggs in animals
3. Fertilization and types of cleavage
4. Extra embryonic membranes in amniotes
5. Placentation in mammals
6. Development of Neanthes and Callus
7. Embryonic circulation and nutrition

Books Recommended:

1. S. F. Gilbert and A. M. Raunio (Editors). 1997: Embryology: Constructing the Organism. Sinauer
2. B. I. Balinsky: An Introduction of Embryology
3. B. H. Wilier and J. M. Oppenheimer. 1968: Foundations of Experimental Embryology. Prentice- Hall of India Pvt. Ltd., New Delhi

Physiology

1. Homeostasis: definition, role or various systems of body in homeostasis
2. Food and nutrition; definition and types; digestion and absorption of different types of food
3. Vitamins: sources, properties and deficiency symptoms
4. Metabolism: definition; carbohydrates, lipid and protein metabolism

5. Circulation: cardiac cycle; blood- components and functions; mechanism of coronary and pulmonary circulations
6. Respiration: mechanism of breathing, pulmonary ventilation, external and internal respiration
7. Excretion: excretory system, structure and functions of kidney, mechanism of formation of urea, ultra filtration and reabsorption, osmoregulation, regulation of blood pH, composition of urine
8. Hormones: types and functions

Books Recommended:

1. C. C. Chatterjee: Human Physiology. Vols. I & II
2. W. H. Davson: A Text Book of General Physiology
3. G. L. Presser and P. A. Brown: Comparative Animal Physiology

Animal adaptation:

1. Introduction and definition.
2. Adaptive diversity in nonchordates particular reference to their habitats and feeding habits
3. Adaptive radiation and the distribution of organisms

Books Recommended:

1. M. R. Rose and G. V. Lauder. 1996: Adaptation. Academic Press
2. R. N. Brandon. 1995: Adaptation and Environment. Princeton UP, USA

Evolution:

1. Theories of evolution: Lamarck, Darwin, Wallace and synthetic
2. Evidences of organic evolution: biogeography, comparative anatomy, physiology, embryology, Palaeontology and genetics
3. Convergent, divergent and parallel evolution

Books Recommended :

1. S. Stearus and R. Hoekstra. 2000: Evolution: An Introduction. OUP, USA
2. G. Bell. 1996: Selection: The Mechanism of Evolution. Chapman & Hall
3. J. B. S. Haldane. 1990: The Causes of Evolution. Princeton UP, USA
4. R. Lewin. 1997: Human Evolution. Blackwell Science
5. T. J. Givnish and K. J. Sytsma. 1997: Molecular Evolution and Adaptive

Radiation. CUP

6. R. Leakey. 1998: The Evolution of Man: An Illustrated History of Human Origins. Ebury Press

Palaeontology:

1. Process of fossilization, types of fossils, significance of fossils, fossil dating methods
2. Geological time table
3. Palaeontological history of horse and man

Books Recommended:

1. A. M. Davis: An Introduction to Palaeontology
2. H. H. Swinerton: Outlines of Palaeontology
3. Tyage A. P. and G. S. Rao: Introduction to Palaeontology
4. C. E. Brett and G. C. Baird (Editors). 1997: Palaeontological Events: Stratigraphic, Ecological and Evolutionary Implications. Columbia UP, USA
5. H. H. Converse. 1999: Handbook of Paleo-Preparation Techniques. Florida UP, USA

Zoogeography:

1. History of the distribution of the land and water bodies of the world,
Gondwana land and continental drift theories
2. Zoogeographical regions and sub-regions of the world-their boundaries, physical characteristics, climatic conditions, vegetation and fauna with particular reference to Bangladesh
3. Pleistocene glaciation and its influence on the distribution of animals
4. Insular fauna

Books Recommended:

1. P. J. Darlington. 1998: Zoogeography: The Geographical Distribution of Animals. Krieger, USA.

Third Year

Paper Code	Paper	Paper Title	Marks	Credits
133101	Paper-V	Ethology and Animal Genetics	100	4

Ethology:

1. Orientation: taxes, kineses
2. Instinct behaviour
3. Learning behaviour
4. Communication behaviour: sounds, pheromones, etc.
5. Parental care of Amphibia
6. Migration of fishes
7. Social behaviour of honey bee
8. Breeding behaviour of three-spine stickle back and sea gull

Animal Genetics:

1. Introduction
2. Mendel's principles of segregation and of independent assortment
3. Modification of Mendelian ratio
4. Test cross and back cross
5. Linkage and crossing over
6. Mutation and chromosomal aberrations
7. Sex linked, sex limited and sex influenced inheritance
8. Sex determination

Books Recommended:

1. E.W. Sinnott, L.C. Dunn and Dobzhansky: Principles of Genetics. McGraw Hill
Book Co. New York
2. A. S. Islam: Fundamentals of Genetics. Vikas Publishing House Pvt. Ltd

3. R. F. Weaver and P. W. Hedrick. 1995: Basic Genetics. Wm. C. Brown

Publisher, Dubuque, Iowa

4. T. A. Brown. 1997: Genetics: A Molecular Approach. Chapman and Hall

Paper Code	Paper	Paper Title	Marks	Credits
133103	Paper-VI	Economic Zoology and Systematics	100	4

Economic Zoology:

1. Apiculture: life cycle of a honey producing bee species; types of hive; honey processing
2. Sericulture: varieties of silkworm and their host plants; techniques of silkworm rearing; silkworm diseases and pests, and their control
3. Lac culture: systematic position and distribution of lac insects; life cycle of a lac insect species; collection and processing of lac
4. Integrated Pest Management (IPM): concept; components of IPM
5. Carp culture: carp culture including induced breeding of carps in ponds
6. Prawn and shrimp culture: types, techniques and management
7. Poultry farming: varieties of fowls and ducks; techniques of poultry farming; diseases of poultry and their control; economic importance of poultry
8. Economic importance of Molluscs
9. Economic importance of amphibians and reptiles in Agriculture, Fisheries and Forestry
10. Animal husbandry: concepts, farming of domestic animals- cattle and goats, diseases of domestic animals and their control, economic importance of farm animals.

Books Recommended:

1. Dennis S. Hill. 1997: The economic importance of insects (1st edition). Chapman and Hall, London
2. D. Dent: Integrated Pest Management. Chapman & Hall, London
3. R. Wall and D. Shearer. 1997: Veterinary Entomology. Chapman and Hall
4. M. Huet. 1986: Text Book of Fish culture-Breeding and Cultivation of Fish (2nd Edition) Fishing News Books

5. V. G. Jhingran and R. S. V. Pullin. 1985: A Hatchery Manual for the Common Chinese and Indian Major Carps ADB/ICLARM
6. P. R. Boyle: Molluscs and man. Edward Arnold, London

Systematics:

1. Definition of taxonomy, systematics, classification and nomenclature
2. Taxonomic hierarchy
3. Species concept
4. Taxonomic keys- types and significance
5. International Code for Zoological Nomenclature (ICZN), rules of nomenclature
6. Type methods
7. Law of priority

Books Recommended:

1. G. G. Simpson. 1990: Principles of Animal Taxonomy. Columbia UP, USA
2. E. Mayr and P. D. Ashlock. 1997: Principles of Systematic Zoology. McGraw Hill
3. V. C. Kapoor. 1988: Theory and Practice of Animal Taxonomy. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
4. W. D. L. Ride et al. (Editors) 1999: International Code of Zoological Nomenclature (ICZN)

Paper Code	Paper	Paper Title	Marks	Credits
133104	Paper-VII	Practical	100	4

I. Nonchordates:

1. Study of museum specimens; representative of non-chordate phyla (minimum 50 specimens to be studied)
2. Study of permanent slides: whole mount, body parts, and various cells (at least 20 slides to be studied)
 - a. Whole animals- representatives of Protozoa and Arthropoda; mouth parts of Arthropoda

- b. Parasites- Nematode and Platyhelminthes
- c. Different larval forms of invertebrates
- 3. External morphology and dissection of various organ systems of earthworm, cockroach, prawn and *Pila*:
 - a. Digestive system of earthworm, cockroach, prawn and *Pila*
 - b. Circulatory system of earthworm and prawn
 - c. Nervous system of earthworm, cockroach, prawn and *Pila*
 - d. Reproductive system of earthworm and cockroach
- 4. Temporary mounting:
 - a. Brain, ovary and nephridium of earthworm
 - b. Salivary gland of cockroach
 - c. Statocyst of prawn
 - d. Mouth parts of mosquito

II. Chordates:

- 1. Study of museum specimens: representatives of all types of chordates particular reference to Bangladesh (minimum 50 specimens to be studied)
- 2. Dissection: dissection of the following specimens-
 - i. Lata fish- digestive system; afferent and efferent blood vessels
 - ii. Frog/toad- digestive system and circulatory systems
 - iii. Lizard- digestive and circulatory systems
- 3. Histological slides of vertebrates
- 4. Temporary mounting- scales and weberian ossicle of fishes; hyoid apparatus of toad; preparation of blood smear
- 5. Study of bones: Comparative study of the skeletons of amphibian, reptile, bird and mammal

III. Fresh water studies: identification of micro fauna in fresh water samples

- IV. Field visit to observe local invertebrate and vertebrate fauna and their habitats, and prepare a report on the visit. Students will also collect specimens and submit these along with the report in the final practical examination to be held in the 3rd year.

Distribution of marks for final examination:

1. Dissection:
 - a.) Nonchordate: (dissection 7 + display 2 + drawing & labeling 3) = 12 marks
 - b.) Chordate: (dissection 7 + display 2 + drawing & labeling 3) = 12 marks
2. Temporary mount: (any one from either nonchordates or chordates)
(Staining, mounting and displaying) = 6 marks
5. Spotting of museum specimens; invertebrates, vertebrates, whole mount slide, histological slide and bones

Items and numbers:

- a.) Invertebrate museum specimens: 7 specimens x 2 = 14 marks
- b.) Vertebrate museum specimens: (Chondrichthyes-1, Osteichthyes-1, Amphibia-1, Reptilia-1, Aves-1, & Mammalia-1): 6 specimens x 2 = 12 marks
- c.) Slide whole mount- 1x2 = 2 marks
- d.) Histological slide-1x2 = 2 marks
- e.) bones- 3x2 = 6 marks
4. Fresh water studies: (3 micro species to be shown- Identification 1 mark, classification 0.5 mark, and characters 0.5 mark)-
3 specimens x 2 marks for each = 6 marks
5. Collection of specimens (4 invertebrates and 2 vertebrates) and report writing- (collection 4 + report writing 4) = 8 marks
6. Class records = 10 marks
7. Viva-voce = 10 marks