ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

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REVISED SYLLABUS OF BOTANY UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

<u>PROGRAMME: THREE-YEAR BOTANY</u>

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

APSCHE/ REVISION OF C.B.C.S – BOTANY COURSE W.E.F.2020-21

S. No.	Semester	Title of the Course (Paper)	Hours /week	Max. Marks (SEE)	Marks in CIA	Credits
1.	Sem.-I/ Course-1	Fundamentals of Microbes and Non-vascular Plants	04	75	25	03
	Course-1 Practical	Fundamentals of Microbes and Non-vascular Plants	03	Max. Marks-50 Internal assessment at Semester end		02
2.	Sem.-II/ Course-2	Basics of Vascular plants and Phytogeography	04	75	25	03
	Course-2 Practical	Basics of Vascular plants and Phytogeography	03	Max. Marks-50 External assessment at Semester end		02
3.	Sem.-III/ Course-3	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	04	75	25	03
	Course-3 Practical	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	03	Max. Marks-50 Internal assessment at Semester end		02
4.	Sem.-IV Course-4	Plant Physiology and Metabolism	03	75	25	03
	Course-4Practical	Plant Physiology and Metabolism	03	Max. Marks-50 External assessment at Semester end		02
5.	Sem.- IV Course- 5	Cell Biology, Genetics and Plant Breeding	04	75	25	03
	Course-5Practical	Cell Biology, Genetics and Plant Breeding	03	Max. Marks-50 External assessment at Semester end		02
6.	Sem.– V Course – 6 & 7	Domain related Skill Enhancement Courses (02) - Three (3) pairs ofcourses (each pair has 2 related courses) will be offered, student has to choose a pair of courses.	03	75	25	03
			03	Max. Marks-50 Internal assessment at Semester end		02
			03	75	25	03
			03	Max. Marks-50 Internal assessment at Semester end		02

CBCS / Semester System (w.e.f. 2020-‘21 Admitted Batch)

I Semester /Botany Core Course - 1

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning Outcomes:

On successful completion of this course, the students will be able to:

- Explain origin of life on the earth.
- Illustrate diversity among the viruses and prokaryotic organisms and can categorize them.
- Classify fungi, lichens, algaeand bryophytes based on theirstructure, reproduction and life cycles.
- Analyze and ascertain the plant disease symptoms due to viruses, bacteria and fungi.
- Recall and explain theevolutionary trends among amphibians of plant kingdom for their shift to land habitat.
- Evaluate the ecological and economic value of microbes, thallophytes and bryophytes.

Unit – 1:Origin of life and Viruses 12Hrs.

1. Origin of life, concept of primary Abiogenesis;Miller and Urey experiment.Five kingdom classification of R.H. Whittaker
2. Discovery of microorganisms,Pasteur experiments, germ theory of diseases.
3. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplicationof TMV; A brief account of Prions and Viroids.
4. A general account on symptoms of plant diseases caused by Viruses.Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production,bio-pesticides and as cloning vectors.

Unit – 2:Special groups of Bacteria and Eubacteria 12Hrs.

1. Brief account of Archaebacteria, ActinomycetesandCyanobacteria.
2. Cell structure and nutritionof Eubacteria.

3. Reproduction- Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation,Transduction).
4. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
5. A general account on symptoms of plant diseases caused by Bacteria; Citrus canker.

Unit – 3: Fungi & Lichens 12 Hrs.

1. General characteristics of fungi and Ainsworth classification (upto classes).
2. Structure, reproductionand life history of(a)*Rhizopus*(Zygomycota)and (b)*Puccinia* (Basidiomycota).
3. Economic uses of fungi in food industry, pharmacy and agriculture.
4. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice.
5. Lichens- structure and reproduction; ecological and economic importance.

Unit – 4: Algae 12 Hrs.

1. General characteristics of Algae (pigments, flagella and reserve food material);Fritsch classification (upto classes).
2. Thallus organization and life cycles in Algae.
3. Occurrence, structure, reproduction and life cycle of (a) *Spirogyra* (Chlorophyceae) and (b) *Polysiphonia* (Rhodophyceae).
4. Economic importance of Algae.

Unit – 5:Bryophytes 12 Hrs.

1. General characteristics of Bryophytes; classification upto classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) *Marchantia* (Hepaticopsida) and (b) *Funaria*(Bryopsida).
3. General account on evolution of sporophytes in Bryophyta.

Text books:

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-I,* S. Chand Publishing, New Delhi
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I,* New Central Book Agency Pvt. Ltd., Kolkata
- Bhattacharjee, R.N., (2017) *Introduction to Microbiology and Microbial Diversity*, Kalyani Publishers, New Delhi.

Books for Reference:

- Dubey, R.C. &D.K.Maheswari (2013) *A Text Book of Microbiology,*S.Chand& Company Ltd., New Delhi
- Pelczar Jr., M.J., E.C.N. Chan &N.R.Krieg (2001)*Microbiology*, Tata McGraw-Hill Co, New Delhi
- Presscott, L. Harley, J. and Klein, D. (2005)*Microbiology, 6th edition*, Tata McGraw –Hill Co. New Delhi.
- Alexopoulos, C.J., C.W.Mims&M.Blackwell (2007) *Introductory Mycology,*Wiley& Sons, Inc., New York
- Mehrotra, R.S. & K. R. Aneja (1990)*An Introduction to Mycology*. New Age International Publishers, New Delhi
- Kevin Kavanagh (2005) *Fungi ; Biology and Applications* John Wiley & Sons, Ltd.,West Sussex, England
- John Webster & R. W. S. Weber (2007) *Introduction to Fungi*,Cambridge University Press, New York
- Fritsch, F.E. (1945)*The Structure & Reproduction of Algae (Vol. I & Vol. II)*Cambridge UniversityPress Cambridge, U.K..
- Bold, H.C. & M. J. Wynne (1984)*Introduction to the Algae*, Prentice-Hall Inc., New Jersey
- Robert Edward Lee (2008)*Phycology*. Cambridge University Press, New York
- Van Den Hoek, C., D.G.Mann&H.M.Jahns (1996)*Algae : An Introduction to Phycology*. Cambridge University Press, New York
- Shaw, A.J.&B.Goffinet (2000)*Bryophyte Biology*.Cambridge University Press, New York.

Practical syllabus ofBotanyCoreCourse – 1/ Semester – I

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

Course Outcomes: Onsuccessful completion of this practical course, student shall be able to;

1. Demonstrate the techniques of use of lab equipment, preparing slides and identify the material and draw diagrams exactly as it appears.
2. Observe and identify microbes and lower groups of plants on their own.
3. Demonstrate the techniques of inoculation, preparation of media etc.
4. Identify the material in the permanent slides etc.

Practical Syllabus:

1. Knowledge of Microbiology laboratory practices and safety rules.
2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, Laminar air flow chamber and Incubator) and their working principles. (In case of the non-availability of the laboratory equipment the students can be taken to the local college/clinical lab. with required infrastructural facilities or they can enter a linkage with the college/lab for future developments and it will fetch creditsduring the accreditation by NAAC).
3. Demonstration of Gram's staining technique for Bacteria.
4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
5. Study of Archaebacteriaand Actinomycetes using permanent slides/ electron micrographs/diagrams.
6. Study of *Anabaena* and *Oscillatoria*using permanent/temporary slides.
7. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent or temporary slides/ electron micrographs/ diagrams.
8. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
   a. Fungi : *Rhizopus*,*Penicillium*and*Puccinia*

b. Lichens: Crustose, foliose and fruiticose
c. Algae :*Volvox, Spirogyra*, *Ectocarpus*and *Polysiphonia*
d. Bryophyta : *Marchantia*and *Funaria*

9. Study of specimens of Tobacco mosaic disease, Citrus canker and Blast of Rice.

Model Question Paper for Practical Examination

Semester – I/ Botany Core Course – 1

Fundamentals of Microbes and Non-vascular Plants

(Viruses, Bacteria, Fungi, Lichens, Algae and Bryophytes)

Max. Time: 3 Hrs. Max. Marks: 50

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1. Take the T.S. of material 'A' (Fungi), make a temporary mount and make comments about identification. 10 M
2. Identify any 2 algae from the mixture (material 'B') given with specific comments about identification. 10 M
3. Take the T.S. of material 'C' (Bryophyta), make a temporary mount and make comments about identification. 10 M
4. Identify the following with specific reasons. 4x 3 = 12 M

   D. A laboratory equipment of Microbiology

   E. Virus

   F. Archaebacteria /Ascomycete /Cyanobacteria/ Eu-Bacteria

   G. Lichen
5. Record + Viva-voce 5+3 = 8 M

Suggested co-curricular activities for Botany Core Course-1 in Semester-I:

A. **Measurable :**

   a. **Student seminars :**

      1. Baltimore classification of Viruses.
      2. Lytic and lysogenic cycle of T- even Bacteriophages.
      3. Viral diseases of humans and animals.
      4. Retroviruses
      5. Bacterial diseases of humans and animals.
      6. Significance of Bacteria in Biotechnology and Genetic engineering.
      7. Fungi responsible for major famines in the world.
      8. Poisonous mushrooms (Toad stools).
      9. Algae as Single Cell Proteins (SCPs)
      10. Parasitic algae

11. Origin of Bryophytes through : Algae vsPteridophytes
12. Fossil Bryophytes
13. Evolution of gametophytes in Bryophyta.
14. Ecological and economic importance of Bryophytes.

b. Student Study Projects :

1. Isolation and identification of microbes from soil, water and air.
2. Collection and identification of algae from fresh /estuarine /marine water.
3. Collection and identification of fruiting bodies of Basidiomycetes and Ascomycetes.
4. Collection and identification of Lichens from their native localities.
5. Collection of diseased plants/parts and identification of symptoms.
6. Collection and identification of Bryophytes from their native localities.

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to Agriculture and/or Horticulture University/College/Research station to learn about microbial diseases of plants.
2. Visit to industries working on microbial, fungal and algal products.
3. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

II Semester /BotanyCoreCourse – 2

Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms,Taxonomy of Angiosperms and Phytogeography)

(Total hours of teaching – 60 @ 02 Hrs./Week)

Theory:

Learning Outcomes:

On successful completion of this course,the students will be able to:

- Classify and compare Pteridophytes and Gymnosperms based on their morphology, anatomy, reproduction and life cycles.
- Justifyevolutionary trends in tracheophytes to adapt for land habitat.
- Explain the process of fossilization and compare the characteristics of extinct and extant plants.
- Critically understand various taxonomical aids for identification of Angiosperms.
- Analyze the morphology of the most common Angiospermplantsof their localities and recognize their families.
- Evaluate the ecological, ethnic and economic value of different tracheophytes and summarize their goods and services for human welfare.
- Locate different phytogeographical regions of the world and India and can analyze their floristic wealth.

Unit – 1:Pteridophytes **12 Hrs.**

1. General characteristics of Pteridophyta; classification of Smith (1955)uptodivisions.
2. Occurrence, morphology,anatomy, reproduction (developmental details are notneeded) and life historyof (a) *Lycopodium* (Lycopsida) and (b) *Marsilea* (Filicopsida).
3. Stelar evolution in Pteridophytes;
4. Heterospory and seed habit.

Unit – 2:Gymnosperms **14 Hrs.**

1. General characteristics of Gymnosperms; Sporneclassification uptoclasses.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) *Cycas*(Cycadopsida) and (b) *Gnetum* (Gnetopsida).
3. Outlines of geological time scale.
4. A brief account on *Cycadeoidea.*

Unit – 3:Basic aspects of Taxonomy **13Hrs.**

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques,BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification;
5. Systematic description and economic importance of the following families:
   (a) Annonaceae (b) Curcurbitaceae

Unit – 4: Systematic Taxonomy **13 Hrs.**

1.Systematic description and economic importance of the following families:

(a) Asteraceae (b) Asclepiadaceae (c)Amaranthaceae(d) Euphorbiaceae

(e) Arecaceaeand (f) Poaceae

2. Outlines of Angiosperm Phylogeny Group (APG IV).

Unit – 5:Phytogeography **08 Hrs.**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Endemism – types and causes.
3. Phytogeographic regions of World.
4. Phytogeographic regions of India.
5. Vegetation types in Andhra Pradesh.

Text books:

- Botany – I (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – II (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Acharya, B.C., (2019) *Archchegoniates,* Kalyani Publishers, New Delhi
- Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II,* New Central Book Agency Pvt. Ltd., Kolkata
- Hait,G., K.Bhattacharya&A.K.Ghosh (2011) *A Text Book of Botany, Volume-I,* New Central Book Agency Pvt. Ltd., Kolkata
- Pandey, B.P. (2013)*College Botany, Volume-I,* S. Chand Publishing, New Delhi
- Pandey, B.P. (2013)*College Botany, Volume-II,* S. Chand Publishing, New Delhi

Books for Reference:

- Smith, G.M. (1971)*CryptogamicBotanyVol. II.*, Tata McGraw Hill, New Delhi
- Sharma,O.P.(2012)Pteridophyta. Tata McGraw-Hill, New Delhi
- Kramer, K.U.&P. S. Green (1990) *The Families and Genera of Vascular Plants, Volume –I*: *Pteridophytes and Gymnosperms*(Ed.K.Kubitzki) Springe-Verlag, New York
- Bhatnagar, S.P. &AlokMoitra (1996)*Gymnosperms*. New Age International, New Delhi
- Coulter, J.M. &C.J.Chamberlain(1910) *Morphology of Gymnosperms,*The University of Chicago Press, Chicago, Illinois
- Govil, C.M. (2007)*Gymnosperms : Extinct and Extant*. KRISHNA Prakashan Media (P) Ltd.Meerut& Delhi
- Sporne, K.R.(1971)*The Morphology of Gymnosperms.*Hutchinsons Co. Ltd., London
- Arnold, C.A., (1947) *An introduction to Paleobotany*McGraw –Hill Book Company,INC, New York
- Stewart,W.N., and G.W.Rothwell (2005) *Paleobotany and the evolution of plants* Cambridge University Press, New York
- Lawrence, George H.M. (1951) *Taxonomy of Vascular Plants.* The McMillan Co., New York
- Heywood, V. H. and D. M. Moore (1984)*Current Concepts in Plant Taxonomy.* Academic Press, London.

- Jeffrey, C. (1982)*An Introduction to Plant Taxonomy*. Cambridge University Press, Cambridge. London.
- Sambamurty, A.V.S.S. (2005)*Taxonomy of Angiosperms* I. K .International Pvt. Ltd., New Delhi
- Singh, G. (2012*). Plant Systematics: Theory and Practice.*Oxford & IBH Pvt. Ltd., NewDelhi.
- Simpson, M.G. (2006). *Plant Systematics.* Elsevier Academic Press, San Diego, CA,U.S.A.
- Cain, S.A . (1944)*Foundations of Plant Geography*Harper & Brothers, N.Y.
- Good, R. (1997)*The Geography of flowering Plants (2nd Edn.)*Longmans, Green &

  Co., Inc., London & Allied Science Publishers, New Delhi
- Mani, M.S (1974)*Ecology & Biogeography of India*Dr. W. Junk Publishers, The Haque

Practical syllabus ofBotanyCore Course – 2/ Semester – II

Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms,Taxonomy of Angiosperms and Phytogeography)(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course Outcomes:

On successful completion ofthiscourse students shall be able to:

1. Demonstrate the techniques of section cutting, preparing slides, identifying of the materialand drawing exact figures.
2. Compare and contrast the morphological, anatomical and reproductive features of vascular plants.
3. Identify the local angiosperms of the families prescribed to their genus and species level and prepare herbarium.
4. Exhibit skills of preparing slides, identifying the given twigs in the lab and drawing figures of plant twigs, flowers and floral diagrams as they are.
5. Prepare and preserve specimens of local wild plants using herbarium techniques.

Practical Syllabus:

1. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
   a. Pteridophyta : *Lycopodium* and *Marselia*
   b. Gymnosperms : *Cycas*and *Gnetum*
2. Study of fossil specimens of *Cycadeoidea* and *Pentoxylon*(photographs /diagrams can be shown if specimens are not available).
3. Demonstration of herbarium techniques.
4. Systematic / taxonomicstudy of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 number of Herbarium sheets of wild plants with the standard system is mandatory).
5. Mapping of phytogeographical regions of the globe and India.

Model Question Paper for Practical Examination

Semester – II/ Botany Core Course – 2

Basics of Vascular plants and Phytogeography

(Pteridophytes, Gymnosperms,Taxonomy of Angiosperms and Phytogeography)

Max. Time: 3 Hrs. Max. Marks: 50

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1. Take T.S. of the material 'A' (Pteridophyta), make a temporary slide and justify the identification with apt points. 10 M
2. Take T.S. of the material 'B' (Gymnosperms), make a temporary slide and justify the identification with apt points. 10 M
3. Describe the vegetative and floral characters of the material 'C' (Taxonomy of Angiosperms) and derive its systematic position. 10 M
4. Identify the specimen 'D' (Fossil Gymnosperm) and give specific reasons. 5 M
5. Locate the specified phytogeographical regions (2x2M) in the world / India (E) map supplied to you. 4 M
6. Record + Herbarium & Field note book + Viva-voce 5 +4+3 = 12 M

Suggested co-curricular activities for Botany Core Course-2 in Semester-II:

A. **Measurable :**
   a. **Student seminars :**
      1. Fossil Pteridophytes.
      2. Aquatic ferns and tree ferns
      3. Ecological and economic importance of Pteridophytes
      4. Evolution of male and female gametophytes in Gymnosperms.
      5. Endemic and endangered Gymnosperms.
      6. Ecological and economic importance of Gymnosperms.
      7. Floras and their importance: Flora of British India and Flora of Madras Presidency.
      8. Botanical gardens and their importance:National Botanic garden and Royal Botanic garden.
      9. Artificial, Natural and Phylogenetic classification systems.
      10. Molecular markers used in APG system of classification.
      11. Vessel less angiosperms.

12. Insectivorous plants.

13. Parasitic angiosperms.

14. Continental drift theory and species isolation.

b. Student Study Projects :

1. Collection and identification of Pteridophytes from their native locality/ making

an album by collecting photographs of Pteridophytes.

2. Collection and identification of Gymnospermsfrom their native locality/ making an album by collecting photographs of Gymnosperms.

4. Collection of information on famous herbaria in the world and preparation of a report.
5. Collection of information on famous botanic gardens in the world and preparation of a report.
6. Collection of data on vegetables (leafy and fruity) plants in the market and and preparation of a report on their taxonomy.

7. Collection and identification of fresh and dry fruits plants in the market and and preparation of a report on their taxonomy.

7. Collection of data on plants of ethnic and ethnobotanical importance from theirnative locality.
9. Preparation of a local flora by enlisting the plants of their native place.

c. Assignments: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to Botanic garden in a Research institute/University to see the live plants.
2. Virtual tour in websites for digital herbaria and botanic gardens.
3. Acquaint with standard floras like – Flora of Madras Presidency, Flora of their respective district in Andhra Pradesh.
4. Looking into vegetation of different phytogeographical regions using web resources.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

III Semester /Botany CoreCourse - 3

Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course, thestudents will be able to;

- Understand on the organization of tissuesand tissue systems in plants.
- Illustrate and interpret various aspects of embryology.
- Discuss the basic concepts of plant ecology, andevaluate the effects of environmental and biotic factors on plant communities.
- Appraise various qualitative and quantitative parameters to study the population and community ecology.
- Correlate theimportance of biodiversity and consequences due to its loss.
- Enlistthe endemic/endangered flora and fauna from two biodiversity hot spots in India and assess strategies for their conservation.

Unit – 1: Anatomy of Angiosperms 12 Hrs.

1. Organization of apical meristems: Tunica-carpus theory and Histogen theory.
2. Tissue systems–Epidermal, ground and vascular.
3. Anomalous secondary growth in *Boerhaavia* and *Dracaena.*
4. Study of timbers of economic importance - Teak, Red sanders and Rosewood.

Unit – 2: Embryology of Angiosperms 12 Hrs.

1. Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of male gametophyte.
2. Structure of ovule, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) and tetrasporic (*Peperomia*) types of embryo sacs.
3. Outlines of pollination, pollen – pistil interaction and fertilization.
4. Endosperm - Types and biological importance - Free nuclear, cellular,helobialand ruminate.
5. Development of Dicot (*Capsella bursa-pastoris*) embryo.

Unit – 3: Basics of Ecology 12 Hrs.

1. Ecology: definition, branches and significance of ecology.
2. Ecosystem: Concept and components, energy flow, food chain, food web, ecologicalpyramids.
4. Plants and environment: Climatic (light and temperature), edaphic and biotic factors.
5. Ecological succession:Hydrosere and Xerosere.

Unit – 4:Population, Community and Production Ecology 12 Hrs.

1. Population ecology: Natality, mortality, growth curves, ecotypes, ecads
2. Community ecology: Frequency, density, cover, life forms, biological spectrum
3. Concepts of productivity: GPP, NPP and Community Respiration
4. Secondary production, P/R ratio and Ecosystems.

Unit – 5:Basics of Biodiversity 12 Hrs.

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
3. Biodiversity Hot spots in India.Biodiversity in North Eastern Himalayas and Western Ghats.
4. Principles of conservation: IUCN threat-categories, RED data book
5. Role of NBPGR and NBA in the conservation of Biodiversity.

Text books:

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-II,* S. Chand Publishing, New Delhi
- Pandey, B.P. (2013) *College Botany, Volume-III,* S. Chand Publishing, New Delhi
- Bhattacharya, K., G. Hait&Ghosh, A. K., (2011) *A Text Book of Botany, Volume-II,* New Central Book Agency Pvt. Ltd., Kolkata

Books for Reference:

- Esau, K. (1971)*Anatomy of Seed Plants.* John Wiley and Son, USA.
- Fahn, A. (1990)*Plant Anatomy,* Pergamon Press, Oxford.
- Cutler, D.F., T. Botha & D. Wm. Stevenson (2008)*Plant Anatomy: An Applied Approach,* Wiley, USA.
- Paula Rudall (1987)*Anatomy of Flowering Plants: An Introduction to Structure and Development.* Cambridge University Press, London
- Bhojwani, S. S. and S. P. Bhatnagar (2000)*The Embryology of Angiosperms (4th Ed.),*Vikas Publishing House, Delhi.
- Pandey, A. K. (2000) *Introduction to Embryology of Angiosperms*. CBS Publishers & Distributors Pvt. Ltd. , New Delhi
- Maheswari, P. (1971)*An Introduction to Embryology of Angiosperms*. McGraw Hill Book Co., London.
- Johri, B.M. (2011)*Embryology of Angiosperms.* Springer-Verlag, Berlin
- Pandey, B.P. (2013)*College Botany, Volume-III,* S. Chand Publishing, New Delhi
- Bhattacharya, K., A. K. Ghosh, & G. Hait (2011) *A Text Book of Botany, Volume-IV,* New Central Book Agency Pvt. Ltd., Kolkata
- Kormondy, Edward J. (1996) *Concepts of Ecology,*Prentice-Hall of India Private Limited, New Delhi
- Begon, M., J.L. Harper & C.R. Townsend (2003) *Ecology,* Blackwell Science Ltd., U.S.A.
- Eugene P. Odum (1996)*Fundamentals of Ecology,*Natraj Publishers, Dehradun
- Sharma, P.D. (2012) *Ecology and Environment*. Rastogi Publications, Meerut, India.
- N.S.Subrahmanyam& A.V.S.S. Sambamurty (2008)*Ecology*Narosa Publishing House,

New Delhi

- A. K. Agrawal& P.P. Deo (2010) *Plant Ecology*,Agrobios (India), Jodhpur
- Kumar, H.D. (1992) *Modern Concepts of Ecology (7th Edn.,)*Vikas Publishing Co., New Delhi.
- Newman, E.I. (2000): *Applied Ecology*Blackwell Scientific Publisher, U.K.
- Chapman, J.L&M.J. Reiss (1992): *Ecology - Principles & Applications.*Cambridge University Press, U.K.
- Kumar H.D. (2000)*Biodiversity & Sustainable Conservation* Oxford & IBH Publishing Co Ltd. New Delhi.
- U. Kumar (2007) *Biodiversity : Principles & Conservation*,Agrobios (India), Jodhpur

Practical syllabus of BotanyCore Course – 3 /Semester – III

Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs./Week)

Course Outcomes:

On successful completion ofthispractical course students shall be able to:

1. Get familiarized with techniques of section making, staining and microscopic study of vegetative, anatomical and reproductive structure of plants.
2. Observe externally and under microscope, identify and draw exact diagrams of the material in the lab.
3. Demonstrate application of methods in plant ecology and conservation of biodiversityand qualitative and quantitative aspects related to populations and communities of plants.

Practical Syllabus

1. Tissue organization in root and shoot apices using permanent slides.
2. Anomalous secondary growth in stemsof *Boerhavia* and *Dracaena*.
3. Study of anther and ovule using permanent slides/photographs.
4. Study of pollen germination and pollen viability.
5. Dissection and observation of Embryo sac haustoria in *Santalum*or*Argemone.*
6. Structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
7. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
8. Developmental stages of dicot and monocot embryos using permanent slides / photographs.
9. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, rain gauze, and lux meter. (visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical).
10. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02 each).
11. Quantitative analysis of herbaceous vegetation in the college campus forfrequency, density and abundance.

12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer’s frequency distribution law.
13. Find out the alpha-diversity of plants in the area
14. Mapping of biodiversity hotspots of the world and India.

Model paper for Practical Examination

Semester – III/ Botany Core Course – 3

Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity

Max. Time: 3 Hrs. Max. Marks: 50

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1. Take T.S. of the material ‘A’ (Anatomy), prepare a temporary slide and justify the identification with specific reasons. 10 M
2. Write the procedure for the experiment ‘B’ (Embryology) and demonstrate the same. 10 M
3. Take T.S. of the material ‘C’, prepare a temporary slide and justify the identification with specific reasons. 10 M
4. Identify the following with specific reasons. 4 x 3 = 12 M

   D. Anatomy/Embryology

   E. Ecology instrument

   F. Mapping of Biodiversity hot spot

   G. Endemic/endangered plant/animal

5. Record + Viva-voce 5 + 3 = 8 M

Suggested co-curricular activities for Botany CoreCourse-3 in Semester-III:

A. Measurable :

a. Student seminars :

1. Anatomy in relation to taxonomy of Angiosperms.
2. Nodal anatomy
3. Floral anatomy
4. Embryology in relation to taxonomy of Angiosperms.
5. Apomictics and polyembryony.
6. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.
7. Deforestation and Afforestation.
8. Green house effect and ocean acidification.
9. The Montreal protocol and the Kyoto protocol.
10. Productivity of aquatic ecosystems.
11. Mangrove ecosystems in India.
12. Kollerulake – Ramsar site.
13. Biodiversity hotspots of the world.
14. Origin of Crop plants - Vavilov centers
15. Agrobiodiversity
16. International organizations working on conservation of Biodiversity
17. Nagoya protocol – ABS system.
18. Endemic and endangered plants in Andhra Pradesh.

b. Student Study Projects :

1. Stomata structure in plants from college campus/ their native place.
2. Report on xylem elements in plants using maceration technique.
3. Collection of information on famous herbaria in the world and preparation of a report.
4. Microscopic observations on pollen morphology from plants in college Campus/ their native locality.
5. Study report on germination and viability of pollen in different plants.
6. Observation of anthesis time in different plants and their pollinators.
7. A report on autecology and synecology of some plants in college campus or their native place.
8. Collection of photos of endemic/endangered plant and animal species to Makean album.

9. Biodiversity of the college or their own residential/ native area.
10. Collection of seeds/vegetative organs of rare plant species from their localities and to raise/grow in college garden

c. **Assignments**: Written assignment at home / during '0' hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Visit to an arboretum/silviculture station/Forest research institute to see the live timber yielding plants or to visit a local timber depot. to observe various woods.
2. Field visit to a nearby ecosystem to observe the abiotic-biotic relationships.
3. Visit to National park/Sanctuary/Biosphere reserve etc., to observe in-situ conservation of plants and animals.
4. Visit to a Botanical garden or Zoo to learn about ex-situ conservation of rare plants or animals.
5. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

IV Semester/ BotanyCore Course – 4

Plant Physiology and Metabolism

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course,the students will be able to;

- Comprehendthe importance of water in plant life and mechanisms for transport of water and solutes in plants.
- Evaluate the role of minerals in plant nutrition and their deficiency symptoms.
- Interpret the role of enzymes in plant metabolism.
- Critically understand the light reactions and carbon assimilation processes responsible for synthesis of foodin plants.
- Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
- Evaluate the physiological factors that regulategrowth and development in plants.
- Examine the role of light on flowering and explain physiology of plants under stress conditions.

Unit – 1: Plant-Water relations 10 Hrs.

1. Importance of water to plant life, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux).
4. Mechanism of phloem transport; source-sink relationships.

Unit – 2: Mineral nutrition, Enzymes and Respiration 14 Hrs.

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics.

4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

Unit – 3: Photosynthesis and Photorespiration 12 Hrs.

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation
3. Carbon assimilation pathways (C3,C4 and CAM);
4. Photorespiration - C2 pathway

Unit – 4: Nitrogen and lipid metabolism 12 Hrs.

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system.
2. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides, β-oxidation of fatty acids, Glyoxylate cycle.

Unit – 5: Plant growth - development and stress physiology 12 Hrs.

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brassinosteroids.
3. Physiology of flowering:Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence; physiological changes.

Text books:

- Botany – IV (Vrukshasastram-II) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III*, S. Chand Publishing, New Delhi
- Ghosh, A. K., K. Bhattacharya &G. Hait (2011) *A Text Book of Botany, Volume-III*, New Central Book Agency Pvt. Ltd., Kolkata

Books for Reference:

- Aravind Kumar & S.S. Purohit (1998) *Plant Physiology – Fundamentals and Applications*,AgroBotanica, Bikaner
- Datta, S.C. (2007) *Plant Physiology*,New Age International (P) Ltd., Publishers, New Delhi
- Hans Mohr & P. Schopfer (2006)*Plant Physiology*, Springer (India) Pvt. Ltd., New Delhi
- Hans-Walter heldt (2005) *Plant Biochemistry*,Academic Press, U.S.A.
- Hopkins, W.G. & N.P.A. Huner (2014)*Introduction to Plant Physiology*, Wiley India Pvt. Ltd., New Delhi
- Noggle Ray & J. Fritz (2013)*Introductory Plant Physiology*, Prentice Hall (India), New Delhi
- Pandey, S.M. &B.K.Sinha (2006)*Plant Physiology*, Vikas Publishing House, New Delhi
- Salisbury, Frank B. & Cleon W. Ross (2007)*Plant Physiology*, Thomsen & Wadsworth, Austalia&U.S.A
- Sinha, R.K. (2014) *Modern Plant Physiology*, Narosa Publishing House,New Delhi
- Taiz, L.&E. Zeiger (2003)*Plant Physiology*, Panima Publishers, New Delhi
- Verma, V.(2007)*Text Book of Plant Physiology*,Ane Books India, New Delhi

Practical Syllabus of BotanyCore Course – 4 / Semester – IV

Plant Physiology and Metabolism

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course outcomes: On successful completion of this practical course, students shall be able to:

1. Conduct lab and field experiments pertaining to Plant Physiology, that is, biophysical and biochemical processes using related glassware, equipment, chemicals and plant material.
2. Estimate the quantities and qualitative expressions using experimental results and calculations
3. Demonstrate the factors responsible for growth and development in plants.

Practical Syllabus

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo*/ *Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.

3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least for a dicot and a monocot).

4. Effect of Temperature on membrane permeability by colorimetric method.

5. Study of mineral deficiency symptoms using plant material/photographs.

6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzymeconcentration.

7. Separation of chloroplast pigments using paper chromatography technique.

8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C3, C4 and CAM leaves

10. Estimation of protein by biuret method/Lowry method

11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmic streaming.

Model Question Paper for Practical Examination

Semester – IV/ Botany Core Course – 4

Plant Physiology and Metabolism

Max. Time: 3 Hrs. Max. Marks: 50

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1. Conduct the experiment ‘A’ (Major experiment), write aim, principle, material and apparatus/equipment, procedure, tabulate results and make conclusion. 20 M
2. Demonstrate the experiment ‘B’ (Minor experiment), write the principle, procedure and give inference. 10 M
3. Identify the following with apt reasons. 3 x 4 = 12 M
   C. Plant water relations / Mineral nutrition
   D. Plant metabolism
   E. Plant growth and development
4. Record + Viva-voce 5 + 3 = 8 M

Suggested co-curricular activities for Botany Core Course-4 in Semester-IV:

A. Measurable :

a. Student seminars :

1. Antitranspirants and their significance in crop physiology and horticulture.
2. Natural chelating agents in plants.
3. Criteria of essentiality of elements and beneficial elements.
4. Hydroponics, aquaponics and aeroponics.
5. Mycorrhizal association and mineral nutrition in plants.
6. Non-proteinaceous enzymes.
7. Respiratory inhibitors.
8. Structure of ATPase and Chemiosmotic hypothesis.
9. Transpiration and photosynthesis – a compromise.
10. Amphibolic pathways and bypass pathways in plants.
11. Non-biological nitrogen fixation.
12. Role of Hydrogenase in nitrogen fixation.
13. Plant lectins – their role in plants and use in medicine and medical research.

b. Student Study Projects :

1. Stomatal densities among different groups of plants.
2. Various treatments (salt, cold, high temperature, heavy metals) and their effects on seed germination.
3. Effects of plant hormones (IAA, Gibberellin and Kinetin) on Seed Germination.
4. Diurnal variation of stomatal behavior in CAM and C3 plants found in local area.
5. Effects of nitrogen fertilizer on plant growth.
6. Enumeration of C3, C4 and CAM plants in the local area.
7. Effect of different light wavelengths (red light, green light, blue light) on apparent photosynthesis in terms of growth.
8. Light effects on leaf growth and leaf orientation.
9. Artificial Fruit Ripening Process by various treatments (carbide and ethylene).
10. Study of relative water content and water retention by leaves under different environments.
11. Study of soil nutrients in local agricultural fields.
12. Study of mineral deficiency symptoms of various crops of local area.
13. Study of local weeds in crop fields.
14. Studies on seed storage proteins, oils and starch in local millets and pulse crops.
15. Making a report on LDPs, SDPs and DNPs in their locality.

c. Assignments: Written assignment at home / during ‘0’ hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.
2. Visit to a Plant Physiology laboratory in a University or Physiology division in a Agriculture/Horticulture University/Research station.

IV Semester / BotanyCoreCourse –5

Cell Biology, Genetics and Plant Breeding

(Total hours of teaching – 60 @ 04 Hrs./Week)

Theory:

Learning outcomes:

On successful completion of this course,the students will be able to:

- Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
- Explain the organization of a eukaryotic chromosomeand the structure of genetic material.
- Demonstrate techniques to observe the cell and its componentsunder a microscope.
- Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
- Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
- Evaluate the structure, function and regulation of genetic material.
- Understand the application of principles and modern techniques inplant breeding.
- Explain the procedures of selection and hybridization for improvement of crops.

Unit – 1: The Cell **12 Hrs.**

1. Cell theory; prokaryotic vs eukaryotic cell;animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultrastructure of chloroplast. Plastid DNA.

Unit – 2: Chromosomes **12 Hrs.**

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukayotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

Unit – 3:Mendelian and Non-Mendelian genetics 14Hrs.

1. Mendel’s laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to be dealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point test cross.
4. Concept of maternal inheritance (Corren’s experiment on *Mirabilis jalapa*); Mitochondrial DNA.

Unit – 4:Structure and functions of DNA 12 Hrs.

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi-conservative method).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code and Translation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

Unit – 5:Plant Breeding 12 Hrs.

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction and acclimatization.
2. Definition, procedure; applications and uses; advantages and limitations of :(a) Mass selection, (b) Pure line selection and (c) Clonal selection.
3. Hybridization – schemes, and technique; Heterosis(hybrid vigour).
4. A brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.

Text books :

- Botany – III (Vrukshasastram-I) : Telugu Akademi, Hyderabad
- Pandey, B.P. (2013) *College Botany, Volume-III,* S. Chand Publishing, New Delhi
- Ghosh, A.K., K.Bhattacharya&G. Hait (2011) *A Text Book of Botany, Volume-III,* New Central Book Agency Pvt. Ltd., Kolkata
- Chaudhary, R. C. (1996) *Introduction to Plant Breeding,* Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Books for Reference:

- S. C. Rastogi (2008)*Cell Biology,*New Age International (P) Ltd. Publishers, New Delhi
- P. K. Gupta (2002)*Cell and Molecular biology,*Rastogi Publications, New Delhi
- B. D. Singh (2008) *Genetics,*Kalyani Publishers, Ludhiana
- A.V.S.S. Sambamurty (2007) *Molecular Genetics*,Narosa Publishing House,New Delhi
- Cooper, G.M. & R.E. Hausman (2009)*The Cell – A Molecular Approach,* A.S.M. Press, Washington
- Becker, W.M., L.J. Kleinsmith& J. Hardin (2007)*The World of Cell,* Pearson Education, Inc., New York
- De Robertis, E.D.P. & E.M.F. De Robertis Jr. (2002)*Cell and Molecular Biology,* Lippincott Williams & Wilkins Publ., Philadelphia
- Robert H. Tamarin (2002)*Principles of Genetics,*Tata McGraw –Hill Publishing Company Limited, New Delhi.
- Gardner, E.J., M. J. Simmons & D.P. Snustad (2004)*Principles of Genetics,* John Wiley & Sons Inc., New York
- Micklos, D.A., G.A. Freyer& D.A. Cotty (2005) *DNA Science: A First Course,* I.K. International Pvt. Ltd., New Delhi
- Chaudhari, H.K.(1983)*Elementary Principles of Plant Breeding*, TMHpublishers Co., New Delhi
- Sharma, J.R. (1994)*Principles and Practice of Plant Breeding*, Tata McGraw- Hill Publishers, New Delhi
- Singh,B.D. (2001)*Plant Breeding : Principles and Methods* ,Kalyani Publishers, Ludhiana

- Pundhan Singh (2015) *Plant Breeding for Undergraduate Students,* Kalyani Publishers, Ludhiana
- Gupta, S.K. (2010)*Plant Breeding : Theory and Techniques,*Agrobios (India), Jodhpur
- Hayes, H.K., F.R. Immer& D.C. Smith (2009) *Methods of Plant Breeding,*Biotech Books, Delhi

Practical Syllabus of Botany Core Course – 5/IVSemester

Cell Biology, Genetics and Plant Breeding

(Total hours of laboratory exercises 30 Hrs. @ 02 Hrs. /Week)

Course Outcomes: After successful completion of this practical course the student shall be able to:

1. Show the understanding of techniques of demonstrating Mitosis and Meiosis in the laboratory and identify different stages of cell division.
2. Identify and explain with diagram the cellular parts of a cell from a model or picture and prepare models
3. Solve the problems related to crosses and gene interactions.
4. Demonstrate plant breeding techniques such as emasculation and bagging

Practical Syllabus:

1. Study of ultra structureof plant cell and its organelles using Electron microscopic Photographs/models.

2. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squashtechnique; observation of various stages of mitosis in permanent slides.

4. Demonstration of Meiosis in P.M.C.s of *Allium cepa*flower buds using squash technique; observation of various stages of meiosis in permanent slides.

4. Study of structure of DNA and RNA molecules using models.

5. Solving problems monohybrid, dihybrid, back and test crosses.

6.Solving problems on gene interactions (atleast one problem for each of the gene interactions in the syllabus).

7. Chromosome mapping using 3- point test cross data.

8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

Model paper for Practical Examination

Semester-IV / Botany Core Course – 5

Cell Biology, Genetics and Plant Breeding

Max. Time: 3 Hrs. Max. Marks: 50

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1. Make a cytological preparation of given material 'A' (mitosis or meiosis in Onion) by squash technique, report any two stages, draw labeled diagrams and write the reasons. 15 M

2. Solve the given Genetic problem (Dihybrid cross/ Interaction of genes/ 3-point test cross) 'B' and write the conclusions. 15 M

3. Identify the following and justify with apt reasons. 3 x 4 = 12 M

   C. Cell Biology (Cell organelle)

   D. Genetics (DNA/RNA)

   E. Plant Breeding

4. Record + Viva-voce 5 + 3 = 8 M

Suggested co-curricular activities for Botany Core Course- 5 in Semester-IV:

A. **Measurable :**
   a. **Student seminars :**
      1. Light microscopy : bright field and dark field microscopy.
      2. Scanning Electron Microscopy (SEM).
      3. Transmission Electron Microscopy (TEM).
      4. Mitosis and Meiosis
      5. Cell cycle and its regulation.
      6. Cell organelles bounded by single membrane.
      7. Prokaryotic chromosomes
      8. Special types of chromosomes :Polytene, Lampbrush and B-chromosomes.
      9. Different forms of DNA.
      10. Gene mutations.
      11. DNA damage and repair mechanisms.
      12. Reverse transcription.
      13. Protein structure.

14. Modes of reproduction in plants.

15. Modes of pollination in plants

b. Student Study Projects :

1. Study of mitoticcell cycle in roots of*Aliumcepa*

2. Study of mitoticcell cycle in roots of*Aloe vera*

3. Observation of chromosomal aberrations in *Allium cepa* root cells exposed toindustrial effluent(s).

4. Observation of chromosomal aberrations in *Allium cepa* root cells exposed toheavy metal(s).

5. Observation of polyembryony in *Citrus* spp.and *Mangiferaindica*.

c. Assignments: Written assignment at home / during ‘0’ hour at college; preparation of charts with drawings, making models etc., on topics included in syllabus.

B. General :

1. Field visit to Agriculture/Horticulture University/ Research station to observe Plant breeding methods.

2. Group Discussion (GD)/ Quiz/ Just A Minute (JAM) on different modules in syllabus of the course.

RECOMMENDED ASSESSMENT OF STUDENTS:

Recommended continuous assessment methods for all courses:

Some of the following suggested assessment methodologies could be adopted. Formal assessment for awarding marks for Internal Assessment in theory.

(a) Formal:

1. The oral and written examinations (Scheduled and surprise tests),
2. Simple, medium and Critical Assignments and Problem-solving exercises,
3. Practical assignments and laboratory reports,
4. Assessment of practical skills,
5. Individual and group project reports,
6. Seminar presentations,
7. Viva voce interviews.

(b) Informal:

1. Computerized adaptive testing, literature surveys and evaluations,
2. Peers and self-assessment, outputs form individual and collaborative work
3. Closed-book and open-book tests,

Common pattern for Question Paper for Theory Examination(s) at Semester end

Max. Time: 3 Hrs. Max. Marks: 75 M

Section – A

Answer all the following questions. 5 x 2 = 10 M

- ✓ One question should be given from each Unit in the syllabus.

Section – B

Answer any <u>three</u> of the following questions. Draw a labeled diagram wherever necessary 3 x 5 = 15 M

- ✓ One question should be given from each Unit in the syllabus.

Section – C

Answer any <u>five</u> of the following questions. Draw a labeled diagram wherever necessary 5 x 10 = 50 M

- ✓ Two questions (a & b) are to be given from each Unit in the syllabus (internal choice in each unit). Student has to answer 5 questions by choosing one from a set of questions given from a Unit.

Note: Questions should be framed in such a way to test the understanding, analytical and creative skills of the students. All the questions should be given within the frame work of the syllabus prescribed.

Annexure

Objectives and General Outcomes of Programme and Domain Subject

Programme(B.Sc.) Objectives: The objectives of bachelor's degree programmewith Botany are:

1. To provide a comprehensive knowledge on various aspects related to microbes and plants.
2. To deliver knowledge on latest developments in the field of Plant sciences with a practical approach.
3. To produce a student who thinks independently, critically and discuss various aspects of plant life.
4. To enable the graduate to prepare and pass through national and international examinations related to Botany.
5. To empower the student to become an employee or an entrepreneur in the field of Botany /Biology and to serve the nation.

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ProgrammeOutcomes:

1. Understand the basic concepts of Botany in relation to its allied core courses.
2. Perceive the significance of microbes and plants for human welfare, and structural and functional aspects of plants.
3. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them with the theoretical knowledge.
4. Work in teams with enhanced inter-personal skills.
5. Develop the critical thinking with scientific temper.
6. Effectively communicate scientific ideas both orally and in writing.

Domain Subject(Botany) Objectives :

1. To impart knowledge on origin, evolution, structure, reproduction and interrelationships of microbes and early plant groups.
2. To provide knowledge on biology and taxonomy of true land plants within a phylogenetic framework.
3. To teach aspects related to anatomy, embryology and ecology of plants, and importance of Biodiversity.
4. To explain the structural and functional aspects of plants with respect to the cell organelles, chromosomes and genes, and methods of plant breeding.

5. To develop a critical understanding on SPAC, metabolism and growth and development in plants.
6. To enable the students proficient in experimental techniques and methods of analysis appropriate for various sub-courses in Botany.

Domain Subject(Botany) Outcomes:

1. Students will be able to identify, compare and distinguish various groups of microbes and primitive plants based on their characteristics.
2. Students will be able to explain the evolution of trachaeophytes and also distribution of plants on globe.
3. Students will be able to discuss on internal structure, embryology and ecological adaptations of plants, and want of conserving Biodiversity.
4. Students will be able to interpret life processes in plants in relation to physiology and metabolism.
5. Students will be able to describe ultrastructure of plant cells, inheritance and crop improvement methods.
6. Students will independently design and conduct simple experiments based on the knowledge acquired in theory and practicals of the different sub-courses in Botany.

SUBJECT EXPERTS

Prof. C.Sudhakar
Dept of Botany,
Sri Krishnadevaraya University,
Anantapur

Dr.A.Srinivasa Rao
Lecturer in Botany,
Govt Degree College,
Mandapeta

SYLLABUS VETTED BY

Prof.M.Vijaya Lakshmi,

Dept of Botany and Microbiology,

Acharya Nagarjuna University,

Nagarjuna Nagar

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

3^{rd},4^{th} and 5^{th} floors, Neeladri Towers, Sri Ram Nagar,6^{th} Battalion Road,
Atmakur (V), Mangalagiri (M), Guntur-522 503, Andhra Pradesh
Web: www.apsche.org **Email**: acapsche@gmail.com

REVISED SYLLABUS OF B.Sc (Chemistry)

UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

<u>PROGRAMME: THREE-YEAR B.Sc. (B.Sc Chemistry)</u>

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

Andhra Pradesh State Council of Higher Education

B.Sc. Chemistry Revised Syllabus under CBCS

w.e.f. 2020-21

Structure of Chemistry Core Syllabus under CBCS

YEAR	SEMESTER	COURSE	TITLE	MARKS	CREDITS
I	I	I	Inorganic and Physical Chemistry	100	03
			Practical – I Analysis of SALT MIXTURE	50	02
	II	II	Organic and General Chemistry	100	03
			Practical – IIVolumetric Analysis	50	02
II	III	III	Organic Chemistry and Spectroscopy	100	03
			Practical – IIIOrganic preparations and IR Spectral Analysis	50	02
	IV	IV	Inorganic, Organic and Physical Chemistry	100	03
			Practical – IVOrganic Qualitative analysis	50	02
		V	Inorganic and Physical Chemistry	100	02
			Practical-V Course Conductometric and Potentiometric Titrimetry	50	02

SEMESTER – I

Course I (Inorganic &Physical Chemistry) 60 hrs. (4h/w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of p-block elements
2. Explainthe differencebetweensolid,liquidandgasesintermsof intermolecularinteractions.
3. Applytheconceptsofgasequations,pHandelectrolyteswhilestudyingotherchemistrycourses.

INORGANIC CHEMISTRY 24 h

UNIT –I

Chemistry of p-block elements 8h

Group 13: Preparation & structure of Diborane, Borazine

Group 14: Preparation, classification and uses of silicones

Group 15: Preparation & structures of Phosphonitrilic halides {$(PNCl_2)_n$where n=3, 4

Group 16: Oxides and Oxoacids of Sulphur (structures only)

Group 17: Pseudohalogens, Structures of Interhalogen compounds.

UNIT-II

1. Chemistry of d-block elements: 6h

Characteristics of d-block elements with special reference to electronic configuration, variable valence, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states.

2. Chemistry of f-block elements: 6h

Chemistry of lanthanides - electronic structure, oxidation states, lanthanide contraction, consequences of lanthanide contraction, magnetic properties. Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.

3. Theories of bonding in metals: 4h

Valence bond theory andFree electron theory, explanation of thermal and electrical conductivity of metals based on these theories, Band theory- formation of bands, explanation of conductors, semiconductors and insulators.

PHYSICAL CHEMISTRY 36h

UNIT-III

Solidstate 10h

Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. The law of symmetry. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects.

UNIT-IV

1. Gaseous state 6h

van der Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Lawof corresponding states. Joule- Thomson effect. Inversion temperature.

2.Liquid state 4h

Liquid crystals,mesomorphicstate. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices.

UNIT-V

Solutions, Ionic equilibrium& dilute solutions

1. Solutions 6h

Azeotropes-HCl-H_2O system and ethanol-water system. Partially miscible liquids-phenol-water system. Critical solution temperature (CST), Effect of impurity on consulate temperature. Immiscible liquids and steam distillation.Nernst distribution law. Calculation of the partition coefficient. Applications of distribution law.

2. **Ionic equilibrium 3h**

Ionic product, common ion effect, solubility and solubility product. Calculations based on solubility product.

3. Dilute solutions 7h

Colligative properties- RLVP, Osmotic pressure, Elevation in boing point and depression in freezing point. Experimental methods for the determination of molar mass of a non-volatile solute using osmotic pressure, Elevation in boing point and depression in freezing point. Abnormal colligative properties. Van't Hoff factor.

Co-curricular activities and Assessment Methods

1. ContinuousEvaluation:Monitoringtheprogressof student'slearning
2. ClassTests,WorksheetsandQuizzes
3. Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriticalthinking skillsand personality
4. Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

1. Principles of physical chemistry by Prutton and Marron
2. Solid State Chemistry and its applications by Anthony R. West
3. Text book of physical chemistry by K L Kapoor
4. Text book of physical chemistry by S Glasstone
5. Advanced physical chemistry by Bahl and Tuli
6. Inorganic Chemistry by J.E.Huheey
7. Basic Inorganic Chemistry by Cotton and Wilkinson
8. A textbook of qualitative inorganic analysis by A.I. Vogel
9. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
10. Castellan,G.W.PhysicalChemistry4thEd.Narosa(2004).
11. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).
12. Barrow,G.M.PhysicalChemistry

LABORATORY COURSE -I **30**hrs (2 h / w)

Practical-I Analysis of SALT MIXTURE

(At the end of Semester-I)

Qualitative inorganic analysis (Minimum of Six mixtures should be analysed) 50 M

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic mixture
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Analysis of SALT MIXTURE **50 M**

Analysis of mixture salt containing two anions and two cations (From two different groups) from the following:

Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Potassium and Ammonium.

MODEL PAPER

FIRST YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-I

CHEMISTRY Course-I: INORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours Maximum Marks: 75

PART- A5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Explain the preparation & structures of Phosphonitrilic compounds.
2. Explain in brief, catalytic properties & stability of various oxidation states of d-block elements.
3. Write short note on Bravais lattices and crystal systems.
4. What are Smectic&Nematic liquid Crystals? Explain.

5. Write account on Common ion effect & Solubility product.
6. Describe Andrew's isotherms of carbon dioxide.
7. Explain Actinide Constraction.
8. Explain the structure of Borazine.

PART- B5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). Explain Classification, Preparations & uses of Silicones

(or)

(b). (i) What are Pseudohalogens.
(ii) Explain the Structures of any one AX3& AX_5interhalogen compounds.

10 (a). What is Lanthanide Contraction? Explain the Consequences of Lanthanide Contraction.

(or)

(b). (i) Explain the magnetic properties of d- block elements.
(ii) Explain about Conductors, Semi-Conductors& Insulators using Band Theory.

11.(a). Write an essay on Crystal defects.

(or)

(b). What is Bragg's Law. Explain the determination of structure of a crystal by powder method.

12.(a). Derive the relationship between Critical constants &Vanderwaal constants

(or)

(b). (i) Write any 5 differences between liquid crystals & liquids, solids
(ii) Write the applications of Liquid crystals.

13.(a). Explain Nernst distribution Law. Explain its applications

(or)

(b). What are colligative properties. Write experimental methods for determination of molar mass of a non-volatile solute by using Elevation in boiling point & depression in freezing point.

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SEMESTER – II

Course II – (Organic & General Chemistry) 60 hrs (4h/w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understandandexplainthedifferentialbehaviorof organiccompoundsbasedonfundamental conceptslearnt.
2. Formulatethemechanismoforganicreactionsby recallingandcorrelatingthefundamentalproperties ofthereactantsinvolved.
3. Learnandidentifymanyorganicreactionmechanismsincluding FreeRadical Substitution, Electrophilic AdditionandElectrophilicAromaticSubstitution.
4. Correlateanddescribethestereochemicalpropertiesoforganiccompoundsand reactions.

ORGANIC CHEMISTRY **36h**

UNIT-I

RecapitulationofBasicsofOrganicChemistry

Carbon-Carbon sigma bonds (Alkanes and Cycloalkanes) **12h**

General methods of preparation of alkanes- Wurtz and WurtzFittig reaction, Corey House synthesis, physical and chemical properties of alkanes, Isomerism and its effect on properties, Free radical substitutions; Halogenation, concept of relative reactivity v/s selectivity. Conformational analysis of alkanes (Conformations, relative stability and energy diagrams of Ethane, Propane and butane).General molecular formulae of cycloalkanes and relative stability, Baeyer strain theory, Cyclohexane conformations with energy diagram, Conformations of monosubstituted cyclohexane.

UNIT-II

Carbon-CarbonpiBonds(AlkenesandAlkynes) **12h**

Generalmethodsofpreparation,physicaland chemicalproperties.Mechanism ofE1,E2,E1cbreactions,SaytzeffandHoffmanneliminations, Electrophilic Additions,mechanism(Markownikoff/Antimarkownikoff addition) with suitableexamples,,*syn*and*anti*-addition;additionofH_2,X_2, HX. oxymercurationdemercuration, hydroboration-oxidation,ozonolysis,hydroxylation, Diels Alderreaction,1,2- and1,4-additionreactionsinconjugateddienes.

Reactionsofalkynes;acidity,electrophilic andnucleophilicadditions,hydrationtoformcarbonyl compounds,Alkylationof terminalalkynes.

UNIT-III

Benzene and its reactivity **12h**

Concept of aromaticity, Huckel's rule - application to Benzenoid (Benzene, Naphthalene) and Non - Benzenoid compounds (cyclopropenylcation, cyclopentadienyl anion and tropyliumcation)

Reactions - General mechanism of electrophilic aromatic substitution, mechanism of nitration, Friedel- Craft's alkylation and acylation. Orientation of aromatic substitution - ortho, para and meta directing groups. Ring activating and deactivating groups with examples (Electronic interpretation of various groups like NO_2 and Phenolic). Orientation of (i) Amino, methoxy and methyl groups (ii) Carboxy, nitro, nitrile, carbonyl and sulphonic acid groups (iii) Halogens

(Explanation by taking minimum of one example from each type)

GENERAL CHEMISTRY **24 h**

UNIT-IV

1. Surface chemistry and chemical bonding

Surface chemistry **6h**

Colloids- Coagulation of colloids- Hardy-Schulze rule. Stability of colloids,Protection of Colloids, Gold number.

Adsorption-Physical and chemical adsorption, Langmuir adsorption isotherm, applications of adsorption.

2. Chemical Bonding **6h**

Valence bond theory, hybridization, VB theory as applied toClF_3**,**$Ni(CO)_4$**,** Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo-nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).

3. HSAB **2h**

Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.

UNIT-V

Stereochemistry of carbon compounds **10h**

Molecular representations- Wedge, Fischer, Newman and Saw-Horse formulae.

Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation.

Chiral molecules- definition and criteria(Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples- Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.

D,L, R,S and E,Z- configuration with examples.

Definition of Racemic mixture – Resolution of racemic mixtures (any 3 techniques)

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning

ClassTests,WorksheetsandQuizzes

Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriticalthinkingskillsand personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

Theory:

Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd. (PearsonEducation).

Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Finar, I. L. Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

Eliel, E. L. &Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.

Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International, 2005.

Practical:

Ahluwalia, V.K. &Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).
Ahluwalia, V.K. &Dhingra, S. Comprehensive Practical Organic Chemistry: Qualitative Analysis, University Press (2000).
Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. Practical Organic Chemistry, 5th Ed., Pearson (2012)

Additional Resources:

Solomons, T. W. G.; Fryhle, C. B. &Snyder, S. A. Organic Chemistry, 12th Edition, Wiley.
Bruice, P. Y. Organic Chemistry, Eighth Edition, Pearson.
Clayden, J.; Greeves, N.&Warren, S. Organic Chemistry, Oxford.
Nasipuri, D. Stereochemistry of Organic Compounds: Principles and Applications, Third Edition, NewAge International.
Gunstone, F. D. Guidebook to Stereochemistry, Prentice Hall Press, 1975.

LABORATORY COURSE-II **30**hrs (2 h / w)

Practical-II Volumetric Analysis

(At the end of Semester-II)

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understandandexplainthevolumetric analysisbasedonfundamental conceptslearnt in ionic equilibria
3. Learnandidentifythe concepts of a standard solutions, primary and secondary standards
4. Facilitate the learner to make solutions of various molar concentrations. This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis **50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard.

3. Determination of Cu (II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.

4. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$

MODEL PAPER

FIRST YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-II

CHEMISTRY COURSE -II: ORGANIC & GENERAL CHEMISTRY

Time: 3 hours   Maximum Marks: 75

PART- A   5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Write different conformations of n-butane. Explain their relative stability..
2. Explain 1,2- & 1,4- addition reactions of conjugated dienes.
3. Explain the orientation effect of halogens on mono substituted benzene.
4. Explain the mechanism of $E1^{CB}$ elimination reaction.
5. Explain the structure of ClF_3 by Valency Bond theory.
6. What are Hard & soft acids & bases? Explain with examples.
7. Draw the Wedge, Fischer, Newmann& saw-Horse representations for Tartaric acid.
8. Define Enantiomers and Diastereomers and give two examples for each.

PART- B   5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). (i) Write the preparation of alkanes by Wurtz and Corey-House reaction.
(ii) Explain Halogenation of alkanes. Explain the reactivity and selectivity in free radical substitutions.

(or)

(b). (i) Explain Baeyer Strain Theory
(ii) Draw the conformations of Cyclohexane and explain their stability by drawing energy profile diagram.

10 (a). (i) Write any two methods of preparation of alkenes.
(ii) Explain the mechanism of Markownikiff and Anti-Markownikoff addition of HBr to alkene.

(or)

(b). (i) Explain the acidity of 1-alkynes
(ii) How will you prepare acetaldehyde and acetone from alkynes?
(iii) Write alkylation reaction of terminal alkne.

11.(a). Define Huckel rule of aromatic compounds. What are benzenoid and non-benzenoid aromatic compounds? Give examples.

(or)

(b). Explain the mechanisms of Nitration and Friedel-Craft’s alkylation of Benzene.

12.(a). (i) Define Hardy-Schulze rule & Gold number.
(ii) Differentiate Physisorption& Chemisorption. Explain Langmuir adsorption isotherm.

(or)

(b). Construct the Molecular Orbital diagram for O_2 and NO and explain their bond order and magnetic property.

13.(a). Define racemic mixture. Explain any two techniques for resolution of racemic mixture.

(or)

(b). (i) Define Optical activity and Specific rotation.
(ii) Draw the R- & S- isomers of Alanine, Glyceraldehyde.
(iii) Write the E- & Z- isomers of 2-butene.

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SEMESTER - III

Course III (ORGANICCHEMISTRY&SPECTROSCOPY) 60hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understandpreparation,propertiesandreactionsofhaloalkanes,haloarenesand oxygencontaining functionalgroups.
2. Usethesyntheticchemistrylearntinthiscoursetodofunctionalgroup transformations.
3. Toproposeplausiblemechanismsforanyrelevantreaction

ORGANIC CHEMISTRY **34h**

UNIT – I

1. ChemistryofHalogenatedHydrocarbons: **6h**

Alkylhalides:Methodsofpreparationandproperties,nucleophilicsubstitutionreactions–S_N1,$S_N2$and$S_Ni$mechanismswithstereochemicalaspectsandeffectofsolventetc.;nucleophilicsubstitutionvs.elimination, Williamson's synthesis.

Arylhalides:Preparation(includingpreparationfromdiazoniumsalts)andproperties,nucleophilic aromatic substitution;S_NAr,Benzynemechanism.

Relativereactivityofalkyl,allyl,benzyl,vinylandarylhalidestowardsnucleophilicsubstitutionreactions.

2. Alcohols &Phenols **6h**

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, BouvaeltBlanc Reduction; Oxidationofdiolsbyperiodicacidandleadtetra acetate,Pinacol-Pinacolonerearrangement;

Phenols:Preparationandproperties;Acidityandfactorseffectingit, Ringsubstitution reactions, Reimer–Tiemannand Kolbe's–Schmidt Reactions, Fries and Claisenrearrangements with mechanism;

UNIT-II

CarbonylCompounds **10h**

Structure,reactivity,preparationandproperties;

Nucleophilicadditions,Nucleophilicaddition-eliminationreactionswithammoniaderivatives MechanismsofAldolandBenzoincondensation, Claisan-Schmidt, Perkin, CannizzaroandWittigreaction,Beckmannhaloformreactionand BaeyerVilligeroxidation,α-substitutionreactions,oxidationsandreductions(Clemmensen, wolf –kishner, with $LiAlH_4$ &$NaBH_4$).

Additionreactionsof α,β-unsaturatedcarbonylcompounds:Michaeladdition.

Activemethylenecompounds: Keto-enoltautomerism.Preparationandsyntheticapplicationsofdiethyl malonateandethylacetoacetate.

UNIT-III

CarboxylicAcidsand their Derivatives **12h**

General methods of preparation, physical properties and reactions of monocarboxylic acids, effect of substituentsonacidicstrength.Typicalreactionsofdicarboxylicacids,hydroxyacidsandunsaturatedacids.

Preparationandreactionsofacidchlorides,anhydrides,estersandamides; Comparativestudyofnucleophilicsubstitutionatacylgroup-Mechanism ofacidicandalkalinehydrolysisof esters,Claisencondensation,Reformatskyreactions and Curtiusrearrangement

Reactions involving H, OH and COOH groups- salt formation, anhydride formation, acid chloride formation, amide formation and esterification (mechanism). Degradation of carboxylic acids by Huns-Diecker reaction, decarboxylation by Schimdt reaction, Arndt-Eistert synthesis, halogenation by Hell- Volhard- Zelinsky reaction.

SPECTROSCOPY **26 h**

UNIT-IV

MolecularSpectroscopy: **18h**

Interactionofelectromagneticradiationwithmoleculesandvarioustypesof spectra;

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrationalspectroscopy: Classicalequationofvibration, computationofforceconstant, Harmonic and anharmonic oscillator, Morsepotential curve,vibrational degreesoffreedom forpolyatomic molecules, modesofvibration. Selection rules for vibrational transitions, Fundamentalfrequencies, overtones and hotbands.

Electronic spectroscopy: Energy levels of molecular orbitals (σ, π, n). Selection rules for electronic spectra. Types of electronic transitions in molecules, effect of conjugation. Concept of chromophore. bathochromic and hypsochromic shifts.Beer-Lambert’s law and its limitations.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of nuclear magnetic resonance, equivalent and non-equivalent protons, position of signals. Chemical shift, NMR splitting of signals - spin-spin coupling, coupling constants. Applications of NMR with suitable examples - ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane, ethyl acetate, toluene and acetophenone.

UNIT-V **8h**

Application of Spectroscopy to Simple Organic Molecules

Application of visible, ultraviolet and Infrared spectroscopy in organic molecules.

Application of electronic spectroscopy and Woodward rules for calculating λ_{max} of conjugated dienes and α,β – unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions).

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning

ClassTests,WorksheetsandQuizzes

Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriticalthinkingskillsand personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

1. A Text Book of Organic Chemistry by Bahl and Arunbahl
2. A Text Book of Organic chemistry by I L FinarVol I
3. Organic chemistry by Bruice
4. Organic chemistry by Clayden
5. Spectroscopy by William Kemp
6. Spectroscopy by Pavia
7. Organic Spectroscopy by J. R. Dyer
8. Elementary organic spectroscopy by Y.R. Sharma
9. Spectroscopy by P.S.Kalsi
10. Spectrometric Identification of Organic Compounds by Robert M Silverstein, Francis X Webster
11. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry, Pearson Education (2009)
12. Furniss, B.S., Hannaford, A.J., Smith, P.W.G. &Tatchell, A.R. Practical Organic Chemistry, 5th Ed. Pearson (2012)

13. Ahluwalia, V.K. & Aggarwal, R. Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis, University Press (2000).

LABORATORY COURSE -III 30hrs (2 h / w)

Practical Course-IIIOrganic preparations and IR Spectral Analysis

(At the end of Semester- III)

Course outcomes:

Onthecompletionofthecourse,thestudentwillbe abletodothefollowing**:**

1. how to use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. how to calculate limiting reagent, theoretical yield, and percent yield
3. how to engage in safe laboratory practices by handling laboratory glassware, equipment, and chemical reagents appropriately
4. how to dispose of chemicals in a safe and responsible manner
5. how to perform common laboratory techniques including reflux, distillation, recrystallization, vacuum filtration.
6. how to create and carry out work up and separation procedures
7. how to critically evaluate data collected to determine the identity, purity, and percent yield of products and to summarize findings in writing in a clear and concise manner

Organic preparations: 40M

i. Acetylation of one of the following compounds:

amines (aniline, o-, m-, ptoluidines and o-, m-, p-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzolyation of one of the following amines

(aniline, o-, m-, p- toluidines and o-, m-, p-anisidine)

iii. Nitration of any one of the following:

a. Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

IR Spectral Analysis **10M**

IR Spectral Analysis of the following functional groups with examples

a) Hydroxyl groups

b) Carbonyl groups

c) Amino groups

d) Aromatic groups

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-III

CHEMISTRY COURSE-III: ORGANIC CHEMISTRY & SPECTROSCOPY

Time: 3 hours Maximum Marks: 75

PART- A 5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Discuss two methods for preparation of aryl halides.
2. Explain the mechanism for Pinacol-Pinacolone rearrangement.
3. Discuss the mechanism for Bayer-villiger oxidation reaction.
4. Explain the effect of substituents on acidic strength of mono-carboxylic acids.
5. Write the mechanism for Claisen Condensation reaction.
6. Write the selection rules in rotational spectroscopy.
7. Explain Spin – Spin coupling and Coupling Constant.
8. Explain types of electronic transitions in UV spectroscopy.

PART- B 5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). Give the mechanism & stereochemistry of SN^1& SN^2 reactions of alkyl halides with suitable example.

(or)

(b). Explain the following reactions with mechanism.
(i) Reimer-Tiemann reaction (ii) Fries rearrangement.

10 (a). Discuss the mechanism for following reactions.
(i) Perkin reaction. (ii) Cannizaro reaction

(or)

(b). Write the preparation and any three synthetic applications of diethyl malonate.

11.(a). Explain acid and base hydrolysis reaction of esters with mechanism.

(or)

(b). Explain the mechanisms of Curtius rearrangement & Arndt –Eistert reaction.

12.(a). (i) Write a note on vibrational degrees of freedom for polyatomic molecules.
(ii) Explain different modes of vibrations & selection rules in IR spectroscopy.

(or)

(b). (i) Define Bathochromic shift. Explain the effect of conjugation in U.V. spectroscopy.
(ii) Discuss the principle of NMR spectroscopy.

13.(a). Write Woodward-Fieser rules for calculating λmax for conjugated dienes and α,β – unsaturated carbonyl compounds , and apply them for one example each.

(or)

(b). (i) What is Fingerprint region. Explain its signigicance with an example.(ii) Write IR spectral data for any one alcohol, aldehyde and ketone

SEMESTER - IV

Course IV (INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY) 60hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

1. Tolearnaboutthelawsofabsorptionoflightenergybymoleculesandthesubsequentphotochemical reactions.
2. Tounderstandtheconceptofquantumefficiencyandmechanismsofphotochemicalreactions.

UNIT - I

OrganometallicCompounds **8h**

Definitionandclassification oforganometallic compoundsonthebasisofbondtype,Conceptofhapticityof organicligands.Metalcarbonyls:18electronrule,electroncountofmononuclear, polynuclearandsubstituted metalcarbonylsof3dseries.Generalmethodsofpreparationofmonoandbinuclearcarbonylsof 3d series.P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – II

Carbohydrates 8h

Occurrence,classificationandtheirbiologicalimportance,Monosaccharides: Constitutionandabsolute configurationofglucoseandfructose,epimersandanomers,mutarotation,determinationofringsiz eofglucose andfructose,Haworthprojectionsandconformationalstructures;Interconversions ofaldosesandketoses; Killiani-FischersynthesisandRuffdegradation; Disaccharides–Elementarytreatmentofmaltose, lactoseand sucrose.Polysaccharides–Elementarytreatmentof starch.

UNIT- III

Amino acids and proteins 6h

Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.

Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.

Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.

Heterocyclic Compounds 7h

Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis.

Properties: Acidic character of pyrrole - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan.

Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.

UNIT- IV

NitrogenContainingFunctionalGroups

Preparation, propertiesandimportantreactionsof nitrocompounds,aminesanddiazoniumsalts.

1. Nitro hydrocarbons **3h**

Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction.

2.Amines: **11h**

Introduction,classification,chiralityin amines (pyramidal inversion),importanceand generalmethodsofpreparation.

Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. DistinctionbetweenPrimary, secondaryandtertiaryaminesusingHinsberg’smethodandnitrousacid. Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimidesynthesis,Hoffmann-Bromamidereaction,Carbylaminereaction,Mannichreaction,Hoffmann’sexhaustive methylation,Hofmann-eliminationreactionandCopeelimination.

Diazonium Salts:Preparationand syntheticapplicationsofdiazoniumsaltsincludingpreparationofarenes, haloarenes, phenols,cyanoandnitrocompounds. Couplingreactionsofdiazoniumsalts (preparationofazo dyes).

UNIT- V

Photochemistry **5h**

Difference between thermal and photochemical processes, Laws of photochemistry- Grothus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield-Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).

Thermodynamics **12 h**

The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff s equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning

ClassTests,WorksheetsandQuizzes

Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriticalthinkingskillsand personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
6. Concise Inorganic Chemistry by J.D.Lee
7. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
8. A Text Book of Organic Chemistry by Bahl and Arunbahl
9. A Text Book of Organic chemistry by I L FinarVol I
10. A Text Book of Organic chemistry by I L FinarVol II
11. Advanced physical chemistry by Gurudeep Raj

LABORATORY COURSE -IV 30hrs(2 h / w)

Practical Course-IVOrganic Qualitative analysis 50 M

(At the end of Semester- IV)

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Determine melting and boiling points of organic compounds
3. Understandtheapplication of concepts of different organic reactions studied in theory part of organic chemistry

Organic Qualitative analysis **50 M**

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

Alcohols, Phenols, Aldehydes, Ketones, Carboxylic acids, Aromatic primary amines, amides and simple sugars

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-IV

CHEMISTRY COURSE -IV: INORGANIC, ORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours Maximum Marks: 75

PART- A 5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples.
2. What are epimers and anomers. Give examples.
3. Discuss about iso electric point and zwitter ion.
4. Discuss the Paul-Knorr synthesis of five membered heterocyclic compounds.
5. Explain Tautomerism shown by nitro alkanes
6. Discuss the basic nature of amines.
7. Write the differences between thermal and photochemical reactions.
8. Derive heat capacities and derive $C_p - C_v = R$

PART- B 5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). What are organometallic compounds? Discuss their Classification on the basis of type of bonds with examples.

(or)

(b). Discuss the general methods of preparations of mono & bi-nuclear carbonyls of 3d series.

10 (a). Discuss the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose.

(or)

(b). (i) Explain Ruff's degradation.
(ii) Explain Kiliani- Fischer synthesis.

11.(a). What are amino acids? Write any three general methods of preparation of amino acids.

(or)

(b). Discuss the aromatic character of Furan, Thiophene and Pyrrole.

12.(a). Write the mechanism for the following.
(i) Nef reaction (ii) Mannich reaction

(or)

(b). (i) Explain Hinsberg separation of amines.
(ii) Discuss any three synthetic applications of diazonium salts.

13.(a). What is quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine.

(or)

(b). Define entropy. Describe entropy changes in the reversible and irreversible process.

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SEMESTER - IV

CourseV(INORGANIC &PHYSICAL CHEMISTRY) 60 hrs (4 h / w)

Course outcomes:

At the end of the course, the student will be able to;

1. Understand concepts ofboundaryconditionsandquantization,probabilitydistribution,mostprobablevalues, uncertainty andexpectationvalues
2. Applicationofquantizationtospectroscopy.
3. Varioustypesofspectraandtheiruseinstructuredetermination.

INORGANIC CHEMISTRY 26 h

UNIT –I

Coordination Chemistry 12 h

IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectrochemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry,Jahn-Teller distortion, square planar coordination.

UNIT –II

1. InorganicReactionMechanism: **4h**

Introductiontoinorganicreactionmechanisms.Conceptofreaction pathways,transitionstate,intermediateand activatedcomplex. Labile and inert complexes, ligand substitution reactions - SN^1 and SN^2,Substitutionreactionsinsquare planar complexes,Trans-effect,theoriesoftranseffect and its applications

2. Stability of metal complexes: 2h

Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.

BioinorganicChemistry: 8h

Metalionspresentinbiologicalsystems,classificationofelementsaccordingtotheiractioninbiolog ical system.Geochemical effectonthedistributionofmetals,Sodium/K-pump,carbonicanhydraseand carboxypeptidase.

Excessanddeficiencyofsometracemetals.Toxicityofmetalions(Hg,Pb,CdandAs), reasonsfortoxicity,Useof chelatingagentsinmedicine,Cisplatinasananti-cancerdrug. Ironanditsapplicationinbio-systems,Haemoglobin,Myoglobin.Storageandtransferof iron.

PHYSICAL CHEMISTRY 34 h

UNIT-III

1 .Phase rule

6hConcept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point , freezing mixtures.

UNIT-IV

Electrochemistry 14h

Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes,Kohlrausch's law and its applications, Definition of transport number,determination of transport number by Hittorf's method. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations.

Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal-metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations.

Fuel cells- Basic concepts, examples and applications

UNIT-V

ChemicalKinetics: 14 h

The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.

Co-curricular activities and Assessment Methods

ContinuousEvaluation:Monitoringtheprogressof student'slearning

ClassTests,WorksheetsandQuizzes

Presentations,ProjectsandAssignmentsandGroupDiscussions:Enhancescriticalthinkingskillsand personality

Semester-endExamination:criticalindicatorofstudent'slearningandteachingmethodsadoptedby teachersthroughoutthesemester.

List of Reference Books

1. . Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D.Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E.Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins,P.W.&Paula,J.deAtkin'sPhysicalChemistryEd.,OxfordUniversityPress 10thEd(2014).
11. Castellan,G.W.PhysicalChemistry4thEd.Narosa(2004).
12. Mortimer,R. G.PhysicalChemistry3rdEd. Elsevier:NOIDA,UP(2009).
13. Barrow,G.M.PhysicalChemistry

SEMESTER - IV

CourseV **LABORATORY COURSE** **30**hrs (2 h / w)

Practical-Course -VConductometric and Potentiometric Titrimetry **50 M**

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Apply conceptsof electrochemistry in experiments
3. Be familiar with electroanalytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte

Conductometric and Potentiometric Titrimetry **50 M**

1. **Conductometric titration**- Determination of concentration of HCl solution using standard NaOH solution.
2. **Conductometric titration**- Determination of concentration of CH_3COOH Solution using standard NaOH solution.
3. **Conductometric titration**- Determination of concentration of CH_3COOH and HCl in a mixture using standard NaOH solution.
4. **Potentiometric titration**- Determination of Fe (II) using standard $K_2Cr_2O_7$ solution.
5. Determination of rate constant for acid catalyzed ester hydrolysis.

MODEL PAPER

SECOND YEAR B.Sc., DEGREE EXAMINATION

SEMESTER-IV

CHEMISTRY COURSE V: INORGANIC & PHYSICAL CHEMISTRY

Time: 3 hours Maximum Marks: 75

PART- A5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Write note on Jahn-Teller distortion.
2. Explain Labile & inert complexes.
3. Explain Job’s method for determination of composition of complex.
4. Explain Thermodynamic derivation of Gibb’s phase rule.
5. Explain any two conductometric titrations.
6. Write note on Fuel Cells with examples and applications.
7. What is enzyme catalysis? Write any three factors effecting enzyme catalysis.

8. Derive Michaels- Menten equation.

PART- B 5 X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a). Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT.

(or)

(b). Define CFSE. Explain the factors effecting the magnitude of crystal field splitting energy.

10 (a). Explain Trans effect. Explain the theories of trans effect and write any two applications of trans effect.

(or)

(b). (i) Write the biological functions of Haemoglobin and Myoglobin.
(ii) Write note on use of chelating agents in medicines.

11.(a). Define Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.

(or)

(b). (i) Explain phase diagram for NaCl-water system.
(ii) Explain briefly about Freezing mixtures.

12.(a). Define Transport number. Write experimental method for the determination of transport number by Hittorf method.

(or)

(b). (i) Define single electrode potential.
(ii) Explain four types of electrodes with examples.

13.(a). Explain general methods for determination of order of a reaction.

(or)

(b). Explain Collision theory and Activated complex theory of bimolecular reactions.

***

SUBJECT EXPERTS

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SYLLABUS VETTED BY

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ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

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REVISED SYLLABUS OF B.Sc. (COMPUTER SCIENCE/ INFORMATION TECHNOLOGY) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: FOUR-YEAR UG HONOURS PROGRAMME

B.Sc. Computer Science/ Information Technology (IT)

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

<u>Structure of Computer Science /Information Technology (IT)</u>

Programme: B.Sc. with Computer Science as one of the Core Subjects.
Discipline: Computer Science

Year	Semester	Paper Code	Subject	Hrs. per Week	Credits	IA	ES	Total
First Year	I	C1	Problem Solving in C	4	3	25	75	100
	I	C1-P	Problem Solving in C Lab	2	2		50	50
	II	C2	Data Structures using C	4	3	25	75	100
	II	C2-P	Data Structures using C Lab	2	2		50	50
Second Year	III	C3	Database Management System	4	3	25	75	100
	III	C3-P	Database Management System Lab	2	2		50	50
	IV	C4	Object Oriented Programming using Java	4	3	25	75	100
	IV	C4-P	Object Oriented Programming using Java Lab	2	2		50	50
	IV	C5	Operating Systems	4	3	25	75	100
	IV	C5-P	Operating Systems Lab using C/Java	2	2		50	50

PROBLEM SOLVING IN C

Semester	Course Code	Course Title	Hours	Credits
I	**C1**	**PROBLEM SOLVING IN C**	**60**	**3**

Objectives:

This course aims to provide exposure to problem-solving through programming. It introduces the concepts of the C Programming language.

Course Learning Outcomes:

Upon successful completion of the course, a student will be able to:

1. Understand the evolution and functionality of a Digital Computer.
2. Apply logical skills to analyse a given problem
3. Develop an algorithm for solving a given problem.
4. Understand ‘C’ language constructs like Iterative statements, Array processing, Pointers, etc.
5. Apply ‘C’ language constructs to the algorithms towrite a ‘C’ language program.

UNIT I

General Fundamentals: Introduction to computers: Block diagram of a computer, characteristics and limitations of computers, applications of computers, types of computers, computer generations.

Introduction to Algorithms and Programming Languages: Algorithm – Key features of Algorithms, Flow Charts, Programming Languages – Generations of Programming Languages – Structured Programming Language- Design and Implementation of Correct, Efficient and Maintainable Programs.

UNIT II

Introduction to C: Introduction – Structure of C Program – Writing the first C Program – File used in C Program – Compiling and Executing C Programs – Using Comments –

Keywords – Identifiers – Basic Data Types in C – Variables – Constants – I/O Statements in C- Operators in C- Programming Examples.

Decision Control and Looping Statements: Introduction to Decision Control Statements– Conditional Branching Statements – Iterative Statements – Nested Loops – Break and Continue Statement – Goto Statement

UNIT III

Arrays: Introduction – Declaration of Arrays – Accessing elements of the Array – Storing Values in Array– Operations on Arrays – one dimensional, two dimensional and multi dimensional arrays, character handling and strings.

UNIT IV

Functions: Introduction – using functions – Function declaration/ prototype – Function definition – function call – return statement – Passing parameters – Scope of variables – Storage Classes – Recursive functions.

Structure, Union, and Enumerated Data Types: Introduction – Nested Structures – Arrays of Structures – Structures and Functions– Union – Arrays of Unions Variables – Unions inside Structures – Enumerated Data Types.

UNIT V

Pointers: Understanding Computer Memory – Introduction to Pointers – declaring Pointer Variables – Pointer Expressions and Pointer Arithmetic – Null Pointers - Passing Arguments to Functions using Pointer – Pointer and Arrays – Memory Allocation in C Programs – Memory Usage – Dynamic Memory Allocation – Drawbacks of Pointers

Files: Introduction to Files – Using Files in C – Reading Data from Files – Writing Data to Files – Detecting the End-of-file – Error Handling during File Operations – Accepting Command Line Arguments.

BOOKS

1. E Balagurusamy – Programming in ANSIC – Tata McGraw-Hill publications.
2. Brain W Kernighan and Dennis M Ritchie - The 'C' Programming language" - Pearson publications.
3. Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson Edition Publications.
4. YashavantKanetkar - Let Us 'C' – BPB Publications.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,

5. Observation of practical skills,
6. Individual and group project reports like “Creating Text Editor in C”.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
I	**C1-P**	**PROBLEM SOLVING IN C LAB**	**30**	**2**

Problem solving in C LAB

1. Write a program to check whether the given number is Armstrong or not.
2. Write a program to find the sum of individual digits of a positive integer.
3. Write a program to generate the first n terms of the Fibonacci sequence.
4. Write a program to find both the largest and smallest number in a list of integer values
5. Write a program to demonstrate refection of parameters in swapping of two integer values using **Call by Value**&**Call by Address**
6. Write a program that uses functions to add two matrices.
7. Write a program to calculate factorial of given integer value using recursive functions
8. Write a program for multiplication of twoN X N matrices.
9. Write a program to perform various string operations.
10. Write a program to search an element in a given list of values.
11. Write a program to sort a given list of integers in ascending order.
12. Write a program to calculate the salaries of all employees using ***Employee (ID, Name, Designation, Basic Pay, DA, HRA, Gross Salary, Deduction, Net Salary)*** structure.
    a. DA is 30 % of Basic Pay
    b. HRA is 15% of Basic Pay
    c. Deduction is 10% of (Basic Pay + DA)
    d. Gross Salary = Basic Pay + DA+ HRA
    e. Net Salary = Gross Salary - Deduction
13. Write a program to illustrate pointer arithmetic.

14. Write a program to read the data character by character from a file.
15. Write a program to create ***Book (ISBN,Title, Author, Price, Pages, Publisher)*** structureand store book details in a file and perform the following operations
    a. Add book details
    b. Search a book details for a given ISBN and display book details, if available
    c. Update a book details using ISBN
    d. Delete book details for a given ISBN and display list of remaining Books

DATA STRUCTURES USING C

Semester	Course Code	Course Title	Hours	Credits
II	C2	DATA STRUCTURES USING C	60	3

Course Objectives

To introduce the fundamental concept of data structures and to emphasize the importance of various data structures in developing and implementing efficient algorithms.

Course Learning Outcomes:

Upon successful completion of the course, a student will be able to:

1. Understand available Data Structures for data storage and processing.
2. ComprehendData Structure and their real-time applications - Stack, Queue, Linked List, Trees and Graph
3. Choose a suitable Data Structures for an application
4. Develop ability to implement different Sorting and Search methods
5. Have knowledge onData Structures basic operations like insert, delete, search,update and traversal
6. Design and develop programs using various data structures
7. Implement the applications of algorithms for sorting, pattern matching etc

UNIT – I:

Introduction to Data Structures: Introduction to the Theory of Data Structures, Data Representation, Abstract Data Types, Data Types, Primitive Data Types, Data Structure and Structured Type, Atomic Type, Difference between Abstract Data Types, Data Types, and Data Structures, Refinement Stages

Principles of Programming and Analysis of Algorithms: Software Engineering, Program Design, Algorithms, Different Approaches to Designing an Algorithm, Complexity, Big ‘O’ Notation, Algorithm Analysis, Structured Approach to Programming, Recursion, Tips and Techniques for Writing Programs in ‘C’

UNIT – II:

Arrays: Introduction to Linear and Non- Linear Data Structures, One- Dimensional Arrays, Array Operations, Two- Dimensional arrays, Multidimensional Arrays, Pointers and Arrays, an Overview of Pointers

Linked Lists: Introduction to Lists and Linked Lists, Dynamic Memory Allocation, Basic Linked List Operations, Doubly Linked List, Circular Linked List, Atomic Linked List, Linked List in Arrays, Linked List versus Arrays

UNIT – III:

Stacks: Introduction to Stacks, Stack as an Abstract Data Type, Representation of Stacks through Arrays, Representation of Stacks through Linked Lists, Applications of Stacks, Stacks and Recursion

Queues: Introduction, Queue as an Abstract data Type, Representation of Queues, Circular Queues, Double Ended Queues- Deques, Priority Queues, Application of Queues

UNIT – IV:

Binary Trees: Introduction to Non- Linear Data Structures, Introduction Binary Trees, Types of Trees, Basic Definition of Binary Trees, Properties of Binary Trees, Representation of Binary Trees, Operations on a Binary Search Tree, Binary Tree Traversal, Counting Number of Binary Trees, Applications of Binary Tree

UNIT – V:

Searching and sorting: Sorting – An Introduction, Bubble Sort, Insertion Sort, Merge Sort, Searching – An Introduction, Linear or Sequential Search, Binary Search, Indexed Sequential Search

Graphs: Introduction to Graphs, Terms Associated with Graphs, Sequential Representation of Graphs, Linked Representation of Graphs, Traversal of Graphs, Spanning Trees, Shortest Path, Application of Graphs.

BOOKS:

1. "Data Structures using C", ISRD group Second Edition, TMH

2. “Data Structures through C”, Yashavant Kanetkar, BPB Publications
3. “Data Structures Using C” Balagurusamy E. TMH

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
II	**C2-P**	**DATA STRUCTURES USING C LAB**	**30**	**2**

1. Write a program to read ‘N’ numbers of elements into an array and also perform the following operation on an array
    a. Add an element at the begging of an array
    b. Insert an element at given index of array
    c. Update a element using a values and index
    d. Delete an existing element
2. Write a program using stacks to convert a given
    a. postfix expression to prefix
    b. prefix expression to postfix
    c. infix expression to postfix
3. Write Programs to implement the Stack operations using an array
4. Write Programs to implement the Stack operations using Liked List.
5. Write Programs to implement the Queue operations using an array.
6. Write Programs to implement the Queue operations using Liked List.
7. Write a program for arithmetic expression evaluation.
8. Write a program for Binary Search Tree Traversals
9. Write a program to implement dequeue using a doubly linked list.
10. Write a program to search an item in a given list using the following Searching Algorithms
    a. Linear Search
    b. Binary Search.
11. Write a program for implementation of the following Sorting Algorithms
    a. Bubble Sort
    b. Insertion Sort
    c. Quick Sort
12. Write a program for polynomial addition using single linked list
13. Write a program to find out shortest path between given Source Node and Destination Node in a given graph using Dijkstrar’s algorithm.

14. Write a program to implement Depth First Search graph traversals algorithm
15. Write a program to implement Breadth First Search graph traversals algorithm

DATABASE MANAGEMENT SYSTEMS

Semester	Course Code	Course Title	Hours	Credits
III	**C3**	**DATABASE MANAGEMENT SYSTEMS**	**60**	**3**

Course Objective:

The objective of the course is to introduce the design and development of databases with special emphasis on relational databases.

Course Learning Outcomes:

On completing the subject, students will be able to:

1. Gain knowledge of Database and DBMS.
2. Understand the fundamental concepts of DBMS with special emphasis on relational data model.
3. Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database
4. Model database using ER Diagrams and design database schemas based on the model.
5. Create a small database using SQL.
6. Store, Retrieve data in database.

UNIT I

Overview of Database Management System: Introduction to data, information, database, database management systems, file-based system, Drawbacks of file-Based System, database approach, Classification of Database Management Systems, advantages of database approach, Various Data Models, Components of Database Management System, three schema architecture of data base, costs and risks of database approach.

UNIT II

Entity-Relationship Model: Introduction, the building blocks of an entity relationship diagram, classification of entity sets, attribute classification, relationship degree, relationship classification, reducing ER diagram to tables, enhanced entity-relationship model (EER model), generalization and specialization, **IS A** relationship and attribute inheritance, multiple inheritance, constraints on specialization and generalization, advantages of ER modeling.

UNIT III

Relational Model: Introduction, CODD Rules, relational data model, concept of key, relational integrity, relational algebra, relational algebra operations, advantages of relational algebra, limitations of relational algebra, relational calculus, tuple relational calculus, domain relational Calculus (DRC), Functional dependencies and normal forms upto 3rd normal form.

UNIT IV

Structured Query Language: Introduction, History of SQL Standard, Commands in SQL, Data Types in SQL, Data Definition Language, Selection Operation, Projection Operation, Aggregate functions, Data Manipulation Language, Table Modification Commands, Join Operation, Set Operations, View, Sub Query.

UNIT V

PL/SQL: Introduction, Shortcomings of SQL, Structure of PL/SQL, PL/SQL Language Elements, Data Types, Operators Precedence, Control Structure, Steps to Create a PL/SQL, Program, Iterative Control, Procedure, Function, Database Triggers, Types of Triggers.

BOOKS:

1. Database System Concepts by Abraham Silberschatz, Henry Korth, and S. Sudarshan, McGrawhill
2. Database Management Systems by Raghu Ramakrishnan, McGrawhill
3. Principles of Database Systems by J. D. Ullman
4. Fundamentals of Database Systems by R. Elmasri and S. Navathe
5. SQL: The Ultimate Beginners Guide by Steve Tale.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

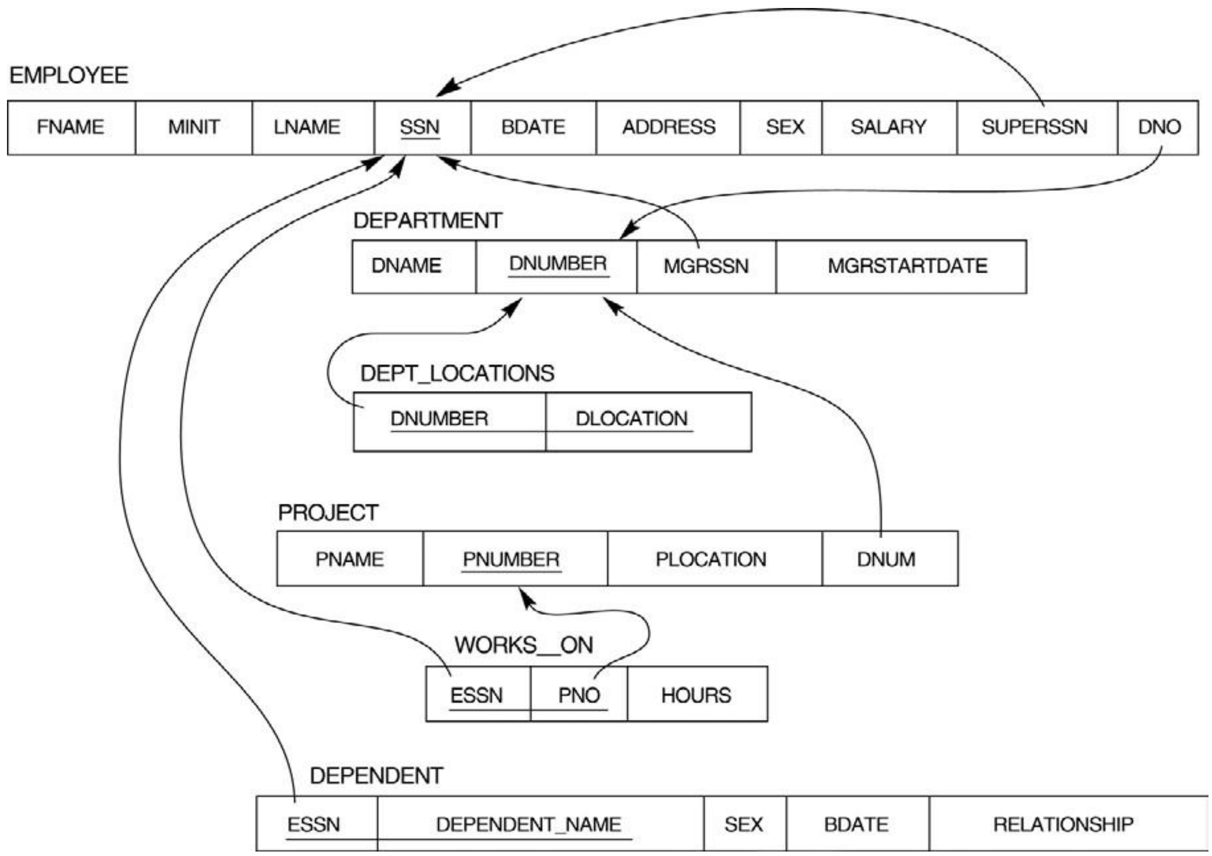
1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Practical assignments and laboratory reports,
4. Observation of practical skills,

5. Individual and group project reports like Create your college database for placement purpose.
6. Efficient delivery using seminar presentations,
7. Viva voce interviews.
8. Computerized adaptive testing, literature surveys and evaluations,
9. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
III	C3-P	DATABASE MANAGEMENT SYSTEMS LAB	30	2

1. Draw ER diagram for hospital administration
2. Creation of college database and establish relationships between tables
3. Relational database schema of a company is given in the following figure.

Relational Database Schema - COMPANY



Questions to be performed on above schema

1. Create above tables with relevant ***Primary Key, Foreign Key and other constraints***

2. Populate the tables with data
3. Display all the details of all employees working in the company.
4. Display ***ssn, lname, fname, address*** of employees who work in department no 7.

5. Retrieve the ***Birthdate and Address*** of the employee whose name is 'Franklin T. Wong'
6. Retrieve the name and salary of every employee
7. Retrieve all distinct salary values
8. Retrieve all employee names whose address is in ‘Bellaire’
9. Retrieve all employees who were born during the 1950s
10. Retrieve all employees in department 5 whose salary is between 50,000 and 60,000(inclusive)
11. Retrieve the names of all employees who do not have supervisors
12. Retrieve SSN and department name for all employees
13. Retrieve the name and address of all employees who work for the 'Research' department
14. For every project located in 'Stafford', list the project number, the controlling department number, and the department manager's last name, address, and birth date.
15. For each employee, retrieve the employee's name, and the name of his or her immediate supervisor.
16. Retrieve all combinations of Employee Name and Department Name
17. Make a list of all project numbers for projects that involve an employee whose last name is 'Narayan’ either as a worker or as a manager of the department that controls the project.
18. Increase the salary of all employees working on the 'ProductX' project by 15%. Retrieve employee name and increased salary of these employees.
19. Retrieve a list of employees and the project name each works in, ordered by the employee's department, and within each department ordered alphabetically by employee first name.
20. Select the names of employees whose salary does not match with salary of any employee in department 10.
21. Retrieve the employee numbers of all employees who work on project located in Bellaire, Houston, or Stafford.
22. Find the sum of the salaries of all employees, the maximum salary, the minimum salary, and the average salary. Display with proper headings.
23. Find the sum of the salaries and number of employees of all employees of the ‘Marketing’ department, as well as the maximum salary, the minimum salary, and the average salary in this department.

24. Select the names of employees whose salary is greater than the average salary of all employees in department 10.
25. Delete all dependents of employee whose ***ssn is '123456789'***.
26. Perform a query using alter command to drop/add field and a constraint in Employee table.

OBJECT ORIENTATED PROGRAMMING THROUGH JAVA

Semester	Course Code	Course Title	Hours	Credits
IV	**C4**	**OBJECT ORIENTATED PROGRAMMING THROUGH JAVA**	**60**	**3**

Objectives:

To introduce the fundamental concepts of Object-Oriented programming and to design & implement object oriented programming concepts in Java.

Course Learning Outcomes: At the end of this course student will:

1. Understand the benefits of a well-structured program
2. Understand different computer programming paradigms
3. Understand underlying principles of Object-Oriented Programming in Java
4. Develop problem-solving and programming skills using OOP concepts
5. Develop the ability to solve real-world problems through software development in high-level programming language like Java

UNIT – I

Introduction to Java: Features of Java, The Java virtual Machine, Parts of Java

Naming Conventions and Data Types: Naming Conventions in Java, Data Types in Java, Literals

Operators in Java: Operators, Priority of Operators

Control Statements in Java: if... else Statement, do... while Statement, while Loop, for Loop, switch Statement, break Statement, continue Statement, return Statement

Input and Output: Accepting Input from the Keyboard, Reading Input with Java.util.Scanner Class, Displaying Output with System.out.printf(), Displaying Formatted Output with String.format()

Arrays: Types of Arrays, Three Dimensional Arrays (3D array), arrayname.length, Command Line Arguments

UNIT – II

Strings: Creating Strings, String Class Methods, String Comparison, Immutability of Strings

Introduction to OOPs: Problems in Procedure Oriented Approach, Features of Object-Oriented Programming System (OOPS)

Classes and Objects: Object Creation, Initializing the Instance Variables, Access Specifiers, Constructors

Methods in Java: Method Header or Method Prototype, Method Body, Understanding Methods, Static Methods, Static Block, The keyword 'this', Instance Methods, Passing Primitive Data Types to Methods, Passing Objects to Methods, Passing Arrays to Methods, Recursion, Factory Methods

Inheritance: Inheritance, The keyword 'super', The Protected Specifier, Types of Inheritance

UNIT – III

Polymorphism: Polymorphism with Variables, Polymorphism using Methods, Polymorphism with Static Methods, Polymorphism with Private Methods, Polymorphism with Final Methods, final Class

Type Casting: Types of Data Types, Casting Primitive Data Types, Casting Referenced Data Types, The Object Class

Abstract Classes: Abstract Method and Abstract Class

Interfaces: Interface, Multiple Inheritance using Interfaces

Packages: Package, Different Types of Packages, The JAR Files, Interfaces in a Package, Creating Sub Package in a Package, Access Specifiers in Java, Creating API Document

Exception Handling: Errors in Java Program, Exceptions, throws Clause, throw Clause, Types of Exceptions, Re – throwing an Exception

UNIT – IV

Streams: Stream, Creating a File using FileOutputStream, Reading Data from a File uingFileInputStream, Creating a File using FileWriter, Reading a File using FileReader, Zipping and Unzipping Files, Serialization of Objects, Counting Number of Characters in a File, File Copy, File Class

Threads: Single Tasking, Multi Tasking, Uses of Threads, Creating a Thread and Running it, Terminating the Thread, Single Tasking Using a Thread, Multi Tasking Using Threads, Multiple Threads Acting on Single Object, Thread Class Methods, Deadlock of Threads, Thread Communication, Thread Priorities, thread Group, Daemon Threads, Applications of Threads, Thread Life Cycle

UNIT – V

Applets: Creating an Applet, Uses of Applets, <APPLET> tag, A Simple Applet, An Applet with Swing Components, Animation in Applets, A Simple Game with an Applet, Applet Parameters

Java Database Connectivity: Database Servers, Database Clients, JDBC (Java Database Connectivity), Working with Oracle Database, Working with MySQL Database, Stages in a JDBC Program, Registering the Driver, Connecting to a Database, Preparing SQL Statements, Using jdbc–odbc Bridge Driver to Connect to Oracle Database, Retrieving Data from MySQL Database, Retrieving Data from MS Access Database, Stored Procedures and CallableStatements, Types of Result Sets

BOOKS:

1. Core Java: An Integrated Approach, Authored by Dr. R. Nageswara Rao &Kogent Learning Solutions Inc.
2. E.Balaguruswamy, Programming with JAVA, A primer, 3e, TATA McGraw-Hill Company.
3. John R. Hubbard, Programming with Java, Second Edition, Schaum's outline Series, TMH.
4. Deitel&Deitel. Java TM: How to Program, PHI (2007)

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. **Measurable**
    1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
    2. Student seminars (on topics of the syllabus and related aspects (individual activity))
    3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
    4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. **General**
    1. Group Discussion
    2. Try to solve MCQ's available online.
    3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,

4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C4-P**	**OBJECT ORIENTATED PROGRAMMING THROUGH JAVA LAB**	**30**	**2**

1. Write a program to read ***Student Name, Reg.No, Marks[5]*** and calculate ***Total***, ***Percentage, Result***. Display all the details of students
2. Write a program to perform the following String Operations
   a. Read a string
   b. Find out whether there is a given substring or not
   c. Compare existing string by another string and display status
   d. Replace existing string character with another character
   e. Count number of works in a string
3. Java program to implements Addition and Multiplication of two N X N matrices.
4. Java program to demonstrate the use of Constructor.
5. Calculate area of the following shapes using method overloading.
   a. Triangle
   b. Rectangle
   c. Circle
   d. Square
6. Implement inheritance between ***Person (Aadhar, Surname, Name, DOB, and Age)*** and ***Student (Admission Number, College, Course, Year)***classes where ReadData(), DisplayData() are overriding methods.
7. Java program for implementing Interfaces
8. Java program on Multiple Inheritance.
9. Java program for to display ***Serial Number from 1 to N*** by creating two Threads
10. Java program to demonstrate the following exception handlings
    a. Divided by Zero
    b. Array Index Out of Bound
    c. File Not Found
    d. Arithmetic Exception
    e. User Defined Exception

11. Create an Applet to display different shapes such as Circle, Oval, Rectangle, Square and Triangle.

12. Write a program to create ***Book (ISBN,Title, Author, Price, Pages, Publisher)***structure and store book details in a file and perform the following operations

a. Add book details

b. Search a book details for a given ISBN and display book details, if available

c. Update a book details using ISBN

d. Delete book details for a given ISBN and display list of remaining Books

OPERATING SYSTEMS

Semester	Course Code	Course Title	Hours	Credits
IV	**C5**	**OPERATING SYSTEMS**	**60**	**2**

Objectives:

This course aims to introduce the structure and organization of a file system. It emphasizes various functions of an operating system like memory management, process management, device management, etc.

Course Learning Outcomes:

Upon successful completion of the course, a student will be able to:

1. Know Computer system resources and the role of operating system in resource management with algorithms
2. Understand Operating System Architectural design and its services.
3. Gain knowledge of various types of operating systems including Unix and Android.
4. Understand various process management concepts including scheduling, synchronization, and deadlocks.
5. Have a basic knowledge about multithreading.
6. Comprehenddifferent approaches for memory management.
7. Understand and identify potential threats to operating systems and the security features design to guard against them.
8. Specify objectives of modern operating systems and describe how operating systems have evolved over time.
9. Describe the functions of a contemporary operating system

UNIT- I

What is Operating System? History and Evolution of OS, Basic OS functions, Resource Abstraction, Types of Operating Systems– Multiprogramming Systems, Batch Systems, Time Sharing Systems; Operating Systems for Personal Computers, Workstations and Hand-held Devices, Process Control & Real time Systems.

UNIT- II

Processor and User Modes, Kernels, System Calls and System Programs, System View of the Process and Resources, Process Abstraction, Process Hierarchy, Threads, Threading Issues, Thread Libraries; Process Scheduling, Non-Preemptive and Preemptive Scheduling Algorithms.

UNIT III

Process Management: Deadlock, Deadlock Characterization, Necessary and Sufficient Conditions for Deadlock, Deadlock Handling Approaches: Deadlock Prevention, Deadlock Avoidance and Deadlock Detection and Recovery.

Concurrent and Dependent Processes, Critical Section, Semaphores, Methods for Inter-process Communication; Process Synchronization, Classical Process Synchronization Problems: Producer-Consumer, Reader-Writer.

UNIT IV

Memory Management: Physical and Virtual Address Space; Memory Allocation Strategies– Fixed and -Variable Partitions, Paging, Segmentation, Virtual Memory.

UNIT V

File and I/O Management, OS security : Directory Structure, File Operations, File Allocation Methods, Device Management, Pipes, Buffer, Shared Memory, Security Policy Mechanism, Protection, Authentication and Internal Access Authorization

Introduction to Android Operating System, Android Development Framework, Android Application Architecture, Android Process Management and File System, Small Application Development using Android Development Framework.

REFERENCE BOOKS:

1. Operating System Principles by Abraham Silberschatz, Peter Baer Galvin and Greg Gagne (7^{th}Edition) Wiley India Edition.
2. Operating Systems: Internals and Design Principles by Stallings (Pearson)
3. Operating Systems by J. Archer Harris (Author), Jyoti Singh (Author) (TMH)
4. Online Resources for UNIT V

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. **Measurable**
   1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
   2. Student seminars (on topics of the syllabus and related aspects (individual activity))
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   4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity
B. **General**
   1. Group Discussion
   2. Try to solve MCQ's available online.
   3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Programming exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports.

7. Efficient delivery using seminar presentations,
8. Viva-Voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C-5**	**OPERATING SYSTEMS LAB USING C/Java**	**30**	**2**

1. Write a program to implement Round Robin CPU Scheduling algorithm
2. Simulate SJF CPU Scheduling algorithm
3. Write a program the FCFS CPU Scheduling algorithm
4. Write a program to Priority CPU Scheduling algorithm
5. Simulate Sequential file allocation strategies
6. Simulate Indexed file allocation strategies
7. Simulate Linked file allocation strategies
8. Simulate MVT and MFT memory management techniques
9. Simulate Single level directory File organization techniques
10. Simulate Two level File organization techniques
11. Simulate Hierarchical File organization techniques
12. Write a program for Bankers Algorithm for Dead Lock Avoidance
13. Implement Bankers Algorithm Dead Lock Prevention.
14. Simulate all Page replacement algorithms.
    a) FIFO
    b) LRU
    c) LFU
15. Simulate Paging Techniques of memory management

SUBJECT EXPERTS

Dr.M.Ussenaiah
Dept of Computer Science,
Vikrama Simhapuri University

Dr.A.Kavitha,
Govt. Degree College,
Repalle

SYLLABUS VETTED BY

Dr.Gangadhar,
Dept of Computer Science
Acgharya Nagarjuna University,
Nagarjuna Nagar

REVISED SYLLABUS OF B.Sc. (Data Science) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.Sc (Computers – Statistics – Data science)

Market oriented course in Computer Science

Data Science

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities)

For 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

Data Science

Semester	Paper	Subject	Hrs.	Credits	IA	ES	Total
FIRST YEAR							
SEMESTER I	I	Maths for Data science	4	3	25	75	100
		Maths for Data science tutorial	2	2	0	50	50
SEMESTER II	II	Introduction to Data science With R	4	3	25	75	100
		R Programming Lab	2	2	0	50	50
SECOND YEAR							
SEMESTER III	III	Big Data Technology	4	3	25	75	100
		Big Data Technology through Hadoop Lab	2	2	0	50	50
SEMESTER IV	IV	Data Mining and Data Analysis	4	3	25	75	100
		Data Mining and Data Analysis lab	2	2	0	50	50
	V	Big data Acquisition and Analysis.	4	3	25	75	100
		Big data Acquisition and Analysis lab	2	2	0	50	50

I YEAR I SEMESTER PAPER– I MATHS FOR DATA SCIENCE

Objective

The course is a brief overview of the basic tools from Linear Algebra and Multivariable Calculus that will be needed in subsequent course of the program.

Outcome

By completing the course the students will have been reminded of the basic tools of Linear Algebra and Multivariable Calculus needed in subsequent courses in the program notably:

- Fundamental properties of matrices, their norms, and their applications.
- Differentiating/Integrating multiple variable functions and the role of the gradient and the hessian matrix.
- Basic properties of optimization problems involving matrices and functions of multiple variables.

Unit-I

Matrices and Basic Operations, Special structures Matrices and Basic Operations, Interpretation of matrices as linear mappings and some examples.

Square Matrices, Determinants, Properties of determinants, singular and non-singular matrices, examples, finding an inverse matrix.

Unit-II

Eigen values and Eigenvectors Characteristic Polynomial, Definition of Left/Right Eigen values and Eigenvectors, Caley – Hamilton theorem, singular value Decomposition, Interpretation of Eigen values/vectors.

Unit-III

Linear Systems Definition, applications, solving linear systems, linear inequalities, linear programming.

Unit-IV

Real-valued functions of two or more variables. Definition, examples, simple demos, applications.

Unit-V

Analysis elements Distance, Limits, Continuity, Differentiability, the gradient and the Gaussian.

Optimization problems Simple examples, motivation, the role of the Hessian maxima and minima and related extreme conditions.

Integration Double integrals, Fubini's theorem, properties, applications.

References

1. Gilbert Strang, *Linear Algebra and its Applications*. Thomson /Brooks Cole (Available in a Greek Translation).
2. Thomas M. Apostol, Calculus, Wiley, 2nd Edition, 1991 ISBN 960-07-0067-2.
3. Michael Spivak. *Calculus,* publish or Perish, 2008, ISBN 978-0914098911.
4. Ross L. Finney, Maurice D.Weir . and Frank R. Giordano. Thomas's Calculus, Pearson
   12th Edition 2009.
5. David C. Lay, Linear Algebra and Its Applications, 4th Editoin.
6. Yourself saad, Iterative Methods for spare Linear Systems.

Student Activity:

1. Find the Eigenvectors of A = { 1 1 1 1,2 3 4 5,3 4 5 6}
2. Find orthogonal S =Spam{(1 1 1 1),(1 4 4 0),(-1 4 4 0),(-4 2 2 0)}

I YEAR I SEMESTER MATHS FOR DATA SCIENCE

Tutorial

1. Study various applications of Matrices.
2. Study different polynomial functions and their uses.
3. Take one real world example and apply the Linear System solution.
4. Study some real valued functions and its applications.
5. Study and solve one optimization problem.

I YEAR II SEMESTER PAPER– II

INTRODUCTION TO DATA SCIENCE WITH R

Objective

Data Science is a fast-growing interdisciplinary field, focusing on the analysis of data to extract knowledge and insight. This course will introduce students to the collection. Preparation, analysis, modeling and visualization of data, covering both conceptual and practical issues. Examples and case studies from diverse fields will be presented, and hands-on use of statistical and data manipulation software will be included.

Outcomes

1. Recognize various disciplines that contribute to a successful data science effort.
2. Understand the processes of data science - identifying the problem to be solved, data collection, preparation, modeling, evaluation and visualization.
3. Be aware of the challenges that arise in data sciences.
4. Develop and appreciate various techniques for data modeling and mining.
5. Be cognizant of ethical issues in many data science tasks.
6. Be comfortable using commercial and open source tools such as the R language and its associated libraries for data analytics and visualization.
7. Learn skills to analyze real time problems using R
8. Able to use basic R data structures in loading, cleaning the data and preprocessing the data.
9. Able to do the exploratory data analysis on real time datasets
10. Able to understand and implement Linear Regression
11. Able to understand and use - lists, vectors, matrices, dataframes, etc.

Unit-1:

Introduction to Data Science- Introduction- Definition - Data Science in various fields - Examples - Impact of Data Science - Data Analytics Life Cycle - Data Science Toolkit - Data Scientist - Data Science Team

Understanding data: Introduction – Types of Data: Numeric – Categorical – Graphical – High Dimensional Data – Classification of digital Data: Structured, Semi-Structured and Un-Structured - Example Applications. Sources of Data: Time Series – Transactional Data – Biological Data – Spatial Data – Social Network Data – Data Evolution.

Unit-2:

Introduction to R- Features of R - Environment - R Studio. Basics of R-Assignment - Modes - Operators - special numbers - Logical values - Basic Functions - R help functions - R Data Structures - Control Structures. Vectors: Definition- Declaration - Generating - Indexing - Naming - Adding & Removing elements - Operations on Vectors - Recycling - Special Operators - Vectorized if- then else-Vector Equality – Functions for vectors - Missing values - NULL values - Filtering & Subsetting.

Unit-3:

Matrices - Creating Matrices - Adding or Removing rows/columns - Reshaping - Operations - Special functions on Matrices. Lists - Creating List – General List Operations - Special Functions - Recursive Lists. Data Frames - Creating Data Frames - Naming - Accessing -

Adding - Removing - Applying Special functions to Data Frames - Merging Data Frames- Factors and Tables.

Unit- 4:

Input / Output – Reading and Writing datasets in various formats - Functions - Creating User-defined functions - Functions on Function Object - Scope of Variables - Accessing Global, Environment - Closures - Recursion. Exploratory Data Analysis - Data Preprocessing - Descriptive Statistics - Central Tendency - Variability - Mean - Median - Range - Variance - Summary - Handling Missing values and Outliers - Normalization
Data Visualization in R : Types of visualizations - packages for visualizations - Basic Visualizations, Advanced Visualizations and Creating 3D plots.

Unit- 5:
Inferential Statistics with R - Types of Learning - Linear Regression- Simple Linear Regression - Implementation in R - functions on lm() - predict() - plotting and fitting regression line. Multiple Linear Regression - Introduction -comparison with simple linear regression - Correlation Matrix - F-Statistic - Target variables Vs Predictors - Identification of significant features - Implementation of Multiple Linear Regression in R.

References

1.Nina Zumel, John Mount, "Practical Data Science with R", Manning Publications, 2014. 2.Jure Leskovec, Anand Rajaraman, Jeffrey D.Ullman, "Mining of Massive Datasets",
Cambridge University Press, 2014.
3.Mark Gardener, "Beginning R - The Statistical Programming Language", John Wiley & Sons, Inc., 2012.
4.W. N. Venables, D. M. Smith and the R Core Team, "An Introduction to R", 2013. 5.Tony Ojeda, Sean Patrick Murphy, Benjamin Bengfort, Abhijit Dasgupta, "Practical Data
Science Cookbook", Packt Publishing Ltd., 2014.
6. Nathan Yau, "Visualize This: The FlowingData Guide to Design, Visualization, and Statistics", Wiley, 2011.
7. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.

Student Activity

Databases need to undergo pre-processing to be useful for data mining. Dirty data can cause confusion for the data mining procedure, resulting in unreliable output. Data cleaning includes smoothing noisy data, filling in missing values, identifying and removing outliers, and resolving inconsistencies.

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A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)

2. Student seminars (on topics of the syllabus and related aspects (individual activity))

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. General

1. Group Discussion

2. Try to solve MCQ's available online.

3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests)

2. Closed-book and open-book tests

3. Problem-solving exercises

4. Practical assignments and laboratory reports

5. Observation of practical skills

6. Individual and group project reports like "COVID-19 Analysis", "Estimated Quanrantain Period for Covid-19 Contacts", etc.

7. Efficient delivery using seminar presentations,

8. Viva voce interviews.

9. Computerized adaptive testing, literature surveys and evaluations,

10. Peers and self-assessment, outputs form individual and collaborative work

I YEAR II SEMESTER PAPER– II

R Programming LAB

1) Installing R and R studio
2) Create a folder DS_R and make it a working directory. Display the current working directory
3) installing the "ggplot2", "caTools", "CART" packages

4) load the packages "ggplot2", "caTools".
5) Basic operations in r
6) Working with Vectors:
    - Create a vector v1 with elements 1 to 20.
    - Add 2 to every element of the vector v1.
    - Divide every element in v1 by 5
    - Create a vector v2 with elements from 21 to 30. Now add v1 to v2.
7) Getting data into R, Basic data manipulation
8) Using the data present in the table given below, create a Matrix "**M**"

	C1	*C2*	*C3*	*C4*	*C5*
C1	*0*	*12*	*13*	*8*	*20*
C2	*12*	*0*	*15*	*28*	*88*
C3	*13*	*15*	*0*	*6*	*9*
C4	*8*	*28*	*6*	*0*	*33*
C5	*20*	*88*	*9*	*33*	*0*

    - Find the pairs of cities with shortest distance.
9) Consider the following marks scored by the 6 students

Section	Student no	M1	M2	M3
A	1	45	54	45
A	2	34	55	55
A	3	56	66	64
B	1	43	44	45
B	2	67	76	78
B	3	76	68	37

- create a data structure for the above data and store in proper positions with proper names
- display the marks and totals for all students
- Display the highest total marks in each section.
- Add a new subject and fill it with marks for 2 sections.

- Three people denoted by P1, P2, P3 intend to buy some rolls, buns, cakes and bread. Each of them needs these commodities in differing amounts and can buy them in two shops S1, S2. The individual prices and desired quantities of the commodities are given in the following table "demand.

	price	
	S1	S2
Roll	1.5	1
Bun	2	2.5
Cake	5	4.5
Bread	16	17

	demand.quantity			
	Roll	Bun	Cake	Bread
P1	6	5	3	1
P2	3	6	2	2
P3	3	4	3	1

- Create matrices for above information with row names and col names.
- Display the demand.quantity and price matrices
- Find the total amount to be spent by each person for their requirements in each shop
- Suggest a shop for each person to buy the products which is minimal.

10) Consider the following employee details:

employee details as follows		
	emp_no:1	
	name: Ram	
	salary	
		basic: 10000
		hra: 2500
		da: 4000
	deductions	
		pf: 1100
		tax: 200
	total salary	
		gs(Gross Salary):
		ns(Net Salary)

- Create a list for the employee data and fill gross and net salary.
- Add the address to the above list
- display the employee name and address
- remove street from address
- remove address from the List.

11) Loops and functions - Find the factorial of a given number
12) Implementation of Data Frame and its corresponding operators and functions
13) Implementation of Reading data from the files and writing output back to the specified file
14) Treatment of NAs, outliers, Scaling the data, etc
15) Applying summary() to find the mean, median, standard deviation, etc
16) Implementation of Visualizations - Bar, Histogram, Box, Line, scatter plot, etc.
17) Implementation of Linear and multiple Linear Regression
18) Fitting regression line

II YEAR III SEMESTER PAPER– III

BIG DATA TECHNOLOGY

Objectives:

This course provides practical foundation level training that enables immediate and effective participation in big data projects. The course provides grounding in basic and advanced methods to big data technology and tools, including MapReduce and Hadoop and its ecosystem.

Outcome

1. Learn tips and tricks for Big Data use cases and solutions.
2. Acquire knowledge of HDFS components , Namenode, Datanode, etc.
3. Acquire knowledge of storing and maintaining data in cluster, reading data from and writing data to Hadoop cluster.
4. Able to maintain files in HDFS
5. Able to write MapReduce applications to access data present on HDFS
6. Able to read different formats of files into map-reduce application.
7. Able to develop MapReduce applications to analyze Big Data related to the real world use cases.
8. Able to write MapReduce applications that can take data from multiple datasets and join them
9. Able to optimize the performance of Map-Reduce application

Unit-I: Introduction to Big Data

Introduction –Distributed File System – Big Data and its importance, Characteristics of Big Data, Limitation of Conventional Data Processing Approaches, Need of big data frameworks, Big data analytics, Limitations of Big Data and Challenges, Big data applications

Unit-II

Hadoop: Basic Concepts of Hadoop and its features -The Hadoop Distributed File System (HDFS)- Anatomy of a Hadoop Cluster - Hadoop cluster modes - Hadoop Architecture, Hadoop Storage - Hadoop daemons (Name node-Secondary name node-Job tracker-Task tracker-Data node,etc) - Anatomy of Read & Write operations – Interacting HDFS using command-line (HDFS Shell and FS shell commands) -Interacting HDFS using Java APIs – Dataflow – Blocks –Replica - YARN.

Unit-III

Hadoop Ecosystem Components – Schedulers- Fair and Capacity, Hadoop 2.0 Vs Hadoop 3.0 and its new features.

Hadoop Cluster Setup – SSH & Hadoop Configuration –HDFS Administering – Monitoring & Maintenance.

Unit-IV

Hadoop MapReduce - Introduction - Phases in MapReduce Framework - Anatomy of MapReduce Job run - Failures, Job Scheduling, Shuffle and Sort, Task Execution, Map Reduce

Types and Formats, Map Reduce Features. Understanding Basic MapReduce Pogram (WordCount program): The Driver Code - The Mapper class - The Reducer class.

Unit-V:

Writing first MapReduce Program - Hadoop's Streaming API - Using Eclipse for Rapid Development – YARN Vs MapReduce Advanced MapReduce Concepts: Partitioner – Combiner – Joins – Map-side Join – Reduce-side Join - Case Study: Weblog Analysis done using Mapper, Reducer, Combiner, Partitioner, etc.

References

1. Boris lublinsky, Kevin t. Smith Alexey Yakubovich, "Professional Hadoop Solutions".
   Wiley, ISBN : 9788126551071, 2015.
2. Chris Eaton, Dirk Deroos et al., "Understanding Big Data", McGraw Hill , 2010.
3. Tom White, "HADOOP" : The definitive Guide", O Reilly 2012.
4. Srinath Perera, Thilina Gunarathne, "Hadoop MapReduce Cookbook", PACKT publishing, 2013.

Student Activity:

Case Study I: Centers for Medicare & Medicaid Services: The Integrity of Healthcare Data and Secure Payment Processing.

Case Study II: Movie Lens Data set Analysis

Case Study III: Web Server Log Analysis using MapReduce.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)

2. Student seminars (on topics of the syllabus and related aspects (individual activity))

3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))

4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests)
2. Closed-book and open-book tests
3. Problem-solving exercises
4. Practical assignments and laboratory reports
5. Observation of practical skills
6. Individual and group project reports like "Movie Lens Data Analysis", "Youtube Click stream Data

   Analysis", etc.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

II YEAR III SEMESTER PAPER– III

BIG DATA TECHNOLOGY Through Hadoop LAB

1. Implement the following Data Structures in Java
   a) Linked Lists
   b) Stacks
   c) Queues
   d) Set
   e) Map

2. Hadoop Cluster Setup
   (i) Perform setting up and Installing Hadoop in its three operating modes: Standalone Pseudo distribute d Fully distribute d
   (ii) Use web based tools to monitor your Hadoop setup.

3. Implement the following file management tasks in Hadoop:
   - Adding files and directories, List the files and directories
   - Retrieving files
   - Deleting files
   - Copying files from one folder to another in HDFS
   - Copying files from Local File System to HDFS

4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm
5. Write a Map Reduce program that mines weather data (NCDC). Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: ftp://ftp.ncdc.noaa.gov/pub/data/noaa/.
   - Find average, max and min temperature for each year in NCDC data set
   - Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.
6. Implement Matrix Multiplication program with Hadoop Map Reduce.
7. Stop word elimination problem:
   Input:
   - A large textual file containing one sentence per line
   - A small file containing a set of stop words (One stop word per line)

Output:

- A textual file containing the same sentences of the large input file without the words appearing in the small file.

8. Write a MapReduce Application to implement Combiners
9. Write a MapReduce Application to implement Reduce-side Join
10. Write a MapReduce Application to implement Map-side Join

Outcome:

- Able to develop MapReduce applications to analyze Big Data related to the real world use cases.
- Able to setup, configure and manage Hadoop cluster on single node
- Able to access the Hadoop cluster through Web UI.
- Able to track the execution of MapReduce jobs through Web UI
- Able use Joins, partitioner, combiners as and when needed while developping MapReduce application to analyze the Big Data.

II YEAR IV SEMESTER PAPER– IV

DATA MINING AND DATA ANALYSIS

Objective

- To learn data analysis techniques.
- To understand Data mining techniques and algorithms.
- Comprehend the data mining environments and application.

Outcome

Students who complete this course will be able to

1. To understand and demonstrate data mining
2. Compare various conceptions of data mining as evidenced in both research and application.
3. Characterize various kinds of patterns that can be discovered by association rule mining.
4. Evaluate mathematical methods underlying the effective application of data mining.
5. To Analyze the data using statistical methods
6. Gain hands-on skills and experience on data mining tools.

Unit-I

Data mining - KDD Vs Data Mining, Stages of the Data Mining Process-Task Primitives, Data Mining Techniques – Data Mining Knowledge Representation. Major Issues in Data Mining – Measurement and Data – Data Preprocessing – Data Cleaning - Data transformation- Feature Selection - Dimensionality reduction

Unit-II: Predictive Analytics

Classification and Prediction - Basic Concepts of Classification and Prediction, General Approach to solving a classification problem- Logistic Regression - LDA - Decision Trees: Tree Construction Principle – Feature Selection measure – Tree Pruning - Decision Tree construction Algorithm, Random Forest, Bayesian Classification-Accuracy and Error Measures- Evaluating the Accuracy of the classifier / predictor- Ensemble methods and Model selection.

Unit-III : Classification and Descriptive Analytics

Rule Based Classification – Classification by Back propagation – Support Vector Machines – Associative Classification – Lazy Learners – Other Classification Methods – Prediction. Descriptive Analytics - Mining Frequent Itemsets - Market based model – Association and Sequential Rule Mining

Unit - IV : Cluster Analysis

Cluster Analysis: Basic concepts and Methods – Cluster Analysis – Partitioning methods – Hierarchical methods – Density Based Methods – Grid Based Methods – Evaluation of Clustering – Advanced Cluster Analysis: Probabilistic model based clustering – Clustering High – Dimensional Data – Clustering Graph and Network Data – Clustering with Constraints- Outlier Analysis.

Unit-V: Factor Analysis

Factor Analysis: Meaning, objectives and Assumptions, Designing a factor analysis, Deriving factors and assessing overall factors, Interpreting the factors and validation of factor analysis.

References

1. Adelchi Azzalini, Bruno Scapa, "Data Analysis and Data mining" , 2nd Ediiton, Oxford Univeristy Press Inc., 2012.
2. Jiawei Han and Micheline Kamber, "Data Mining: Concepts and Techniques", 3rd Edition, Morgan Kaufmann Publishers, 2011.
3. Alex Berson and Stephen J. Smith, "Data Warehousing, Data Mining & OLAP", 10th Edition, TataMc Graw Hill Edition , 2007.
4. G.K. Gupta, "Introduction to Data Mining with Case Studies", 1st Edition, Easter Economy Edition, PHI, 2006.
5. Joseph F Hair, William C Black etal, "Multivariate Data Analysis", Pearson Education, 7th edition, 2013.

Student Activity

Case Study I: Analysis and Forecasting of House Price Indices

Case Study II: Customer Response Prediction and Profit Optimization

Case Study III: Iris Species Prediction

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B. General

1. Group Discussion

2. Try to solve MCQ's available online.

3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests)

2. Closed-book and open-book tests

3. Problem-solving exercises

4. Practical assignments and laboratory reports

5. Observation of practical skills

6. Individual and group project reports like "Movie Lens Data Analysis", "COVID-19 Analysis", etc.

7. Efficient delivery using seminar presentations,

8. Viva voce interviews.

9. Computerized adaptive testing, literature surveys and evaluations,

10. Peers and self-assessment, outputs form individual and collaborative work

II YEAR IV SEMESTER PAPER– IV

DATA MINIG AND DATA ANALYSIS LAB

1. Data Analysis – Getting to know the Data (Using ORANGE WEKA or R Programming)
    - Parametric – Means, T-Test, Correlation
    - Prediction for numerical outcomes – Linear regression, Multiple Linear Regression
    - Correlation analysis
    - Preparing data for analysis
        - Pre-Processing techniques

2. Data Mining (Using ORANGE WEKA or R Programming)
    - Implement clustering algorithm
    - Implement Association Rule mining
    - Implement classification using
        - Decision tree
        - Back Propagation
        - Logistic Regression
        - Decision Tree
        - Random Forest
        - Naive Bayes
        - Support Vector Machines
    - Visualization methods

II YEAR IV SEMESTER PAPER– V

BIG DATA ACQUISITION AND ANALYSIS

Objective

Learn to develop Hadoop applications for storing processing and analyzing data stored in Hadoop cluster. The course is mainly covering Big Data tools for Data Transformation (Apache PIG), Data Analysis (HIVE) and for handling unstructured data HBase. To Understand the complexity and volume of Big Data and their challenges. To analyse the various methods of data collection. To comprehend the necessity for pre-processing Big Data and their issues

Outcome

1. Identify the various sources of Big Data
2. Able to collect and store Big Data from various sources
3. Able to write Pig Scripts- Extract, Transform and Load the data on HDFS
4. Able to write Hive Scripts- Extract, Transform, Load and Analyse the data present in HDFS
5. Able to write scripts to extract data from structured and un-structured data for analytics
6. Able to extract and process semi and un-structured data using HBase

Unit- I

Introduction To Big Data Acquisition: Big data framework – fundamental concepts of Big Data Management and analytics – Current challenges and trends in Big Data Acquisition. Map Reduce Algorithm- Hadoop Storage [HDFS], Common Hadoop Shell commands - Anatomy of File Write and Read, NameNode, Secondary NameNode, and DataNode - Hadoop Configuration – Pig Configuration – Hive Configuration - HBase Configuration.

Unit-II

Data Collection And Transmission: Big data collection – Strategies – Types of Data Sources – Structured Vs Unstructured data – ELT vs ETL – storage infrastructure requirements – Collection methods – Log files – sensors – Methods for acquiring network data (Libcap-based and zero-copy packet capture technology) – Specialized network monitoring softwares (Wireshark, Smartsniff and Winnetcap) – Mobile equipments, Transmission methods, Issues.

Unit-III

Apache Pig - Introduction - Pig features - Pig Architecture - Pig Execution modes, Pig Grunt shell and Shell commands. Pig Latin Basics: Data model, Data Types, Operators - Pig Latin Commands - Load & Store , Diagnostic Operators, Grouping, Cogroup, Joining, Filtering, Sorting, Splitting - Built-In Functions, User define functions. Pig Execution Modes: Batch Mode – Embedded Mode – Pig Execution in Batch Mode –Use cases - Map Reduce programs with Pig – Pig Vs SQL

Unit-IV

Hive: Introduction - Hive Features - Hive architecture -Hive Meta store - Hive data types -

Hive Tables - Table types - Creating database, Altering database, Create table, alter table, Drop table, Built-In Functions - Built-In Operators, User defined functions(UDFs), View, Pig Vs Hive.

HiveQL–Introduction, HiveQL Select, HiveQL – MapReduce using HiveQL OrderBy, Group By Joins, LIMIT, Distribute By , Cluster By - Sorting And Aggregation – Partitioning: Static & Dynamic partitioning – Index Creation - Bucketing – Analysis of MapReduce execution – Hive Optimization – Setting Hiivng Parameters. Comparison between MapReduce, Hive QL and SQL. UseCase: Implementation of MapReduce programs with HiveQL.

Unit-V

Hbase : HBasics, Features of HBase, Concepts, Clients, Example, Hbase Versus RDBMS, Limitations of HBase

Big Data Privacy And Applications: Data Masking – Privately identified Information (PII) – Privacy preservation in Big Data – Popular Big Data Techniques and tools –Applications-Social Media Analytics – Fraud Detection.

References

1. Bart Baesens, "Analytics in a Big Data World: The Essential Guide to Data Science and its Applications', John Wiley & Sons, 2014.
2. Tom White " Hadoop: The Definitive Guide" Third Edit on, O'reily Media, 2012.
3. Seema Acharya, Subhasini Chellappan, "Big Data Analytics" Wiley 2015.
4. Min Chen. Shiwen Mao, Yin Zhang. Victor CM Leung, Big Data: Related Technologies, Challenges and Future Prospects, Springer, 2014.
5. Michael Minelli, Michele Chambers Ambiga Dhiraj, "Big Data, Big Analytics : Emerging Business Intelligence and Analytic Trends", John Wiley & Sons, 2013.
6. Raj. Pethuru " Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global.

Student Activity:

Case study I: "BankAmeriDeals" provides cash-back offers to credit and debit-card customers based upon analyses of their prior purchases.

Case Study II: ***GOOGLE:*** Working with the U.S. Centers for Disease Control, tracks when users are inputting search terms related to flu topics, to help predict which regions may experience outbreaks.

Case Study III: Twitter data Analysis

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B. General

1. Group Discussion

2. Try to solve MCQ's available online.

3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests)
2. Closed-book and open-book tests
3. Problem-solving exercises
4. Practical assignments and laboratory reports
5. Observation of practical skills
6. Individual and group project reports like "Movie Lens Data Analysis", "Youtube Click stream Data Analysis, Twitter Data Analysis, etc
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

II YEAR IV SEMESTER Paper-V

Data Acquisition and Analysis Lab

1. Hadoop Cluster Setup
   - Perform setting up and Installing Hadoop in its three operating modes:
     - standalone
     - Pseudo distributed
     - Fully distributed
   - Use web based tools to monitor your Hadoop setup.

2. Install and Run Pig and also use Pig Shell commands to display the list of files in HDFS

3. Install and Run Hive and also use Hive Shell commands to display the list of files in HDFS

4. Install and Run HBase and also use HBase Shell commands to display the version and user of HBase

5. Use Hive to create, alter, and drop databases, tables, views, functions, and indexes

6. Write and execute Pig Script to Load data into a Pig relation without a schema

7. Write and execute Pig Script Load data into a Pig relation with a schema

8. Write a Pig script to find the word count in a text file

9. Write a Pig Script that mines weather data (NCDC). Weather sensors collecting data every hour at many locations across the globe gather a large volume of log data, which is a good candidate for analysis with MapReduce, since it is semi structured and record-oriented. Data available at: ftp://ftp.ncdc.noaa.gov/pub/data/noaa/.

   - Find average, max and min temperature for each year in NCDC data set

   - Filter the readings of a set based on value of the measurement, Output the line of input files associated with a temperature value greater than 30.0 and store it in a separate file.

10. Write HiveQL command to create Weather table and to find the year-wise maximum temperature

11. Write a Pig Script to remove null and duplicate values from the given input file.

12. Write Pig scripts to implement filter, project, sort, group by, joins

13. Write Hive Query to create database, managed table, external table, join, index, view, etc

14. Create a table in HBase and insert the data into with Shell

15. Display the data present in a HBase table using Shell

REVISED SYLLABUS OF B.Sc. (Internet of Things) UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.Sc. (Maths – Electronics – Internet of Things)

Market oriented course in Computer Science

Internet of Things (IoT)

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities)

For 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

Internet of Things

Year	Semester	Paper Code	Subject	Hrs. per Week	Credits	IA	ES	Total
First Year	I	C1	Fundamentals of Computer and C -Programming	4	3	25	75	100
	I	C1-P	Hardware and C Programming Lab	2	2	0	50	50
	II	C2	Fundamentals of IoT and Applications	4	3	25	75	100
	II	C2-P	Arduino Lab	2	2	0	50	50
Second Year	III	C3	Data Communications & Computer Networks	4	3	25	75	100
	III	C3-P	Wire and Wireless Network Lab	2	2	0	50	50
	IV	C4	RFID and Sensor Networks	4	3	25	75	100
	IV	C4-P	Network Simulator –3 Lab	2	2	0	50	50
	IV	C5	Implementing IoT with Raspberry Pi	4	3	25	75	100
	IV	C5-P	Raspberry Pi Lab	2	2	0	50	50

SEMESTER-I

Semester	Course Code	Course Title	Hours	Credits
I	C1	**Fundamentals of Computer and C-Programming**	60	4

Course Objectives

1. To explore basic knowledge on computers
2. Learn how to solve common types of computing problems.
3. Learn basic constructs of computer programming languages
4. Learn data types and control structures of C
5. Learn to map problems to programming features of C.
6. Learn to write good portable C programs.

Course Outcomes

Upon successful completion of the course, a student will be able to:

1. Appreciate and understand the working of a digital computer
2. Analyze a given problem and develop an algorithm to solve the problem
3. Improve upon a solution to a problem
4. Use the 'C' language constructs in the right way
5. Design, develop and test programs written in 'C'

UNIT-I

Introduction to computers - Characteristics and limitations of computer, Block diagram of computer, types of computers, computer generations. Number systems: binary, hexadecimal and octal numbering system. Input and output devices: Keyboard and mouse, inputting data in other ways

Types of Software: system software, Application software, commercial, open source, domain and free ware software, Memories: primary, secondary and cache memory.

UNIT-II

Problem Analysis and its Tools: Problem solving technique and Program Development Life Cycle, Problem Definition, Algorithm, Flow Charts, Types of Errors, Testing and Debugging.
Basics of C: Historical development of C Language, Basic Structure of C Program, C Character Set, Identifiers and Keywords, constants, variables, Data types.

Operators and expressions: Arithmetic, Relational, Logical, Assignment, Unary, Conditional and Bitwise operators.Type conversions. Input and output statements: getchar( ), getch( ), getche( ), putchar( ), printf( ), scanf( ), gets( ), puts( )

UNIT-III

Control statements: Decision making statements: if, if else, else if ladder, switch statements. Loop control statements: while loop, for loop and do-while loop. Jump Control statements: break, continue and goto.
Arrays: one dimensional Array, two dimensional arrays.

UNIT-IV

Strings: Input/ Output of strings, string handling functions, table of strings
Functions: Function Prototype, definition and calling. Return statement. Nesting of functions. Categories of functions. Recursion, Parameter Passing by address & by value. Local and Global variables. Storage classes: automatic, external, static and register.

UNIT-V

Pointers: Pointer data type, Pointer declaration, initialization, accessing values using pointers. Pointer arithmetic. Pointers and arrays, pointers and functions.
Structures and Unions : Using structures and unions, use of structures in arrays and arrays in structures. Comparison of structure and Union.

Text Books:

1. E. Balagurusway, “Programming in C”, Tata McGrwal Hill.
2. Computer fundamentals and c programming in c by Reemathareja, oxford university press

Reference Books

1. Introduction to C programming by REEMA THAREJA from OXFORD UNIVERSITY PRESS
2. E Balagurusamy: ―COMPUTING FUNDAMENTALS & C PROGRAMMING – Tata McGraw-Hill, Second Reprint 2008, ISBN 978-0-07-066909-3.
3. Ashok N Kamthane: Programming with ANSI and Turbo C, Pearson Edition Publ, 2002.
4. Henry Mullish&HuubertL.Cooper: The Spirit of C An Introduction to modern Programming, Jaico Pub. House,1996.
5. Y kanithkar, let us C BPB, 13 th edition-2013, ISBN:978-8183331630,656 pages.

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B. General

1. Group Discussion
2. Try to solve MCQ’s available online.
3. Others

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Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like “Creating Text Editor in C”.
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
I	**C1-P**	**Hardware and C Programming Lab**	**30**	**1**

SEMESTER-I

Hardware Lab:

1. Identify various Memory components of the Computer.
2. Identify Various Cables and their uses
3. Identify various Network Devices.
4. Assembling and Disassembling of Computers.

C Programming Lab

1. Find the biggest of three numbers using C.
2. Write a c program to find the sum of individual digits of a positive integer.
3. A Fibonacci sequence is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence.
4. Write a c program to check whether a number is Armstrong or not.
5. Write a program to perform various string operations.
6. Write a c program to generate all the prime numbers between 1 and n, where n is a value supplied by the user.
7. Write a c program that uses functions to perform the following: Addition of two matrices. Multiplication of two matrices.
8. Write a c program that implements searching of given item in given list.
9. Write a c program to sort a given list of integers in ascending order.
10. Write a c program to perform various operations using pointers.
11. Write a c program to read data of 10 employees with a structure of 1.employee id 2.aadar no, 3.title, 4.joined date, 5.salary, 6.date of birth, 7.gender, 8.department.
12. Write a program for concatenation of two strings.
13. Write a program for length of a string

SEMESTER-II

Semester	Course Code	Course Title	Hours	Credits
II	C2	**Fundamentals of IoT and Applications**	60	4

Course Objectives

1. To study fundamental concepts of IoT
2. To understand roles of sensors in IoT
3. To Learn different protocols used for IoT design
4. To be familiar with data handling and analytics tools in IoT
5. Appreciate the role of big data, cloud computing and data analytics in a typical IoT system.

6. Understand the role of IoT in various domains of Industry.

Course Outcomes:

On completion of the course, student will be able to

1. Understand the various concepts, terminologies and architecture of IoT systems.
2. Use sensors and actuators for design of IoT.
3. Understand and apply various protocols for design of IoT systems
4. Use various techniques of data storage and analytics in IoT
5. Understand various applications of IoT
6. Understand APIs to connect IoT related technologies

UNIT-I

Fundamentals of IoT: Introduction, Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M.

UNIT-II

Sensors Networks : Definition, Types of Sensors, Types of Actuators, Examples and Working, IoT Development Boards: Arduino IDE and Board Types, RaspberriPi Development Kit, RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.

UNIT-III

Wireless Technologies for IoT: WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.
IP Based Protocols for IoT IPv6, 6LowPAN, RPL, REST, AMPQ, CoAP, MQTT.
Edge connectivity and protocols

UNIT-IV

Data Handling& Analytics: Introduction, Bigdata, Types of data, Characteristics of Big data, Data handling Technologies, Flow of data, Data acquisition, Data Storage, Introduction to Hadoop. Introduction to data Analytics, Types of Data analytics, Local Analytics, Cloud analytics and applications

UNIT-V

Applications of IoT: Home Automation, Smart Cities, Energy, Retail Management, Logistics, Agriculture, Health and Lifestyle, Industrial IoT, Legal challenges, IoT design Ethics, IoT in Environmental Protection.

Text Books:

1. Hakima Chaouchi, — "The Internet of Things Connecting Objects to the Web" ISBN : 978-1- 84821-140-7, Wiley Publications
2. Olivier Hersent, David Boswarthick, and Omar Elloumi, — "The Internet of Things: Key Applications and Protocols", WileyPublications
3. Vijay Madisetti and ArshdeepBahga, — "Internet of Things (A Hands-on-Approach)", 1st Edition, VPT, 2014.
4. J. Biron and J. Follett, "Foundational Elements of an IoT Solution", O'Reilly Media, 2016.
5. Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.

References

1. Daniel Minoli, — "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118-47347-4, Willy Publications
2. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press
3. https://onlinecourses.nptel.ac.in/noc17_cs22/course
4. http://www.cse.wustl.edu/~jain/cse570-15/ftp/iot_prot/index.html

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual

participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Developing IoT real time application using Arduino".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
II	**C2-P**	**Arduino Lab**	**30**	**1**

List of Experiments

1. Understanding Arduino UNO Board and Components
2. Installing and work with Arduino IDE
3. Blinking LED sketch with Arduino
4. Simulation of 4-Way Traffic Light with Arduino
5. Using Pulse Width Modulation
6. LED Fade Sketch and Button Sketch
7. Analog Input Sketch (Bar Graph with LEDs and Potentio metre)

8. Digital Read Serial Sketch (Working with DHT/IR/Gas or Any other Sensor)
9. Working with Adafruit Libraries in Arduino
10. Spinning a DC Motor and Motor Speed Control Sketch
11. Working with Shields
12. Interfacing Arduino with Cloud (Thingspeak API)

SEMESTER-III

Semester	Course Code	Course Title	Hours	Credits
III	**C3**	**Data Communications & Computer Networks**	**60**	**4**

UNIT - I

Introduction to Data communications, Network Criteria, point-to-point and multi point connection, physical topology, Local Area Networks, Metropolitan Area Networks, Wide Area Networks, Wireless Networks, protocols and standards.

Network Models: Layered tasks, Connection-Oriented and Connectionless Services, Service Primitives, The OSI Reference Model, The TCP/IP Reference Model, Comparison of the OSI and TCP/IP Reference Models, addressing.

UNIT – II

Physical Layer: Basis for Data Communication: Transmission of digital signals: Bit rate, bit length, baseband and broadband transmission, transmission impairment, data rate limits, performance, Guided Transmission Media Twisted Pair Coaxial Cable and Fiber Optics

Data Link Layer: Framing, Error Control, Flow Control, Error-Detection and correction: Introduction, Error detection using CRC. Data Link Protocols: Simplest Protocol, Stop-and-Wait Protocol, Stop-and-Wait ARQ, Go-Back-N ARQ, Selective Repeat ARQ, HDLC.

UNIT – III

Multiple Accesses. Random Access: ALOHA, Carrier Sense Multiple Access (CSMA) Protocols, CSMA with Collision Detection, CSMA with Collision Avoidance..Controlled Access: Reservation, Polling and Token Passing. Channelization: FDMA, TDMA, CDMA.

Wired LAN: Ethernet, IEEE standards, Standard Ethernet. Changes in the standards, Fast Ethernet, Gigabit Ethernet, Wireless LAN (802.11).

UNIT - IV

Connecting LANs, Backbone and Virtual LANs: Connecting devices, Back bone Networks, Virtual LANs. Network Layer: Need for network layer, Logical addressing, Ipv4 addresses, Ipv6 addresses, Ipv4 and Ipv6 datagram's, Transition from Ipv4 to Ipv6.

UNIT - V

Network Layer: Delivery, Forwarding, Types of Routing protocols, Unicast Routing Protocols, The Transport Layer: Process to process Delivery, User Datagram Protocol (UDP) and TCP. Application layer: Domain name space, Distribution of name space, Resolution.

Text Books:

1. Data communications and Networking-4th edition BeharouzA.Forouzan, TMH
2. Alberto Leon-Garcia, Communication Networks, 2012, Ninth Reprint, Tata McGraw-Hill, India.

Reference Books:

1. Data Communications and Computer Networks By Prakash C. Gupta, PHI Publishers.
2. Computer Networks By Andrew S.Tanenbaum, Pearson Education.
3. Wireless Technologies Circuits, Systems and Devices by Krzysztof Iniewski CRC Press.
4. Wireless Networking Technology: From Principles to Successful Implementationby Stephen A. Rackley.
5. Robert Gallager, Data Networks, 2010, 2nd edition, Prentice Hall, India.
6. W. Stallings, Data and Computer Communications, 2004, Prentice Hall, India.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

(Co-curricular activities shall not promote copying from textbook or from others work and shall encourage self/independent and group learning)

A. Measurable

1. Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
2. Student seminars (on topics of the syllabus and related aspects (individual activity))
3. Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
4. Study projects (by very small groups of students on selected local real-time

problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Establishing a hybrid network protocol as per your college needs".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
III	**C3-P**	**Wire and Wireless Networks Lab**	**30**	**1**

List of Experiments

List of Experiments (NS2/QUALNET/BWSIM/MATLAB)

1. Study of Network Devices in detail
2. Study of Network IP and basic network command and network configuration commands
3. Wired and Wireless network scenario creation.

4. Simulation of Four Node Point To Point Network
5. Transmission Of Ping Message
6. Implement various Topologies
7. Study of Routing Protocols.
8. Study of performance of MAC Protocols
9. UDP and TCP Simulation
10. Call establishment in cellular network.
11. Handover in cellular network.
12. Study of Performance Comparison of TCP and UDP using NS – 2

SEMESTER-IV

Semester	Course Code	Course Title	Hours	Credits
IV	C4	**RFID and Wireless Sensor Networks**	60	4

Course Objectives:

1. Understand and designing Radio frequency identification (RFID) systems, middleware architectures for real-world applications.
2. Understanding RFID and related Architectures, RFID Principles and security issues
3. Determine road map for transformation of flexible electronics from foils to textiles
4. Understanding the implementation, challenges and design constraints of WSN
5. Knowing about the MAC layer and routing protocols in WSN
6. Modeling of WSN for interfacing with IoT platform.
7. Knowing Security threats and resolution methods in WSN

.

Course Outcomes

1. Students will be familiar with RFID technology, various components involved.
2. Getting familiar with various RFID standards, Students learn various Security issues involved in RFID.
3. Students learn about Wireless Sensor Networks
4. Familiar with WSN protocols routing algorithms.
5. Various Security issues involved in Wireless Sensor Networks.

UNIT-I

Introduction of RFID, Automatic Identification Systems, A Comparison of Different ID Systems, Components of an RFID System, Differentiation Features of RFID Systems, Transponder Construction Formats, Frequency, Range and Coupling , Active and Passive Transponders, Information Processing in the Transponder , Selection Criteria for RFID Systems, Fundamental Operating Principles.

UNIT-II

Frequency Ranges and Radio Licensing Regulations, Coding and Modulation, Data Integrity, Multi-Access Procedures – Anticollision, Security of RFID Systems, Attacks on RFID Systems

UNIT-III

Wireless Sensor Networks- Introduction, Challenges and Constraints, Applications, Node Architecture, Operating Systems, Physical Layer.

UNIT-IV

Medium Access Control: Characteristics of MAC Protocols in Sensor Networks, Contention-Free MAC Protocols, Contention-Based MAC Protocols, Network Layer: Various Routing Protocols.

UNIT-V

Security in WSN: Challenges of Security in Wireless Sensor Networks, Security Attacks in Sensor Networks, Protocols and Mechanisms for Security, IEEE 802.15.4 and ZigBee Security

Text Books

1. RFID Handbook, Klaus Finkenzeller,WILEY & SONS
2. Fundamentals of Wireless Sensor Networks: theory and practice by Waltenegus Dargie, Christian Poellabauer

Reference Books

1. RFID and Sensor Networks Architecture, Protocols, Security and integration by Yan Zhang, Laurence T. Yang, Jining.
2. Ian F. Akyildiz, and Mehmet Can Vuran, Wireless Sensor Networks, 2010, Wiley, USA.
3. IBM Bluemix: The Cloud Platform for Creating and Delivering Applications, http://www.redbooks.ibm.com/redpapers/pdfs/redp5242.pdf
4. Wireless Sensor Networks Technology, protocols and applications by KAZEM SOHRABY, DANIEL MINOLI TAIEB ZNATI, JOHN WILEY & SONS, INC Publication.

5. REILLY, RFID Essentials By Bill Glover, Himanshu Bhatt.
6. W. Dargie and C. Poellabauer, Fundamentals of Wireless Sensor Networks, 2010, Wiley, USA.
7. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, 2011, Wiley, USA.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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4. Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity))

B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,

5. Observation of practical skills,
6. Individual and group project reports like "Design of RFID Smart Attendance cum Doorlock System for College Laboratory".
7. Efficient delivery using seminar presentations,
8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C4-P**	**Network Simulator Lab-3**	**30**	**1**

List of Experiments

1. Introduction to network simulators used for wireless Ad Hoc and Sensor Networks.
2. Introduction to TCL scripting: demonstration of one small network simulation script.
3. To study various trace file formats of network simulators.
4. To implement and compare various MAC layer protocols.
5. To implement and compare AODV and DSR routing algorithms in MANET
6. To implement DSDV routing algorithms in MANET
7. To implement signal strength based link management routing protocols.
8. To calculate and compare average throughput for various TCP variants
9. To implement and compare various routing protocols for wireless sensor networks

Semester	Course Code	Course Title	Hours	Credits
IV	**C5**	**Implementing IoT with Raspberry Pi**	**60**	**4**

Course Objectives:

The course is aimed at

1. This program aims to train students to be equipped with a solid theoretical foundation, systematic professional knowledge and strong practical skills in the Raspberry Pi.

2. The course focuses on higher-level operating systems, advanced networking, user interfaces, multimedia and uses more computing intensive IoT applications as examples using Raspberry Pi running Linux as the platform of choice
3. After doing this course, students should be able to design and deploy multiple IoT devices that could connect to the gateway.
4. Acquainting students with the basic web app creation
5. Connecting and Using various IoT Cloud Based Platforms such as Blynk, Thingspeak, AWS IoT, Google Cloud IoT Core etc..
6. Working with Big Data Processing Techniques
7. Developing Mobile App for IoT application

Course Outcomes:

At the end of the course the student should be able to

1. Appreciate the development technology for IoT
2. Familiar with Basic Concepts of Linux
3. Design real time IoT Devices.
4. Familiar with basic foundations of Python Programming and libraries
5. Comprehend the basic concepts of Mobile Cloud Computing
6. Develop a Mobile App for IoT applications.

UNIT-I

Getting Started with Raspberry Pi: Basic functionality of Raspberry Pi B+ board, setting up the board, configuration and use, implications of an operating system on the behavior of the Raspberry Pi as an IoT device, booting Raspberry Pi 3, Downloading an Operating System, format an SD card and booting the OS, Basics of Linux and its use, main features including navigating the file system and managing processes, text based user interface through the shell, overview of the graphic user interface for Raspian Linux distribution.

UNIT-II

Interfacing Hardware with the Raspberry Pi, Raspberry Pi Remote Access, operate the Raspberry Pi in “headless mode”, Bash Command line, operating Raspberry Pi without needing a GUI interface.

Basics of the Python programming language, programming on the Raspberry Pi. Python on Raspberry Pi, Python Programming Environment, Python Expressions, Strings, Functions and Function arguments, Lists, List Methods, Control Flow.

UNIT-III

Communication with devices through the pins of the Raspberry Pi, RPi.GPIO library, Python Functions, setting up the pins, General purpose IO Pins, Protocol Pins, GPIO Access, applying digital voltages, and generating Pulse Width Modulated signals, Tkinter Python library, accessing pins through a graphic user interface

UNIT-IV

IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs. Webserver – Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. Connecting to APIs

UNIT-V

IoT Design using Raspberry Pi IoT Applications based on Pi, LAMP Web-server, GPIO Control over Web Browser, Creating Custom Web Page for LAMP, Communicating data using on-board module, Home automation using Pi, Node-RED, MQTT Protocol, Using Node-RED Visual Editor on Rpi

Text books:

1. Simon Monk, “Programming the Raspberry Pi: Getting Started with Python”, January 2012, McGraw Hill Professional
2. The official raspberry Pi Projects Book https://www.raspberrypi.org/magpi-issues/Projects_Book_v1.pdf

Reference Books

1. Eben Upton and Gareth Halfacree, “Raspberry Pi User Guide”, August 2016, 4th edition, John Wiley & Sons
2. Alex Bradbury and Ben Everard, “Learning Python with Raspberry Pi”, Feb 2014, JohnWiley & Sons
3. Michael Margolis, “Arduino Cookbook”, First Edition, March 2011, O'Reilly Media, Inc

RECOMMENDED CO-CURRICULAR ACTIVITIES:

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B. General

1. Group Discussion
2. Try to solve MCQ's available online.
3. Others

RECOMMENDED CONTINUOUS ASSESSMENT METHODS:

Some of the following suggested assessment methodologies could be adopted;

1. The oral and written examinations (Scheduled and surprise tests),
2. Closed-book and open-book tests,
3. Problem-solving exercises,
4. Practical assignments and laboratory reports,
5. Observation of practical skills,
6. Individual and group project reports like "Develop a Real time application like a smart home with following requirements: If anyone comes at door the camera module automatically captures his image send it to the email account of user or send notification to the user. Door will open only after user„s approval.".
7. Efficient delivery using seminar presentations,

8. Viva voce interviews.
9. Computerized adaptive testing, literature surveys and evaluations,
10. Peers and self-assessment, outputs form individual and collaborative work

Semester	Course Code	Course Title	Hours	Credits
IV	**C5-P**	**Raspberry Pi Lab**	**30**	**1**

List of Experiments

1. Getting started with Raspberry Pi, Install Raspian on your SD card
2. Linux basic commands.
3. Coding simple programs in Python.
4. How to use Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device
5. How to have your Raspberry Pi interact with online services through the use of public APIs and SDKs
6. Understanding the connectivity of Raspberry-Pi with IR sensor. Write an application to detect obstacle and notify user using LEDs.
7. Design APP Using MIT App Inventor and Connect to Temperature Sensor

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

(A Statutory body of the Government of Andhra Pradesh)

3rd,4th and 5th floors, Neeladri Towers, Sri Ram Nagar, 6th Battalion Road,
Atmakur(V), Mangalagiri(M), Guntur-522 503, Andhra Pradesh
Web: www.apsche.org **Email**: acapsche@gmail.com

REVISED SYLLABUS OF B.A. /B.Sc. MATHEMATICS UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.A. /B.Sc. MATHEMATICS

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

A.P. STATE COUNCIL OF HIGHER EDUCATION

B.A./B.Sc. MATHEMATICS

REVISED SYLLABUS FOR CORE COURSES

CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

CORE COURSES STRUCTURE

(Sem-I to Sem-IV)

Course	Subject	Hrs.	Credits	IA	ES	Total
Course -I	Differential Equations & Differential Equations Problem Solving Sessions	6	5	25	75	100
Course -II	Three dimensional analytical Solid geometry & Three dimensional analytical Solid Geometry Problem Solving Sessions	6	5	25	75	100
Course -III	Abstract Algebra & Abstract Algebra Problem Solving Sessions	6	5	25	75	100
Course -IV	Real Analysis & Real Analysis Problem Solving Sessions	6	5	25	75	100
Course -V	Linear Algebra & Linear Algebra Problem Solving Sessions	6	5	25	75	100

COURSE-I

CBCS/ SEMESTER SYSTEM

B.A./B.Sc. MATHEMATICS (w.e.f. 2020-21 Admitted Batch)

DIFFERENTIAL EQUATIONS

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1.Solve linear differential equations

2.Convertnonexact homogeneous equations to exact differential equations by using integrating factors.

3.Know the methods of finding solutions ofdifferential equations of the firstorder but not of the firstdegree.

4.Solvehigher-order linear differential equations, both homogeneous and non homogeneous, with constant coefficients.

5. Understand the concept and apply appropriate methods for solving differential equations.

Course Syllabus:

UNIT – I (12 Hours)

Differential Equations of first order and first degree:

Linear Differential Equations; Differential equations reducible to linear form; Exact differential equations; Integrating factors; Change of variables.

UNIT – II (12 Hours)

Orthogonal Trajectories

Differential Equations of first order but not of the first degree:

Equations solvable for p; Equations solvable for y; Equations solvable for x; Equations that do not contain x (or y); Equations homogeneous in x and y;Equations of the first degree in x and y – Clairaut's Equation.

UNIT – III (12 Hours)

Higher order linear differential equations-I:

Solution of homogeneous linear differential equations of order n with constant coefficients; Solution of the non-homogeneous linear differential equations with constant coefficients by means of polynomial operators.General Solution of f(D)y=0.

General Solution of f(D)y=Q when Q is a function of x, $\frac{1}{f(D)}$ is expressed as partial fractions.

P.I. of f(D)y = Q when Q= be^{ax}

P.I. of f(D)y = Q when Q is bsinax or b cos ax.

UNIT – IV (12 Hours)

Higher order linear differential equations-II:

Solution of the non-homogeneous linear differential equations with constant coefficients.

P.I. of f(D)y = Q when Q= bx^k

P.I. of f(D)y = Q when Q= $e^{ax}V$, where V is a function of x.

P.I. of f(D)y = Q when Q= xV, where V is a function of x.

P.I. of f(D)y = Q when Q= x^mV, where V is a function of x.

UNIT –V (12 Hours)

Higher order linear differential equations-III :

Method of variation of parameters; Linear differential Equations with non-constant coefficients; The Cauchy-Euler Equation, Legendre's linear equations, miscellaneous differential equations.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Applications of Differential Equations to Real life Problem /Problem Solving.

Text Book :

Differential Equations and Their Applications by Zafar Ahsan, published by Prentice-Hall of India Pvt. Ltd, New Delhi-Second edition.

Reference Books :

1. A text book of Mathematics for B.A/B.Sc, Vol 1, by N. Krishna Murthy & others, published by S.Chand & Company, New Delhi.
2. Ordinary and Partial Differential Equations by Dr. M.D,Raisinghania, published by S. Chand & Company, New Delhi.
3. Differential Equations with applications and programs – S. Balachandra Rao & HR Anuradha- Universities Press.
4. Differential Equations -Srinivas Vangala & Madhu Rajesh, published by Spectrum University Press.

COURSE-II

CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Syllabus (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. get the knowledge of planes.
2. basic idea of lines, sphere and cones.
3. understand the properties of planes, lines, spheres and cones.
4. express the problems geometrically and then to get the solution.

Course Syllabus:

UNIT – I (12 Hours)

The Plane :

Equation of plane in terms of its intercepts on the axis, Equations of the plane through the given points, Length of the perpendicular from a given point to a given plane, Bisectors of angles between two planes, Combined equation of two planes, Orthogonal projection on a plane.

UNIT – II (12 hrs)

The Line :

Equation of a line; Angle between a line and a plane; The condition that a given line may lie in a given plane; The condition that two given lines are coplanar; Number of arbitrary constants in the equations of straight line; Sets of conditions which determine a line; The shortest distance between two lines; The length and equations of the line of shortest distance between two straight lines; Length of the perpendicular from a given point to a given line.

UNIT – III (12 hrs)

The Sphere :

Definition and equation of the sphere; Equation of the sphere through four given points; Plane sections of a sphere; Intersection of two spheres; Equation of a circle; Sphere through a given circle;

Intersection of a sphere and a line; Power of a point; Tangent plane; Plane of contact; Polar plane; Pole of a Plane; Conjugate points; Conjugate planes;

UNIT – IV (12 hrs)

The Sphere and Cones :

Angle of intersection of two spheres; Conditions for two spheres to be orthogonal; Radical plane; Coaxial system of spheres; Simplified from of the equation of two spheres.

Definitions of a cone; vertex; guiding curve; generators; Equation of the cone with a given vertex and guiding curve; equations of cones with vertex at origin are homogenous; Condition that the general equation of the second degree should represent a cone;

UNIT – V (12 hrs)

Cones :

Enveloping cone of a sphere; right circular cone: equation of the right circular cone with a given vertex, axis and semi vertical angle: Condition that a cone may have three mutually perpendicular generators; intersection of a line and a quadric cone; Tangent lines and tangent plane at a point; Condition that a plane may touch a cone; Reciprocal cones; Intersection of two cones with a common vertex.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/Three dimensional analytical Solid geometry and its applications/ Problem Solving.

Text Book :

Analytical Solid Geometry by Shanti Narayan and P.K. Mittal, published by S. Chand & Company Ltd. 7th Edition.

Reference Books :

1. A text book of Mathematics for BA/B.Sc Vol 1, by V Krishna Murthy & Others, published by S. Chand & Company, New Delhi.
2. A text Book of Analytical Geometry of Three Dimensions, by P.K. Jain and Khaleel Ahmed, published by Wiley Eastern Ltd., 1999.
3. Co-ordinate Geometry of two and three dimensions by P. Balasubrahmanyam, K.Y. Subrahmanyam, G.R. Venkataraman published by Tata-MC Gran-Hill Publishers Company Ltd., New Delhi.
4. Solid Geometry by B.Rama Bhupal Reddy, published by Spectrum University Press.

COURSE-III

CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

ABSTRACT ALGEBRA

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. acquire the basic knowledge and structure of groups, subgroups and cyclic groups.
2. get the significance of the notation of a normal subgroups.
3. get the behavior of permutations and operations on them.
4. study the homomorphisms and isomorphisms with applications.
5. understand the ring theory concepts with the help of knowledge in group theory and to prove the theorems.
6. understand the applications of ring theory in various fields.

Course Syllabus:

UNIT – I (12 Hours)

GROUPS :

Binary Operation – Algebraic structure – semi group-monoid – Group definition and elementary properties Finite and Infinite groups – examples – order of a group, Composition tables with examples.

UNIT – II (12 Hours)

SUBGROUPS :

Complex Definition – Multiplication of two complexes Inverse of a complex-Subgroup definition- examples-criterion for a complex to be a subgroups. Criterion for the product of two subgroups to be a subgroup-union and Intersection of subgroups.

Co-sets and Lagrange's Theorem :

Cosets Definition – properties of Cosets–Index of a subgroups of a finite groups–Lagrange's Theorem.

UNIT –III (12 Hours)

NORMAL SUBGROUPS :

Definition of normal subgroup – proper and improper normal subgroup–Hamilton group – criterion for a subgroup to be a normal subgroup – intersection of two normal subgroups – Sub group of index 2 is a normal sub group –quotient group – criteria for the existence of a quotient group.

HOMOMORPHISM :

Definition of homomorphism – Image of homomorphism elementary properties of homomorphism – Isomorphism – automorphism definitions and elementary properties–kernel of a homomorphism – fundamental theorem on Homomorphism and applications.

UNIT – IV (12 Hours)

PERMUTATIONS AND CYCLIC GROUPS :

Definition of permutation – permutation multiplication – Inverse of a permutation – cyclic permutations – transposition – even and odd permutations – Cayley's theorem.

Cyclic Groups :- Definition of cyclic group – elementary properties – classification of cyclic groups.

UNIT – V (12 Hours)

RINGS :

Definition of Ring and basic properties, Boolean Rings, divisors of zero and cancellation laws Rings, Integral Domains, Division Ring and Fields, The characteristic of a ring - The characteristic of an Integral Domain, The characteristic of a Field. Sub Rings, Ideals

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Group theory and its applications / Problem Solving.

Text Book :

A text book of Mathematics for B.A. / B.Sc. by B.V.S.S. SARMA and others, published by S.Chand & Company, New Delhi.

Reference Books :

1. Abstract Algebra by J.B. Fraleigh, Published by Narosa publishing house.
2. Modern Algebra by M.L. Khanna.
3. Rings and Linear Algebra by Pundir & Pundir, published by Pragathi Prakashan.

COURSE-IV

CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

REAL ANALYSIS

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to

1. get clear idea about the real numbers and real valued functions.
2. obtain the skills of analyzing the concepts and applying appropriate methods for testing convergence of a sequence/ series.
3. test the continuity and differentiability and Riemann integration of a function.
4. know the geometrical interpretation of mean value theorems.

Course Syllabus:

UNIT – I (12 Hours)

REAL NUMBERS :

The algebraic and order properties of R, Absolute value and Real line, Completeness property of R, Applications of supremum property; intervals. (No question is to be set from this portion).

Real Sequences:

Sequences and their limits, Range and Boundedness of Sequences, Limit of a sequence and Convergent sequence. The Cauchy's criterion, properly divergent sequences, Monotone sequences, Necessary and Sufficient condition for Convergence of Monotone Sequence, Limit Point of Sequence, Subsequences and the Bolzano-weierstrass theorem – Cauchy Sequences – Cauchy's general principle of convergence theorem.

UNIT –II (12 Hours)

INFINITIE SERIES :

Series : Introduction to series, convergence of series. Cauchy's general principle of convergence for series tests for convergence of series, Series of Non-Negative Terms.

1. P-test
2. Cauchy's n^{th} root test or Root Test.

3. D'-Alemberts' Test or Ratio Test.

4. Alternating Series – Leibnitz Test.

Absolute convergence and conditional convergence.

UNIT – III (12 Hours)

CONTINUITY :

Limits : Real valued Functions, Boundedness of a function, Limits of functions. Some extensions of the limit concept, Infinite Limits. Limits at infinity. (No question is to be set from this portion).

Continuous functions : Continuous functions, Combinations of continuous functions, Continuous Functions on intervals, uniform continuity.

UNIT – IV (12 Hours)

DIFFERENTIATION AND MEAN VALUE THEORMS :

The derivability of a function, on an interval, at a point, Derivability and continuity of a function, Graphical meaning of the Derivative, Mean value Theorems; Rolle's Theorem, Lagrange's Theorem, Cauchy's Mean value Theorem

UNIT – V (12 Hours)

RIEMANN INTEGRATION :

Riemann Integral, Riemann integral functions, Darboux theorem. Necessary and sufficient condition for R – integrability, Properties of integrable functions, Fundamental theorem of integral calculus, integral as the limit of a sum, Mean value Theorems.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Real Analysis and its applications / Problem Solving.

Text Book:

Introduction to Real Analysis by Robert G.Bartle and Donlad R. Sherbert, published by John Wiley.

Reference Books:

1.A Text Book of B.Sc Mathematics by B.V.S.S. Sarma and others, published by S. Chand & Company Pvt. Ltd., New Delhi.

2.Elements of Real Analysis as per UGC Syllabus by Shanthi Narayan and Dr. M.D. Raisinghania, published by S. Chand & Company Pvt. Ltd., New Delhi.

COURSE-V

CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

LINEAR ALGEBRA

SYLLABUS (75 Hours)

Course Outcomes:

After successful completion of this course, the student will be able to;

1. understand the concepts of vector spaces, subspaces, basises, dimension and their properties
2. understand the concepts of linear transformations and their properties
3. apply Cayley- Hamilton theorem to problems for finding the inverse of a matrix and higher powers of matrices without using routine methods
4. learn the properties of inner product spaces and determine orthogonality in inner product spaces.

Course Syllabus:

UNIT – I (12 Hours)

Vector Spaces-I:

Vector Spaces, General properties of vector spaces, n-dimensional Vectors, addition and scalar multiplication of Vectors, internal and external composition, Null space, Vector subspaces, Algebra of subspaces, Linear Sum of two subspaces, linear combination of Vectors, Linear span Linear independence and Linear dependence of Vectors.

UNIT –II (12 Hours)

Vector Spaces-II:

Basis of Vector space, Finite dimensional Vector spaces, basis extension, co-ordinates, Dimension of a Vector space, Dimension of a subspace, Quotient space and Dimension of Quotient space.

UNIT –III (12 Hours)

Linear Transformations:

Linear transformations, linear operators, Properties of L.T, sum and product of LTs, Algebra of Linear Operators, Range and null space of linear transformation, Rank and Nullity of linear transformations – Rank – Nullity Theorem.

UNIT –IV (12 Hours)

Matrix :

Matrices, Elementary Properties of Matrices, Inverse Matrices, Rank of Matrix, Linear Equations, Characteristic equations, Characteristic Values & Vectors of square matrix, Cayley – Hamilton Theorem.

UNIT –V (12 Hours)

Inner product space :

Inner product spaces, Euclidean and unitary spaces, Norm or length of a Vector, Schwartz inequality, Triangle Inequality, Parallelogram law, Orthogonality, Orthonormal set, complete orthonormal set, Gram – Schmidt orthogonalisation process. Bessel's inequality and Parseval's Identity.

Co-Curricular Activities(15 Hours)

Seminar/ Quiz/ Assignments/ Linear algebra and its applications / Problem Solving.

Text Book:

Linear Algebra by J.N. Sharma and A.R. Vasista, published by Krishna Prakashan Mandir, Meerut- 250002.

Reference Books :

1. Matrices by Shanti Narayana, published by S.Chand Publications.
2. Linear Algebra by Kenneth Hoffman and Ray Kunze, published by Pearson Education (low priced edition),New Delhi.
3. Linear Algebra by Stephen H. Friedberg et. al. published by Prentice Hall of India Pvt. Ltd. 4th Edition, 2007.

Recommended Question Paper Patterns and Models

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-I, DIFFERENTIAL EQUATIONS

Unit	**TOPIC**	**S.A.Q**(including choice)	**E.Q**(including choice)	**Total Marks**
I	Differential Equations of 1^{st} order and 1^{st} degree	2	2	30
II	Orthogonal Trajectories, Differential Equations of 1^{st} order but not of 1^{st} degree	2	2	30
III	Higher Order Linear Differential Equations (with constant coefficients) – I	1	2	25
IV	Higher Order Linear Differential Equations (with constant coefficients) – II	2	2	30
V	Higher Order Linear Differential Equations (with non constant coefficients)	1	2	25
TOTAL		8	10	140

S.A.Q. **=** Short answer questions (5 marks)

E.Q. **=** Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M

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CBCS/ SEMESTER SYSTEM

(W.e.f 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-I, DIFFERENTIAL EQUATIONS

MATHEMATICS MODEL PAPER

Time: 3Hrs **Max.Marks:75M**

SECTION - A

Answer any <u>FIVE</u> questions. Each question carries <u>FIVE</u> marks5 X 5 M=25 M

1. Solve $\left(1+e^{x/y}\right)dx+e^{x/y}\left(1-\frac{x}{y}\right)dy=0.$
2. Solve $\left(y-e^{\sin^{-1}x}\right)\frac{dx}{dy}+\sqrt{1-x^2}=0$
3. Solve $\mathrm{y+px=p^2x^4}$.
4. Solve $\mathrm{(px-y)(py+x)=2p}$
5. Solve $\mathrm{(D^2-3D+2)=\cosh x}$
6. Solve$\mathrm{(D^2-4D+3)y=\sin 3x\cos 2x}$.
7. Solve $\mathrm{\frac{d^2y}{dx^2}-6\frac{dy}{dx}+13y=8e^{3x}\sin 2x}$.
8. Solve $\mathrm{x^2y''-2x(1+x)y'+2(1+x)y=x^3}$

SECTION - B

Answer <u>ALL</u> the questions. Each question carries <u>TEN</u> marks. 5 X 10 M = 50 M

9 a) Solve $\mathrm{x\frac{dy}{dx}+y=y^2\log x}$.

(Or)

9 b) Solve $\left(\mathrm{y+\frac{1}{3}y^3+\frac{1}{2}x^2}\right)\mathrm{dx+\frac{1}{4}(x+xy^2)\,dy=0}$.

10 a) Solve$\mathrm{p^2+2py\cot x=y^2}$.

(Or)

10 b) Find the orthogonal trajectories of the family of curves

$x^{2/3}+y^{2/3}=a^{2/3}$ where ‘a’ is the parameter.

11 a) Solve$(D^3 + D^2 - D - 1)y = \cos 2x$.

(Or)

11 b) Solve$(D^2 - 3D + 2)y = \sin e^{-x}$.

12 a) Solve $(D^2 - 2D + 4)y = 8(x^2 + e^{2x} + \sin 2x)$

(Or)

12 b) $\frac{d^2y}{dx^2} + 3\frac{dy}{dx} + 2y = xe^x \sin x$

13 a) Solve $(D^2 - 2D)y = e^x \sin x$ by the method of variation of parameters.

(Or)

13 b) Solve $3x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + y = x$

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Unit	**TOPIC**	**S.A.Q**(including choice)	**E.Q**(including choice)	**Total Marks**
I	The Plane	2	2	30
II	The Right Line	2	2	30
III	The Sphere	2	2	30
IV	The Sphere & The Cone	1	2	25
V	The Cone	1	2	25
TOTAL		8	10	140

S.A.Q. **=** Short answer questions (5 marks)

E.Q. **=** Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-II, THREE DIMENSIONAL ANALYTICAL SOLID GEOMETRY

Time: 3Hrs **Max.Marks:75 M**

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Find the equation of the plane through the point (-1,3,2) and perpendicular to the planes x+2y+2z=5 and 3x+3y+2z=8.
2. Find the bisecting plane of the acute angle between the planes 3x-2y-6z+2=0, -2x+y-2z-2=0.
3. Find the image of the point (2,-1,3) in the plane 3x-2y+z =9.
4. Show that the lines $2x + y - 4 = 0 = y + 2z$ and $x + 3z - 4 = 0$, $2x + 5z - 8 = 0$ are coplanar.
5. A variable plane passes through a fixed point (a, b, c). It meets the axes in A,B,C. Show that the centre of the sphere OABC lies on $ax^{-1}+by^{-1}+cz^{-1}=2$.
6. Show that the plane 2x-2y+z+12=0 touches the sphere $x^2+y^2+z^2-2x-4y+2z-3=0$ and find the point of contact.
7. Find the equation to the cone which passes through the three coordinate axes and the lines $\frac{x}{1}=\frac{y}{-2}=\frac{z}{3}$ and $\frac{x}{2}=\frac{y}{1}=\frac{z}{1}$
8. Find the equation of the enveloping cone of the sphere $x^2 + y^2 + z^2 + 2x - 2y = 2$ with its vertex at (1, 1, 1).

SECTION - B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9(a) A plane meets the coordinate axes in A, B, C. If the centroid of ΔABC is

(a,b,c), show that the equation of the plane is $\frac{x}{a}+\frac{y}{b}+\frac{z}{c}=3.$

(OR)

(b) A variable plane is at a constant distance p from the origin and meets the axes in A,B,C. Show that the locus of the centroid of the tetrahedron OABC is $x^{-2}+y^{-2}+z^{-2}=16p^{-2}$.

10(a) Find the shortest distance between the lines

$$\frac{x-3}{3}=\frac{y-8}{-1}=\frac{z-3}{1};\ \frac{x+3}{-3}=\frac{y+7}{2}=\frac{z-6}{4}.$$

(OR)

(b) Prove that the lines $\frac{x-1}{2}=\frac{y-2}{3}=\frac{z-3}{4};\frac{x-2}{3}=\frac{y-3}{4}=\frac{z-4}{5}$ are coplanar. Also find their point of intersection and the plane containing the lines.

11 (a) Show that the two circles $x^2+y^2+z^2-y+2z=0$, $x-y+z=2$; $x^2+y^2+z^2+x-3y+z-5=0$, $2x-y+4z-1=0$ lie on the same sphere and find its equation.

(OR)

(b) Find the equation of the sphere which touches the plane $3x+2y-z+2=0$ at $(1,-2,1)$ and cuts orthogonally the sphere $x^2+y^2+z^2-4x+6y+4=0$.

12 (a) Find the limiting points of the coaxial system of spheres $x^2+y^2+z^2-8x+2y-2z+32=0$, $x^2+y^2+z^2-7x+z+23=0$.

(OR)

(b) Find the equation to the cone with vertex is the origin and whose base curve is $x^2+y^2+z^2+2ux+d=0$.

13 (a) Prove that the equation $\sqrt{fx}\pm\sqrt{gy}\pm\sqrt{hz}=0$ represents a cone that touches the coordinate planes and find its reciprocal cone.

(OR)

(b) Find the equation of the sphere $x^2+y^2+z^{2-}2x+4y-1=0$ having its generators parallel to the line $x=y=z$.

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-III, ABSTRACT ALGEBRA

Unit	**TOPIC**	**S.A.Q**(including choice)	**E.Q**(including choice)	**Total Marks**
I	Groups	2	2	30
II	Subgroups, Cosets & Lagrange's theorem	1	2	25
III	Normal Subgroups and Homomorphism	1	2	25
IV	Permutations and Cyclic groups	2	2	30
V	Rings	2	2	30
Total		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-III, ABSTRACT ALGEBRA

Time: 3Hrs **Max.Marks:75M**

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Show that the set G=$\{x/x = 2^a3^b \text{ and } a,b \in Z\}$ is a group under multiplication

2. Define order of an element. In a group G, prove that if $a \in G$ then $O(a) = O(a)^{-1}$.

3. If H and K are two subgroups of a group G, then prove that HK is a subgroup ⇔ HK=KH

4.If G is a group and H is a subgroup of index 2 in G then prove that H is a normal subgroup.

5. Examine whether the following permutations are even or odd

i) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 \\ 6 & 1 & 4 & 3 & 2 & 5 & 7 & 8 & 9 \end{pmatrix}$

ii) $\begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 & 7 \\ 3 & 2 & 4 & 5 & 6 & 7 & 1 \end{pmatrix}$

6. Prove thata group of prime order is cyclic.

7.Prove that the characteristic of an integral domain is either prime or zero.

8. If F is a field then prove that $\{0\}$ and F are the only ideals of F.

SECTION - B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9 a) Show that the set of n^{th} roots of unity forms an abelian group under multiplication.

(Or)

9 b) In a group G, for $a, b \in G$, O(a)=5, b ≠ e and $aba^{-1} = b^2$. Find O(b).

10 a) The Union of two subgroups is also a subgroup ⇔ one is contained in the other.

(Or)

b) State and prove Langrage’s theorem.

11 a) Prove that a subgroup H of a group G is a normal subgroup of G iff the product of two right cosets of H in G is again a right coset of H in G.

(Or)

11 b) State and prove fundamental theorem of homomorphisms of groups.

12 a) Let S_n be the symmetric group on n symbols and let A_n be the group of even permutations. Then show that A_n is normal in S_n and $O(A_n) = \frac{1}{2}(n!)$

(Or)

12 b)prove thatevery subgroup of cyclic group is cyclic.

13 a) Prove that every finite integral domain is a field.

(Or)

13 b) Define principal idea. Prove that every ideal of Z is a principal ideal.

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-IV, REAL ANALYSIS

Unit	**TOPIC**	**S.A.Q**(including choice)	**E.Q**(including choice)	**Total Marks**
I	Real Number System and Real Sequence	2	2	30
II	Infinite Series	1	2	25
III	Limits and Continuity	1	2	25
IV	Differentiation and Mean Value Theorem	2	2	30
V	Riemann Integration	2	2	30
	TOTAL	8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-IV, REAL ANALYSIS

Time: 3Hrs **Max.Marks:75M**

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1.Prove that every convergent sequence is bounded.

2. Show that $\lim\left(\frac{1}{(n+1)^2}+\frac{1}{(n+2)^2}+\text{------------------}+\frac{1}{(n+n)^2}\right)=0$.

3. Test the convergenceof the series $\sum_{n=1}^{\infty}\left(\sqrt[3]{n^3+1}-n\right)$.

4. Examine for continuity of the function f defined by $f(x)=|x|+|x-1|$ at x=0 and 1.

5. Show that $f(x)=x\sin\frac{1}{x},\ x\neq 0; f(x)=0, x=0$ is continuous but not derivable at x=0.

6.Verify Rolle's theorem for the function $f(x) = x^3 - 6x^2+11x-6$ on $[1,3]$.

7. If $f(x)=x^2\ \forall\, x\in[0,1]$ and $p=\{0,\frac{1}{4},\frac{2}{4},\frac{3}{4},1\}$ then find L(p, f) and U(p, f).

8.prove that if $f:[a,b]\rightarrow R$ is continuous on [a, b] then f is R- integrable on [a, b].

SECTION –B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9.(a)If $s_n = 1+\frac{1}{2!}+\frac{1}{3!}+------+\frac{1}{n!}$ then show that $\{s_n\}$ converges.

(OR)

(b) State and prove Cauchy's general principle of convergence.

10.(a) State and Prove Cauchy's nth root test.

(OR)

(b) Test the convergence of $\sum \frac{x^n}{x^n+a^n}$ $(x > 0, a > 0)$.

11.(a) Let f: R→ R be such that

$$f(x) = \frac{\sin(a+1)x+\sin x}{x} \quad \text{for } x < 0$$

$$= c \qquad \text{for } x = 0$$

$$= \frac{(x+bx^2)^{1/2}-x^{1/2}}{bx^{3/2}} \quad \text{for } x > 0$$

Determine the values of a, b, c for which the function f is continuous at x=0.

(OR)

(b) Define uniform continuity, If a function f is continuous on [a b] then f is uniformly continuous on [a b]

12.(a) Using Lagrange's theorem, show that $x > \log(1+x) > \frac{x}{(1+x)} \forall x > 0$.

(OR)

(b) State and prove Cauchy's mean value theorem.

.

13.(a) State and prove Riemman's necessary and sufficient condition for R- integrability.

(OR)

(b) Prove that $\frac{\pi^3}{24} \leq \int_0^{\pi} \frac{x^2}{5+3\cos x} dx \leq \frac{\pi^3}{6}$.

BLUE PRINT FOR QUESTION PAPER PATTERN

COURSE-V, LINEAR ALGEBRA

Unit	TOPIC	S.A.Q (including choice)	E.Q (including choice)	Marks Allotted
I	Vector spaces - I	2	2	30
II	Vector spaces - II	1	2	25
III	Linear Transformation	2	2	30
IV	Char. values and char. vectors	1	2	25
V	Inner product spaces	2	2	30
Total		8	10	140

S.A.Q. = Short answer questions (5 marks)

E.Q. = Essay questions (10 marks)

Short answer questions : 5 X 5 M = 25 M

Essay questions : 5 X 10 M = 50 M

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Total Marks = 75 M

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CBCS/ SEMESTER SYSTEM

(w.e.f. 2020-21 Admitted Batch)

B.A./B.Sc. MATHEMATICS

COURSE-V, LINEAR ALGEBRA

Time: 3Hrs **Max.Marks:75M**

SECTION - A

Answer any FIVE questions. Each question carries FIVE marks 5 X 5 M=25 M

1. Let p, q, r be fixed elements of a field F. Show that the set W of all triads (x, y, z) of elements of F, such that px+qy+rz=0 is a vector subspace of $V_3(R)$.

2. Define linearly independent &linearly dependent vectors in a vector space. If α, β, γ are linearly independent vectors of $V(R)$ then show that $\alpha+\beta, \beta+\gamma, \gamma+\alpha$ are also linearly independent.

3. Prove that every set of $(n+1)$ or more vectors in an n dimensional vector space is linearly dependent.

4. The mapping T : $V_3(R) \rightarrow V_3(R)$ is defined by T(x,y,z) = (x-y,x-z). Show that T is a linear transformation.

5. Let $T: R^3 \rightarrow R^2$ and $H: R^3 \rightarrow R^2$ be defined by T (x, y, z)= (3x, y+z) and H (x, y, z)= (2x-z, y). Compute i) T+H ii) 4T-5H iii) TH iv) HT.

6. If the matrix A is non-singular, show that the eigen values of A^{-1} are the reciprocals of the eigen values of A.

7. State and prove parallelogram law in an inner product space V(F).

8. Prove that the set S = $\left\{\left(\frac{1}{3}, \frac{-2}{3}, \frac{-2}{3}\right), \left(\frac{2}{3}, \frac{-1}{3}, \frac{2}{3}\right), \left(\frac{2}{3}, \frac{2}{3}, \frac{-1}{3}\right)\right\}$ is an orthonormal set in the inner product space $R^3(R)$ with the standard inner product.

SECTION - B

Answer ALL the questions. Each question carries TEN marks. 5 X 10 M = 50 M

9(a)) Define vector space. Let V (F) be a vector space. Let W be a non empty sub set of V. Prove that the necessary and sufficient condition for W to be a subspace of V is $a, b \in F$ and $\alpha, \beta \epsilon V => a\alpha + b\beta \epsilon W$.

(OR)

(b) Prove that the four vectors (1,0,0), (0,1,0), (0,0,1) and (1,1,1) of $V_3(C)$ form linearly dependent set, but any three of them are linearly independent.

10(a)Define dimension of a finite dimensional vector space. If W is a subspace of a finite dimensional vector space V(F) then prove that W is finite dimensional and dim W$\leq n$.

(OR)

(b) If W be a subspace of a finite dimensional vector space V(F) then Prove that

$$\dim {}^{V}/_{W} = \dim V - \dim W.$$

11(a) Find T (x, y, z) where $T: R^3 \rightarrow R$ is defined by T (1, 1, 1) =3, T (0, 1, -2) =1, T (0, 0, 1) = -2

(OR)

(b) State and prove Rank Nullity theorem.

12(a) Find the eigen values and the corresponding eigen vectors of the matrix

$$A=\begin{pmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{pmatrix}.$$

(OR)

(b) State and prove Cayley-Hamilton theorem.

13(a) State and prove Schwarz's inequality in an Inner product space V(F).

(OR)

(b) Given $\{(2,1,3),(1,2,3),(1,1,1)\}$ is a basis of R^3(R).Construct an orthonormal basis using Gram-Schmidt orthogonalisation process.

SUBJECT EXPERTS

Prof. GVR Babu
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Visakhapatnam

Dr.K.Chitti Babu,
Lecturer in Mathematics,
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SYLLABUS VETTED BY

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REVISED SYLLABUS OF B.Sc. PHYSICS
(FOR MATHEMATICS COMBINATIONS)
UNDER CBCS FRAMEWORK WITH EFFECT FROM 2020-2021

PROGRAMME: THREE-YEAR B.Sc.

(Physics for Mathematics Combinations)

(With Learning Outcomes, Unit-wise Syllabus, References, Co-curricular Activities & Model Q.P.)

For Fifteen Courses of 1, 2, 3 & 4 Semesters)

(To be Implemented from 2020-21 Academic Year)

AP STATE COUNCIL OF HIGHER EDUCATION

B.Sc. PHYSICSSYLLABUS UNDER CBCS

[For Mathematics combinations]

w.e.f. 2020-21 (Revised in May 2020)

First Semester
Course I: Mechanics, Waves and Oscillations
Practical Course I (Lab-1)

Second Semester
Course II: Wave Optics
Practical Course II (Lab-2)

Third Semester
Course III: Heat and Thermodynamics
Practical Course III (Lab-3)

Fourth Semester
Course IV: Electricity, Magnetism and Electronics
Practical Course IV (Lab- 4)

Course V:Modern Physics
Practical Course V (Lab-V)

B.Sc.PHYSICS COURSE STRUCTURE UNDER CBCS

Year	***Semester***	***Course***	***Title of the Course***	***Marks***	***No.ofHrs /Week***	***No.of Credits***
I	I	I	Mechanics, Waves and Oscillations	100	4	03
			Practical Course- I	50	2	02
	II	II	Wave Optics	100	4	03
			Practical Course – II	50	2	02
II	III	III	Heat and Thermodynamics	100	4	03
			Practical Course – III	50	2	02
	IV	IV	Electricity, Magnetism and Electronics	100	4	03
			Practical Course – IV	50	2	02
		V	Modern Physics	100	4	03
			Practical Course –V	50	2	02
Total No. of Courses : **05 (Five)**						

B.Sc. PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Physics:I Semester

Course I: MECHANICS, WAVES AND OSCILLATIONS

Work load:60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Understand Newton's laws of motion and motion of variable mass system and its application to rocket motion and the concepts of impact parameter, scattering cross section.*
- *Apply the rotational kinematic relations, the principle and working of gyroscope and itapplicationsand the precessional motion of a freely rotating symmetric top.*
- *Comprehend the general characteristics of central forces and the application of Kepler's laws to describe the motion of planets and satellite in circular orbit through the study of law of Gravitation.*
- *Understand postulates of Special theory of relativity and its consequences such as length contraction, time dilation, relativistic mass and mass-energy equivalence.*
- *Examinephenomena of simple harmonic motionand the distinction between undamped, damped and forced oscillations and the concepts of resonance and quality factor with reference to damped harmonic oscillator.*
- *Appreciate the formulation of the problem of coupled oscillations and solve them to obtain normal modes of oscillation and their frequencies in simple mechanical systems.*
- *Figure outthe formation of harmonics and overtones in a stretched string and acquire the knowledge on Ultrasonic waves, their production and detection and their applications in different fields.*

UNIT-I:

1. Mechanics of Particles (5 hrs)

Review of Newton's Laws of Motion, Motion of variable mass system, Motion of a rocket, Multistage rocket, Concept of impact parameter, scattering cross-section, Rutherford scattering-Derivation.

2. Mechanics of Rigid bodies (7 hrs)

Rigid body, rotational kinematic relations, Equation of motion for a rotating body, Angular momentum and Moment of inertia tensor, Euler equations, Precession of a spinning top, Gyroscope, Precession of atom and nucleus in magnetic field, Precession of the equinoxes

Unit-II:

3. Motion in a Central Force Field (12hrs)

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, Equation of motion under a central force, Kepler's laws of planetary motion-Proofs, Motion of satellites, Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts

UNIT-III:

4. Relativistic Mechanics (12hrs)

Introduction to relativity, Frames of reference, Galilean transformations, absolute frames, Michelson-Morley experiment, negative result, Postulates of Special theory of relativity, Lorentz transformation, time dilation, length contraction, variation of mass with velocity, Einstein's mass-energy relation

Unit-IV:

5. Undamped, Damped and Forced oscillations: (07 hrs)

Simple harmonic oscillator and solution of the differential equation, Damped harmonic oscillator, Forced harmonic oscillator – Their differential equations and solutions, Resonance, Logarithmic decrement, Relaxation time and Quality factor.

6. Coupled oscillations: (05 hrs)

Coupled oscillators-Introduction, Two coupled oscillators, Normal coordinates and Normal modes- N-coupled oscillators and wave equation

Unit-V:

7. Vibrating Strings: (07 hrs)

Transverse wave propagation along a stretched string, General solution of wave equation and its significance, Modes of vibration of stretched string clamped at ends, Overtones and Harmonics,Melde’s strings.

8. Ultrasonics: (05 hrs)

Ultrasonics, General Properties of ultrasonic waves, Production of ultrasonics by piezoelectric and magnetostriction methods, Detection of ultrasonics, Applications of ultrasonic waves, SONAR

REFERENCE BOOKS:

- B. Sc. Physics, Vol.1, Telugu Academy, Hyderabad
- Fundamentals of Physics Vol. I - Resnick, Halliday, Krane ,Wiley India 2007
- College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.
- University Physics-FW Sears, MW Zemansky& HD Young,Narosa Publications, Delhi
- Mechanics, S.G.Venkatachalapathy, Margham Publication, 2003.
- Waves and Oscillations. N. Subramanyam and Brijlal, VikasPulications.
- Unified Physics - Waves and Oscillations, Jai PrakashNath&Co.Ltd.
- Waves & Oscillations. S.Badami, V. Balasubramanian and K.R. Reddy, Orient Longman.
- The Physics of Waves and Oscillations, N.K.Bajaj, Tata McGraw Hill
- Science and Technology of Ultrasonics- Baldevraj, Narosa, New Delhi,2004

Practical Course 1: Mechanics, Waves and Oscillations

Work load: 30 hrs per semester **2 hrs/week**

Course outcomes (Practicals):

On successful completion of this practical course, the student will be able to;

- Perform experiments on Properties of matter such as the determination of moduli of elasticity *viz.*, Young's modulus, Rigidity modulus of certain materials; Surface tension of water , Coefficient of viscosity of a liquid , Moment of inertia of some regular bodies by different methods and compare the experimental values with the standard values.
- Know how to determine the acceleration due to gravity at a place using Compound pendulum and Simple pendulum.
- Notice the difference between flat resonance and sharp resonance in case of volume resonator and sonometer experiments respectively.
- Verify the laws of transverse vibrations in a stretched string using sonometer and comment on the relation between frequency, length and tension of a stretched string under vibration.
- Demonstrate the formation of stationary waves on a string in Melde's string experiment.
- Observe the motion of coupled oscillators and normal modes.

Minimum of 6 experiments to be done and recorded:

1. Young's modulus of the material of a bar (scale) by uniform bending
2. Young's modulus of the material a bar (scale) by non- uniform bending
3. Surface tension of a liquid by capillary rise method
4. Viscosity of liquid by the flow method (Poiseuille's method)
5. Bifilar suspension –Moment of inertia of a regular rectangular body.
6. Fly-wheel -Determination of moment of inertia
7. Rigidity modulus of material of a wire-Dynamic method (Torsional pendulum)
8. Volume resonator experiment
9. Determination of 'g' by compound/bar pendulum
10. Simple pendulum- normal distribution of errors-estimation of time period and the error of the mean by statistical analysis
11. Determination of the force constant of a spring by static and dynamic method.

12. Coupled oscillators
13. Verification of laws of vibrations of stretched string –Sonometer
14. Determination of frequency of a bar –Melde's experiment.
15. Study of a damped oscillation using the torsional pendulum immersed in liquid-decay constant and damping correction of the amplitude.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- ❖ Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- ❖ Student seminars (on topics of the syllabus and related aspects (individual activity)
- ❖ Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
- ❖ Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
- ❖ Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- ❖ Group Discussion
- ❖ Visit to Research Stations, Science Museum Centres to understand the basic principles of mechanics with live examplesand related industries
- ❖ Visit to Satellite launching station at Sri Harikota.

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- ❖ The oral and written examinations (Scheduled and surprise tests)
- ❖ Problem-solving exercises
- ❖ Practical assignments and Observation of practical skills
- ❖ Individual and group project reports
- ❖ Efficient delivery using seminar presentations
- ❖ Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

I Year B.Sc.-Physics: II Semester

Course-II: WAVE OPTICS

Work load:60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the student will be able to:

- *Understand the phenomenon of interference of light and its formation in (i) Lloyd's single mirror due to division of wave front and (ii) Thin films, Newton's rings and Michelson interferometer due to division of amplitude.*
- *Distinguish between Fresnel's diffraction and Fraunhoffer diffraction and observe the diffraction patterns in the case of single slit and the diffraction grating.*
- *Describe the construction and working of zone plate and make the comparison of zone plate with convex lens.*
- *Explain the various methods of production of plane, circularly and polarized light and their detection and the concept of optical activity..*
- *Comprehend the basic principle of laser, the working of He-Ne laser and Ruby lasers and their applications in different fields.*
- *Explain about the different aberrations in lenses and discuss the methods of minimizing them.*
- *Understand the basic principles of fibreoptic communication andexplore the field of Holography and Nonlinear optics and their applications.*

UNIT-I Interference of light: (12hrs) Introduction, Conditions for interference of light, Interference of light by division of wave front and amplitude,Phase change on reflection-Stokes' treatment, Lloyd's single mirror,Interference in thin films: Plane parallel and wedge-shaped films, colours in thin films, Newton's rings in reflected light-Theory and experiment, Determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

UNIT-II Diffraction of light:(12hrs)

Introduction, Types of diffraction: Fresnel and Fraunhoffer diffractions, Distinction between Fresnel and Fraunhoffer diffraction,Fraunhoffer diffraction at a single slit, Plane diffraction grating,Determination of wavelength of light using diffraction grating, Resolving power of grating, Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate, comparison of zone plate with convex lens.

UNIT-III Polarisation of light:(12hrs)

Polarized light: Methods of production of plane polarized light, Double refraction, Brewster's law, Malus law, Nicol prism, Nicol prism as polarizer and analyzer, Quarter wave plate, Half wave plate, Plane, Circularly and Elliptically polarized light-Production and detection, Optical activity, Laurent's half shade polarimeter: determination of specific rotation, Basic principle of LCDs

UNIT-IV Aberrations and Fibre Optics: (12hrs)

Monochromatic aberrations, Spherical aberration, Methods of minimizing spherical aberration, Coma, Astigmatism and Curvature of field, Distortion; Chromatic aberration-the achromatic doublet; Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Fibre optics: Introduction to Fibers, different types of fibers, rays and modes in an optical fiber, Principles of fiber communication (qualitative treatment only), Advantages of fiber optic communication.

UNIT-V Lasersand Holography:(12hrs)

Lasers: Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers; Holography: Basic principle of holography, Applications of holography

REFERENCE BOOKS:

- BSc Physics, Vol.2, Telugu Akademy, Hyderabad
- A Text Book of Optics-N Subramanyam, L Brijlal, S.Chand& Co.
- Optics-Murugeshan, S.Chand& Co.

- Unified Physics Vol.IIOptics, Jai PrakashNath&Co.Ltd., Meerut
- Optics,F.A. Jenkins and H.G.White, McGraw-Hill
- Optics, AjoyGhatak,TataMcGraw-Hill.
- Introduction of Lasers – Avadhanulu, S.Chand& Co.
- Principles of Optics- BK Mathur, Gopala Printing Press, 1995

Practical Course II: Wave Optics

Work load:30hrs **2 hrs/week**

Course outcomes (Practicals):

On successful completion of this practical course the student will be able to,

1. *Gain hands-on experience of using various optical instruments like spectrometer, polarimeterand making finer measurements of wavelength of light using Newton Ringsexperiment, diffraction grating etc.*
2. *Understand the principle of working of polarimeter and the measurement of specific rotatory power of sugar solution*
3. *Know the techniques involved in measuring the resolving power of telescope and dispersive power of the material of the prism.*
4. *Be familiar with the determination of refractive index of liquid by Boy's methodand the determination of thickness of a thin wire by wedge method.*

Minimum of 6 experiments to be done and recorded

1. Determination of radius of curvature of a given convex lens-Newton's rings.
2. Resolving power of grating.
3. Study of optical rotation –polarimeter.
4. Dispersive power of a prism.
5. Determination of wavelength of light using diffraction grating-minimum deviation method.
6. Determination of wavelength of light using diffraction grating-normal incidence method.
7. Resolving power of a telescope.
8. Refractive index of a liquid-hallow prism
9. Determination of thickness of a thin wire by wedge method
10. Determination of refractive index of liquid-Boy's method.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- ❖ Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)

- Student seminars (on topics of the syllabus and related aspects (individual activity)
- Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
- Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- Group Discussion
- Visit to Research Stations/laboratories and related industries

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- The oral and written examinations (Scheduled and surprise tests),
- Practical assignments and laboratory reports,
- Efficient delivery using seminar presentations,
- Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: III Semester

Course-III: HEAT AND THERMODYNAMICS

Work load:60hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the student will be able to:

- *Understand the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions and the transport phenomenon in ideal gases*
- *Gain knowledge on the basic concepts of thermodynamics, the first and the second law of thermodynamics, the basic principles of refrigeration,the concept of entropy,the thermodynamic potentials and their physical interpretations.*
- *Understand the working of Carnot's ideal heat engine, Carnot cycle and its efficiency*
- *Develop critical understanding of concept of Thermodynamic potentials,the formulation of Maxwell's equations and its applications.*
- *Differentiate between principles and methods to produce low temperature and liquefy air and also understand the practical applications of substances at low temperatures.*
- *Examine the nature of black body radiations and the basic theories.*

UNIT-I: Kinetic Theory of gases: **(12 hrs)**

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification,Mean free path, Degrees of freedom, Principle of equipartition of energy (Qualitative ideas only), Transport phenomenon in ideal gases: viscosity, Thermal conductivity and diffusion of gases.

UNIT-II: Thermodynamics: **(12hrs)**

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes, Carnot's engine and its efficiency, Carnot's theorem, Thermodynamic scale of temperature and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT-III: Thermodynamic Potentials and Maxwell's equations: (12hrs)

Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of C_P-C_V (iii) Value of C_P/C_V (iv) Joule-Kelvin coefficient for ideal and Van der Waals' gases

UNIT-IV: Low temperature Physics: (12hrs)

Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment , Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substances at low temperatures.

UNIT-V: Quantum theory of radiation: (12 hrs)

Blackbody and its spectral energy distribution of black body radiation, Kirchoff's law, Wein's displacement law, Stefan-Boltzmann's law and Rayleigh-Jean's law (No derivations), Planck's law of black body radiation-Derivation, Deduction of Wein's law and Rayleigh-Jean's law from Planck's law, Solar constant and its determination using Angstrom pyroheliometer, Estimation of surface temperature of Sun.

REFERENCE BOOKS:

- ❖ BSc Physics, Vol.2, Telugu Akademy, Hyderabad
- ❖ Thermodynamics, R.C.Srivastava, S.K.Saha&AbhayK.Jain, Eastern Economy Edition.
- ❖ Unified Physics Vol.2, Optics & Thermodynamics, Jai PrakashNath&Co.Ltd., Meerut
- ❖ Fundamentals of Physics. Halliday/Resnick/Walker.C. Wiley India Edition 2007
- ❖ Heat and Thermodynamics -N BrijLal, P Subrahmanyam, S.Chand& Co.,2012
- ❖ Heat and Thermodynamics- MS Yadav, Anmol Publications Pvt. Ltd, 2000
- ❖ University Physics, HD Young, MW Zemansky,FW Sears, Narosa Publishers, New Delhi

Practical Course-III: Heat and Thermodynamics

Work load: 30 hrs **2 hrs/week**

On successful completion of this practical course,the student will be able to;

- *Perform some basic experiments in thermal Physics, viz., determinations of Stefan's constant, coefficient of thermal conductivity, variation of thermo-emf of athermocouple with temperature difference at its two junctions, calibration of a thermocouple and Specific heat of a liquid.*

Minimum of 6 experiments to be done and recorded

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.
6. Heating efficiency of electrical kettle with varying voltages.
7. Thermoemf- thermo couple - Potentiometer
8. Thermal behavior of an electric bulb (filament/torch light bulb)
9. Measurement of Stefan's constant- emissive method
10. Study of variation of resistance with temperature - Thermistor.

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- Student seminars (on topics of the syllabus and related aspects (individual activity))
- Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
- Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)

- Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- Group Discussion
- Visit to Research Stations/laboratories and related industries
- Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- The oral and written examinations (Scheduled and surprise tests),
- Problem-solving exercises,
- Efficient delivery using seminar presentations,
- Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: IV Semester

Course-IV: ELECTRICITY, MAGNETISM AND ELECTRONICS

Work load:60 hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- ❖ *Understand the Gauss law and its application to obtain electric field in different cases and formulate the relationship between electric displacement vector, electric polarization, Susceptibility, Permittivity and Dielectric constant.*
- ❖ *Distinguish between the magnetic effect of electric current and electromagnetic induction and apply the related laws in appropriate circumstances.*
- ❖ *Understand Biot and Savart's law and Ampere's circuital law to describe and explain the generation of magnetic fields by electrical currents.*
- ❖ *Develop an understanding on the unification of electric and magnetic fields and Maxwell's equations governing electromagnetic waves.*
- ❖ *Phenomenon of resonance in LCR AC-circuits, sharpness of resonance,Q-factor,Power factor and the comparative study of series and parallel resonant circuits.*
- ❖ *Describe the operation of p-n junction diodes, zener diodes, light emitting diodes and transistors*
- ❖ *Understand the operation of basic logic gates and universal gates and their truth tables.*

UNIT-I

1. Electrostatics: (6hrs)

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere and (ii) an infinite conducting sheet of charge, Deduction of Coulomb's law from Gauss law, Electrical potential–Equipotential surfaces, Potential due to a (i) dipole (ii)uniformly charged sphere

2.Dielectrics: (6 hrs)

Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics,Dielectric strength, Capacitance of a parallel plate condenser with dielectric slab between the plates, Electric displacement D, electric polarization P,Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II

3.Magnetostatics: (6 hrs)

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Divergence and curl of magnetic field, Ampere's Circuital Law and its application to Solenoid,Hall effect, determination of Hall coefficient and applications.

4.Electromagnetic Induction: (6 hrs)

Faraday's laws of electromagnetic induction, Lenz's law,Self induction and Mutual induction, Self inductance of a long solenoid, Mutual inductance of two coils, Energy stored in magnetic field, Eddy currents and Electromagnetic damping

UNIT-III

5.Alternating currents: (6 hrs)

Alternating current - Relation between current and voltage in LR and CR circuits,Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

6.Electromagnetic waves-Maxwell's equations: (6 hrs)

Idea of displacement current,Maxwell's equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement and proof)

UNIT-IV

7. Basic Electronic devices: (12 hrs)

PN junction diode, Zenerdiode andLight Emitting Diode (LED) and their I-V characteristics, Zener diode as a regulator- Transistors and its operation, CB, CE and CC configurations, Input and output characteristicsofa transistor in CE mode, Relation between alpha, beta and gamma; Hybrid parameters, Determination of hybrid parameters from transistor characteristics; Transistor as an amplifier.

UNIT-V:

8. Digital Electronics: (12 hrs)

Number systems, Conversion of binary to decimal system and vice versa, Binary addition & Binary subtraction (1's and 2's complement methods), Laws of Boolean algebra, DeMorgan's laws-Statements and Proofs, Basic logic gates, NAND and NOR as universal gates, Exclusive-OR gate, Half adder and Full adder circuits.

REFERENCE BOOKS

- BSc Physics, Vol.3, Telugu Akademy, Hyderabad.
- Electricity and Magnetism, D.N. Vasudeva. S. Chand & Co.
- Electricity and Magnetism, B.D.Duggal and C.L.Chhabra. Shobanlal& Co.
- Electricity, Magnetism with Electronics, K.K.Tewari, R.Chand& Co.,
- Electricity and Magnetism, R.Murugeshan, S. Chand & Co.
- Principles of Electronics, V.K. Mehta, S.Chand& Co.,
- Digital Principles and Applications, A.P. Malvino and D.P.Leach, McGrawHill Edition.

Practical CourseIV:Electricity, Magnetism and Electronics

Work load: 30 hrs **2 hrs/week**

Course outcomes (Practicals):

On successful completion of this practical course the student will be able to;

- *Measure the current sensitivity and figure of merit of a moving coil galvanometer.*
- *Observe the resonance condition in LCR series and parallel circuit*
- *Learn how a sonometer can be used to determine the frequency of AC-supply.*
- *Observe the variation of magnetic field along the axis of a circular coil carrying current using Stewart and Gee's apparatus.*
- *Understand the operation of PN junction diode, Zener diode and a transistor and their V-I characteristics.*
- *Construct the basic logic gates, half adder and full adder and verify their truth tables. Further, the student will understand how NAND and NOR gates can be used as universal building blocks.*

Minimum of 6 experiments to be done and recorded

1. Figure of merit of a moving coil galvanometer.
2. LCR circuit series/parallel resonance, Q factor.
3. Determination of ac-frequency –Sonometer.
4. Verification of Kirchoff's laws and Maximum Power Transfer theorem.
5. Field along the axis of a circular coil carrying current-Stewart & Gee's apparatus.
6. PN Junction Diode Characteristics
7. Zener Diode –V-I Characteristics
8. Zener Diode as a voltage regulator
9. Transistor CE Characteristics- Determination of hybrid parameters
10. Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.
11. Verification of De Morgan's Theorems.
12. Construction of Half adder and Full adders-Verification of truth tables

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- ❖ Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- ❖ Student seminars (on topics of the syllabus and related aspects (individual activity))
- ❖ Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams)
- ❖ Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
- ❖ Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- ❖ Group Discussion
- ❖ Visit to Research Stations/laboratories and related industries
- ❖ Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- ❖ The oral and written examinations (Scheduled and surprise tests),
- ❖ Practical assignments and laboratory reports,
- ❖ Observation of practical skills,
- ❖ Efficient delivery using seminar presentations,
- ❖ Viva voce interviews.

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B.Sc. PHYSICS SYLLABUS UNDER CBCS

For Mathematics Combinations

[2020-21 Batch onwards]

II Year B.Sc.-Physics: IV Semester

Course V: MODERN PHYSICS

Work load:60hrs per semester **4 hrs/week**

Course outcomes:

On successful completion of this course, the students will be able to:

- *Develop an understanding on the concepts of Atomic and Modern Physics, basic elementary quantum mechanics and nuclear physics.*
- *Develop critical understanding of concept of Matter waves and Uncertainty principle.*
- *Get familiarized with the principles of quantum mechanics and the formulation of Schrodinger wave equation and its applications.*
- *Examine the basic properties of nuclei, characteristics of Nuclear forces, salient features of Nuclear models and different nuclear radiation detectors.*
- *Classify Elementary particles based on their mass, charge, spin, half life and interaction.*
- *Get familiarized with the nano materials, their unique properties and applications.*
- *Increase the awareness and appreciation of superconductors and their practical applications.*

UNIT-I :

1. Atomic and Molecular Physics:(12 hrs)

Vector atom model and Stern-Gerlach experiment, Quantum numbers associated with it, Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect,Experimental arrangement to study Zeeman effect;Raman effect, Characteristics of Raman effect, Experimental arrangement to study Raman effect, Quantum theory of Raman effect,Applications of Raman effect.

UNIT-II:

2. Matter waves&Uncertainty Principle: (12 hrs)

Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Phase and group velocities, Heisenberg's uncertainty principle for position and momentum& energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit)and photons(Gamma ray microscope),Bohr's principle of complementarity.

UNIT-III:

3. Quantum (Wave) Mechanics:(12 hrs)

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to (i) one dimensional potential box of infinite height(InfinitePotential Well) and (ii) one dimensional harmonic oscillator

UNIT-IV:

4. Nuclear Physics:(12 hrs)

Nuclear Structure:General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces*: Characteristics of nuclear forces- Yukawa's meson theory; *Nuclear Models*: Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors*: G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles*: Elementary Particles and their classification

UNIT-V:

5. Nano materials:(7hrs)

Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D); Quantum dots, Nano wires, Fullerene, CNT, Graphene(Mention of structures and properties),Distinct properties of nano materials (Mention-*mechanical,optical, electrical, and magnetic properties*); Mention of applications of nano materials: (*Fuel cells,Phosphors for HD TV, Next Generation Computer chips, elimination of pollutants, sensors*)

6. Superconductivity: (5 hrs)

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect , Isotope effect,Type I and Type II superconductors, BCS theory (elementary ideas only),Applications of superconductors

REFERENCE BOOKS

- BSc Physics, Vol.4, Telugu Akademy, Hyderabad
- Atomic Physics by J.B. Rajam; S.Chand& Co.,
- Modern Physics by R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
- Concepts of Modern Physics by Arthur Beiser. Tata McGraw-Hill Edition.
- Nuclear Physics, D.C.Tayal, Himalaya Publishing House.
- S.K. Kulkarni, Nanotechnology: Principles & Practices (Capital Publ.Co.)
- K.K.Chattopadhyay&A.N.Banerjee, Introd.to Nanoscience and Technology(PHI LearningPriv.Limited).
- Nano materials, A K Bandopadhyay. New Age International Pvt Ltd (2007)
- Textbook of Nanoscience and Nanotechnology, BS Murthy, P Shankar, Baldev Raj,BB Rath

and J Murday-Universities Press-IIM

Practical Course V:Modern Physics

Work load: 30 hrs **2 hrs/week**

On successful completion of this practical course, the student will be able to;

- *Measure charge of an electron ande/m value of an electron by Thomson method.*
- *Understand how the Planck's constant can be determined using Photocell and LEDs.*
- *Study the absorption of α-rays and β-rays, Range of β-particles and the characteristics of GM counter*
- *Determine the Energy gap of a semiconductor using thermistor and junction diode.*

Minimum of 6 experiments to be done and recorded

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. Determination of work function of material of filament of directly heated vacuum diode.
6. Study of absorption of α-rays.
7. Study of absorption of β-rays.
8. Determination of Range of β-particles.
9. Determination of M & H.
10. Analysis of powder X-ray diffraction pattern to determine properties of crystals.
11. Energy gap of a semiconductor using junction diode.
12. Energy gap of a semiconductor using thermistor
13. GM counter characteristics

RECOMMENDED CO-CURRICULAR ACTIVITIES:

MEASURABLE

- Assignments (in writing and doing forms on the aspects of syllabus content and outside the syllabus content. Shall be individual and challenging)
- Student seminars (on topics of the syllabus and related aspects (individual activity)

- Quiz (on topics where the content can be compiled by smaller aspects and data (Individuals or groups as teams))
- Field studies (individual observations and recordings as per syllabus content and related areas (Individual or team activity)
- Study projects (by very small groups of students on selected local real-time problems pertaining to syllabus or related areas. The individual participation and contribution of students shall be ensured (team activity)

GENERAL

- Group Discussion
- Visit to Research Stations/laboratories and related industries
- Others

RECOMMENDED ASSESSMENT METHODS

Some of the following suggested assessment methodologies could be adopted;

- The oral and written examinations (Scheduled and surprise tests),
- Practical assignments and laboratory reports,
- Efficient delivery using seminar presentations,
- Viva voce interviews.

***

Note:

1. The duration of the examination for each theory course is 3.00 hrs.
   The duration of each practical examination is 3 hrs with 50 marks

2. Each course in theory is of 100 marks and practical course is of 50 marks.
   - Semester End University Examination in Theory Course: 75 marks [External evaluation]
   - Mid-Semester Examination in Theory Course at the college level: 25 marks [Internal evaluation]

3. The University (external) examination for Theory and Practical shall be conducted at the end of each Semester.

4. In each semester the evaluation in Practical courses shall be done by an external examiner appointed by the University.
   There shall not be Internal valuation in any semester end practical examinations.

5. The candidate shall prepare and submit at the time of practical examination a certified Record based on the practical course with a minimum of **6** experiments from each semester.

6. Numerical Problems must be solved at the end of every chapter of all Units.

7. Numerical problems, each having a weightage of 4 marks, should be asked in the Semester end University examinations.

8. The minimum passing marks in each theory course is 40 (External:30 and Internal:10)
   The minimum passing marks in each Practical/Lab course is 20.

9. The teaching work load per week for semesters I to IV is 4 hours for theory course and 2 hours for all laboratory (practical) courses.

10. Visits to industry, national research laboratories, and scientific exhibitions should be encouraged.

11. The syllabus for Practical courses is same for both Mathematics and Non-Mathematics combinations.

12. The marks distribution for the Semester End practical examination is as follows:

(i)	*Formula/ Principle / Statement with explanation of symbols and*	05
(ii)	*Diagram/Circuit Diagram / Tabular Columns ... ...*	10
(iii)	*Setting up of the experiment and taking readings/Observations*	10
(iv)	*Calculations (explicitly shown) + Graph + Result with Units…*	10
(v)	*Viva-voce ... ...*	05
(vi)	*Class Records (to be valued at the time of practical*	10
	Total Marks :	**50**

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B.Sc. PHYSICS

[For Mathematics combinations]

w.e.f. 2020-21 (Revised in May 2020)

MODEL QUESTION PAPER COMMON FOR ALL FIVE THEORY COURSES

Time : 3 hrs *Max marks : 75*

SECTION-A

(Essay Type Questions) *Marks* : 5x10M = 50M

Answer All questions with internal choice from each Unit

1. Essay type question from Unit-I

   Or

   Essay type question from Unit-I

2. Essay type question from Unit-II

   Or

   Essay type question from Unit-II

3. Essay type question from Unit-III

   Or

   Essay type question from Unit-III

4. Essay type question from Unit-IV

   Or

   Essay type question from Unit-IV

5. Essay type question from Unit-V

   Or

   Essay type question from Unit-V

SECTION-B

(Short Answer Type Questions) *Marks* : 5x5M = 25M

Answer any five out of the following ten questions

6. Short answer type question from Unit-I
7. Short answer type question from Unit-I
8. Short answer type question from Unit-II
9. Short answer type question from Unit-II
10. Short answer type question from Unit-III
11. Short answer type question from Unit-III
12. Short answer type question from Unit-IV
13. Short answer type question from Unit-IV
14. Short answer type question from Unit-V
15. Short answer type question from Unit-V

[**Note:***Question Paper setters are instructed to add Numerical Problems (each of 4 marks) with a maximum weightage of 16 marks either in Section-A or Section-B covering all the five units in the syllabus*]

***

SUBJECT EXPERTS

Prof.K.T.Rama Krishna Reddy
Dept of Physics,
S V University,
Tirupati

Dr.M.Ravi Kumar,
Lecturer in Physics,
Govt. Degree College,
Ananthapuram

SYLLABUS VETTED BY

Prof.R.Rama Krishna Reddy
Dept of Physics,
S K University,
Anantapur

ANDHRA UNIVERSITY

SCHOOL OF CHEMISTRY

M.Sc CHEMISTRY(PREVIOUS)SYLLABUS

SEMESTER-I

PAPER-I: GENERAL CHEMISTRY-I

(Effective from the admitted batch of 2021-2022)

Course Outcomes (COs)/Course Specific Outcomes (CSOs):

Upon completion of the course the students will be able to,

CO1: Learn and understand the selection rules and criteria for molecules to exhibit rotational and IR spectroscopy.

CO2: Understand the Classical and quantum mechanical theories of Raman spectroscopy and basic concepts of electronic spectroscopy.

CO3: Learn spectroscopic methods based on magnetic resonance principles.

CO4: Learn basics of group theory and its application in chemistry.

CO5: Understand the basic concepts of FORTRAN programming and its applications.

Learning Outcomes (LOs):

Upon completion of the course the student will be able

- To apply the spectroscopic methods for structure elucidation of molecules.
- To acquire knowledge of molecular symmetry and group theory and to solve chemical problems.
- To write FORTRAN programs for simple chemical problems.

COURSE CONTENT

UNIT – I **[12 Hours]**

Rotational spectra of diatomic molecules-rigid rotor-selection rules-calculation of bond length-isotopic effect, second order stark effect and its applications, Infrared spectra of diatomic molecules-harmonic and anharmonic oscillators. Selection rules-overtones-combination bands calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibration rotation spectra of diatomic molecules.

UNIT-II **[12 Hours]**

Raman effect-classical and quantum mechanical explanations-Rotational Raman and vibrational Raman spectra, Electronic spectra of diatomic molecules-Vibrational coarse structure-intensity of spectral lines-Franck Condon principle-applications, Rotational fine structure-band head and band shading, Charge transfer spectra.

UNIT-III **[12 Hours]**

Spin Resonance Spectroscopy: Principle and theory of NMR spectroscopy-Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction- experimental methods. Application of NMR to structural elucidation-Structure of ethanol, dimethylformamide, styrene and acetophenone. Principle and theory of ESR-g-factor, hyperfine interactions-applications of ESR studies to the structure of free radicals, metal complexes.

UNIT-IV **[12 Hours]**

Basic concepts of Symmetry and Group theory – Symmetry elements, symmetry operations and point groups – Schoenflies symbols – Classification of molecules into point groups – Axioms of Group theory – Group multiplication tables for C_{2V} and C_{3V} point groups – Similarity Transformation and classes – Representations – reducible and irreducible representations, Mulliken symbols, Orthogonality theorem and its implications, character table and its anatomy.

UNIT-V[12 Hours]

Basic components of Computers, higher and lower level languages, Microsoft Fortran: constants, variables and operators, arithmetic expressions, assignment and replacement statements, Input and Output statements – Format free and Format directed I/O statements – Iw, Fw.d, Ew.d and Gw.d format specifications, conditional and unconditional statements – Logical IF, Block IF and Go To statements, Do statement – syntax and rules.

Application of Chemical Problems:

Flowcharts and Programs for

1. Statistical Analysis calculation of arithmetic mean, mean deviation, variance and standard deviation of replicate measurements.
2. Solution of Quadratic equation – calculation of the roots of a quadratic equation.
3. Calculation of the pH and hydrogen ion concentration of an aqueous solution of a strong acid taking into account the auto ionization of water.
4. Calculation of the root of a polynomial using Gauss-Newton method – Application to Vander-Waal's equation.
5. Calculation of the rate constant of a first order reaction or calculation of molar extinction coefficient using Beer-Lambert's Law by Linear least-squares method.

Text Books:

1. Symmetry and Spectroscopy of Molecules, K Veera Reddy, New Age International Publishers.
2. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
3. Chemical Applications of Group Theory, F. A. Cotton Wiley Eastern Limited New Delhi.
4. Group Theory and its Applications to Chemistry, K. V. Raman, Tata McGraw – Hill Publishing Company Ltd., New Delhi.
5. Computer programming in Fortran-IV by V .Rajaraman, Prentice-Hall of India Pvt. Ltd., New Delhi.
6. Molecular Spectroscopy, - Gordon M. barrow
7. Fundamentals of Molecular Spectroscopy – Banwell.

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
M.Sc CHEMISTRY (PREVIOUS) SYLLABUS
SEMESTER-I
PAPER-II: INORGANIC CHEMISTRY-I
(Effective from the admitted batch of 2021-2022)

CourseObjectives:Tomakethestudents

CO 1:Acquiretheknowledgeon applications of VSEPR, Valence Bond and Molecular orbital theories in explaining thestructures of simple molecules **and** role of p and d orbitals in pi bonding.
CO 2:Understandthe concept of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$).
And Walsh diagram for H_2O molecule
CO 3:Apply theknowledgeandunderstandingofUnderstand the Orgel and Tanabe-Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series stonewly prepared metal complexex
CO 4:Develop interest in the areas of magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.
CO5: To understand the concept of Term symbols and Electronic spectra and Magnetic properties of complexes
LearningOutcomes: Attheendofthecourse,thelearnersshouldbeableto:
LO 1:Explainidea of structure and bonding theories of inorganic compounds
LO 2:InterpretWalsh diagram for other liner and bent molecules
LO 3:Introduce electron counting rules for higher boranes
LO 4:Analyse the preparation and structures of heteropoly acids
LO 5:Understanding structure and bonding in coordination compounds
LO 6:Explain selections rules, Tanabe-Sugano diagrams. Orgel diagrams
LO7: Experimentally Identify the covalency in metal complexes.
LO8:To calculate the magnetic susceptibility of metal complexes
LO9: understand and analyse structure-property correlation of coordination compounds
LO10:design new coordination compounds based on a fundamental understanding of their electronic properties

COURSE CONTENT

UNIT-1 **[12 Hours]**

Structure & Bonding: Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pπ-dπ bonding, Bent's rule, Non-valence cohesive forces

Application of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$).

Walsh diagrams for linear (BeH_2) and bent (H_2O) molecules

UNIT-II **[12 Hours]**

Inorganic cage and ring compounds – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ($H_3B_3N_3H_3$), phosphorus–nitrogen ($N_3P_3Cl_6$) and sulphur-nitrogen (S_4N_4, $(SN)_x$) cyclic compounds. Structure and bonding in higher boranes with (special reference to B12 icosahedra). Electron counting rules in boranes – Wades rules (Polyhedral skeletal electron pair theory).

Polyacids: Introduction to polyacids- Types of polyacids- Isopolyacdis, Isopoly molybdates, Isopolytungstates, Isopolyvanadates, Structures of Polyacids $]Mo_7O_{24}],^{6-}(V_{10}O_{28})^{6-}$ and $W4O_{16}]^{8-}$, Heteropolyacids- properties of heteropolyacids and salts, structures of heteropolyacids and theories , Mialalicopause and Roscnneium theories , Pauling's theory and keggin's theory, applications of polyacids.

UNIT-III **[12 Hours]**

Coordination compounds: Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series, Jahn – Teller theorem (static and dynamic Jahn-Teller theorem) and its consequences, nephelauxetic effect, applications and limitations of CFT; ligand field theory

Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor and π -acceptor ligands on Δo. Experimental evidence for π - bonding in complexes

UNIT- IV **[12 Hours]**

Electronic spectra of transition metal complexes:

Term symbol-Free Ion terms and Energy Levels: Configurations, Terms, States and Microstates, calculation of Microstates for P^2 and d^2 Configuration, Russell- Saunders Coupling Schemes, J-J Coupling scheme, derivation of terms for various configurations P^2 and d^2 configuration, spectroscopic Ground state , Hole Formalism, Energy ordering of terms (Hund's Rules), Selection rules: Laporte orbital selection rule, spin selection rules. Splitting of energy levels and spectroscopic states Orgel diagrams of d^1 to d^9 metal complexes. Interpretation of electronic spectra of aquo Complexes of Ti(III), V(III), Cr(III), Mn(II), Fe(II), Fe(III), Co(II), Ni(II) and Cu(II). Calculation of interelectronic and spectral parameters for d^8 metal complexes.

UNIT- V **[12 Hours]**

Tanabe- Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series. Calculation of Dq, Racah Parameter (B) and nephelauxetic parameter (β), Charge transfer (L→M and M→L) spectra of metal complexes.

Magnetic properties of metal Complexes: Types of magnetic behavior, Temperature independent paramagnetism. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes. Magnetic susceptibility and its determination by Gouy's method, and Faraday's method. orbital contribution to magnetic moment ($O_h$and T_d Complexes)

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
M.Sc CHEMISTRY (PREVIOUS) SYLLABUS
SEMESTER-I
PAPER-III: ORGANICCHEMISTRY-I
(Effective from the admitted batch of 2021-2022)

CourseObjectives:Tomakethestudents

CO 1:Acquiretheknowledgeofaliphaticnucleophilic,aliphaticelectrophilic,stereochemistry and conformational analysis, chemistry of heterocyclic compoundsandchemistryofnaturalproducts

CO 2:Understandaliphaticnucleophilic, aliphaticelectrophilic, stereochemistry andconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

CO3:Applytheknowledgeandunderstandingofaliphaticnucleophilic,aliphaticelectrophilic,stereochemistryandc onformationalanalysis,chemistryofheterocycliccompoundsandchemistryofnaturalproductstonewsituations

CO 4:Develop interest in the areas of aliphatic nucleophilic, aliphatic electrophilic,stereochemistry and conformational analysis, chemistry of heterocyclic compoundsandchemistryofnaturalproducts

LearningOutcomes: Attheendofthecourse,thelearnersshouldbeableto:

LO 1:Explainaliphaticnucleophilic,aliphatic electrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO 2:Interpretaliphaticnucleophilic,aliphatic electrophilic,stereochemlstryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO 3:Comparealiphaticnucleophilic, aliphaticelectrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO 4:Analysealiphaticnucleophilic,aliphaticelectrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO 5:SolvealiphaticnucleophillG,aliphaticelectrophilic,stereochemistryandconformational analysis, chemistry of heterocycliccompounds and chemistry ofnaturalproducts

LO6: Identify aliphatic nucleophilic,aliphaticelectrophilic, stereochemistry andconformationalanalysis,chemistryofheterocycliccompoundsand chemistryofnaturalproducts

LO7: Apply aliphaticnucleophilic,aliphaticelectrophilic, stereochemistry andconformationalanalysis,chemistryofheterocycliccompoundsand chemistryofnaturalproducts

COURSE CONTENT

UNIT–I [12 Hours]

Aliphatic Nucleophilic Substitutions: The SN2, SN1, SNi and SET mechanisms.Substitutionreactionsofambidentnucleophiles,anchimericassistance,theneighbouring group mechanism: neighbouring group participation by 0,N, S,halogens, aryl groups, alkyl and cycloalkyl groups in nucleophilic substitutionreactions. Sigma, Pi bond participation in acylic and bicyclic systems (Non-classiccarbocations).NucleophilicSubstiłutional allylic,ŁrigonalandVinyliccarbons.Effectofsubstrate,attackingnucleophile,leavinggroupandreactionmedium.

UNIT-II **[12 Hours]**

Aliphatic ElectrophilicSubstitutions: SEI SE2 and SEi mechanisms. Reactivity-effects of substrate, leaving group and solvent. Reactions- hydrogen exchange,migration of doublebonds, halogenation of aldehydes, ketones, carboxylic acids, acylhalides,sulphoxidesandsulphones.

UNIT-III **[12 Hours]**

Stereochemistry and Conformational Analysis: Optical Isomerism:FtiCal activity,moleculardissymmetryand chirality- elements of symmetry.Fisher'sprojectionD,L. and R,S. configurations - relative and absolute configurations optical isomerismdue to asymmetric carbon atoms - optical isomerism in biphenyls, allenes andspirans-opticalisomerismofnitrogenouscompounds,racemisationandresolution.

Geometricalisomerism:E,Z-configurations,propertiesofgeometricalisomers.Conformationalanalysis:Conformationsofacyclicmolecules-alkanesandsubstitutedalkanes-compoundshavingintramolecularhydrogenbonding.Conformations of cyclohexane, mono and disubstituted cyclohexanes and decalins,effectofconformationsonreactivity.

UNIT—IV **[12 Hours]**

Chemistry of Heterocyclic Compounds :Structure, reactivity and synthesis of threemembered Heterocycles: (a) Oxirane: Sharpless method, Shi epoxidation, Jacobsenepoxidation, etc, (b) Aziridine; four membered Heterocycles: (a) Oxetane (b) Azetine;five memberedHeterocycles:(a) Pyrrole: Paa1 Knorr, Hantzsch Methods,etc, (b)Thiophene: Paa1 Knorr, Hinsberg method, etc. (c) Furan: Paa1 Knorr, Fiest-Benary,IndustrialMethod, etc.; (d) Pyrazole,(e) Imidazole,(f) Oxazole, (g) Thiazole; Sixmembered Heterocycles: (a) Pyridine, (b)Pyridazine,(c) pyrimidine and (d) Pyrazine;Aromatic heterocyclics: a) Indole: Fischer indole synthesis, Bischler synthesis, andMadelungsynthesis(b)QuinolineandIsoquinoline,(c)CoumarinsandChromones.

UNIT—V **[12 Hours]**

ChemistryofNaturalProducts:

A) Terpenoids:-Occurrence,Isolation,isoprenerule,structureelucidationandsynthesisofn-Terpineolandn-pinene

B) Steroids:-
Nomenclatureofsteroids,structureelucidation,synthesisandstereochemistryofcholesterolandprogesterone

C) Lipids:-Classification,propertiesandfunction-
freefattyacids,triglycerides,phospholipids,glycolipids&waxesconjugatedlipids-lipoproteins

ReferenceBooks

1. AdvancedOrganicChemistry:ReactionsMechanismsandStructurebyJerryMarch, Mc.GrawHillandKogakush.

2. OrganicChemistryVol.I(Sixth Ed.)andVol.II(FifthEd.)byILFinarELBS.

3. OrganicChemistry(fifthEd.,)byMorrison andBoyd,PHI,India.

4. OrganicChemistry(fifthedition)byFrancisA.CareyTataMcGrawHillpublishing CompanyLimited,NewDelhi.

5. StereochemistryofOrganiccompoundsbyErnestL.E1ie1,SamuelH.Wilen

6. Chemistry of natural products by S. V. Bhat, B. A. Nagasampangi and M.Sivakumar NarosaPublishingHouse,6threprint2010

ANDHRA UNIVERSITY

SCHOOL OF CHEMISTRY

M.Sc CHEMISTRY (PREVIOUS) SYLLABUS SEMESTER-I

PAPER-IV: PHYSICALCHEMISTRY-I

(Effective from the admitted batch of 2021-2022)

Course Outcomes (COs)/Course Specific Outcomes (CSOs)

Upon completion of the course the students will be able to,

CO1: Explain the basic concepts of Thermodynamics and its applications

CO2: Understand the concepts of thermodynamics of solutions.

CO3: To understand the principle of micellisation.

CO4: Understand the various kinetic theories, measurements of reaction rates.

CO5: Learn experimental techniques for measuring the kinetics of fast reactions and homogenous catalyzed reactions.

Learning Outcomes (LOs):

Upon completion of the course the student will be able to understand

- To apply the concepts of thermodynamics to various problems in chemistry.
- To predict various reaction mechanisms.
- To apply the concept of micellization to various chemical reactions.

COURSE CONTENT

UNIT-I **[12Hours]**

Basic concepts of second law of Thermodynamics-Entropy- Entropy changes accompanying different processes-Entropy changes in an ideal gas, entropy changes in the mixing of ideal gases, entropy as a function of V and T and entropy as a function of P and T- Entropy change in isolated systems- Clausius inequality-Helmholtz and Gibbs energy -Maxwell relations - Criteria for spontaneity-variation of Gibbs energy with temperature and pressure for solids, liquids and gases-Concept of fugacity-determination of fugacity coefficient of gases- Thermodynamics of phase transitions- Concept of chemical potential-Location of phase boundaries-(Clausius-Clapeyron equation for Liquid- Vapour, Solid -Liquid and Solid- Vapour boundaries)- Ehrenfest classification of phases.

UNIT-II **[12Hours]**

Thermodynamics of mixtures -partial molar quantities - experimental methods of determination of partial molar quantities -Gibbs-Duhem equation and Duhem-Margules equation-Thermodynamics of mixing of liquids (ΔH_{mix}, ΔG_{mix} and ΔS_{mix}) - Thermodynamics of ideal solutions - Raoult's law -Thermodynamics of colligative properties of dilute solutions - concept of activity and activity coefficient- Experimentaldetermination of activity coefficient - Thermodynamic concept of equilibrium, variation of equilibrium with temperature (Van't Hoff equation) and pressure - Nernst heat theorem, Third law of thermodynamics- exceptions to third law of thermodynamics.

UNIT-III **[12 Hours]**

Surface tension- Capillary action- Adsorption-Adsorption isotherms- Freundlich adsorption isotherm, Langmuir adsorption isotherm-limitations - BET adsorption isotherm-estimation of Surface area.Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants, counter ion binding to micelles, thermodynamics of micellization- phase separation and mass action models.

UNIT-IV **[12 Hours]**

Chemical Kinetics: Theories of reaction rates- Collision theory- Limitations, Transition state theory.Lindeman's theory of unimolecular reactions -Limitations. Diffusion controlled reactions. Effect of ionic strength on rates of reactions- Primary and secondary salt effects. Effect of dielectric constant onreactions - kinetic isotope effect -Primary and secondary isotopic effects -Effect of substituent -Linear free energy relationships - Hamett equation -limitations- Taft equation. Kinetics of consecutive reactions, parallel reactions, opposing reactions (Uni molecular steps only, no derivation).

UNIT-V **[12 Hours]**

Specific and general acid-base catalysis. Skrabal diagrams. Steady state approximation- Enzyme catalysis- Michaelis -Menten mechanism. Derivation of Kinetic equation and Kinetic parameters. Lock and Key hypothesis-pH dependence of enzyme catalyzed reactions.Fast reactions- different methods of studying fast reactions- flow methods, relaxation methods- temperature jump and pressure jump methods.

Text Books:

1. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
2. Chemical Kinetics by K. J. Laidler, McGraw Hill Pub.
3. Physical chemistry by K.L. Kapoor

Reference Books:

1. Thermodynamics for Chemists, Samuel Glasstone
2. Physical chemistry by Puri, Sharma and Pathania
3. Micelles, Theoretical and applied aspects, V. Moroi, Plenum publisher

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
M.Sc. CHEMISTRY(PREVIOUS) SYLLABUSSEMESTER-I
PAPER-I: GENERAL CHEMISTRY-I
(Effective from the admitted batch of 2021-2022)

Course Outcomes (COs)/Course Specific Outcomes (CSOs):

Upon completion of the course the students will be able to,

CO1: Learn and understand the selection rules and criteria for molecules to exhibit rotational and IR spectroscopy.

CO2: Understand the Classical and quantum mechanical theories of Raman spectroscopy and basic concepts of electronic spectroscopy.

CO3: Learn spectroscopic methods based on magnetic resonance principles.

CO4: Learn basics of group theory and its application in chemistry.

CO5: Understand the basic concepts of FORTRAN programming and its applications.

Learning Outcomes (LOs):

Upon completion of the course the student will be able

- To apply the spectroscopic methods for structure elucidation of molecules.
- To acquire knowledge of molecular symmetry and group theory and to solve chemical problems.
- To write FORTRAN programs for simple chemical problems.

COURSE CONTENT

UNIT – I **[15 Hours]**

Rotational spectra of diatomic molecules-rigid rotor-selection rules-calculation of bond length-isotopic effect, second order stark effect and its applications, Infrared spectra of diatomic molecules-harmonic and anharmonic oscillators. Selection rules-overtones-combination bands calculation of force constant, anharmonicity constant and zero point energy. Fermi resonance, simultaneous vibration rotation spectra of diatomic molecules.

UNIT-II **[15 Hours]**

Raman effect-classical and quantum mechanical explanations-Rotational Raman and vibrational Raman spectra, Electronic spectra of diatomic molecules-Vibrational coarse structure-intensity of spectral lines-Franck Condon principle-applications, Rotational fine structure-band head and band shading, Charge transfer spectra.

UNIT-III **[15 Hours]**

Spin Resonance Spectroscopy: Principle and theory of NMR spectroscopy-Nature of spinning particle and its interaction with magnetic field. Chemical shift and its origin. Spin-Spin interaction-experimental methods. Application of NMR to structural elucidation-Structure of ethanol, dimethylformamide, styrene and acetophenone. Principle and theory of ESR-g-factor, hyperfine interactions-applications of ESR studies to the structure of free radicals, metal complexes.

UNIT-IV **[15 Hours]**

Basic concepts of Symmetry and Group theory – Symmetry elements, symmetry operations and point groups – Schoenflies symbols – Classification of molecules into point groups – Axioms of Group theory – Group multiplication tables for C_{2V} and C_{3V} point groups – Similarity Transformation and classes

– Representations – reducible and irreducible representations, Mulliken symbols, Orthogonality theorem and its implications, character table and its anatomy.

UNIT-V **[15 Hours]**

Basic components of Computers, higher and lower level languages, Microsoft Fortran: constants, variables and operators, arithmetic expressions, assignment and replacement statements, Input and Output statements – Format free and Format directed I/O statements – Iw, Fw.d, Ew.d and Gw.d format specifications, conditional and unconditional statements – Logical IF, Block IF and Go To statements, Do statement – syntax and rules.

Application of Chemical Problems:

Flowcharts and Programs for

1. Statistical Analysis calculation of arithmetic mean, mean deviation, variance and standard deviation of replicate measurements.
2. Solution of Quadratic equation – calculation of the roots of a quadratic equation.
3. Calculation of the pH and hydrogen ion concentration of an aqueous solution of a strong acid taking into account the auto ionization of water.
4. Calculation of the root of a polynomial using Gauss-Newton method – Application to Vander-Waal's equation.
5. Calculation of the rate constant of a first order reaction or calculation of molar extinction coefficient using Beer-Lambert's Law by Linear least-squares method.

Text Books:

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2. Physical Chemistry by Peter Atkins and Julio de Paula, Oxford University Press.
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ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
M.Sc CHEMISTRY (PREVIOUS) SYLLABUS SEMESTER-I
PAPER-II: INORGANIC CHEMISTRY-I
(Effective from the admitted batch of 2021-2022)

CourseObjectives:Tomakethestudents

CO 1:Acquiretheknowledgeon applications of VSEPR, Valence Bond and Molecular orbital theories in explaining thestructures of simple molecules **and** role of p and d orbitals in pi bonding.
CO 2:Understand the concept of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$).
And Walsh diagram for H_2O molecule
CO 3:Apply theknowledgeandunderstandingofUnderstand the Orgel and Tanabe-Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series stonewly prepared metal complexex
CO 4:Develop interest in the areas of magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes.
CO5: To understand the concept of Term symbols and Electronic spectra and Magnetic properties of complexes

LearningOutcomes: Attheendofthecourse,thelearnersshouldbeableto:

LO 1:Explainidea of structure and bonding theories of inorganic compounds
LO 2:InterpretWalsh diagram for other liner and bent molecules
LO 3:Introduce electron counting rules for higher boranes
LO 4:Analyse the preparation and structures of heteropoly acids
LO 5:Understanding structure and bonding in coordination compounds
LO 6:Explain selections rules, Tanabe-Sugano diagrams. Orgel diagrams

LO7: Experimentally Identify the covalency in metal complexes.
LO8:To calculate the magnetic susceptibility of metal complexes
LO9: understand and analyse structure-property correlation of coordination compounds

LO10:design new coordination compounds based on a fundamental understanding of their

electronic properties

COURSE CONTENT

UNIT-1 **[15 Hours]**

Structure & Bonding: Applications of VSEPR, Valence Bond and Molecular orbital theories in explaining the structures of simple molecules- role of p and d orbitals in pπ-dπ bonding, Bent's rule, Non-valence cohesive forces

Application of MO theory to square planar ($PtCl_4^{2-}$) and Octahedral complexes (CoF_6^{3-}, $Co(NH_3)_6^{3+}$).

Walsh diagrams for linear (BeH_2) and bent (H_2O) molecules

UNIT-II **[15 Hours]**

Inorganic cage and ring compounds – preparation, structure and reactions of boranes, carboranes, metallocarboranes, boron–nitrogen ($H_3B_3N_3H_3$), phosphorus–nitrogen ($N_3P_3Cl_6$) and sulphur-nitrogen (S_4N_4, $(SN)_x$) cyclic compounds. Structure and bonding in higher boranes with (special reference to B12 icosahedra). Electron counting rules in boranes – Wades rules (Polyhedral skeletal electron pair theory).

Polyacids: Introduction to polyacids- Types of polyacids- Isopolyacdis, Isopoly molybdates, Isopolytungstates, Isopolyvanadates, Structures of Polyacids $]Mo_7O_{24}],^{6-}(V_{10}O_{28})^{6-}$ and $W4O_{16}]^{8-}$, Heteropolyacids- properties of heteropolyacids and salts, structures of heteropolyacids and theories , Mialalicopause and Roscnneium theories , Pauling's theory and keggin's theory, applications of polyacids.

UNIT-III **[15 Hours]**

Coordination compounds: Crystal field theory - crystal field splitting patterns in octahedral, tetrahedral, tetragonal, square planar, square pyramidal and trigonal bipyramidal geometries. Calculation of crystal field stabilization energies. Factors affecting crystal field splitting energies – Spectrochemical series, Jahn – Teller theorem (static and dynamic Jahn-Teller theorem) and its consequences, nephelauxetic effect, applications and limitations of CFT; ligand field theory

Experimental evidences for covalence in complexes. Molecular Orbital Theory of bonding for Octahedral, tetrahedral and square planar complexes. π-bonding and MOT - Effect of π - donor and π -acceptor ligands on Δo. Experimental evidence for π - bonding in complexes

UNIT- IV **[15 Hours]**

Electronic spectra of transition metal complexes:

Term symbol-Free Ion terms and Energy Levels: Configurations, Terms, States and Microstates, calculation of Microstates for P^2 and d^2 Configuration, Russell- Saunders Coupling Schemes, J-J Coupling scheme, derivation of terms for various configurations P^2 and d^2 configuration, spectroscopic Ground state , Hole Formalism, Energy ordering of terms (Hund's Rules), Selection rules: Laporte orbital selection rule, spin selection rules. Splitting of energy levels and spectroscopic states Orgel diagrams of d^1 to d^9 metal complexes. Interpretation of electronic spectra of aquo Complexes of Ti(III), V(III), Cr(III), Mn(II), Fe(II), Fe(III), Co(II), Ni(II) and Cu(II). Calculation of interelectronic and spectral parameters for d^8 metal complexes.

UNIT- V **[15 Hours]**

Tanabe- Sugano diagrams for d^1 –d^9 octahedral and tetrahedral transition metal complexes of 3d series. Calculation of Dq, Racah Parameter (B) and nephelauxetic parameter (β), Charge transfer (L→M and M→L) spectra of metal complexes.

Magnetic properties of metal Complexes: Types of magnetic behavior, Temperature independent paramagnetism. Magnetic properties of transition and inner transition metal complexes – spin and orbital moments – quenching of orbital momentum by crystal fields in complexes. Magnetic susceptibility and its determination by Gouy's method, and Faraday's method. orbital contribution to magnetic moment ($O_h$and T_d Complexes)

Text books:

1. Advanced Inorganic Chemistry by F.A. Cotton and G. Wilkinson, IV Edition, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III Edition, Harper International Edition, 1983.
3. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)

MODEL QUESTION PAPER

ANDHRA UNIVERSITY SCHOOL OF CHEMISTRY

M.Sc. Chemistry (Previous)Paper- II: GENERAL CHEMISTRY-ISemester-I

(Effective from 2021-2022 admitted batch)

Time: 3 hours **Answer ALL questionsMax. Marks**: 80 **(5x16=80 Marks)**

1. (a) (i)What kind of molecules exhibit microwave spectra.
   (ii) Discuss isotope effect in microwave spectra.

(or)

(b) (i)Derive an expression for energy or harmonic oscillator and discuss the selection rules.
   (ii) Describe the origin of PQR structure of Vibrational-Rotational spectra.

2. (a)(i) Discuss the classical and quantum mechanical theories of Raman spectra.
   (ii) Explain rotational fine structure in electronic spectroscopy?

(or)

(b) (i)State and explain Franck Condon principle.
   (ii) Write a short note on charge transfer spectra.

3 (a) (i)Explain the terms spin active nuclei, resonance, larmor precession and chemical shifts in NMR.
   (ii) Explain hyperfine interactions in ESR spectroscopy taking examples.

(or)

(b) (i)What are the factors affecting g value in ESR spectroscopy.
   (ii) Explain spin-spin interactions in NMR spectroscopy?

4 (a) (i)State and explain the axioms of group theory.
   (ii) State the great Orthogonality theorem and discuss its implications.

(or)

(b) (i)Give the points groups for NH_3, XeF_4, eclipsed C_2H_6, Cis C_2H_4, $B_3N_3H_6$ and allene.
   (ii) Describe the anatomy of character table.

5 (a) (i)Write a flowchart and FORTRAN program for calculation of rate constant of a first order reaction.
   (ii) Give the syntax and rules of DO statement.

(or)

(b) (i)Write a flowchart and FORTRAN program for calculation of pH and hydrogen ion concentration of an aqueous solution of a strong acid taking into account the auto ionization of water.
   (ii) Write a brief note on format directed Input/output statements.

MODEL QUESTION PAPER

ANDHRA UNIVERSITY SCHOOL OF CHEMISTRY

M.Sc. Chemistry (Previous) Paper- II: INORGANIC CHEMISTRY-ISemester-I

(Effective from 2021-2022 admitted batch)

Time: 3 hours **Answer ALL questions** **Max. Marks**: 80 **(5x16=80 Marks)**

1. (a) (i)Predict the geometries of ClF_3, XeF_4 and SF_4 molecules using VSEPR theory.
(ii)What is LCAO method? Predict bond order and bond lengths in O_2^+ and O_2^- ions based on MO energy level diagram

OR

(b) (i)Draw the MO energy level diagram for $[Co(NH_3)_6]^{3+}$ and discuss its magnetic properties.
(ii) Draw the Walsh diagram for H_2O molecule and predict its structure.

2. (a) (i)Discuss the preparation of, structure of, and bonding in $N_3P_3Cl_6$.
(II) Discuss the structure and properties of borazole.

OR

(b) (i)Explain Mialalicopause and Roscnneium theories, Pauling's theory and keggin's theory of polyacids.
(ii) Explain the method of counting skeletal electrons in cluster compounds

3. (a) (i)Draw and explain the crystal field splitting of 'd ' orbitals in square planar and trigonal bipyramidalgeometries.
(ii) Discuss the factors affecting crystal field splitting energies.

OR

(b) (i) what are static and dynamic Jahn-Teller theorem and discuss its consequences
(ii) Write a note on nephelauxetic effect

4. (a) (i)How do Tanabe – Sugano diagrams differ from Orgel diagrams? Draw Tanabe – Sugano diagram for $[V(H_2O)_6]^{3+}$
(ii) Draw the Orgel diagram for $[TiCl_4]^-$ ion and explain the electronic transitions.

OR

(b) (i)Write an account on Russell – Saunders coupling.
(ii) Derive the term symbols for Ni^{2+} and identify the ground state term symbol

5. (a) (i)Discuss different types of paramagnetic behaviourof transition metal complexes
(ii) Calculate the spin only magnetic moments of the $[MnCl_6]^{3-}$ and $[Fe(CN)_6]^3$

OR

(b) (i)Describe the Magnetic properties of inner transition metal complexes
(ii) Determination of magnetic susceptibility a determination by Gouy's and Faraday's methods

School of Chemistry
Andhra University
M.Sc.(Previous) Chemistry Syllabus for II Semester
Paper I: General chemistry
(w.e.f. 2021-2022 admitted batch)

Unit I **[15 Hours]**

Wave equation – interpretation of wave function – properties of wave function – normalization and orthogonalisation, operators – linear and non-linear commutators of operators, Postulates of quantum mechanics, setting up of operators observables – Hermitian operator – Eigen values of Hermitian operator.

Unit-II **[15 Hours]**

Wave mechanics of simple systems with constant potential energy, particle in one dimensional box – factors influencing colour – transition – dipole integral, symmetry arguments in deriving the selection rules-the concept of tunneling – particle in a three dimensional box, Rigid rotor, wave mechanics of systems with variable potential energy-simple harmonic oscillator-solution of wave equation-selection rules.

UNIT-III **[15 Hours]**

Hydrogen atom-solution of R(r), θ(θ) and Φ(ϕ) equations-probability density in orbitals-shapes of orbitals. Perturbation theory-time independent perturbation (only first order perturbation is to be dealt with) – application to ground state energy of hydrogen and helium atom

UNIT –IV **[15 Hours]**

Variation principle-applications to hydrogen and helium atoms-calculation of zero point energy of harmonic oscillator-many electron atom- Comparison between Perturbation and variation theorems. Hartee-Fock self-consistent field method and introductory concepts of Density functional theory(DFT).

UNIT-V **[15 Hours]**

Valence bond approach-directed valence-hybridization-covalent bond-calculation of ionic and covalent bond contributions in hydrogen molecule. Molecular orbital theory – LCAO approximation – hydrogen molecule ion – hydrogen molecule (fundamental concepts only) – The electronic transitions in the hydrogen molecule.

ANDHRA UNIVERSITY
SCHOOL OF CHEMISTRY
M.ScCHEMISTRY (PREVIOUS) SYLLABUSSEMESTER-II
PAPER-II: INORGANICCHEMISTRY-II

(Effective from the admitted batch of 2021-2022)

CourseObjectives:Tomakethestudents

CO1:To give a basic and updated knowledge for the students on metal clusters,

Organometallic chemistry of transition metals

CO 2:To discuss the preparation and structures of and functional aspects of metal clusters
CO 3: Design new coordination compounds based on a fundamental understanding of their electronic properties
CO4: To discuss basics principles of reaction mechanism in metal complexes
CO5: To understand the concept of Term symbols and Electronic spectra and Magnetic properties of complexes
LearningOutcomes: Attheendofthecourse,thelearnersshouldbeable to:

LO 1:Explain the idea of metal clusters

LO 2:Interpret the bonding nature in metal clusters

LO 3:understand the basics of inorganic and coordination chemistry

LO 4:verify the 18 electron rules in various metal clusters

LO 5:determine the stability constants of metal complexes

LO6: Explain the kinetics of substitution reaction, conjugate bas mechanism and trans effect

LO 7: design new coordination compounds based on a fundamental understanding of their Reaction mechanism

COURSE CONTENT

UNIT-I **[15 Hours]**
Metal cluster compounds - definition – evidences for existence of M-M bonds - conditions favorable for formation of M-M bonds – preparation, structure and bonding of the following metal cluster compounds.
$Re_2Cl_8^{2-}$, $Mo_2Cl_8^{4-}$, $Re_2(RCOO)_4X_2$, $Mo_2(RCOO)_4(H_2O)_2$, $Cr_2(RCOO)_4(H_2O)_2$, $Cu_2(RCOO)_4(H_2O)_2$, $Cr_2Cl_9^{3-}$, $Mo_2Cl_9^{3-}$, $W_2Cl_9^{3-}$, Re_3Cl_9, $Re_3Cl_{12}^{3-}$, $Mo_6Cl_8^{4+}$, $Nb_6X_{12}^{2+}$ and $Ta_6X_{12}^{2+}$.
Polyatomic clusters – Zintle ions, Chevrel phases.

UNIT-II **[15 Hours]**
Organometallic compounds - 16 and 18 electron rules.
Isoelectronicrelationship - Synthesis, structure, bonding and reactions of carbon monoxide, dinitrogen and nitric oxide complexes.
Isolobal relationship – H, Cl, CH_3, $Mn(CO)_5$; S, CH_2, $Fe(CO)_4$; P, CH, $Co(CO)_3$
Synthesis, structure, bonding and reactions of metallocenes with special reference to ferrocene

UNIT-III **[15 Hours]**

Metal Ligand equilibria in solution:

Step wise and overall formation constants and their interaction. Trends in stepwise constants ((statistical effect and statistical ratio), factors affecting the stability of metal complexes; Stability correlations - Irwing -William's series, Pearson's theory of hard and soft acids and bases (HSAB), Application of HSAB: Biological functions and toxicology of metals, and medicinal applications; chelate effect and its thermodynamic origin

UNIT-IV **[15 Hours]**

Determination of stability constants of complexes by spectrophotometric method ((Job's method) and pH –metric method(Bjerrum's).

Reactivity of metal complexes – inert and labile complexes. Explanation of lability on the basis of valence bond and crystal field theories.

.**UNIT- V** **[15 Hours]**

Reaction Mechanisms of Metal Complexes:

Reactivity of metal complexes, inert and labile complexes, Kinetics and mechanisms of substitution reactions, kinetics of substitutions reactions in octahedral complexes, acid hydrolysis, Factors affecting acid hydrolysis, Base hydrolysis, Conjugate base mechanism, Anation reactions, substitution reactions in square planar complexes, Trans effect, Mechanism of trans effect, Electron transfer reactions-– concept of complementary and non-complementary reactions with examples, inner sphere and outer sphere mechanisms, Marcus theory.

<u>Text books</u>:

1. Advanced Inorganic Chemistry by F.A. Cotton and R.G. Wilkinson, IV Edition, John, John Wiley and Sons, New York, 1980.
2. Inorganic Chemistry by J.E. Huheey, III edition, Harper International Edition, 1983.
3. Organometallic Chemistry-A unified approach by A. Singh and R.C. Mehrotra, Wiley Eastern Ltd.
4. Inorganic Chemistry by Shriver and Atkins, Oxford University Press (1999)
5. Theoretical Inorganic Chemistry, II Edition by M.C. Day and J. Selbin, Affiliated East-West press Pvt. Ltd., New Delhi.
6. Mechanisims of Inorganic reactions in solution by D.Benson, MCgraw Hill, London, 1968.
7. Inorganic chemistry by K.F. Purcell and J.C.Kotz, W.B. Saunders company, New York, 1977.

Model Question paper
Andhra University, School of Chemistry
M.Sc. Chemistry (Previous) Paper I: General Chemistry-II Semester-II
(w.e.f. 2021-2022 admitted batch)
Time: 3 Hours Answer ALL questionsMaximum marks: 80 (5X16 =80 marks)

(1) (a) i) Derive Schrodinger wave equation?
ii) Explain the postulates of Quantum mechanics
Or
(b) i) Write notes on Hermitian operator and its properties
ii) Explain normalization and orthogonalisation

(2) (a) i) Solve the Schrodinger wave equation for a particle in a one-dimensional box.
ii) Write the factors influencing color
Or
(b) i) Derive the Schrodinger wave equation for a simple harmonic oscillator
ii) Describe the concept of tunneling

(3) (a) i) Explain the solutions of R(r), θ(θ) and Φ(ϕ) equations of hydrogen atom
ii) Explain probability density in orbitals
Or
(b) i) Explain the time independent perturbation theory to evaluate the ground state energy of helium atom.
ii) Application of above to ground state energy of hydrogen and helium atom

(4) (a) i) What is variation principle. Write its application to calculation of ground state energy of harmonic oscillator.
ii) Compare Perturbation and variation theorems.
Or
(b) i) Explain Hartee-Fock self-consistent field method for multi electron atoms.
ii) Write a note on Density functional theory(DFT)

(5) (a) i) Explain quantum mechanical approach of molecular orbital theory.
ii) Calculate the ionic and covalent bond contributions in hydrogen molecule
Or
(b) i) Discuss the valence bond approach of H_2 molecule.
ii) Write the electronic transitions in the hydrogen molecule.

MODEL QUESTION PAPER

ANDHRA UNIVERSITY SCHOOL OF CHEMISTRY

M.Sc. Chemistry (Previous)Paper- II: Inorganic Chemistry-IISemester-II

(Effective from 2021-2022 admitted batch)

Time: 3 hours **Answer ALL questionsMax. Marks**: 80 **(5x16=80 Marks)**

1. a) (i) Discuss the structure and magnetic property of $Cu_2(RCOO)_4(H_2O)_2$.
(ii) Write a note on Chevrel phases

OR

(b) (i) Discuss the preparation of, structures of and bonding in $Re_2Cl_8^{2-}$.
(ii) Describe the structures of hexanuclear metal clusters.

2. a) (i) Explain the synthesis, structure and reactions of metal carbonyls.
(ii) Explain Isolobal relationship with suitable examples.

OR

b) (i) Describe the preparation of, structure of and bonding in ferrocene.
(ii) What is 18 electron rules? Illustrate with suitable examples

3. a) (i) Explain the factors affecting the stability of coordination compounds.
(ii) Distinguish between stepwise and overall stability constants.

OR

(b) (i) Describe the Irwing -William's series, Pearson's theory of hard and soft acids and bases (HSAB), (ii) What is chelate effect and discuss its thermodynamic origin

4. a) (i) Discuss a spectrophotometric method for the determination of binary formation constant of a metal complex.
(ii) What are inert and labile complexes?

OR

(b) (i) Describe the pH – metric method for the determination of stability constants.
(ii) Explain inert and labile complexes by using crystal field stabilization energies?

5. a) (i) What is acid hydrolysis reactions? Discuss Factors affecting acid hydrolysis reactions
(ii) What is trans effect? Distinguish between the trans effect and trans influence.

OR

b) (i) Give an account of base hydrolysis of Cobalt (III) complexes.
(ii) Discuss the various factors affecting the rates of substitution reactions of octahedral complexes.

ANDHRA UNIVERSITY
DEPARTMENT OF ORGANIC CHEMISTRY & FDW
Revised Syllabus for M.Sc Chemistry (Organic chemistry specialization)
(With effect from the Admitted batch of 2021-2022 Academic Year)

Programme objectives:

1. To provide students in the scientific skills and chemical knowledge essential to develop and apply the knowledge in chemical sciences for preparing chemists of exceptional skills and abilities.
2. To provide knowledge, application, skills in required areas of chemical education
3. To equip students with effective scientific communication skills
4. To encourage the pursuit of lifelong education
5. To develop each student into a committed individual with ethical and social responsibility

Programme Specific objectives:

The students who complete the M.Sc. Organic Chemistry course shall:

1. Have strong foundation in the fundamentals and applications of chemical knowledge and understanding
2. Have the abilities to think critically, logically and analytically and solve problem in the area of chemical sciences, materials, environmental aspects, medicines and energy
3. Have the abilities to carry out chemical experiments, record and analyze the results and design advanced models
4. Have the abilities to use modern library and information retrieving tools to obtain information and assimilate to generate concepts and apply them in challenging situations
5. Have the abilities to effectively communicate their knowledge and skills to other chemists and non-chemists in oral or written formats
6. Secure suitable employment in the areas of chemical industries like pharmaceutical, steel and metals, polymers, fuels and nuclear, environmental and pollution control, nanotechnology and composite materials, teaching and research, etc.
7. Have the personal attributes and ethical sensibilities to enable them to function as effective scientists and citizens

M.Sc. Chemistry (Final Year)

Specialization: ORGANIC CHEMISTRY

Syllabus (w.e.f.2021-22 admitted batch)

Scheme of Instruction and Examination for **III Semester**

S.No	Course Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Organic Reaction Mechanisms, Pericyclic Reactions and Photochemistry	Theory	4	80	20	100	3 hours	4
2	Organic Spectroscopy	Theory	4	80	20	100	3 hours	4
3	Organic Synthesis	Theory	4	80	20	100	3 hours	4
4	Chemistry of Natural Products	Theory	4	80	20	100	3 hours	4
5	Practical-I: Multi stage organic synthesis	Lab	3	80	20	100	6 hours	4
6	Practical-II: Chromatography & Viva-voce	Lab	3	80	20	100	6 hours	4
7	MOOC course		-	-	-	-	-	4
8	Value added course - Intellectual Property Rights (IPR)		-	-	-	-	-	2
	Total					600		30

Scheme of Instruction and Examination for **IV Semester**

S.No	Paper Title	Course Type	Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Modern Synthetic Methodology in Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Organic Spectroscopy and Structure determination of natural products	Theory	4	80	20	100	3 hours	4
3	Designing organic synthesis and synthetic applications of organo- boranes and – silanes	Theory	4	80	20	100	3 hours	4
4	Drug design and drug chemistry	Theory	4	80	20	100	3 hours	4
5	Project work	Lab	-	100	-	100	-	4
6	Practical-I: Organic Mixture analysis	Lab	3	80	20	100	6 hours	4
7	Practical-II: Estimations and Isolation		3	80	20	100	6 hours	4
8	MOOC course		-	-	-	-	-	4
9	Value added course (Research Methodology)		-	-	-	-	-	2
	Total					700		34

M.Sc. Chemistry (First Year**)**

SEMESTER I

Paper III- Organic Chemistry

(w.e.f. 2021-22 admitted batch)

Scheme of Instruction and Examination for **I Semester**

S.No	Paper Title		Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credi
1	Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Practical : Organic Chemistry	lab	3	60	15	75	3 hours	3
					Total	175		7

M.Sc. Chemistry (First Year**)**

SEMESTER II

Paper III- Organic Chemistry

(w.e.f. 2021-22 admitted batch)

Scheme of Instruction and Examination for **II Semester**

S.No	Paper Title		Instruction Periods per week	External Marks	Internal Marks	Total Marks	Duration of External Examination	Credits
1	Organic Chemistry	Theory	4	80	20	100	3 hours	4
2	Practical : Organic Chemistry	Lab	3	60	15	75	3 hours	3
					Total	175		7

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – I SYLLABUS
(From the batch admitted during the academic year 2021-2022)

PAPER III - ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

CO 2: Understand aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

CO 3: Apply the knowledge and understanding of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products to new situations

CO 4: Develop interest in the areas of aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 2: Interpret aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 3: Compare aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 4: Analyse aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 5: Solve aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 6: Identify aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

LO 7: Apply aliphatic nucleophilic, aliphatic electrophilic, stereochemistry and conformational analysis, chemistry of heterocyclic compounds and chemistry of natural products

UNIT - I

Aliphatic Nucleophilic Substitutions: The SN2, SN1, SNi and SET mechanisms. Substitution reactions of ambident nucleophiles, anchimeric assistance, the neighbouring group mechanism: neighbouring group participation by O, N, S, halogens, aryl groups, alkyl and cycloalkyl groups in nucleophilic substitution reactions. Sigma, Pi bond participation in acylic and bicyclic systems (Non- classic carbocations). Nucleophilic Substitution at allylic, trigonal and Vinylic carbons. Effect of substrate, attacking nucleophile, leaving group and reaction medium.

UNIT-II

Aliphatic Electrophilic Substitutions: SE1 SE2 and SEi mechanisms. Reactivity- effects of substrate, leaving group and solvent. Reactions- hydrogen exchange, migration of doublebonds, halogenation of aldehydes, ketones, carboxylic acids, acyl halides, sulphoxides and sulphones.

UNIT-III

Stereochemistry and Conformational Analysis : Optical Isomerism: optical activity, molecular dissymmetry and chirality - elements of symmetry. Fisher's projection D,L. and R,S. configurations - relative and absolute configurations optical isomerism due to asymmetric carbon atoms - optical isomerism in biphenyls, allenes and spirans- optical isomerism of nitrogenous compounds, racemisation and resolution.
Geometrical isomerism: E, Z -configurations, properties of geometrical isomers. Conformational analysis: Conformations of acyclic molecules –alkanes and substituted alkanes- compounds having intramolecular hydrogen bonding. Conformations of cyclohexane, mono and disubstituted cyclohexanes and decalins, effect of conformations on reactivity.

UNIT-IV

Chemistry of Heterocyclic Compounds : Structure, reactivity and synthesis of three membered Heterocycles: (a) Oxirane: Sharpless method, Shi epoxidation, Jacobsen epoxidation, etc, (b) Aziridine; four membered Heterocycles: (a) Oxetane (b) Azetine; five membered Heterocycles: (a) Pyrrole: Paal Knorr, Hantzsch Methods, etc, (b) Thiophene: Paal Knorr, Hinsberg method, etc. (c) Furan: Paal Knorr, Fiest-Benary, Industrial Method, etc.; (d) Pyrazole, (e) Imidazole, (f) Oxazole, (g) Thiazole; Six membered Heterocycles: (a) Pyridine, (b)Pyridazine,(c) pyrimidine and (d) Pyrazine; Aromatic heterocyclics: a) Indole: Fischer indole synthesis, Bischler synthesis, and Madelung synthesis (b) Quinoline and Isoquinoline, (c) Coumarins and Chromones**.**

UNIT-V

Chemistry of Natural Products:
A) Terpenoids: - Occurrence, Isolation, isoprene rule, structure elucidation and synthesis of α- Terpineol and α- pinene
B) Steroids:- Nomenclature of steroids, structure elucidation, synthesis and stereochemistry of cholesterol and progesterone

C) Lipids:- Classification,properties and function-free fatty acids, triglycerides, phospholipids, glycolipids & waxes conjugated lipids-lipoproteins

Reference Books

1. Advanced Organic Chemistry: Reactions Mechani;sms and Structure by Jerry March,
   Mc.Graw Hill and Kogakush.

2. Organic Chemistry Vol. I (Sixth Ed.) and Vol. II (Fifth Ed.) by I L Finar ELBS.

3. Organic Chemistry (fifth Ed.,) by Morrison and Boyd, PHI, India.

4. Organic Chemistry (fifth edition) by Francis A. Carey Tata Mc Graw Hill publishing
   Company Limited, New Delhi.

5. Stereochemistry of Organic compounds by Ernest L. Eliel, Samuel H. Wilen

6. Chemistry of natural products by S. V. Bhat, B. A. Nagasampangi and M. Sivakumar
   Narosa Publishing House, 6th reprint 2010

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – II SYLLABUS
(From the batch admitted during the academic year 2021-2022)

PAPER III - ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO 2: Understand aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

CO 3: Apply the knowledge and understanding of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids to new situations

CO 4: Develop interest in the areas of aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 2: Interpret aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 3: Compare aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 4: Analyse aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 5: Solve aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 6: Identify aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

LO 7: Apply aromaticity, aromatic nucleophilic substitution, reactive intermediates and name reactions, molecular rearrangements, spectroscopy, alkaloids, peptides, proteins and nucleic acids

UNIT-I: Aromaticity **[12 Hours]**

A) Aromaticity: Concept of Aromaticity, Aromaticity of five membered, six membered and fused systems - non-benzenoid aromatic compounds:-cyclopropenylcation, cyclobutadienyldication, cyclopentadienyl anion – tropyliumcation and cyclooctatetraenyl di anion – matallocenes, ferrocenes, azulenes, fulvenes, annulenes, fullerenes. Homo aromaticity, Anti aromaticity and Pseudo aromaticity.

B) Aromatic NucleophilicSubstitutions: The SNAr, SN1, benzyne and SRN1 mechanisms. Reactivity: Effect of substrate, leaving group and attacking nucleophile. The Von-Richter,Sommlet- Hauser and Smiles rearrangements.

UNIT-II: Reactive Intermediates and Name Reactions **[12 Hours]**

A) Reactive Intermediates: Generation, structure, stability and reactivity of Reactive intermediates :carbanion, carbocation, free radicals, carbenes and nitrenes.

B) Name Reactions: - Wittig reaction, Grignard reaction, Stork enamine reaction, Michael addition, Mannich Reaction, Diel's-Alder reaction andEne- reaction,

UNIT-III: Molecular Rearrangements **[12 Hours]**

Molecular Rearrangements:

Types of molecular rearrangements, migratory aptitude;

Rearrangements to electron deficient carbon: Pinacol-pinacolone, Wagner-MeerweinandBenzil-Benzilic acid,

Rearrangements to electron deficient nitrogen: Beckmann, Hofmann, Curtius, Schmidt and Lossen rearrangements;

Rearrangements to electron deficient oxygen: Baeyer-villiger, Dakin rearrangements;

Other rearrangements: Neber rearrangement and Favorskii rearrangements

UNIT - IV: Spectroscopy **[12 Hours]**

A)**UV Spectroscopy**: Various electronic transitions, selection rules, effect of solvent on electronic transitions, the absorption laws, chromophores, auxochromes, bathochromic and hypso chromic shifts, hyperchromic and hypochromic effects, Woodward-Fieser rules for conjugated dienes and carbonyl compounds.

B) **Infrared Spectroscopy**: Basic principles: types of molecular vibrations, fingerprint region and identification of functional groups.

C)**Nuclear Magnetic Resonance Spectroscopy (^{1}H-NMR)**: nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shifts, factors affecting the chemical shift, and assignment of chemical shifts.

D) **Mass Spectroscopy**: Basic principles, nitrogen rule and fragmentation pattern of carbonyl compounds and alcohols

UNIT – V Alkaloids, Peptides, Proteins and Nucleic acids **[12 Hours]**

A) **ALKALOIDS**: Occurrence, Isolation, classification based on nitrogen heterocyclic ring and synthesis of quinine and nicotine

B) Peptides and Proteins: α-Aminoacids, their general properties and synthesis, Synthesis of peptides byMerrifield solid phase synthesis.Primary, secondary and tertiary structures of proteins

C) Nucleic acids: Heterocyclic bases; Purines: Adenine and Guanine; Pyramidines: Cytosine, Uracil and Thymine; nucleosides, nucleotides Basic concepts of the structures of RNA and DNA

Text books:

1. Organic Chemistry Vol. I (Sixth Edn.) and Vol. II (Fifth Ed.,) by IL finar ELBS.
2. Organic Chemistry (fifth Edn.,) by Morrison and Boyd, PHI, India.
3. Organic Chemistry (fifth edition) by Francis A. Carey Tata McGraw Hill publishing Company Limited, New Delhi.
4. Reaction Mechanism in Organic Chemistry by Mukherjee Sirigh, N Terniitarr, Indiar
5. A guide book to mechanism in Organic Chemistry by Peter Sykes, ELBS.
6. Advanced organic chemistry by Jerry March (4th Edition)Wiley Eastern. .
7. Stereochemistry of carbon compounds by E.Eliel, John Wiley & Sons, Inc.
8. Stereochemistry of Organic compounds by D. Nasipuri.

   Chemistry of Natural products by R.S. KalsiKalyani Publ

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – III SYLLABUS
(From the batch admitted during the academic year 2020-2021)

PAPER I - ORGANIC REACTION MECHANISMS, PERICYCLIC REACTIONS AND PHOTOCHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 2: Understand reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 3: Apply the knowledge and understanding of new situations reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

CO 4: Develop interest in the areas of reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 2: Interpret reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 3: Compare reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 4: Analyse reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 5: Solve reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 6: Identify reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

LO 7: apply reactions and mechanisms of Substitution, Elimination, Addition, Pericyclic and Organic Photochemistry

UNIT-I: Radical Substitution Reactions **[12 Hours]**

Reactivity for aliphatic substrates,reactivity at Bridgehead, Reactivity in aromatic substrates, neighbouring group assistance in free radical reactions, reactivity in the attacking radical, effect of solvent on reactivity, halogenation at an alkyl carbon and allylic carbon, hydroxylation at aromatic carbon by means of Fenton's reagent, formation of cyclic ethers with Pb (OAC)4, Hunsdiecker reaction, Kolbe reaction, Reed reaction and Sandmayer reaction.

UNIT-II: Elimination Reactions: **[12 Hours]**

Mechanisms of E2, El, and E1CB, factors-effects of substrate,attacking base, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems. Saytzeff elimination, Hoffman elimination and pyrolytic elimination.

UNIT-III: Addition Reactions: **[12 Hours]**

(a) **Addition to carbon-carbon multiple bonds**- Addition reactions involving electrophiles, nucleophiles and free radicals, cyclic mechanisms. Stereochemistry and reactivity. Hydrogenation of double and triple bonds, Birch reduction, Hydroboration, Michael reaction, Prins reaction. Addition of oxygen and N_2O_4.

(b) **Addition to carbon-hetero atom multiple bonds**: Mechanism and reactivity.Reductions of carbonyl compounds, carboxylic acids, esters, nitriles. Addtion of Grignard reagents, Mannich reaction, Reformatsky reaction, Tollen's reaction, Wittig reaction,

UNIT-IV: Pericyclic reactions: [12 Hours]

Molecular Orbital Symmetry, MO diagrams of ethylene, 1,3 Butadiene, 1,3,5- Hexatriene and allyl system. Woodward- Hoffman correlation diagram method, Frontier molecular orbital approach (FMO) and Perturbation molecular orbital approach (PMO) for the explanation of pericyclic reactions under thermal and photochemical conditions.
Classification of pericyclic reactions: **Electrocyclic Reactions**: Conrotatory and Dis rotatory motions. 4n π and 4n+2 π electrons systems. **Cycloadditions**: Antarafacial and Suprafacial additions. 2+2, 4+2 cycloadditions and chelotropic reactions. **Sigmatropic rearrangements** - Suprafacial and Antarafacial shifts of H, Sigmatropic shift involving carbon moieties (1,3), (1,5), (3,3) and (5,5) sigmatropic rearrangements. Claisen, Cope, Oxy-cope and aza- Cope rearrangements. Ene reaction.

UNIT-V: Organic Photochemistry: [12 Hours]

Photochemistry of carbonyl compounds- n-π*and π-π* transitions. Norrish type I and Norrish type II cleavages. Patterno-Buchi reactions, Photoreduction, Photo chemistry of α,ß-unsaturated ketones, photochemistry of enones and cyclohexadienones. Photochemistry of unsaturated systems (Olefins): cis-trans isomerisation, dimerization, and addition.Acetylenes-dimerisation. Photochemistry of 1,3 butadienes, di-π-methane rearrangement.Photochemistry of aromatic compounds – 1,2, 1,3, and 1,4- additions. Photo-Fries rearrangement, Photo-Fries reactions of anilides.

Text Books:

1. Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Mc.Graw Hill and Kogakush.
2. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.
3. Pericyclic reactions by S.N. Mukharji, Mcmilan.
4. Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richgardson.
5. The modern structural theory in Organic Chemistry by L.N.Ferguson, Pretice Hall

PAPER II- ORGANIC SPECTROSCOPY

Course Objectives: To make the students

CO 1: Acquire the knowledge of UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 2: Understand UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 3: Apply the knowledge and understanding of new situations UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

CO 4: Develop interest in the areas of UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 2: Interpret UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 3: Compare UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 4: Analyse UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 5: Solve UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 6: Identify UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

LO 7: Apply UV, Infrared, NMR and Mass Spectrocopic techniques and structural elucidation of organic compounds using the data obtained

UNIT-I: UV SPECTROSCOPY: **[12 Hours]**

UV spectra of aromatic and heterocyclic compounds, α-diketones , β-diketones, enediones and quinines. Applications of UV Specroscopy-study of isomerism, determination of strength of hydrogen bonding and conformations of α-substituted cyclohexanones. Steric effect in biphenyls.

UNIT-II: Infrared Spectroscopy: **[12 Hours]**

Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols, amines, carbonyl compounds, esters, amides, carboxylic acids, anhydrides, lactones, lactums, nitriles and conjugated carbonyl compounds. Effect of hydrogen bonding and solvent on vibrational frequencies.

UNIT-III: Nuclear Magnetic Resonance Spectroscopy (1H NMR): [12 Hours]

Nuclear spin, resonance, satuaration, shielding of magnetic nuclei, chemical shifts and its measurements, factors affecting chemical shift, chemical and magnetic equivalence of spins, spin-spin coupling, integration, the coupling constant, types of spin-spin couplings, factors influencing coupling constants, first-order and non-first order spectra, spin system notations (ABX, AMX, ABC, A_2B_2 etc.). Simplification of non-first order spectra- use of higher magnetic fields, nuclear magnetic double resonance and contact shift reagents. Deuterium exchange, Nuclear Overhauser Effect difference spectra, Study of dynamic processes by Variable temperature (VT) NMR, restricted rotation DMF, cyclohexane ring inversion.

UNIT-IV: Mass spectroscopy: **[12 Hours]**

Basic Principles, instrumentation, isotope abundance, the molecular ion, metastable ions, base peak, fragment ions, even-electron rule and nitrogen rule. McLafferty rearrangement, ortho effect. *retro*-Diels- Alder reaction, Fragmentation processes- fragmentation associated with various functional groups (alkanes, cycloalkanes, alkenes, alkynes, aromatic hydrocarbons, alcohols, phenols, ethers, aldehydes , ketones, esters , carboxylic acids, amides, amines, alkyl chlorides and alkyl bromides.

UNIT-V: Application of UV, IR, NMR and MASS **[12 Hours]**

Structural elucidation of Organic compounds by a combined application of the UV, IR, NMR and MASS spectral data.

Text Books:

1. Spectroscopic identification of organic compounds by RM Silverstein, G C Bassler and T B Morrill
2. Organic Spectroscopy by William Kemp
3. Spectroscopic methods in Organic chemistry by DH Williams and I Fleming
4. Modern NMR techniques for chemistry research by Andrew B Derome
5. NMR in chemistry - A multinuclear introduction by William Kemp
6. Spectroscopic identification of organic compounds by P S Kalsi
7. Introduction to organic spectroscopy by Pavia
8. Carbon-13 NMR for organic chemists by GC Levy and O L Nelson
9. Nuclear Magnetic Resonance Basic principles by Atta-ur-Rahman

PAPER III – ORGANIC SYNTHESIS

Course Objectives: To make the students

CO 1: Acquire the knowledge of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

CO 2: Understand formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

CO 3: Apply the knowledge and understanding of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis to new situations

CO 4: Develop interest in the areas of formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 2: Interpret formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 3: Compare formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 4: Analyse formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 5: Solve formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 6: Identify formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

LO 7: apply formation of C-C and C=C bonds, organic polymers, unactivated C-H bonds, Asymmetric Synthesis

UNIT-I: Formation of Carbon-Carbon (C-C) single bonds: [12 Hours]

Alkylations via enolate anions-1,3-diarbonyl and related compounds, direct alkylation of simple enolates, imine and hydrozone anions, enamines. The aldol reaction, umpolung (dipole inversion). Via Organometallic reagents - organ palladium, organo nickel and organo copper reagents

UNIT-II: Formation of carbon-carbon double bonds: **[12 Hours]**

β- Elimination reactions, Pyrolytic *syn* eliminations, alkenes form hydrazones, 1,2-diols, sulfones, sulphoxide-sulphonate rearrangement, the Wittig and related reactions

UNIT-III: Organic Polymers [12 Hours]

Introduction to organic polymers, general properties and classification of polymers. Methods of polymerization: (a) Addition polymerization-Definition, synthesis and applications, vulcanization. (b) Condensation polymerization- Definition, synthesis and applications. Radical polymerization. (With at least two examples in each category)

UNIT-IV: Reactions of unactivated carbon-hydrogen bonds [12 Hours]

Unactivated carbon-hydrogen bonds: Definition, mechanism and synthetic applications- The Hoffmann-Loeffler-Freytag reaction(HLF reaction)-cyclisation reactions of Nitrenes-the Barton reaction-Photolysis of organic hypohalites, hypochlorites, hypobromites and hypoiodites,

UNIT-V: Asymmetric Synthesis **[12 Hours]**

Topocity – Prochirality – Substrate selectivity – Diastereoselectivity and enantioselectivity – Substrate controlled methods – use of chiral substrates – examples Auxiliary controlled methods – Use of chiral auxiliaries – Chiral enolates – alkylation of chiralimines-Reagent controlled methods – Use of chiral reagents – Asymmetric oxidation – Sharpless epoxidation – Asymmetric reduction – borate reagents.

Text Books:

1. Some Modem Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
3. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
4. Advanced organic chemistry part A & B; Fourth edition; Francis A Cary and Richard J. Sundberg; Kluwer Academic/Plenum Publisher New York, 2000.
5. Organic chemistry Jonathan Clayden, Nick Geeves, Stuart Warren, 2nd Edition, 2012, Oxford University Press.
6. Stereochemistry of organic compounds — Principles & Applications by D Nasipuri.
7. Stereochemistry of Carbon compounds by Ernest L Eliel & Samuel H. wilen.
8. Stereochemistry: Conformation & Mechanism by P S Kalsi.
9. The third dimension in organic chemistry, by Alan Bassendale.
10. Stereo selectivity in organic synthesis by R S Ward.
11. Asymmetric synthesis by Nogradi.
12. Asymmetric organic reactions by J D Morrison and H S Moschcr.
13. Principles in Asymmetric synthesis by Robert E. Gawley & JEFFREY AUBE.

PAPER IV – CHEMISTRY OF NATURAL PRODUCTS

Course Objectives: To make the students

CO 1: Acquire the knowledge of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 2: Understand isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 3: Apply the knowledge and understanding of new situations isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

CO 4: Develop interest in the areas of isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 2: Interpret isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 3: Compare isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 4: Analyse isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 5: Solve isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 6: Identify isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

LO 7: Apply isolation, structural elucidation, stereochemistry, synthesis and biological properties of selected antibiotics, terpenes, alkaloids, flavonoids and natural pigments

UNIT-I: Antibiotics **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis and biological properties of Penicillin G, Cephalosporin-C, Streptomycin, Chloramphenicol and Tetracycline

UNIT-II: Terpenes **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis and biological properties of Terpenes: Forskolin, Taxol and β-amyrin

UNIT-III: Alkaloids **[12 Hours]**

Isolation, structure elucidation, stereochemistry, synthesis, and biological properties of Alkaloids: Morphine, Reserpine and Vincristine

UNIT-IV: Flavonoids **[12 Hours]**

Natural Flavonoids: Apigenin, Flavanones - Hesperetin, Isoflavones - Genistein, Flavonol quercetin, xanthone - Euxanthone.

UNIT-V: Natural Pigments: **[12 Hours]**

Natural Pigments: Introduction structure elucidation and synthesis of quinones-Polyporic acid. Chlorophyll and haemin.

Text Books:

1. Organic Chemistry, Volume 2, Stereochemistry and chemistry of natural products, I.L. Finar, 5th Edition. ELBS.
2. Chemical A spects of Biosynthesis, John Mann, Oxford University Press, Oxford,1996
3. Chemistry of Natural Products. A Unified Approach, N.R. Krishnaswamy, University Press (India) Ltd., Orient Longman Limited, Hyderabad, 1999.
4. Chemistry of Natural Products, S. V. Bhat, Narosa Publishing House, 6th reprint 2010.

M.Sc., CHEMISTRY (Organic Chemistry Specialization)
SEMESTER – IV SYLLABUS
(From the batch admitted during the academic year 2020-2021)
PAPER – 1: MODERN SYNTHETIC METHODOLOGY IN ORGANIC CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

CO 2: Understand various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

CO 3: Apply the knowledge and understanding of new situations various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

CO 4: Develop interest in the areas of various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 2: Interpret various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 3: Compare various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 4: Analyse various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 5: Solve various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 6: Identify various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

LO 7: Apply various modern synthetic methods, multicomponent reactions, oxidation, reduction and green chemistry related reactions

UNIT – I: Modern Synthetic Methods [12 Hours]

Baylis-Hillman reaction, Henry reaction, Nef reaction, Kulinkovich reaction, Ritter reaction, Sakurai reaction, Tishchenko reaction and Ugi reaction. Brook rearrangement; Tebbe olefination. Metal mediated C-C and C-X coupling reactions: Heck, Stille, Suzuki, Negishi and Sonogashira, Nozaki-Hiyama, Buchwald-Hartwig, Ullmann coupling reaction.

UNIT-II: Multi component Reactions: [12 Hours]

Passerini reaction, Biginelli reaction, Hantzsch reaction and Mannich reaction. Metathesis: Grubb's 1st generation and 2nd generation catalyst, Olefin Cross coupling Metathesis (OCM), Ring Closing Metathesis (RCM), Ring Opening Metathesis (ROM) and applications.

UNIT-III: Oxidation [12 Hours]

Oxidation: Metal based and non-metal based oxidations of (a) alcohols to carbonyls (Chromium, Manganese, aluminium, silver, ruthenium, DMSO, hypervalent iodine and TEMPO based reagents). (b) phenols (Fremy's salt, silver carbonate) (c) alkenes to epoxides (peroxides/per acids based), Sharpless asymmetric epoxidation, Jacobsen epoxidation, Shi epoxidation.(d) alkenes to diols (Manganese, Osmium based), Sharpless asymmetric dihydroxylation, Prevost reaction and Woodward modification, (e) alkenes to carbonyls with bond cleavage (Manganese, Osmium, Ruthenium and lead based, ozonolysis) (f) alkenes to alcohols/carbonyls without bond cleavage (hydroboration-oxidation, Wacker oxidation, selenium, chromium based allylic oxidation) (g) ketones to ester/lactones (Baeyer-Villiger)

UNIT-IV: Reduction **[12 Hours]**

Reduction: (a) Catalytic hydrogenation (Heterogeneous: Palladium/ Platinum/ Rhodium/ Nickel etc; Homogeneous: Wilkinson). Noyori asymmetric hydrogenation. (b) Metal based reductions using Li/Na/Ca in liquid ammonia, Sodium, Magnesium, Zinc, Titanium and Samarium (Birch, Pinacol formation, McMurry, Acyloin formation, dehalgenation and deoxygenations) (c) Hydride transfer reagents-NaBH4 triacetoxyborohydride, L-selectride, K-selectride, Luche reduction; LiAlH4, DIBAL-H, and Red-Al.

UNIT-V: NEWER METHODS IN ORGANIC SYNTHESIS: **[12 Hours]**

Green Chemistry: Introduction, principles, atom economy and scope (illustrate with two examples) **Microwave induced reactions:** Principle conditions, advantages over conventional heating methods-applications **Ionic liquids:** Introduction and applications in organic synthesis (illustrate with two examples). **Nanomaterials:** Introduction, methods of preparation, applications in organic synthesis **Phase-transfer catalysis:** solid-solid, solid-liquid systems-mechanism of catalytic action, type of catalysts, application in few important reactions

Text Books:

1. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
2. F. A. Cary and R. I. Sundberg, Advanced Organic Chemistry, Part A and B, 5th Edition, Springer, 2009.
3. M. B. Smith, Organic Synthesis, 2nd Edition, 2005
4. J. Tsuji, Palladium Reagents and Catalysts, New Perspectives for the 21st Century, John Wiley & Sons, 2003.
5. I. Ojima, Catalytic Asymmetric Synthesis, 2nd edition, Wiley−VCH, New York, 2000.
6. J. Clayden, N. Greeves, S. Warren and P. Wothers, Organic Chemistry, Oxford University Press, 2001.
7. R. Noyori, Asymmetric Catalysis in Organic Synthesis, John Wiley & Sons, 1994.
8. L. Kuerti and B. Czako, Strategic Applications of named Reactions in Organic Synthesis Elsevier Academic Press, 2005.
9. Green chemistry, Theory and Practical, Paul T.Anastas and John C.Warner.
10. New trends in green chemistry By V.K.Ahulwalia and M.Kidwai.
11. Organic Synthesis: Special techniques. V.K.Ahulwalia and Renu Agarwal

PAPER II - ORGANIC SPECTROSCOPY AND STRUCTURE DETERMINATION OF NATURAL PRODUCTS

Course Objectives: To make the students

CO 1: Acquire the knowledge of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 2: Understand ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 3: Apply the knowledge and understanding of new situations ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

CO 4: Develop interest in the areas of ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 2: Interpret ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 3: Compare ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 4: Analyse ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 5: Solve ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 6: Identify ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

LO 7: Apply ^{13}C and Heteronuclear, 2D NMR and Instrumentation, ESR, ORD and CD spectroscopy and structural determination of natural products by spectroscopy

UNIT-I: ^{13}C NMR spectroscopy **[12 Hours]**

Introduction, ^{13}C-chemical shifts, factors affecting the chemical shifts, chemical shifts of organic compounds. Calculation of chemical shifts of alkanes, alkenes and aromatic compounds. Types of 13C NMR spectra: Proton-coupled, proton- decoupled and OFF-resonance decoupled (ORD) spectra, DEPT. ^{13}C-NMR solvents:

UNIT-II: Heteronuclear NMR spectroscopy & Electron Spin Resonance Spectroscopy (ESR): Heteronuclear couplings: ^{13}C-^{1}H, ^{13}C-D, ^{13}C-^{19}F, ^{13}C-^{31}P.^{1}H-D, ^{1}H-^{19}F, ^{1}H-^{31}P, ^{1}H-^{15}N
ESR Spectroscopy: Principles, hyperfine splitting

UNIT-III: NMR Instrumentation, 2D-NMR techniques **[12 Hours]**

NMR Instrumentation: Types of NMR Spectrometers-Continuous Wave (CW)-NMR, Fourier Transform (FT)-NMR, NMR solvents, sample preparation

2D-NMR techniques: Principles of 2D NMR, Correlation spectroscopy (COSY) HOMO COSY (1H-1H COSY), Hetero COSY (^{1}H, ^{13}C COSY, HMQC), long range ^{1}H,^{13}C COSY (HMBC), NOESY and 2D-INADEQUATE experiments and their applications.

UNIT-IV: Optical Rotatory Dispersion (ORD) and CD Spectroscopy: [12 Hours]
Optical rotation, circular birefringence, and circular dichroism and Cotton effect. Plain curves and anomalous curves. Empirical and semiempirical rules-The axial haloketone rule, the octant rule, Application of the rules to the study of absolute configuration and conformations of organic molecules.

UNIT-V: Structure Determination of Natural Products by Spectral Methods [12 Hours]
Sructure elucidation - Spectroscopic techniques IR, UV, ^{1}H-NMR, ^{13}C-NMR, COSY, HETEROCOSY, and MS- natural products - Examples, flavones - Apigenin, flavanones-Hesperetin, isoflavones - Genistein, coumarins-7-hydroxycoumarin, alkaloids - morphine, quinine, terpenoids - (-)-Menthol, Steroids - stigmasterol, Glycosides - salicin (Alcoholic β-glucoside)

Text books:

1. Spectroscopy, fourth edition, D. L Pavia, G. M Lampman CENGAGE Learning, 2012
2. Spectroscopic Methods in Organic Chemistry. Forth Edition D. M. Williams and I. Fleming Tata - McGraw Hill, New Delhi, 1990. For all spectral methods except ORD and CD and ESR.
3. Organic Spectroscopy, Second Edition, W. Kemp, ELBS Macmillan, 1987 for ORD and CD and ESR.
4. Chemistry of natural products, S. V. Bhat, Narosa Publishing House, 6th reprint 2010 (For IV th unit)
5. Applications of absorption spectroscopy of Organic Compounds J.R. Dyer, Prentice Hall of India, New Delhi, 1984.
6. Spectrometric identification of Organic Compounds, Fourth Edition, R.M. Silverstein: G.C.Vassiellr and T.C. Merill, Johne Willey, Singapore, 1981.
7. For ORD and CD "Applications of Optical rotation and Circular Dichroism", G.C. Barret, in "Elucidation of Organic structures by Physical and Chemical Methods" Part I (Eds)
8. K.W. Bentley and G.W.Kirty John Wiley, 1972, Chapter VIII (only those aspects mentioned in the syllabus).

PAPER – III: DESIGNING ORGANIC SYNTHESIS AND SYNTHETIC APPLICATIONS OF ORGANO- BORANES AND SILANES

Course Objectives: To make the students

CO 1: Acquire the knowledge of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 2: Understand the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 3: Apply the knowledge and understanding of new situations the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

CO 4: Develop interest in the areas of the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 2: Interpret the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 3: Compare the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 4: Analyse the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 5: Solve the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 6: Identify the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

LO 7: Apply the principles of disconnection approach, synthetic strategies for one group and two group disconnection, organoboranes and organosilanes

UNIT-I: Disconnection Approach – Principles **[12 Hours]**

Introduction, Terminology: Retrosynthesis, Target Molecule (TM), synthon, synthetic equivalent,functional group interconversion (FGI). Linear and convergent synthesis. Criteria for selection oftarget . Order of events in retrosynthesis with reference to Salbutamol, Proparcaine and Dopamine. Chemoselectivity, Regioselectivity, reversal of polarity and cyclizations. Protecting groups- Principles of protection of alcohols, amine, carbonyl and carboxyl groups

UNIT-II: Synthetic Strategies - One group Disconnections **[12 Hours]**

Introduction to one group disconnections: C-C disconnection-alcohols and carbonyl compounds; C-X disconnections- alcohols and carbonyl compounds and sulphides two group C-C and C-X Disconnections.

UNIT-III: Synthetic Strategies - Two group Disconnections **[12 Hours]**

Introduction to Two group C-C disconnections; Diels-Alder reaction, 1,5- difunctionalised compounds, Michael addition and Robinson annulation. Two group C-X disconnections; 1, 1-difunctionalised, 1, 2-difunctionalised and 1, 3-difunctionalised compounds. Control in carbonyl condensations, explanation with examples oxanamide and mevalonic acid.

UNIT –IV: Organoboranes **[12 Hours]**

Hydroboration- Preparation of Organoboranes. Reagents – dicylohexyl borane, disiamyl borane, thexyl borane, 9-BBN and mono-, di-isopinocamphenyl borane. Functional group transformations of Organo boranes-Oxidation, protonolysis and rearrangements. Formation of carbon-carbon-bonds viz organo boranes- carbonylation, cyanoboration.

UNIT –V: Organosilanes **[12 Hours]**

Preparation and synthetic applications of trimethylsilyl chloride, dimethyl-t-butylsilyl chloride, trimethylsilylcyanide, trimethylsilyliodide and trimethylsilyltriflate. Protection of functional groups - Trimethylsilylethers, Silylenolethers. Synthetic applications of α-silyl carbanions, β-silyl carbonium ions. Peterson's olefination.

Text Books:

1. Organic syntheses via boranes / Herbert C. Brown; with techniques by Gary W. Kramer,
2. Alan B. Levy, M. Mark Midland. New York : Wiley, 1975
3. Some Modern Methods of Organic Synthesis W. Carothers, Third Edition, Cambridge University Press, Cambridge, 1988.
4. Organic Synthesis: The disconnection approach, S. Warrant John Wiley & sons, New York, 1984.
5. Modern Synthetic Reactions, Herbert O. House, Second Edition, W.A. Benzamine Inc. Menio Park, California, 1972.
6. Principle of Organic Synthesis- R.O.C. Norman and J. M. Coxon.(ELBS)
7. Organic Synthesis: Special techniques. V.K.Ahulwalia and Renu Aggarwal.
8. Organic Synthesis by C Willis and M Willis
9. Problems on organic synthesis by Stuart Warren

PAPER IV-DRUG DESIGN AND DRUG CHEMISTRY

Course Objectives: To make the students

CO 1: Acquire the knowledge of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 2: Understand drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 3: Apply the knowledge and understanding of new situations drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

CO 4: Develop interest in the areas of drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs, antineoplastic drugs, cardiovascular drugs, oral hypoglycaemic drugs, local anti-infective and antiviral drugs

Learning Outcomes: At the end of the course, the learners should be able to:

LO 1: Explain drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 2: Interpret drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 3: Compare drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 4: Analyse drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 5: Solve drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 6: Identify drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

LO 7: Apply drugs, their classification, drug metabolism and drug development, Structure Activity Relationship in drugs

UNIT I: Introduction to Drugs **[12 Hours]**

General Classification, nomenclature, drug metabolism. Development of drugs: Procedure followed in drug design, concepts of lead compound lead modification, concept of prodrugs, Structure Activity Relationship (SAR)-factors affecting bio-activity-resonance, inductive effect, isosterism, bio-isosterism, spatial considerations, Quantitative Structure Activity Relationships (QSAR)-Concepts of drug receptors. Elementary treatment of drug receptor interactions. Physico-chemical parameters: lipophilicity, partition coefficient, electronic ionization constants, steric, Shelton and surface activity parameters and redox potentials.

UNIT II: Antineoplastic Agents: **[12 Hours]**

Introduction, classification-alkylating agents- mechanism and mode of action, nitrogen mustards-synthesis, properties, uses and dosage - Chlorambucil, cyclophosphamide and melphalan. Antimetobolites- synthesis, properties, uses and dosage-pyrimidine analogues-5-flurouracil, purine analogues-6-mercaptopurine, folic acid analogues-Methotrexate. Antibiotics-structure, properties and dosage-Doxorubicin, Mitomycin.

UNIT III: Cardiovascular Drugs: **[12 Hours]**

Introduction, cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output. Direct acting arteriolar dilators. Synthesis of amyl nitrate, sorbitrate, diltiazem, quinidine, verapamil, methyldopa, atenolol, oxyprenolol.

UNIT IV: Oral Hypoglycaemic Drugs: [12 Hours]

Introduction, Classification, Sulphonylureas- synthesis, mode of action, properties, uses and dosage- tolbutamide, glipizide. Biguanides- synthesis, mode of action, properties, uses and dosage-Metformin. α-glucosidage inhibitors- synthesis, mode of action, properties, uses and dosage- Miglitol. Dipeptidyl Peptidase-4 (DPP-4) inhibitors- synthesis, mode of action, properties, uses and dosage-saxagliptin and sitaglipti

UNIT V: Local Anti-infective & Antiviral drugs [12 Hours]

Local Anti-infective Drugs: Introduction and general mode of action. Synthesis of sulphonamides, ciprofloxacin, norfloxacin, dapsone, amino salicylic acid, isoniazid, fluconazole, econozole and chloroquin.

Antiviral Drugs: Introduction, classification based on mechanism of action, Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NRTIs)-Synthesis, metabolism, properties and uses and dosage-Acyclovir, Zidovudine (Anti-HIV agent). Non-Nucleoside or Nucleotide Reverse Transcriptase Inhibitors (NNRTIs)-Synthesis, metabolism, properties and uses and dosage-Nevirapine, Efavirenz. Protease Inhibitors (PIs)- Synthesis, metabolism, properties and uses and dosage-Indinavir. CCR5-Inhibitors- Synthesis, metabolism, properties and uses and dosage-Maraviroc

Text Books:

1. Text book of medicinal chemistry, Volume 1 & II, Third edition by V Alagarsamy, CBS-publishers
2. Introduction to Medicinal Chemistry, A Gringuage, Wiley-VCH.
3. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F. Dorge.
4. An Introduction to Drug Design, S. S. Pandeya and J. R. Dimmock, New Age International.
5. Burger's Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter.-9 and Ch-14), Ed. M. E. Wolff, John Wiley.
6. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
7. The Organic Chemistry of Drug Design and Drug Action, R. B. Silverman, Academic Press.
8. Strategies for Organic Drug Synthesis and Design, D. Lednicer, John Wiley.

ANDHRA UNIVERSITY
B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY
I SEMESTER
SEMESTER SYSTEM WITH CBCS
(Effective from the Academic Year 2020-21)

SYLLABUS

Semester I – Core I – General Psychology I

UNIT I: Introduction

A) Definition, Nature, Characteristics and Scope of Psychology; Aims of Psychology.
B) Schools and Fields of Psychology.
C) Methods of Psychology- Introspection, Observation, Case Study, Survey and Experimental Method. Techniques of Psychology: Interview, Questionnaires and Observation Schedule.

UNIT II: Biological Basis of Behavior

A) Neuroanatomy - Structure and Conduction of the Neuron; The Central Nervous System: Spinal Cord - Structure and Function; The Brain - Hindbrain, Midbrain & Forebrain, The Autonomic Nervous System-Structure & Function.
B) Hormones and Behavior-Main Endocrine Glands, their Hormone Products and Principal Effects of the Hormones.
C) Psychogenetis - Mechanisms of Heredity and Environment, Nature and Nurture Controversy.

UNIT III: Sensory Process:

A) The Sensory System, Types and General Characteristics of Senses.
B) Visual, Auditory Sensation, Theories of Vision and Hearing.
C) Subliminal Perception and Signal Detection Theory.

UNIT IV: Attention and Perception

A) Types and Phenomena of Attention, Determinants of Attention, Distraction, Division, Fluctuation and Span of Attention
B) Perception- Perceptual Organisation, Figure and Ground Relation, Major Principles of Perceptual Organisation.
C) Depth Perception, Perceptual Constances, Movement Perception, Perceptual

Distractions, Perceptual Defence, Perceptual Vigilance.

UNIT V: Motivation and Emotion

A) Motivation - Definition and Types of Motives- Bio and Psycho- Social Motives.
B) Emotions - Definition and Nature of Emotions, Types of emotions.
C) Theories of Motivation - Freud's Unconscious Motivation, Maslow's Theory of Motivation. Theories of Emotions - James - Lange, Cannon-Bard.

REFERENCE BOOKS:

1. Morgan, Clifford.T., King, Richard.A., Weisz,John.R.^ Schopler, John (1993). Introduction to Psychology, TataMcGraw Hill.
2. Marx, Melvin H. (1976). Introduction to Psychology - Problems, Procedures & Principles, MacMillan Publishing Co.
3. Hilgard, E.R., Atkinson, R.L., Atkinson, R.C., (1979): Introduction to Psychology, Harcourt Brace Jovanovich. Inc.

PSYCHOLOGY Practicum – I Syllabus

Conduct any Eight experiments from the following

1. Visual & Auditory
2. Distraction on attention
3. Span of Attention
4. Division of Attention
5. Fluctuation of attention
6. Illusions - Muller Lyer Illusion
7. Horizontal vertical Illusion
8. Organization in perception
9. Set in Perception
10. Perceptual constancies - size, shape

REFERENCE

Chaube. S.P.(1985): Experimental Psychology, Laxmi Narain Publishers

ANDHRA UNIVERSITY
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SEMESTER SYSTEM WITH CREDITS
(Effective from the Academic Year 2020-2021)

I Semester: PSYCHOLOGY MODEL QUESTION PAPER

Time: 3 Hrs | Marks: 75

Part-A

Answer any five of the following questions

1. Introspection
   అంతః పరిశీలన
2. Interview
   పరిపృచ్ఛ
3. Neuron
   న్యూరాన్
4. Threshold
   థ్రెషోల్డ్
5. Divided Attention
   విభజించిన శ్రద్ధ
6. Perceptual Defence
   గ్రహణ రక్షణ
7. Hunger Motive
   ఆకలి ఉద్దేశ్యం
8. Unconscious Motive
   అపస్మారక ఉద్దేశ్యం

PART-B

Answer the following questions 5X10=50

9. a. Define and Explain Aims of Psychology
   మనస్తత్వశాస్త్రం యొక్క లక్ష్యాలను నిర్వచించండి మరియు వివరించండి
   Or
   b. Discuss Experimental Method
   ప్రయోగాత్మక పద్ధతిని చర్చించండి

10) a. Explain the Role of Autonomic Nervous System
   అటానమిక్ నాడీ వ్యవస్థ యొక్క పాత్రను వివరించండి
   Or
   b. Discuss Nature and Nurture Controversy

ప్రకృతిని చర్చించండి మరియు వివాదాన్ని పెంపొందించుకోండి

11)a. Explain General Characteristics of Sensation

సెన్సేషన్ యొక్క సాధారణ లక్షణాలను వివరించండి

Or

b. Write an Essay on Subliminal Perception

సబ్లిమినల్ పర్సెప్షన్‌పై ఒక వ్యాసం రాయండి

12)a. Explain the Phenomena of Attention

శ్రద్ధ యొక్క దృగ్విషయాన్ని వివరించండి

Or

b. Discuss Principles of Perceptual Organization

పర్సెప్చువల్ ఆర్గనైజేషన్ సూత్రాలను చర్చించండి

13)a. Explain Types of Motives

ప్రేరణ రకాలను వివరించండి

Or

b. Discuss the Maslow's of Theory of Motivation

మాస్లో యొక్క థియరీ ఆఫ్ మోటివేషన్ గురించి చర్చించండి

ANDHRA UNIVERSITY
B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY
II SEMESTER
SEMESTER SYSTEM WITH CBCS
(Effective from the Academic Year 2020-21)

SYLLABUS

Semester II – Core II – General Psychology II

UNIT I : Learning

A) Definition of learning – Classical Conditioning, Operant Conditioning, Insight, Observation and Latent learning.
B) Role of Maturation and Training in learning, Reward and Punishment, Transfer of Learning.
C) Measurement of Learning, Learning Curves.

UNIT II: Memory and Forgetting

A) Meaning and Types of Memory, Methods of Measuring Memory, Information Processing Model of Memory.
B) Factors Influencing Memory – Repetition, Meaning, Whole vs. Part Learning, Massed vs. Spaced Learning, Motivation, Feedback and Passage of Time.
C) Forgetting- Meaning, Nature and Causes, Methods to Improve Memory

UNIT III: Thinking

A) Definition, Nature and Levels of Thinking.
B) Tools of Thinking Images, Concepts and Language.
C) Types of thinking – Reasoning, Problem Solving, Creative Thinking, Critical Thinking.

UNIT IV: Intelligence

A) Intelligence Definition and Nature - Theories: Spearman Two Factor Theory, Thurstone’s Multi Factor Theory and Sternberg’s Triarchic Theory of

Intelligence

B) Measurement of Intelligence- Concept of IQ, Types of Intelligence Tests, Intellectually Gifted and Retardation.

C) Role of Heredity and Environment on Intelligence

UNIT V: Psychology in India

B) Ancient Indian Psychology – Cognition, Consciousness, Super Conscious, Emotions Individuality and Self.

C) The doctrine of Gunas – Satva, Rajas and Thamas

D) The beginning of Modern Psychology – Development of Modern Indian Psychology. Basic and Applied Research. The Testing Movement, Clinical and Counselling Psychology and Organizational Behaviour and Industrial Psychology.

REFERENCE BOOKS:

1. Morgan, Clifford.T., King, Richard.A., Weisz, John.R., Schopler, John (1993): Introduction to Psychology, TataMcGraw Hill.
2. Marx, Melvin H. (1976) Introduction to psychology - Problems, Procedures & Principles, MacMillan Publishing Co.
3. Hilgard, E.R., Atkinson, R.L., Atkinson, R.C.. (1979): Introduction to Psvcholouv. Harconrt
4. Parameswaran E.G., & Beena "An Invitation to psychology" Neelkamal Publication Hyderabad.

ANDHRA UNIVERSITY
B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY
II SEMESTER

SEMESTER SYSTEM WITH CBCS
(Effective from the Academic Year 2020-21)

SYLLABUS

Semester II - Core II - General Psychology Practicum- II

Conduct any Eight experiments from the following

1. Paired Associate Learning
2. Habit Interference
3. Massed vs Spaced learning
4. Effect of meaning on memory
5. Retroactive Inhibition & Proactive inhibition
6. Memory for faces
7. Letter Digit Substitution Test
8. Span of Memory
9. Short term memory for digits
10. Problem solving - Pyramid Puzzle

REFERENCE BOOKS:

Chaube. S.P.(1985): Experimental Psychology, Laxmi Narain Publishers

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II SEMESTER
SEMESTER SYSTEM WITH CREDITS
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PSYCHOLOGY MODEL QUESTION PAPER

Time: 3 Hrs Marks: 75

Part-A

Answer any five of the following questions

1. Latent learning
   లేటెంట్ అభ్యసన
2. Intrinsic motivation
   అంతర్గత ప్రేరణ
3. Long term memory
   దీర్ఘకాలిక స్మృతి
4. Concepts
   భావనలు
5. Types of reasoning
   వివేచన రకములు
6. Concept of IQ
   I Q భావన
7. Mental retardation
   బుద్ధి మాంద్యత
8. Meditation
   ధ్యానము

PART-B

Answer the following questions 5X10=50

9. a. Illustrate classical conditioning
   శాస్త్రీయ నిభందనము
   Or
   b. Describe role of motivation in learning
   అభ్యసనలో ప్రేరణ పాత్ర వివరింపుము
10. a. Explain information processing model of memory
    స్మృతిలో సమాచార సకీర్ణ నమునాను వివరింపుము

Or

b. Discuss nature and causes of forgetting

విస్మృతి స్వబావము మరియు కారణాలను చర్చించుము

11. a. Explain various stages in problem solving

సమస్య పరిస్కారములోని వివిధ దశలను వివరింపుము

Or

b. Write an essay on creativity

సృజనాత్మకతపై వ్యాసము రాయుము

12. a. Write any two theories of intelligence

ఏవేని రెండు ప్రజ్ఞా సిద్ధాంతములను వ్రాయుము

Or

b. Describe intelligence testing

ప్రజ్ఞా మాపనమును వివరింపుము

13. a. Explain waking and sleeping states

మొళకున మరియు నిద్రావస్థలను వివరింపుము

Or

b. Discuss the impact of drugs on consciousness

చేతనపై మాదక ద్రవ్యాల ప్రభావము వివరింపుము

ANDHRA UNIVERSITY

B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY

III SEMESTER

SEMESTER SYSTEM WITH CBCS

W.E.F. 2021-22

Core III - Social Psychology I

UNIT I: Nature and Scope of Social Psychology

A) Definition, Nature and Scope of Social Psychology
B) Social Psychology and other Sciences
C) Research methods in Social Psychology- Observation, Survey, Correlational Method, Field Study and Experimental Method

UNIT II: Social Perception and Impression Formation

A) Social Perception - Meaning and Factors Influencing Social Perception, Types and Mechanisms of Social Interaction
B) Social Norms, Roles and Status
C) Attribution- Meaning and Errors in Attribution - Impression Formation - Meaning and Techniques of Impression Formation

UNIT III: Socialization

A) Definition and goals of Socialization, Socialization Process.
B) Social Motives and Social Incentives, Agencies of Socialization.
C) The Development of Self-Concept, Self Evaluation.

UNIT IV: Social Attitudes

A) Definition- Importance, Distinguishing Features of Attitudes
B) Attitude Formation and Change
C) Measurement of Attitudes- Likert, Bogardus and Thurstone

UNIT V: Communication

A) Definition, Nature and Types of Communication and Barriers of Communication.
B) Formation and change of Public Opinion
C) Rumors and Propaganda

REFERENCE BOOKS:

1. Myers, David G. (1988) Social Psychology, 2nd Edition, McGraw Hill Book Company.
2. Baron, Robert. A. and Byrne, Donn. Social Psychology, 7th edition, Prentice Hall of India Pvt. Ltd.
3. Lindgren, Henry.C. (1973). An Introduction to Social Psychology, John Wiley & Sons
4. Munn, N.L., (1948). Laboratory Manual in Experimental Psychology, Houghton Mifflin Co., New York.
5. Nataraj.P. (1970). A manual of laboratory experiments in psychology, Mysore Printing and Publishing House. Mysore

ANDHRA UNIVERSITY

B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY

III SEMESTER

SEMESTER SYSTEM WITH CBCS

W.E.F.2021-2022

SYLLABUS

Semester III - Core III - Social Psychology Practicum- I

Conduct any Eight experiments from the following

1. Anger Expression
2. Knowledge of results
3. Level of Aspiration
4. Dimensions of Regidity
5. Sociometry
6. Attitude measurement
7. Serial reproduction of an event
8. Rumor transmission
9. Suggestion
10. Field work/ Project Work- Observation visit to two NGO's working with socially disadvantaged people

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(Effective from the academic year 2021-2022)

B.A / B.Sc. - III Semester

Model Question Paper

Subject: Social Psychology

Time: 3 Hrs **Max. Marks: 75**

Part-A

Answer any Five questions **5 X 5 = 25**

1. Observation method
   పరిశీలన పద్ధతి
2. Impression formation
   అభిప్రాయము ఏర్పరచుకోనట
3. Rumours
   వదంతులు
4. Medium of communication
   భావ ప్రసార మాధ్యమము
5. Social perception
   సాంఘిక ప్రత్యక్షము
6. Sex-role identity
   లింగ పాత్ర గుర్తింపు
7. Goals of socialization
   సమజీకరణ గమ్యాలు
8. Propaganda
   ప్రకారము

Part-B

Answer the following questions **(5X5=50)**

9. a. Explain nature and scope of social psychology
   సామాజిక మనో విజ్ఞాన శాస్త్ర స్వభావము మరియు పరిధిని వివరించుము.

Or

b. Explain survey and correlation methods in social psychology

సామాజిక మనో విజ్ఞాన శాస్త్రం లోని సర్వే మరియు సహసంబంధం పద్ధతులను వివరించుము

10. a. Describe errors in attribution
ఆపాదన దోషాలను వివరింపుము

or

b. Discuss techniques of impression formation

అభిప్రాయ నిర్మితి పద్ధతులను చర్చింపుము

11. a. Explain the agents of socialization
సమాజీకరణ సంస్థలను వివరింపుము

or

b. Explain the socialization process

సమాజీకరణ ప్రక్రియను వివరింపుము

12. a. Describe types of communication
భావ ప్రసార రకాలను వివరింపుము

or

b. Discuss barriers to communication

భావ ప్రసారములో అడ్డంకులను చర్చింపుము

13. a. Explain formation of attitudes
వైఖరులు ఏర్పడుతను గూర్చి రాయుము

b. Explain Bogardus Social Distance Scale

బోగార్డాస్ సాంఘిక అంతర మాపనిని వివరింపుము

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SEMESTER SYSTEM WITH CBCS

SEMESTER IV - W.E.F. 2021-2022

Core IV - Social Psychology II

UNIT I: Social Influence

A. Forms of social influence: Conformity, Asch's experiments on conformity; factors affecting conformity; the bases of conformity.
B. Compliance: Tactics used in compliance; Ingratiation, reciprocity and multiple requests, guilt and compliance.
C. Obedience: Milgrams Studies on destructive obedience, resisting the effects of destructive obedience, modeling as a basis for unintentional social influence.

UNIT II: Prejudice

A) Prejudice and Discrimination- Nature and Origin of Prejudice, Techniques of Reducing Prejudice
B) Stereotype
C) Social Distance

UNIT III: Aggression

A) Definition, Determinants of Human Aggression- Social, Personal and Situational Factors
B) Prevention and Control of Aggression
C) Measurement of Aggression

UNIT IV: Groups and Individuals

A) Definition and types of groups
B) Group functions- Roles, Status, Norms, Cohesiveness and Conformity
C) Group and Individual Performance- Social Facilitation, Social Loafing, Decision Making by Groups.

UNIT V: Leadership

A) Definition, Traits of a Leader, Types of Leaders - Autocratic, Democratic and Laissez - faire
B) Classic Studies on Leadership, Leader Behavior- Initiating Structure and Consideration
C) Leadership Training

REFERENCE BOOKS:

1. Myers, David G.(1988). Social Psychology, 2nd Edition, McGraw Hill Book Company.
2. Baron, Robert. A. and Byrne, Donn . Social Psychology, 7th edition, Prentice Hall of India Pvt. Ltd.
3. Lindgren, Henry.C. (1973) .An introduction to Social Psychology, John Wiley & Sons
4. Munn, N.L., (1948). Laboratory Manual in Experimental Psychology , Houghton Mifflin co., New York.
5. Nataraj.P. (1970). A manual of laboratory experiments in psychology, Mysore printing and Publishing House. Mysore

ANDHRA UNIVERSITY

B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY

SEMESTER SYSTEM WITH CBCS

SEMESTER IV - W.E.F. 2021-2022

Core IV - Social Psychology Practicum-II

Conduct any Eight experiments from the following concepts

1. Adjustment Scale-Beirs Adjustment Inventory
2. Test of Values
3. Self concept
4. Emotional maturity / stability
5. The Accuracy of Testimony
6. Intergenerational conflict
7. Family Ideology
8. Decision making styles
9. Styles of leadership behaviour
10. Field work/ Project Work- Observation visit to two NGO's working with disadvantaged people

ANDHRA UNIVERSITY

B.A / B.Sc. DEGREE COURSE IN PSYCHOLOGY

SEMESTER SYSTEM WITH CBCS

(Effective from the academic year 2021-2022)

BA / B.Sc. – IV Semester

Psychology Model Question Paper

Subject : Social Psychology

Time : 3 Hrs   Max. Marks : 75

PART – A

Answer any Five Questions   5 x 5 = 25

1. Factors effecting conformity
   అనుగుణ్యతను ప్రభావితం చేయు కారకాలు

2. Discrimination
   విచక్షణ

3. Human aggression
   మనవ దౌర్జన్యము

4. Decision making by groups
   సముఉహ ప్రయాణాలు

5. Norms of groups
   సముఉహ ప్రయాణాలు

6. Leadership
   నాయకత్వము

7. Autocratic leaders
   అధికారిక నాయకులు

8. Obedience
   నిబద్ధత

Part-B

Answer the following questions   5 x 10 = 50

9. a. Explain forms of social influence
   సాంఘిక ప్రభావాల రకాలను వివరింపుము

or

b. Tactics used in compliance

ఒడంబిడిక లో వాడు విధానాలు

10. a. Describe nature and origin of prejudice
పాక్షికాభిప్రాయాలు స్వబావము మరియు పుట్టుక

or

b. Discuss techniques of reducing prejudice

పాక్షికాభిప్రాయాలను వివరించు పద్ధతులు

a. Explain the determinants of human aggression

మానవ దౌర్జన్య నిర్ణయకాలను వివరింపుము

Or

b. Explain the prevention and control of aggression

దౌర్జన్య నిర్ధము మరియు నిర్మూలాన్ని వివరింపుము

12. a. Describe types of groups
వివిధ సమూహాలను వివరింపుము

Or

b. Discuss group functions

సాముహ విధులను చర్చింపుము

13. a. Discuss traits of leaders
నాయకుల లక్షణాలను చర్చింపుము

Or

b. Explain types of leaders

నాయకుల రకాలను వివరింపుము

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BA/B Sc. DEGREE COURSE IN PSYCHOLOGY
IV - SEMESTER - W.E.F. 2021-22
ABNORMAL PSYCHOLOGY

PAPER V - ABNORMAL PSYCHOLOGY

I. Unit- Introduction

A. Concept of Abnormal Behavior and Criteria for Determining Abnormality.
B. Historical Background of Abnormality.
C. Approaches to Psychopathology- Psycho Dynamic, Behavioral, Cognitive, Behavioral, Existential and Biological.

II. Unit- Causes and Diagnosis of Abnormal Behavior

A. Biological, Psychological and Socio-Cultural; Critical Evaluation of These Causes.
B. Current Diagnostic Systems: Introduction to the International Classification of Diseases (ICD- 10) and Diagnostic & Statistical Manual of Mental Disorders (DSM-5).

III. Unit – Neuro Developmental Disorders

A. Intellectual Disabilities, Communication Disorders, Autism Spectrum Disorder, Attention Deficit/Hyper Activity Disorder
B. Specific Learning Disorder. Motor Disorder, Tic Disorder.
C. Other Neuro Developmental Disorders.

IV. Schizophrenia Spectrum and other Psychotech disorders

A. Psychosis (Psychotic Disorder),
B. Schizophrenia,
C. Schizo Typal (Personality) Disorder

V. Unit – Feeding and Eating Disorders

A. Pica/Rumination Disorder, Avoidant/Restrictive Food Intake Disorder
B. Anerexa Nervosa/Bulimia Nervosa, Binge – Eating Disorder
C. Other Specified Feeding or Eating Disorder, Unspecified Feeding and Eating

Disorder

REFERENCES:

Comer, R. J. (2015). Abnormal psychology. New York: Worth publishers.

Carson, R. C., Butcher, J. N., Mineka, S., & Hooley, J. M. (2013). Abnormal psychology (15th Ed.). New York: Harper Collins.

Diagnostic and Statistical Manual of Mental Disorders. (2013). Washington, D.C.

Nevid, J., Rathus, S., & Greene, B. (2014). Abnormal psychology in a changing world. Upper Saddle River, NJ: Pearson Prentice Hall.

The ICD-10 Classification of Mental and Behavioural Disorders, (1992). Geneva.

ANDHRA UNIVERSITY
BA/B Sc. DEGREE COURSE IN PSYCHOLOGY
IV SEMESTER - W.E.F. 2021-22

PAPER V - ABNORMAL PSYCHOLOGY

PRACTUM SYLLABUS

Five experiments to be conducted from the following

1. Aggression Scale
2. Depression Questionnaire
3. Problem Check List
4. Security- Insecurity Scale
5. Neuroticism
6. Anxiety
7. Stressful life events Scale
8. Any other relevant experiment

Syllabus and Model Papers

M.Sc. Physics
1st Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

Department of Physics
College of Science and Technology
Andhra University
Visakhapatnam.

M.Sc. Physics
Course Curriculum under CBCS

M.Sc. Physics – I Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	P 101	Classical Mechanics
	P 102	Introductory Quantum Mechanics
	P 103	Mathematical Methods of Physics
	P 104	Electronic Devices & Circuits
LABORATORIES	P 105	Modern Physics Lab 1
	P 106	Electronics Lab 1

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Physics – I Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
P-101	Classical Mechanics	4	-	80	20	100	40	4
P-102	Introductory Quantum Mechanics	4	-	80	20	100	40	4
P-103	Mathematical Methods of Physics	4	-	80	20	100	40	4
P-104	Electronic Devices & Circuits	4	-	80	20	100	40	4
P-105	Modern Physics Lab 1 (Practical-80 & Record-20)	-	3	100		100	50	4
P-106	Electronics Lab 1 (Practical-80 & Record-20)	-	3	100		100	50	4
	Total					**600**		**24**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 101 – Classical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To demonstrate knowledge and understanding of the following fundamental concepts in dynamics of particles.
2. To represent the equations of motion for complicated mechanical systems using the Newtonian, D'Alembert, Lagrangian and Hamiltonian formulation of classical mechanics.
3. The course discusses the planetary motion and Kepler's laws, Legendre transformations, canonical transformations, Hamilton's equation of motion, Hamilton-Jacobi equations and its applications.
4. It explains the motion of rigid bodies and Euler's angles, Coriolis effect.
5. The course discusses the special theory of relativity and its applications and also gave the introduction to the general theory of relativity.

Course Outcomes:

1. Students will be able to know the concepts of classical mechanics describe and understand the motion of a mechanical system using Lagrange-Hamilton formalism.
2. They are able to know about canonical transformations, Hamilton's equations of motion.
3. They are able to understand the concept of planar and spatial motion of a rigid body.
4. They are able to differentiate special theory of relativity and general theory of relativity.

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UNIT-I: Mechanics of a particle. Mechanics of a system of particles, constraints, D'Alembert's principle and Lagrange's equations, Velocity Dependent potentials and the Dissipation function Simple applications of the Lagrangian Formulation

Chapter: 1. Section: 1, 2, 3, 4, 5 & 6.

Hamilton's principle, some techniques of the calculus of variations. Derivation of Lagrange's equations from Hamilton's principle. Conservation theorems and symmetry properties, Energy function and the conservation of Energy

Chapter: 2. Section: 1, 2, 3, 5 & 6

UNIT-II: Reduction to the equivalent one body problem. The equation of motion and first Integrals, the equivalent One – Dimensional problem and classification of orbits, the differential equation for the orbit, and Integrable power –law potentials, Conditions for closed orbits (Bertrand's theorem), The Kepler problem inverse square law of force, The motion in time in the Kepler problem, Scattering in a central force field.

Chapter: 3. Section. 1, 2, 3, 5, 6, 7 & 8

Legendre transformations and Hamilton's equations of motion. Cyclic Coordinates, Derivation of Hamilton's equation of motion from variational principle, Principle of Least Action.

Chapter: 7 Section: 1, 2, 3, 4 & 5.

UNIT-III: Equations of canonical transformation, Examples of Canonical transformations, The harmonic Oscillator, Poisson brackets and other Canonical invariants, Equations of motion, Infinitesimal canonical transformations, and conservation theorems in the Poisson bracket formulation, the angular momentum Poisson bracket relations.

Chapter: 8. Section: 1, 2, 4, 5, 6 & 7.

Hamilton – Jacobi equation of Hamilton's principal function, The Harmonic oscillator problem as an example of the Hamilton – Jacobi Method, Hamilton – Jacobi equation for Hamilton's characteristic function. Action – angle variables in systems of one degree of freedom.

Chapter: 9. Section: 1, 2, 3 & 5.

UNIT-IV: Independent coordinates of rigid body. The Euler angles, Euler's theorem on the Motion of a rigid body, Infinitesimal rotations, Rate of change of a vector, The Coriolis Effect.

Chapter: 4. Section: 1, 4, 6, 8 & 9.

The Inertia tensor and the moment of inertia, The Eigenvalues of the inertia tensor and the principal axis transformation, Solving rigid body problems and Euler equations of motion, Torque – free motion of a rigid body

Chapter: 5 Section: 3, 4, 5 & 6.

The Eigenvalue equation and the principal axis transformation, Frequencies of free vibration, and normal coordinates, free vibrations of a linear triatomic molecule

Chapter 10 Section: 2, 3 & 4.

UNIT – V: Special Theory of Relativity, Basic Postulates of the Special Theory, Lorentz Transformations, Velocity Addition and Thomas Precession, Relativistic Kinematics of Collisions and Many-Particle Systems, Relativistic Angular Momentum, Lagrangian Formulation of Relativistic Mechanics, Covariant Lagrangian Formulations, Introduction to the General Theory of Relativity.

Chapter 7 Sections 1 to 11.

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Text Book:

1. Classical Mechanics - H. Goldstein

Reference Books:

1. Classical Mechanics - J. B. Upadhayaya
2. Classical Mechanics - Gupta Kumar Sharma
3. Classical Mechanics - N C Rana and P S Joag
4. Classical Mechanics - Takwale and Puranik
5. Classical Mechanics - G Aruldhas
6. Classical Mechanics - C R Mondal
7. Introduction to Special Relativity - Robert Resnick

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Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

First Semester

P 101 – Classical Mechanics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) State and prove D' Alembert's principle.
   b) Derive Lagrange's equation of motion of a particle using D' Alembert's principle.

(OR)

2. a) Obtain Lagrange's equation of motion from Hamilton's principle for conservative systems.
   b) What is meant by conservation of energy?

Unit – II

3. a) What is the first integral of motion?
   b) Show that the orbit of a planet moving around the sun under the inverse square law of force is a conic.

(OR)

4. a) Derive Hamilton's equations of motion using Legendre transformations.
   b) Give the Physical significance of the Hamiltonian.

Unit – III

5. a) Explain the equations of Canonical Transformation?
   b) Give examples to Canonical Transformations.

(OR)

6. a) Derive the Hamilton – Jacobi equation from Hamilton's principle function.
   b) Solve the problem of one-dimensional harmonic oscillator using Hamilton Jacobi Method.

Unit – IV

7. a) Derive the Eigenvalue equation of the inertia tensor and the principal axis transformation.
   b) What is the degree of freedom of linear triatomic molecule?

(OR)

8. a) Define moment of inertia tensor.
   b) Derive Euler's equations of rotational motion of a rigid body.

Unit – V

9. a) What are the basic postulates of the special theory of relativity?
   b) Derive the equations for the velocity addition and Thomas precession.

(OR)

10. a) Explain the Lagrangian formulation of relativistic mechanics
    b) Derive the equation for the covariant Lagrangian.

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M.Sc. Degree Examination
Physics

SYLLABUS

First Semester

P 102 – Introductory Quantum Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. It is an experimental fact that often a particle behaves like a wave and a wave behaves like a particle. A wave with a precise wavelength (momentum) does not possess a precise location and vice versa.
2. Such uncertainties in conjugate measurable properties and the consequences there of, constitute the essential content of quantum mechanics.
3. Elementary quantum mechanics is the focus of this course.
4. This course provides an understanding of the formalism and language of non-relativistic quantum mechanics.
5. This course will be helpful in understanding the concepts of time-independent perturbation theory and their applications to physical situations.

Course Outcomes:

1. The students will be able to formulate and solve problems in quantum mechanics using Dirac representation.
2. The students will be able to grasp the concepts of spin and angular momentum, as well as their quantization and addition rules.
3. The students will be familiar with various approximation methods applied to atomic, nuclear and solid-state physics.
4. This course is organized in such a way that a student at the end, is skilled enough to understand the advance level Quantum Mechanics.

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UNIT-I: Failures of classical physics, Origin of Quantum theory, the Conceptual aspect: Modifications needed to the classical concepts of particles and Waves (Wave Particle Duality), Interpretations of Quantum mechanics, Applications of uncertainty principle, Principle of superposition - Wave packets, Schrodinger Wave Equation, wave function interpretation, Problems and admissibility conditions, probability current density, expectation value, Ehrenfest theorem, stationary states.

UNIT-II: Bracket notation, orthonormal functions, linear operators and their properties, Hermitian operator, Schmidt orthogonalization, Postulates of quantum mechanics, simultaneous measurability of observables, commutator algebra, equation of motion of an operator (Schrodinger representation), Momentum representation - Dirac delta function and properties.

UNIT-III: One dimensional problem - Particle in a potential well with (i) infinite walls, (ii) finite walls. Potential step, Potential Barrier. Linear Harmonic Oscillator (Schrodinger method). Free particle. Particle moving in a spherically symmetric potential, spherical harmonics, radial equation. Eigen values and Eigen functions of rigid rotator, hydrogen atom, Hydrogenic orbitals, angular momentum operators, commutation relations, Eigen values and Eigen functions of L^2, L_Z, L_+ and L_- operators, spin angular momentum, general angular momentum.

UNIT-IV: Time- independent perturbation theory for **(i)** non-degenerate systems and application to ground state of helium atom., effect of electric field on the ground state of hydrogen, spin orbit coupling (ii) degenerate systems, application to linear stark effect in hydrogen. Variation method and its application to helium atom, exchange energy and low-lying excited states of helium atom. WKB method, barrier penetration.

UNIT – V: Hidden variables, EPR paradox, Bell's theorem, the problem of measurement, time evaluation of a system, discrete or continuous, Q bits and quantum logic gates. (B. H. Bransden and C. J. Joachain; Richard Liboff.

Text Book:
1. Quantum Mechanics - E. Merzbacher

Reference Books:
1. Quantum Mechanics - G. Aruldhas
2. Quantum Mechanics - G. S. Chaddha
3. Quantum Mechanics - B. H. Bransden and C. J. Joachain
4. Quantum Mechanics - R. D. Ratna Raju
5. Quantum Mechanics - Richard Liboff
6. Quantum Mechanics - Ghatak and Lokanathan
7. Quantum Mechanics - Gupta Kumar Sharma
8. Quantum Mechanics - Mathews and Venkatesan
9. Quantum Chemistry - Ira N. Levine
10. Quantum Mechanics - Nouredine Zettili

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Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

First Semester

P 102 – Introductory Quantum Mechanics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Derive the Schrodinger wave equation.
   b) Obtain an expression for Probability Current Density.

(OR)

2. a) State and prove Ehrenfest's theorem.
   b) Show that stationary states probability current density is constant in time.

Unit – II

3. a) State the postulates of Quantum Mechanics.
   b) Write the properties of Hermitian Operator.

(OR)

4. a) Define Dirac Delta function and write its properties.
   b) Derive the equation of motion for an operator.

Unit – III

5. a) Derive the equation for a one-dimensional particle in a potential well with infinite walls.
   b) Obtain Eigen values and Eigen functions of rigid rotator.

(OR)

6. a) Show that L^2 and L_z Commute.
   b) Obtain Eigen values and Eigen functions for these operators.

Unit – IV

7. a) Discuss time independent perturbation theory.
   b) Obtain expression for the first order correction to energy.

(OR)

8. a) Discuss the principle of Variation method and its application to helium atom.
   b) What is meant by WKB Approximation?

Unit – V

9. a) What is EPR Paradox?
   b) State and explain the Bell's theorem.

(OR)

10. a) Give an account on Q bits.
    b) Explain in detail the quantum logic gates.

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M.Sc. Degree Examination **SYLLABUS**

Physics

First Semester

P 103 – Mathematical Methods of Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To provide students the ability to hone the mathematical skills necessary to approach problems in advanced physics courses.
2. To expose the students towards the fascinating world of complex analysis.
3. To make the students learn about special functions essential in solving physics problems.
4. To make them understand about Fourier series and Fourier transforms.
5. To expose the students, get acquainted with the various numerical methods.
6. To make them understand about tensor analysis.

Course Outcomes:

1. The students will be able to understand and apply the mathematical skills to solve quantitative problems in the study of Physics.
2. Will enable students to apply integral transform to solve mathematical problems of interest in Physics.
3. The students will be able to use Fourier transforms as an aid for analyzing experimental data.
4. The students should be able to formulate and express a physical law in terms of tensors, and simplify it by use of coordinate transforms.

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Unit I: Complex Variables

Function of complex number- definition-properties, analytic function-Cauchy –Riemann conditions-polar form-problems, Complex differentiation, complex integration –Cauchy's integral theorem- Cauchy's integral formulae-multiply connected region- problems, Infinite series-Taylor's theorem- Laurent's Theorem-Problems, Cauchy's Residue theorem- evaluation of definite integrals-problems.

Unit II: Beta, Gamma Functions &Special Functions

Beta & Gamma functions -definition, relation between them- properties-evaluation of some integrals

Special Functions- Legendre Polynomial, Hermite Polynomial, Laguerre Polynomial, Bessel Function -Generating function-recurrence relations - Rodrigue's formula-orthonormal property-associated Legendre polynomial- simple recurrence relation-orthonormal property-spherical harmonics.

Unit III: Laplace Transforms & Fourier series, Fourier Transforms

Laplace Transforms – definition- properties – Laplace transform of elementary functions-Inverse Laplace transforms-properties- evaluation of Inverse Laplace Transforms-elementary function method-Partial fraction method-Heaviside expansion method-Convolution method-complex inversion formula method-application to differential equations.

Fourier series-evaluation of Fourier coefficients- Fourier integral theorem-problems-square wave-rectangular wave-triangular wave, Fourier Transforms- infinite Fourier Transforms-Finite Fourier Transforms-Properties-problems-application to Boundary value problem.

Unit IV: Numerical Methods

Linear and non- linear curve fitting, least square fitting, Chi – square test, Errors of Coefficients. Solutions of algebraic and transcendental equations-Bisection method-method of successive approximations-method of false position Iteration method-Newton Rapson method Simultaneous linear algebraic equations-Gauss elimination method-Gauss Jordan Method-Matrix inversion method-Jacobi method – Gauss-Seidel method.

Interpolation with equal intervals-Finite differences-Newton Forward & Backward Interpolation formulae, Interpolation with unequal internals-Newton's divided difference formula-Lagrange interpolation formula Numerical Integration-General Quadrature Formula-Trapezoidal rule -Simpson's 1/3 rule & 3/8 rule. Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem.

Unit V: Tensor Analysis

Introduction, Transformation of Co-ordinates, Contravariant, Covariant and Mixed tensors, Addition, Subtraction, Contraction, Multiplication, Quotient Law, Symmetric and Anti Symmetric tensors, The

line element, Fundamental Tensors, Covariant differentiation, Christoffel Symbols, Curvature tensor, Riemann curvature, Application of Tensors.

Text Books:

1. Mathematical Methods of Physics - G. Arfken
2. Mathematical Physics - Satya Prakash
3. Complex Variables - Murray R Spiegel - Schaum's outline series
4. Mathematical Physics - B.S. Rajput
5. Laplace n Fourier Transforms - Goyal & Gupta
6. Introductory methods of Numerical analysis - S. S. Sastry
7. Fundamentals of Mathematical Statistics - S C Gupta & V K Kapoor
8. Tensor Calculus – A Concise Course - Barry Spain

Reference Books:

1. Numerical Methods - V. N. Vedamurthy & N. Ch. S. N. Iyengar
2. Mathematical Methods - B. D. Gupta
3. Special Functions - Gupta & Sharma
4. Integral Transforms - M. D. Raisinghanna
5. Integral Transforms - Goyal & Gupta
6. Fundamentals of Statistics - S C Gupta
7. Probability and Statistics - Murray R Spiegel - Schaum's outline series
8. Tensor Calculus - David C Kay – Schaum 's outline series

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 103 – Mathematical Methods of Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) State and prove the Taylor's theorem.
   b) Prove that $H_n^1(x) = 2nH_{n-1}(x)$.

(OR)

2. a) State and prove the necessary and sufficient condition for the function to be analytic in a region R.
   b) Show that $\displaystyle\int_{-\infty}^{\infty} \frac{x^2 dx}{(x^2+1)^2(x^2+2x+2)} = 7\pi/50$.

Unit – II

3. a) Starting from the generating function of Laguerre polynomial, Obtain the differential equation satisfied $L_n(x)$.
   b) Define Rodrigue's formula.

(OR)

4. a) Obtain the relation between Beta and Gamma functions
   b) Evaluate the value of Gamma (1/2).

Unit – III

5. a) State and explain Laplace and Inverse Laplace transforms.
   b) Evaluate the Inverse Laplace transform of $\dfrac{7}{s^2-9} + \dfrac{5}{s-7} + \dfrac{1}{2s^{3/2}}$.

(OR)

6. a) Starting form Fourier series obtain the Fourier integral.
   b) Find the Fourier series for function defined by

$$f(x) = -\pi \ \text{ if } -\pi<x<0$$
$$f(x) = x \text{ if } 0<x<\pi.$$

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Unit – IV

7. a) Explain Newton – Raphson method to evaluate the roots of an equation.
   b) Using Bisection method, find the root of the equation $x^3 – x^2 - 1 = 0$

(OR)

8. a) Discuss the Gauss elimination method for solving a system of simultaneous linear equations.
   b) Solve the following equations using Gauss – Seidel method.

$$2x + y + z = 10$$
$$3x + 2y + 3z = 18$$
$$x + 4y + 9z = 16$$

Unit – V

9. a) Explain in detail the Symmetric and Anti-Symmetric tensors?
   b) Write the applications of Tensors.

(OR)

10. a) Give an account on Christoffel Symbols
    b) Define Riemann curvature and write its properties.

SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 104 – Electronic Devices and Circuits
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students familiar about the concepts of components used in various electronic devices.
2. To make the students learn and understand the basics of analogue electronics.
3. To develop an understanding of fundamentals of electronics in order to deepen the understanding of electronic devices that are part of the technologies that surround us.

Course Outcomes:

1. The students will be able to use techniques for analyzing analogue electronic circuits and formulate the concepts of semiconductor devices, microwave devices, operational amplifier circuits and electronic measurements, instrumentation and experimental methods.
2. At the end of this course, the students will be able to understand the fundamentals behind analog devices.

UNIT-I: Semiconductor Devices
Tunnel diode, Photo Diode, Solar Cell, LED, Silicon Controlled Rectifier (SCR), Uni Junction Transistor (UJT), Field Effect Transistor (JFET & MOSFET), CMOS.

UNIT-II: Microwave Devices
Varactor Diode, Parametric Amplifier, Thyristors, Klystron, Reflex Klystron, Gunn Diode, Magnetron, CFA, TWT, BWO, IMPATT, TRAPATT, APD, PIN Diode, Schottky Barrier Diode.

UNIT-III: Operational Amplifier (OP AMP)
The ideal Op Amp – Practical inverting and Non inverting Op Amp stages, Op Amp Architecture – differential stage, gain stage, DC level shifting, output stage, offset voltages and currents. Virtual ground. Operational Amplifier parameters- input offset voltage, input bias current, Band width, Common Mode Rejection Ratio (CMRR), Slew Rate. Op Amp open loop gain configuration, Differential amplifier, Inverting and Non-inverting amplifiers. Op-amp with negative feedback- effect of feedback on closed loop gain input resistance, output resistance, bandwidth and output offset voltage - voltage follower.

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UNIT-IV: OP AMP Applications

Summing amplifier, Integrator, Differentiator Voltage to Current converter, Current to Voltage converter, Logarithmic Amplifier, Instrumentation Amplifier.

Oscillators – Phase shift oscillator, Wien-Bridge Oscillator

Special applications – Monostable and Astable multivibrators using 555, Schmitt Trigger, Voltage Controlled Oscillator (VCO), Phase Locked Loop (PLL), IC 723 Voltage regulator.

UNIT – V: Electronic Measurements, Instrumentation and Experimental Methods

Data interpretation and analysis. Precision and accuracy. Error analysis, propagation of errors Transducers (temperature, pressure, vibration, optical, and particle detectors) Measurement and control. Signal conditioning and recovery, Impedance matching, Amplification, Filtering and noise reduction, Shielding and grounding.

Text Books:

1. Integrated Electronics - Jacob Millman & C.C. Halkies
2. Op. Amps and Linear Integrated Circuits - Ramakant A.Gayakwad
3. Electronic Communication Systems - George Kennedy
4. Electronic Instrumentation and measurement techniques – W D Cooper & A D Helfric
5. A course in electrical and electronic measurements and instrumentation – A K Sawhney
6. Electronic Instrumentation - H S Kalsi

Reference Books:

1. Microelectronics - Jacob Millman & Arvin Grabel
2. Electronic Devices and Circuits - G.K. Mithal
3. Electronic devices and circuit theory - Robert Boylested & Louis Nashlsky
4. Electronic Principles - AP Malvino & J Bates
5. Micro Electronics - Sedra and Smith
6. Linear Integrated Circuits - D Roy Choudhury & Shail Jain
7. Introduction to electronic devices - Micheal Shur
8. Semi-Conductor Electronics - A.K.Sharma
9. Anlog and Digital Electronics - Nagarath
10. Op-amps and Linear Integrated Circuits - D. Mahesh Kumar
11. Electronic instrumentation and measurements – David A Bell
12. Modern Electronic Instrumentation and Measurement Techniques –A D Helfric & W DCooper
13. Electronic Measurements and Instrumentation - Oliver and Cage

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

First Semester
P 104 – Electronic Devices and Circuits
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Describe the working principle of FET Amplifier
   b) Explain its characteristics.

(OR)

2. a) Give the construction and characteristics of SCR
   b) Show how an SCR can be used to control power in a circuit.

Unit – II

3. a) Describe the working of Reflex Klystron
   b) Explain its Characteristics.

(OR)

4. a) Describe the working principle of Magnetron
   b) Explain why magnetron is called as CFA.

Unit – III

5. a) Explain in detail the characteristics of an ideal op-amp.
   b) Explain the terms differential gain and DC level shifting.

(OR)

6. a) Discuss in detail the important parameters of an operational amplifier.
   b) Describe the method of their measurement.

Unit – IV

7. a) Draw the circuit diagram of a Voltage Controlled Oscillator (VCO).
   b) Discuss its operation and applications.

(OR)

8. a) Describe the working principle and necessary theory of a Wein Bridge Oscillator using Op – Amp.
   b) What is meant by Phase Locked Loop?

Unit – V

9. a) Explain briefly the error analysis measurement?
   b) Explain the propagation of errors.

(OR)

10. a) Explain What is meant by signal conditioning?
    b) Give an account on recovery and impedance matching in a measurement system.

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SYLLABUS

M.Sc. Degree Examination
Physics

First Semester

P 105 – Modern Physics Laboratory - 1
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. The aim of this laboratory course is to make the students perceive some of the fundamental laws of Physics through experiments.

Course Outcomes:

1. At the end of this laboratory course, the students will be capable of handling sophisticated instruments besides learning the Physics concepts behind these experiments.

LIST OF EXPERIMENTS

1. Atomic Spectrum of Sodium
2. Atomic Spectrum of Zinc
3. Rydberg's Constant using Grating
4. Raman Spectrum of Carbon Tetrachloride
5. Specific Charge of an Electron using Thomson's Method
6. Determination of Planck's Constant

Reference Books:

1. Advanced Practical Physics, B.L. Worsnop & H.T. Flint.
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna.
3. Practical Physics, Geeta Sanon, R. Chand & Co.Publishers.
4. Advanced Practical Physics, S P Singh, Pragati Prakashan.
5. Practical Physics, Gupta & Kumar, Pragati Prakashan.
6. An Advanced Course in Practical Physics, D Chattopadhyay & P C Rakshit. Central Pub.

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M.Sc. Degree Examination
Physics

SYLLABUS

First Semester

P 106 – Electronics Laboratory - 1
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students familiar with analog electronic components.
2. To provide hands-on experience to the students to make them familiar with the working and handling of the analog electronic devices and circuits.

Course Outcomes:

1. At the end of this laboratory, the students will be skilled enough to handle and understand the use of analog devices.

LIST OF EXPERIMENTS

1. FET Amplifier (BFW 10/11)
2. Negative Feedback Amplifier (BC 147)
3. Colpitts Oscillator (BF 194)
4. Phase Shift Oscillator (BC 147)
5. Astable Multivibrator (BF 194)
6. Op. Amp. Characteristics (IC 741)

Reference Books:

1. The Art of Electronics, P. Horowitz & W. Hill.
2. Microelectronics, J. Millman & A. Grabel.
3. Electronic Devices and Circuits, Schaum's Outline Series, J.J. Cathey.
4. Basic *Electronics*: *A Text-Lab Manual*, Paul Zbar & Albert P Malvino**.**
5. Experiments in Electronics, S V Subrahmanyam.
6. Operational Amplifiers & Linear ICs, S V Subrahmanyam.

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Syllabus and Model Papers

M.Sc. Physics
2nd Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

Department of Physics
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M.Sc. Physics
Course Curriculum under CBCS

M.Sc. Physics – II Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

THEORY	P 201	Electrodynamics
	P 202	Statistical Mechanics
	P 203	Atomic & Molecular Physics
	P 204	Nuclear and Particle Physics
LABORATORIES	P 205	Modern Physics Lab 2
	P 206	Electronics Lab 2

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Physics – II Semester – FIRST YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
P-201	Electrodynamics	4	-	80	20	100	40	4
P-202	Statistical Mechanics	4	-	80	20	100	40	4
P-203	Atomic & Molecular Physics	4	-	80	20	100	40	4
P-204	Nuclear and Particle Physics	4	-	80	20	100	40	4
P-205	Modern Physics Lab 2 (Practical-80 & Record-20)	-	3	100		100	50	4
P-206	Electronics Lab 2 (Practical-80 & Record-20)	-	3	100		100	50	4
	Total					**600**		**24**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

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M.Sc. Degree Examination
Physics

SYLLABUS

Second Semester

P 201 – Electrodynamics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To evaluate fields and forces and potentials in Electrodynamics and Magneto dynamics using basic scientific method.
2. To make the students understand the propagation behavior of electromagnetic waves in different media.
3. To be capable of understanding the physical interpretation of Maxwell's Equations.
4. To provide concepts of relativistic electrodynamics and its applications in branches of Physical Sciences.

Course Outcomes:

1. The students will be able to explain and solve advanced problems based on classical electrodynamics using Maxwell's equation.
2. The students will be able to analyze radiation systems in which the electric dipole, magnetic dipole or electric quadruple dominate.
3. The students will have an understanding of the covariant formulation of electrodynamics and the concept of retarded time for charges undergoing acceleration.
4. This course will lay the foundation for the modern optics, photonics, telecommunications and ionosphere.

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UNIT-I: Gauss's law and its applications, Poisson equation, Laplace equations, Uniqueness theorem, boundary value problems, separation of variables, solution to Laplace's equation in Cartesian, spherical, and cylindrical coordinates, use of Laplace's equation in the solutions of electrostatic problems.

UNIT-II: Biot-Savart law, Ampere's theorem, Faraday's law of electromagnetic induction, magnetic vector potential, displacement current, Maxwell's equations, differential and integral forms, physical significance of Maxwell's equations, Maxwell's equations in free space, Maxwell's equations inside matter, boundary conditions on the fields at interfaces.

UNIT-III: Wave equation, plane electromagnetic waves in free space, in non-conducting isotropic medium, in conducting medium, electromagnetic vector and scalar potentials, uniqueness of electromagnetic potentials and concept of gauge, Lorentz gauge, Coulomb gauge, motion of charged particles in uniform electric field, charged particles in homogenous and non-homogeneous magnetic fields, charged particles in simultaneous electric and magnetic fields.

UNIT-IV: Lienard-Wiechert potentials from a moving charge, electromagnetic fields from Lienard-Wiechert potentials of a moving charge, electromagnetic fields of a uniformly moving charge, radiation from moving charges and dipoles, radiation from an accelerating charge, Bremsstrahlung radiation, Cherenkov radiation and application.

UNIT-V: Lorentz transformations, transformation of electromagnetic potentials, E and B fields from Lorentz transformations, covariance and contra variance, Electromagnetic field tensor and Lorentz invariance of Maxwell's equations.

Text books:
1. Classical Electrodynamics - J. D. Jackson
2. Introduction to Electrodynamics - D.R. Griffiths

Reference Books:
1. Electromagnetic Theory and Electrodynamics - Satyaprakash
2. Electrodynamics - K.L Kakani

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

Second Semester
P 201 – Electrodynamics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) State and prove Gauss Theorem.
   b) Derive Laplace's and Poisson's equations from the Gauss law.

(OR)

2. a) Explain the method of separation of variables in spherical polar Co-ordinates.
   b) Obtain potentials inside and outside a dielectric sphere in a uniform electric field.

Unit – II

3. a) State and prove Biot – Savart law.
   b) What is Faraday's law of electromagnetic induction?

(OR)

4. a) Describe the Maxwell equations in differential and integral forms.
   b) Explain their physical significance.

Unit – III

5. a) Explain how the electromagnetic waves behaves in free space, conducting medium.
   b) Define Lorentz gauge.

(OR)

6. a) Derive the equation of motion of charged particles in uniform electric field.
   b) Derive the equation of motion of charged particles in homogenous magnetic field.

Unit – IV

7. a) What are Lienard – Weichert potentials?
   b) Calculate the electric and magnetic field vectors for a uniformly moving point charge using these potentials.

(OR)

8. a) Give an account on Bremsstrahlung radiation.
   b) What is meant by Cherenkov radiation?

Unit – V

9. a) Explain what is meant by Lorentz Transformations?
   b) Derive the electric and magnetic fields from the Lorentz Transformations.

(OR)

10. a) Give an account on covariance and contra variance of electric and magnetic fields.
    b) Explain briefly about the Electromagnetic field Tensor.

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SYLLABUS

M.Sc. Degree Examination
Physics

Second Semester

P 202 – Statistical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. The course gives an introduction to statistical mechanics and includes the concepts of phase space, ensembles and calculations of thermodynamic parameters using the concepts of ensembles.
2. The course also discusses partition functions and their properties and its applications.
3. It explains quantum statistics such as Maxwell-Boltzmann statistics, Bose-Einstein and Fermi-Dirac statistics, Bose-Einstein condensation, theory of dwarf stars.
4. The course also describes phase transitions and calculation of partition function for non-ideal classical gas.

Course Outcomes:

On completion of course:

1. The student should be able to understand the concepts of phase space, different kinds of ensembles and how to obtain the thermodynamic parameters using these concepts.
2. They are also able to know what Gibb's paradox is and how to resolve it.
3. They are able to differentiate types of quantum statistics and able to know the difference between ideal and non-ideal classical gas.
4. They are able to understand types of orders of phase transitions.

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UNIT-I: Basic Methods and Results of Statistical Mechanics:

Phase space, Isolated systems, Basic postulates, concept of ensembles, different types of ensembles – probability calculations according to micro canonical, canonical and grand canonical ensemble (system with an indefinite number of particles & system in macroscopic motion), simple applications of canonical distribution, system with specified mean energy, calculation of mean values in a canonical ensemble, connection with thermodynamics, Liouvilles theorem, Energy fluctuations in the canonical ensemble. Density and energy fluctuations in the grand canonical ensemble. Thermodynamic equivalence of ensembles.

Reif Chapter: 6.

UNIT-II: Simple Applications of Statistical Mechanics:

Partition functions and their properties. Calculation of thermo dynamic quantities to an ideal mono atomic gas. Gibbs paradox, validity of the classical approximation. Proof of the equipartition theorem. Simple applications – mean K.E. of a molecule in a gas. Brownian motion. Harmonic Oscillator, Partition function for polyatomic molecules, electronic energy, vibrational energy and rotational energy of a diatomic molecule. Effect of Nuclear spin-ortho and para Hydrogen.

Reif Chapter: 7 & 9.12

UNIT-III: Quantum Statistics:

Formulation of the statistical problem. Maxwell–Boltzmann statistics. Photon statistics, Bose-Einstein statistics, Fermi–Dirac statistics, Quantum statistics in the classical limit, calculation of dispersion for MB, BE & FD statistics Equation of state of an Ideal Bose Gas, Bose-Einstein condensation.

Reif Chapter: 9

UNIT-IV: Non Ideal Classical Gas:

Calculation of the partition function for low densities. Equation of state and virial coefficients, Alternative derivation of Van Der Walls equation. Black body radiation, Thermionic emission. The theory of white dwarf stars

Reif Chapter: 10.3, 10.4

UNIT – V: Phase Transitions

Phase transitions, conditions for Phase equilibrium, First order Phase transition – the Clausius–Clayperon equation, Second order phase transition, the critical indices, Van der Waals theory of liquid gas transition. Order parameter, Landau theory.

Sinha Chapter:10

Text Books

1. Fundamentals of Statistical and Thermal Physics - F. Reif

Reference Books:

1. Statistical Mechanics, Theory and Applications - S. K. Sinha
2. Statistical Mechanics - R. K. Pathria
3. Statistical Mechanics - KersonHuang
4. Statistical Mechanics - Gupta Ram

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Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

Second Semester
P 202 – Statistical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain the concept of ensemble.
   b) Mention the different types of ensembles and their properties.

(OR)

2. a) Derive and explain the Liouville's theorem.
   b) What is the thermodynamic equivalence of ensembles?

Unit – II

3. a) State and prove the equipartition theorem.
   b) Calculate the mean kinetic energy of a molecule in a gas.

(OR)

4. a) Derive the equation for the vibrational and rotational energy of a diatomic molecule.
   b) Define Gibb's Paradox.

Unit – III

5. a) Distinguish between Maxwell, Bose – Einstein and Fermi Dirac Statistics.
   b) Obtain an expression for Fermi – Dirac distribution.

(OR)

6. a) Give an account on Bose – Einstein condensation.
   b) Calculate the Maxwell – Boltzmann statistics equation for an ideal Bose gas.

Unit – IV

7. a) Calculate the partition function for low densities.
   b) Derive the equations for the Virial coefficients.

(OR)

8. a) Derive an alternative derivation for Van Der Walls equation.
   b) What is the theory of white dwarf stars?

Unit – V

9. a) Define Phase transition.
   b) What are the conditions for phase equilibrium?

(OR)

10. a) Derive the first and second order equations for phase transitions.
    b) Describe the Landau theory.

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M.Sc. Degree Examination
Physics

SYLLABUS

Second Semester

P 203 – Atomic and Molecular Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To provide an understanding of the fundamental aspects of atomic and molecular physics.
2. To make the students understand various couplings effects.
3. To study spectroscopy of the one electron, one valence electron, multi-electron atoms and diatomic molecules.
4. To make the students understand about various absorption/emission spectroscopic transitions.
5. To make the students understand Quantum mechanical phenomenon at the atomic and molecular level.
6. To make the students understand the molecular orbits using Electronic Spectroscopy and Resonance Raman Spectra.

Course Outcomes:

1. The students will be able to understand the normal and anomalous splitting of atomic and molecular energy levels.
2. The students will have an understanding of quantum behavior of atoms in external electric and magnetic fields.
3. The students will be capable to understand infrared spectroscopy.
4. The students will understand the spectroscopy of molecules using Raman Effect.
5. The students will be able to understand the molecular vibrations using the Group Theory.

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UNIT-I: One Electron Atoms
Derivation of Quantum numbers, Term values, Relation between Magnetic dipole moment and angular momentum of an orbiting electron, Spin- orbit interaction, relativistic kinetic energy correction and dependence of energy on J value only, Selection rules. Fine structure of Hydrogen spectra, Fowler series of ionized Helium, Hyperfine structure of Hα line of hydrogen ($I = ½$).
One Valence Electron Atoms:
Modified term values (quantum defect) due to lifting of orbital degeneracy by core penetration (penetrating orbits), core polarization (non-penetrating orbits) by nl electrons. Term values, Fine structure of chief spectral series of sodium, Intensity rules and application to doublets of sodium. Hyperfine structure of ^2P-^2S transition of sodium ($I= 3/2$).

UNIT-II: Many Electron Atoms
Indistinguishable particles, bosons, fermions, Pauli's principle, Ground states, LS coupling and Hund's rules based on Residual columbic interaction and spin-orbit interaction, Lande's interval rule, Equivalent and non-equivalent electrons, Spectral terms in LS and JJ coupling (ss,s2 ,pp,p2 configurations), Exchange force and Spectral series of Helium.

UNIT - III
Atoms in External Magnetic Field: Normal Zeeman effect, Anomalous Zeeman effect and Paschen-Back effects and application to ^2P-^2S, ^3P-^3S, transitions.
Atoms in External Electric Field: Linear stark pattern of Hα line of hydrogen, Quadratic stark pattern of D1 and D2 lines of Sodium.

UNIT-IV: Diatomic Molecules
Molecular quantum numbers, Bonding and anti-bonding orbitals from LCAO's, Explanation of bond order for N2 and O2 and their ions, Rotational spectra and the effect of isotopic substitution, Effect of nuclear spin functions on Raman rotation spectra of H2 (Fermion) and D2 (Boson), Vibrating rotator and its spectrum, Combination relations and evaluation of rotational constants (infrared and Raman), Intensity of vibrational bands of an electronic band system in absorption.(The Franck-Condon principle), Sequences and progressions, Deslandre's table and vibrational constants.

UNIT- V: Molecular Vibrations
Symmetry elements, operations and identification of point Groups of AH_2, A_2H_2, ABH_2, AB_2H_2, AH_3, and ABH3 type molecules, Properties of irreducible representations and C2v character table. Reducible representation and symmetry in fundamental vibrations of H_2O. Structure determination of AB_2 type molecules from observed and expected fundamental bands of Raman and IR Spectra.
Molecular orbitals:
Walsh diagram, electronic spectroscopy, Herzberg – Teller effect, Resonance Raman Scattering, Fluorescence and Resonance Raman Spectra, Nonlinear effects and Raman Spectra.

Text Books:
1. Introduction to Atomic Spectra - H. E. White
2. Atomic and Molecular Spectra - Rajkumar
3. Fundamentals of Molecular Spectroscopy - C. N. Banwell
4. Group Theory - K. V. Raman

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Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Second Semester

P 203 – Atomic and Molecular Physics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Describe Spin Orbit interaction.
   b) Derive an expression for the relativistic kinetic energy correction.

(OR)

2. a) What are penetrating and non-penetrating orbitals?
   b) Draw the fine structure of chief spectral series of sodium.

Unit – II

3. a) State and explain Pauli's exclusion principle.
   b) Derive the Hund's rules based on residual coulomb and exchange interactions.

(OR)

4. a) Describe Lande's interval rule.
   b) Explain in detail the LS and JJ couplings.

Unit – III

5. a) Explain the Anomalous Zeeman effect.
   b) Apply the quantum theory of Zeeman Effect to the case of 2p-2s transition.

(OR)

6. a) What is meant by Stark effect?
   b) Discuss the quadratic stark pattern of Sodium D1 and D2 lines.

Unit – IV

7. a) What are bonding and anti-bonding orbitals?
   b) Give the theory of Linear combination of atomic orbitals.

(OR)

8. a) State and explain Frank-Condon principle.
   b) Discuss the intensity distribution of vibrational spectra of a diatomic molecule.

Unit – V

9. a) What are the properties of irreducible representations?
   b) Derive its C2v character table.

(OR)

10. a) Draw the Walsh diagram.
    b) Give an account on electronic spectroscopy and Herzberg – Teller effect.

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SYLLABUS

Second Semester

P 202 – Statistical Mechanics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To familiarize about the essential properties of the nucleus such as its shape, size, radius, density, magnetic moment, electric quadruple moment etc.
2. In order to probe these properties several models have been proposed such as liquid drop model, shell models, collective models.
3. The most useful part of this knowledge is the nuclear energy which has immense applications.
4. The concept behind this energy was first given by Hans Bethe in the form of semi-empirical mass formula which is in the course content.
5. Carbon dating, modern medical applications, radio-physics all require the knowledge of radio-activity.
6. It is a well-known fact that all kind of interactions which we perceive in our life are essentially four in number viz. gravitational, electromagnetic, weak and strong.
7. The ultimate aim of particle physics is to unify these interactions.

Course Outcomes:

1. Demonstrate knowledge of fundamental aspects of the structure of the nucleus, radioactive decay, nuclear reactions and the interaction of radiation and matter.
2. Discuss nuclear and radiation physics connection with other physics disciplines – solid state, elementary particle physics, radiochemistry.
3. Discuss nuclear and radiation physics applications in medical diagnostics and therapy, energetic, geology, archaeology.
4. Describe experimental techniques used (or developed) for nuclear physics purposes (gamma cameras, semiconductor detectors) and discuss their influence on development of new technologies.
5. Explore an application of nuclear and/or radiation physics and communicate their understanding to a group of their peers in a short presentation.
6. The students will be able to do higher studies in this field.
7. The students may get employment opportunities in radiology and medical field.

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UNIT – I: Introduction: Objective of Studying Nuclear Physics, Nomenclature, nuclear radius, mass & Binding energy, angular momentum, magnetic dipole moment, Electric quadrupole moment, parity and symmetry, domains of instability, mirror nuclei.

Nuclear Forces: Simple theory of the deuteron, scattering cross-sections, qualitative discussion of neutron-proton and proton- proton scattering, exchange forces, Yukawa's Potential, Characteristics of Nuclear Forces.

UNIT – II

Nuclear Models: Liquid drop model: Weissacker's semi-emperical mass formula, Mass – parabolas. Nuclear shell model: Spin orbit interaction, magic numbers, prediction of angular momenta and parities for ground states, Collective model. More-relistic models.

Nuclear Decay: Aplha decay process, Energy release in Beta-decay, Fermi's Theory of β -decay, parity violation in β -decay, detection and properties of neutrino. Energetics of gamma decay, selection rules, angular correlation, Mossbauer Effect.

UNIT – III

Nuclear Reactions: Types of reactions and conservation laws, the Q – equation, Optical model.

Nuclear Energy: Stability limit against spontaneous fission, Characteristics of fission, delayed neutrons, four factor formula for controlled fission, nuclear fusion, prospects of continued fusion energy.

UNIT – IV

Nuclear Radiation Detectors: Interaction of radiation with matter. Gas filled counters, scintillation detectors, semiconductor detectors, energy measurements, coincidence measurements and time resolution, magnetic spectrometers.

Accelerators: Electrostatic accelerators, cyclotron accelerators, synchrotrons, linear accelerators, colliding beam accelerators.

Applications: Trace Element Analysis, Rutherford Back-scattering, Diagnostic Nuclear Medicine, Therapeutic Nuclear Medicine.

UNIT – V

Elementary Particles: Particle interactions and families, conservation laws (energy and momentum, angular momentum, parity, Baryon number, Lepton number, isospin, strangeness quantum number (Gellmann and Nishijima formula) and charm, Elementary ideas of CP aand CPT invariance, Quark model.

Text Books:

1. Introductory Nuclear Physics - Kenneth S. Krane
2. Elementary Particle Physics – M J Longo

Reference Books:

1. Introduction to Nuclear Physics - Harald A.Enge
2. Concepts of Nuclear Physics - Bernard L.Cohen.
3. Introduction to High Energy physics - D.H. Perkins
4. Introduction to Elementary Particles - D. Griffiths

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DEPT. OF PHYSICS
MVD College of Science & Technology
Andhra University
VISAKHAPATNAM-530 003

Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

Second Semester
P 204 – Nuclear and Particle Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain briefly about the magnetic dipole moment and electric quadrupole moment.
   b) What are the characteristics of nuclear forces?

(OR)

2. a) Describe the simple theory of deuteron and quantitatively.
   b) Discuss the neutron – proton and proton – proton scatterings.

Unit – II

3. a) Discuss the formulation of Semi – empirical mass formula.
   b) Obtain the condition for stable isotope.

(OR)

4. a) Give a brief account of Fermi's theory of β –decay.
   b) Explain in detail the Mossbauer effect.

Unit – III

5. a) What are different types of nuclear reactions?
   b) Derive the Q- equation for the nuclear reaction.

(OR)

6. a) What are the characteristics of nuclear fission?
   b) Derive the four-factor formula for controlled fission.

Unit – IV

7. a) Explain how the radiation interacts with matter.
   b) What are the different types of nuclear radiation detectors?

(OR)

8. a) Give an account on Cyclotron and linear accelerators.
   b) Explain briefly about the Rutherford Back Scattering technique.

Unit – V

9. a) Discuss the conservation laws that explain the behavior of elementary particles.
   b) Define Baryon and Lepton numbers.

(OR)

10. a) Briefly explain the elementary ideas of CP and CPT invariance.
    b) What is Quark Model?

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M.Sc. Degree Examination
Physics

SYLLABUS

Second Semester

P 205 – Modern Physics Laboratory - 2
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. The aim of this laboratory course is to make the students perceive some of the fundamental laws of Physics through experiments.

Course Outcomes:

1. At the end of this laboratory course, the students will be capable of handling sophisticated instruments besides learning the Physics concepts behind these experiments.

LIST OF EXPERIMENTS

1. He-Ne Laser
2. Band Gap of a Semiconductor (Two probe Method)
3. Determination of Curie Temperature
4. Characteristics of LED and Laser Diode
5. Reciprocal Dispersion Curve
6. Vibrational Analysis of ALO Band Spectrum

Reference Books:

1. Advanced Practical Physics, B.L. Worsnop & H.T. Flint.
2. A Text Book of Practical Physics, I.Prakash & Ramakrishna.
3. Practical Physics, Geeta Sanon, R. Chand & Co.Publishers.
4. Advanced Practical Physics, S P Singh, Pragati Prakashan.
5. Practical Physics, Gupta & Kumar, Pragati Prakashan.
6. An Advanced Course in Practical Physics, D Chattopadhyay & P C Rakshit, Central Pub.

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M.Sc. Degree Examination
Physics

SYLLABUS

Second Semester

P 206 – Electronics Laboratory - 2
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students familiar with analog electronic components.
2. To provide hands-on experience to the students to make them familiar with the working and handling of the analog electronic devices and circuits.

Course Outcomes:

1. At the end of this laboratory, the students will be skilled enough to handle and understand the use of analog devices.

LIST OF EXPERIMENTS

1. Active low, High and Band Pass Filters (IC 741)
2. Twin – T Filter (IC 741)
3. Logarithmic Amplifier (IC 741)
4. Wein Bridge Oscillator (IC 741)
5. Monostable Multivibrator (IC 555)
6. Voltage Regulator (IC 723)

Reference Books:

1. The Art of Electronics, P. Horowitz & W. Hill.
2. Microelectronics, J. Millman & A. Grabel.
3. Electronic Devices and Circuits, Schaum's Outline Series, J.J. Cathey.
4. Basic *Electronics*: *A Text-Lab Manual*, Paul Zbar & Albert P Malvino**.**
5. Experiments in Electronics, S V Subrahmanyam.
6. Operational Amplifiers & Linear ICs, S V Subrahmanyam.

Syllabus and Model Papers

M.Sc. Physics
3rd Semester

Under Choice Based Credit System (CBCS)
[Effective from 2021-2022 Admitted Batches]

Department of Physics
College of Science and Technology
Andhra University
Visakhapatnam.

M.Sc. Physics
Course Curriculum under CBCS

M.Sc. Physics – III Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

THEORY	P 301	Solid State Physics
	P 302	Lasers & Fiber Optics
	P 303 **Elective-I**	1. Digital Electronics & Microprocessors
		2. Principles of Ultrasonics
	P 304 **Elective-II**	1. Materials Science
		2. Radar Systems and Satellite Communications
LABORATORIES	P 305	Digital Electronics & Microprocessor Lab
	P 306	Solid State Physics Lab
	P 307	MOOCS Paper
	P 308	Value Added Paper (IPR Chair Paper)

SCHEME OF INSTRUCTION AND EXAMINATION UNDER CBCS

M.Sc. Physics – III Semester – SECOND YEAR
[Effective from the admitted batch 2021-2022]

Theory Code	Title of the Paper	T	P	Semester End Exam Marks	Mid Exam Marks	Total Marks	Pass Minimum	Credits
P-301	Solid State Physics	4	-	80	20	100	40	4
P-302	Lasers & Fiber Optics	4	-	80	20	100	40	4
P-303	Elective - I	4	-	80	20	100	40	4
P-304	Elective – II	4	-	80	20	100	40	4
P-305	Digital Electronics & Microprocessor Lab (Practical-80 & Record-20)	-	3	100		100	50	4
P-306	Solid State Physics Lab (Practical-80 & Record-20)	-	3	100		100	50	4
P - 307	**MOOCS Paper**	**ON LINE MODE**						**4**
P - 308	**VALUE Added Paper (IPR Chair Paper)**	**Total 30 hours learning, No Examination**						**2**
	TOTAL	**600**						**30**

(**T**- Theory Hrs /Week, **P**- Practical Hrs/Week)

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 301 – Solid State Physics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To provide extended knowledge of principles and techniques of Solid-State Physics.
2. To make the students familiar with the structures having regular and irregular arrangements of atoms and their bonding etc.
3. To explain the peculiar behavior of materials.
4. To understand various thermal properties of materials under different length scales.
5. To explain the free electron Fermi gas energy levels and density of orbits.
6. To understand the band theory of solids.

Course Outcomes:

1. The students will be able to formulate basic models for electrons and lattice vibrations for describing the physics of crystalline materials.
2. The students will be able to understand the relation between band structure and the thermal properties of a material.
3. At the end of this course, the students will be able to understand various physical phenomena and the reasons behind them.

UNIT-I: Crystal Structure

Periodic array of atoms—Lattice translation vectors, fundamental types of lattices-two- and three-dimensional lattice types, the Basis and the Crystal Structure, Primitive and compound unit cells, determination of number of atoms in a cell and position of atoms, simple crystal structures-- sodium chloride, cesium chloride and diamond structures, Review of Symmetries in solid, Miller Indices, indexing pattern of cubic crystals and non-cubic crystals (analytical methods).

UNIT-II: X-Ray Diffraction and Reciprocal Lattice

Diffraction of x-rays by crystals, scattered wave amplitude-Fourier analysis, Bragg's law, Laue's equations, Reciprocal lattice vectors, diffraction conditions, reciprocal lattice to bcc and fcc Lattices, concept of Brillouin Zone, Ewald construction, Structure factor and atomic form factors.

UNIT-III: Lattice Vibrations

Vibrations of lattice with monoatomic and diatomic basis, dispersion relation, optical and acoustical branches, quantization of elastic waves and phonons, classical theory of specific heat, phonon density of states, Einstein and Debye models of specific heat.

UNIT-IV: Free Electron Fermi Gas

Free electron theory and electronic specific heat, energy levels and density of orbits in one-dimension, free electron gas in three-dimension, thermal properties of an electron gas, Hall effect, thermal conductivity, Wiedemann-Franz law.

UNIT-V: Band Theory of Solids

Nearly free electron model and origin of energy gap, Block function, Kronig-Penny Model, wave equation of electron in a periodic potential, Bloch theorem and crystal momentum, classification of metals, insulators and semiconductors.

Text Books:

1. Introduction to Solid State Physics - C. Kittel
2. Solid State Physics - A. J .Dekker

Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Third Semester

P 301 – Solid State Physics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain the concept of translation vectors in lattice.
   b) Describe the fundamental types of two- and three-dimensional lattice types.

(OR)

2. a) Draw the simple crystal structures of sodium chloride, cesium chloride and diamond.
   b) Explain the indexing pattern of cubic crystals and non – cubic crystals.

Unit – II

3. a) What is meant by diffraction? Explain the diffraction of X – rays by crystals.
   b) State and prove the Bragg's law.

(OR)

4. a) What are the reciprocal lattice vectors?
   b) Construct the reciprocal lattice to the body centered and face centered cubic crystals.

Unit - III

5. a) Explain the vibrations of lattice with monoatomic and diatomic basis.
   b) Define dispersion relation.

(OR)

6. a) What is the classical theory of specific heat?
   b) Explain in detail the Einstein and Debye models of specific heat.

Unit – IV

7. a) Give an account on free electron theory and electronic specific heat.
   b) Explain the energy levels and density of orbits in one dimension.

(OR)

8. a) What are the thermal properties of an electron gas?
   b) Discuss the Wiedemann – Franz law.

Unit – V

9. a) What is the origin of energy band gap of solids?
   b) Explain the Kronig – Penny model for an electron in one dimensional potential.

(OR)

10. a) Derive the wave equation for an electron in periodic potential.
    b) State and prove Bloch theorem.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 302 – Lasers and Fiber Optics
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To explain the basics of LASER.
2. Describing the construction and working of various types of lasers and the applications of lasers.
3. Explaining the propagation mechanism of light through optical fiber.
4. Deriving the relation between Numerical Aperture and Refractive indices.
5. Classification of the types of optical fibers.
6. Explaining about the attenuation mechanisms.
7. Demonstrate an understanding of light propagating through an optical fiber
8. Characterize different types of optical fibers and optical connectors

Course Outcomes:

1. Absorption and spontaneous and stimulated emission in two level system, the effects of homogeneous and inhomogeneous line broadening, and the conditions for laser amplification.
2. Operations of the cavity including mode separation and line-widths, laser gain conditions, gain clamping in both homogeneous and inhomogeneous line broadened media.
3. Operations and basic properties of the most common laser types such as Ruby, He-Ne, Nd:YAG and knowledge of other main laser types.
4. The various laser systems, the simple homogeneous laser and its output behavior and optimal operating conditions.
5. Spectral properties of longitudinal and transverse modes, mode locked laser operation, schemes for active and passive mode locking in real laser system.
6. Matrix optics of the laser cavity and stability conditions.
7. Basics of Gaussian beam in laser cavity and optical properties of laser output, design of stable laser cavities using Gaussian beam optics, the ABCD law for Gaussian beams.
8. Better understanding of the Ray and Modal Analysis in Optical Fibers.
9. Basic understanding about the various Fiber Signal Characteristics such as pulse broadening and dispersion.
10. Exhaustive understanding about the Nonlinear optics.

UNIT-I

Laser systems: Introduction, Characteristics of Laser Light, coherence, directionality, spontaneous and stimulated emission, absorption and emission processes, Einstein coefficients, Optical pumping mechanism, Population inversion, Rate equations for three level and four level systems, Types of Lasers - Ruby laser, He-Ne laser, Nd:YAG laser, CO_2 Laser, Dye laser, Excimer laser, Semiconductor laser, Hetero junction laser, Optical resonator, laser power and threshold condition confinement of beam within the resonator, coherence length, stability condition, stability diagram.

UNIT – II:

Laser cavity modes: Line shape function and Full Width at half maximum (FWHM) for Natural broadening, Collision broadening, Doppler broadening, Saturation behavior of broadened transitions, Longitudinal and Transverse modes. ABCD matrices and cavity Stability criteria for confocal resonators. Quality factor, Q-Switching, Mode Locking in lasers. Expression for Intensity for modes oscillating at random and modes locked in phase. Methods of Q-Switching and Mode locking.

UNIT-III

Optical fiber waveguides: Basic optical laws and self-focusing. Optical fiber modes and configurations Fiber types, Rays and Modes, Step-index fiber structure. Ray optics representation, wave representation. Mode theory of circular step-index wave guides. Wave equation for step-index fibers, modes in step-index fibers and power flow in step-index fibers. Graded – index fiber structure, Graded-index numerical aperture, modes in Graded-index fibers.

UNIT-IV

Fiber characteristics: Signal Degradation In Fibers - Attenuation, Absorption, Scattering and Bending losses in fibers, radiative losses, Core and Cladding losses. Signal distortion in optical wave guides: Group delay, material dispersion, waveguide dispersion and intermodal dispersion. Pulse broadening in optical fibers. Power launching in Optical fibers, Source-output pattern, Lensing schemes. Fiber-to-fiber joints: Mechanical misalignment, fiber related losses, Fiber and face preparation. Fiber splicing techniques, fiber connectors.

UNIT – V

Nonlinear Optics: Second harmonic generation, parametric amplification, Phase matching, parametric oscillation, Frequency up conversion, Electro optic modulation of laser beams, electro optic effect, electro optic retardation, electro optic amplitude modulation, phase modulation of light, electro optic beam deflection.

Text Books:

1. Lasers -Theory and Applications – K. Thyagarajan and A.K. Ghatak
2. Optical Fiber Communications – Gerd Keiser
3. Optical Electronics – Amnon Yariv

Reference Books:

1. Laser Fundamentals – William T. Silfvast
2. Introduction to Fiber Optics – Ajoy Ghatak and K. Thyagarajan
3. Optical Electronics – Ajoy Ghatak and K.Thyagarajan
4. Optical Electronics – J. Wilson and J.F.B. Hawkes

Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Third Semester

P 302 – Lasers and Fiber Optics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain in detail the characteristics of Lasers.
   b) What are Einstein's Coefficients in laser?

(OR)

2. a) Describe the working and construction of He – Ne laser.
   b) Explain briefly about the optical resonators in lasers.

Unit – II

3. a) Give an account on Collision and Doppler broadening in lasers.
   b) Describe the Longitudinal and Transverse modes in lasers.

(OR)

4. a) What is meant by Q -Switching?
   b) Explain the methods of Q – Switching and mode locking.

Unit – III

5. a) What are the basic optical laws and optical fiber modes?
   b) Describe the mode theory of circular step - index wave guides.

(OR)

6. a) Derive the wave equation for the step – index fibers.
   b) Explain the power flow in step – index fibers.

Unit – IV

7. a) Explain the different types of losses in fiber optics.
   b) Give an account on Group delay and material dispersion in optical fibers.

(OR)

8. a) Describe the power launching in optical fibers.
   b) Explain in detail the different types of optical fiber connectors.

Unit – V

9. a) Write a brief note on parametric amplification and parametric oscillation.
   b) What is the frequency up conversion in nonlinear optics?

(OR)

10. a) Define the electro optic retardation.
    b) Describe the electro optic beam deflection in nonlinear optics.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 303 – ELECTIVE PAPER
1. Digital Electronics and Microprocessors

(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To make the students learn the basics of digital electronics.
2. To Introduce the concept of digital and binary systems
3. To be able to design and analyze combinational logic circuits.
4. To be able to design and analyze sequential logic circuits.
5. To understand the basic design and implementation of digital circuits and systems.
6. To acquire the basic knowledge of digital logic levels and application of knowledge to understand digital electronics circuits.
7. To prepare students to perform the analysis and design of various digital electronic circuits.
8. Reinforce theory and techniques taught in the classroom through experiments in the laboratory.
9. To introduce students with the architecture and operation of typical microprocessors and microcontrollers.
10. To familiarize the students with the programming and interfacing of microprocessors and microcontrollers.
11. To provide strong foundation for designing real world applications using microprocessors and microcontrollers.

Course Outcomes:

1. At the end of the course, a student will be able to:
2. Convert different type of codes and number systems which are used in digital communication and computer systems.
3. Employ the codes and number systems converting circuits and compare different types of logic families which are the basic unit of different types of logic gates in the domain of economy, performance and efficiency.
4. Analyze different types of digital electronic circuit using various mapping and logical tools and know the techniques to prepare the most simplified circuit using various mapping and mathematical methods.
5. Design different types of with and without memory element digital electronic circuits for particular operation, within the realm of economic, performance, efficiency, user friendly and environmental constraints.
6. Apply the fundamental knowledge of analog and digital electronics to get different types analog to digitalized signal and vice-versa converters in real world with different changing circumstances.

7. Assess the nomenclature and technology in the area of memory devices and apply the memory devices in different types of digital circuits for real world application.
8. Learn microprocessor with the help of basic knowledge of digital electronics.
9. Understand the fundamentals of digital electronics and microprocessor and microcontroller, which will be useful to them in understanding the concept behind Digital India.
10. Assess and solve basic binary math operations using the microprocessor and explain the Microprocessor's and Microcontroller's internal architecture and its operation within the area of manufacturing and performance.
11. Apply knowledge and demonstrate programming proficiency using the various addressing modes and data transfer instructions of the target microprocessor and microcontroller.
12. Compare accepted standards and guidelines to select appropriate Microprocessor (8085) and Microcontroller (8051) to meet specified performance requirements.
13. Analyze assembly language programs, select appropriate assemble into machine a cross assembler utility of a microprocessor and microcontroller.
14. Design electrical circuitry to the Microprocessor I/O ports in order to interface the processor to external devices.
15. Evaluate assembly language programs and download the machine code that will provide solutions to real-time control problems.

UNIT- I: Combinational Logic Circuits: **(i)** Simplification of Boolean Expressions: Algebraic method, Karnaugh Map method, **(ii)** Encoder, decoder, Multiplexer, Demultiplexer, Design of Adders and Subtractors, IC parallel adder. **(iii)** Applications of Boolean algebra: Magnitude Comparator, Parity generator, Checker, Code converter, Seven-segment decoder/ Driver display.

UNIT – II: Sequential Logic Circuits: (i) Flip-Flops: NAND latch, NOR latch, , Clocked S-C flip-flop, J-K flip-flop, D flip-flop, Asynchronous inputs **(ii)** Counters: Asynchronous counters (Ripple), Counters with MOD number < 2^N, Asynchronous down counter, Synchronous counters, Up-down counter **(iii)** Registers: Shift Register, Integrated Circuit registers, Parallel In Parallel Out (PIPO), SISO, SIPO, PISO. **(iv)** Applications of Counters: Frequency Counter.
(v) A/D and D/A Converter Circuits**:** D/A Converter, Linear weighted and ladder type, an integrated circuit DAC; Analog-to-Digital Conversion, Digital Ramp ADC, Successive Approximation Method, Sample and Hold Circuit, Digital Voltmeter.

UNIT – III: Intel 8085 Microprocessor (i) Architecture, Functional diagram, Pin description, Timing Diagram of Read Cycle, Timing diagram of write Cycle **(ii)** Programming the 8085 Microprocessor**:** Addressing Methods, Instruction set, Assembly language programming **(iii)** Examples of Assembly Language Programming: Addition/Subtraction of two 8-bit/16-bit numbers, Addition of two decimal numbers, Sum of series of 8-bit numbers, Largest element in the array, Multiple byte addition, Delay sub-routine.

UNIT – IV: Data Transfer Techniques: (i) Serial transfer, Parallel transfer, Synchronous, Asynchronous, DMA transfer, Interrupt driven Data transfer **(ii)** 8085 Interfacing**:** I/O Interfacing: Programmable Peripheral Interfacing, 8255, Programmable Peripheral Interval Timer 8253.

UNIT – V: 8051 Microcontroller: (i) 8051 Internal Architecture, Register Structure, I/O pins, Memory Organization, 8051 Addressing modes**,** 8051 Assembly Language Programming Tools**,** 8051 Instruction set**, (ii)** Data Transfer Instructions, Arithmetic instructions, Logical instructions **(iii)** Boolean Variable Manipulation Instructions-Bit Addressability, Single-Bit instructions, Program Branching instructions-Jump, Loop, and Call instructions, Rotate Instructions, Stack Pointer.

Text Books:

1. Digital Systems – Principles and applications –Ronald J. Tocci
2. Fundamentals of Microprocessors & Microcomputers - B. RAM
3. Digital principles and applications - A. P. Malvino & Donald P. Leech
4. Micro Controllers: Theory and Applications - Ajay V. Deshmukh
5. Micro Controllers – Rajkamal
6. Micro Controllers – Kenneth J Ayala

Reference Books:

1. Digital Electronics – William H Gothmann
2. Digital Fundamentals – Thomas L. Floyd
3. Fundamentals of Digital Circuits - A. Ananda Kumar
4. Introduction to Microprocessors for Engineers and Scientist - P.K.Ghosh and P.R.Sridhar
5. Microprocessor Architecture, Programming and Applications with the 8085 /8080A - Ramesh. S. Gaonkar
6. 8051 Microcontroller and Embedded systems - Mahammad Ali Mazidi & Janice GillispieMazidi
7. 8051 Microcontroller – Mike Predko

Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Third Semester

P 303 – ELECTIVE PAPER

1. Digital Electronics and Microprocessors

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Draw the circuit symbol and truth tables of 3 line-8-line decoder.
   b) Write a detailed note on half adder and full adder.

(OR)

2. a) Write a note on K – Map method of simplification of Boolean function with a variable map.
   b) Write a note on parity generator and checker circuits.

Unit – II

3. a) With a neat block diagram explain the working of JK flip-flop.
   b) Write a note on shift registers.

(OR)

4. a) With a neat block diagram explain the working of 3 bit Up/Down counter.
   b) Distinguish between ripple counters and parallel counters.

Unit – III

5. a) Draw the functional diagram of 8085 and explain the register section of 8085.
   b) Write a note on addressing methods of 8085 with examples.

(OR)

6. a) Write an Assembly Language Programming to find the sum of series of 8-bit numbers.
   b) Write a brief note on Delay sub routine.

Unit – IV

7. a) What are the different data transfer techniques?
   b) Write a note on DMA transfer and Interrupt driven data transfer techniques.

(OR)

8. a) Draw the functional diagram of programmable peripheral interface 8255 and explain the different pin names and functions.
   b) Write a brief note on DAC 0800 and ADC 0800 interfacing.

Unit – V

9. a) Define the internal architecture of 8051 microcontroller and explain the memory organization of 8051.
   b) Write a note on assembly language programming tools of 8051.

(OR)

10. a) Explain in detail the data transfer and arithmetic instructions of 8051 Microcontroller?
    b) Give a brief account on stack pointer.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 303 – ELECTIVE PAPER
2. Principles of Ultrasonics

(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. The course gives introduction of ultrasonics and its properties and production of ultrasonics by various methods.
2. The course also describes the propagation of ultrasonics in different media and describes the measurement of ultrasonic velocities using various techniques.
3. The course discusses different methods in non-destructive testing and its applications.
4. The course discusses the applications of both low and high intensity ultrasonics in various fields.

Course Outcomes:

1. Students will be able to know the concept of different ranges of frequencies and ultrasonic waves and its production and properties by various methods.
2. They also able to learn the concept of propagation of ultrasonic waves in different liquid media with binary and ternary mixtures. They will be able to know the concept viscoelasticity.
3. They able to measure ultrasonic velocities and absorption coefficients in liquids by using various instruments.
4. They able to understand non-destructive testing methods and applications and learn applications of low and high intensities ultrasonic in the medical field, imaging, process control.

UNIT I:

Introduction of ultrasonics, basic principles of ultrasonic waves, properties, production of ultrasonics i. Magnetostriction method. ii. Piezoelectric method. Detection of ultrasonic waves, basic design of ultrasonic transducer.

UNIT II:

Propagation of ultrasonics velocity of plane wave in a medium, absorption of plane longitudinal waves in gases and low viscosity liquids where relaxation effects are absent.
Viscoelasticity**:** Viscoelasticity of a medium, molecular picture of viscoelastic relaxation, propagation of shear wave in a visco elastic medium, The Maxwell model.

UNIT III:

Measurements of ultrasonic velocities and absorption coefficients in liquids.
i. DSA 5000 M (Density and Sound Velocity Meter) ii. The ultrasonic Interferometer iii. Pulse-echo technique iv. Optical diffraction method, Cavitation process, cleaning technique.

UNIT 1V:

Non-destructive testing, different methods in non-destructive testing and applications of ultrasonic waves using non-destructive testing, flaw detection, applications of ultrasonics in medical field.

UNIT V:

Application of ultrasonics (low and high intensities) in mechanical, chemical and metallurgical area. Ultrasonic imaging, process control and applications.

Reference Books:

1. Fundamental of ultrasonics - Jock Blitz
2. Ultrasonics- the low and high intensity applications - Dale Ensminger
3. Engineering Physics -1 - Dr. D. Tirupati Naidu & M. Veeranjaneyulu
4. Molecular Acoustics - A. J. Matheson

Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Third Semester

P 303 – ELECTIVE PAPER

2. Principles of Ultrasonics

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) What is ultrasonics. Explain the production of ultrasonics by Piezoelectric method.
   b) What are ultrasonic transducers. Explain basic design of ultrasonic transducers.

(OR)

2. a) What is meant by Magnetostriction effect and explain how ultrasonic waves are produced using this effect.
   b) Mention Properties of ultrasonic waves and explain how ultrasonic waves are detected.

Unit – II

3. a) Explain the propagation of ultrasonic waves in different media at various temperatures in liquids.
   b) Explain the absorption of plane longitudinal waves in gases at low viscosity where the relaxation effects are absent in the liquids.

(OR)

4. a) What is Viscoelasticity and explain the molecular picture of Visco elastic relaxation.
   b) Explain the propagation of shear wave in a Visco elastic medium using Maxwell model.

Unit – III

5. a) Mention different methods for measuring the ultrasonic velocity. Discuss advantages and disadvantages of these methods.
   b) Using DSA 5000M Density and Sound velocity Meter explain the measurement of refractive index and viscosity with variation of the angles.

(OR)

6. a) Explain in detail the Cavitation process.
   b) Discuss various cleaning techniques using ultrasonic waves.

Unit – IV

7. a) What is the basic principle of ultrasonic testing. How ultrasonics are used in non-destructive testing.
   b) Mention different methods in non-destructive testing. Give brief note on each method.

(OR)

8. a) Explain two or three applications of ultrasonic waves using non-destructive testing.
   b) Discuss applications of ultrasonics in medical field.

Unit – V

9. a) Explain applications of ultrasonics at low and high intensities in mechanical area.
   b) Give a note on ultrasonic imaging and process control.

(OR)

10. a) Give applications of ultrasonics at low and high intensities in chemical and metallurgical area.
    b) Discuss the applications of both low and high intensity ultrasonic waves in various fields.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 304 – ELECTIVE PAPER
1. Material Science
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. Give basic knowledge of science behind materials & physical metallurgy.
2. Introduce the concept of structure property relations.
3. To have fundamental understanding of materials behavior, or conceived, designed, and realized useful products and technology platforms within realistic engineering constraints, as demonstrated by, for example, development of new materials, improvement of existing materials, development of new materials processing, or development of new analytical tools and core competence in materials.
4. Lay the groundwork for studies in mechanical behavior of materials & applications of recent materials.
5. Are valued not only for understanding the structure and composition of materials, but equally for analytical and creative abilities fostered by a broad engineering,
6. To work effectively in multidisciplinary areas of materials science to solve complex problems.
7. Ability to deal with business and non-technical aspects of materials science & engineering.
8. Develop intuitive understanding of the subject to present a wealth of real-world engineering examples to give students a feel of how material science is useful in engineering practices.
9. Analyze the Structure of materials at different levels, basic concepts of crystalline materials etc. understanding.
10. Concept of mechanical behavior of materials and calculations of same using appropriate equations understanding.
11. Explain the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy understanding.
12. Construction and identification of phase diagrams and reactions Understanding,
13. Understand and suggest the heat treatment process & types.
14. Significance of properties.
15. Explain features, classification, applications of newer class materials like smart materials, piezoelectric materials, biomaterials, composite materials, etc.

<u>Course Outcomes</u>:

1. An ability to apply knowledge of mathematics, science and engineering to materials issues.
2. An ability to design and conduct experiments and critically analyze and interpret data.
3. An ability to design a process and/or material system to achieve specific requirements within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
4. An ability to work effectively in multidisciplinary teams, be conversant in languages of other fields, and provide leadership to such teams.
5. An ability to identify, formulates, and solves science & engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of science & engineering solutions in a global, economic, environmental, and societal context.
9. A recognition of the need for, and an ability to engage in, lifelong learning.
10. A knowledge of contemporary issues in science, engineering and society.
11. An ability to use modern techniques, skills, and science & engineering tools appropriate to materials research.
12. An integrated understanding of structure, properties, processing and performance of materials systems.

UNIT-I: Structure of Materials:
Concept of amorphous, single crystal and polycrystalline materials, defects in crystalline materials, point, line and surface imperfections, vacancies, interstitials, dislocations; grain boundaries, twins, stacking faults.

UNIT-II: Classification of Materials:
Metals and Alloys: alloying nature, concept of formation of alloys, types of alloys, solid solutions, Nd-Fe-B alloy, AlNiCo alloys
Ceramics: introduction, classification, oxides, carbides, nitrides, or silicates of metals, glass, porcelain, ferrites
Polymers: structure of polymers, strengthening of polymers, crystallization and glass formation, types of polymers, nylon, polyethylene, polyvinyl chloride, rubber
Composites: definition, classification, types of matrices and reinforcements, metal-matrix composites, polymer-matrix composites, and ceramic-matrix composites, composite strengths, particles, whiskers and fibers as reinforcements
Semiconductors: concept of doping, simple and compound semiconductors, silicon, germanium, gallium arsenide, amorphous silicon, oxide semiconductors.

UNIT-III: Processing of Materials:
Heat treatment of alloys; annealing, re-crystallization and grain growth, preparation of ceramic powders, solid-state reaction, sintering; thin film deposition, evaporation and sputtering techniques, and chemical vapor deposition.

UNIT-IV: Properties of Materials:

Mechanical Properties: stress, strain, elastic properties, deformation- elasticity, hardness, stress-strain response (elastic, inelastic and plastic deformation)

Electrical Properties: dielectric polarization, mechanism of polarization, dielectric constant, dielectric losses and breakdown, piezoelectric and ferroelectric behavior, electrical conduction in semiconductors, temperature dependence of electrical conductivity

Magnetic Properties: classification of magnetic materials, ferromagnetism, ferrimagnetism, antiferromagnetism and superparamagnetism, domain theory and hysteresis, magnetization processes in terms of domain theory, Domain wall, properties of domain walls and domain wall motion, magnetic anisotropy.

UNIT-V: Applications of Materials:

Metals and Alloys: Nd-Fe-B, AlNiCo alloys,

Ceramics: soft and hard ferrites, ferroelectric and piezoelectric materials

Polymers: plastic fibers, coating adhesives, biomedical applications,

Composites: aircraft engineering-space hardware, wind turbine, marine craft-space structure, applications in surgery.

Text & Reference Books:

Composite Materials	Krishnan K. Chawla
Materials Science and Engineering	V Raghavan
Electronic Processes in Materials	L.W. Azaroff and J.J.Brophy
Introduction to Solid State Physics	C.Kittel
Science of Engineering Materials	C.M.Srivastava and C. Srinivasan
Solid State Physics	A.J.Dekkar
Solid State Physics	S.O.Pillai
Solid State Devices and Materials	Ben.G Streetman

Model Question Paper

Andhra University

M.Sc. Degree Examination

Physics

Third Semester

P 304 – ELECTIVE PAPER

1. Material Science

(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit

All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain about the single crystal and polycrystalline materials.
   b) Describe the defects in crystalline materials.

(OR)

2. a) Write a note on line and surface imperfections.
   b) Give an account on grain boundaries and stacking faults.

Unit – II

3. a) Explain the nature and formation of alloys.
   b) What are the different types of ceramics?

(OR)

4. a) Describe the crystallization and glass formation of polymers.
   b) Discuss about the different types of matrices and reinforcements of composites.

Unit – III

5. a) What is meant by annealing?
   b) Explain the re – crystallization and grain growth of alloys.

(OR)

6. a) Describe the preparation of ceramic powders.
   b) Write a detailed note on thin film deposition and evaporation techniques.

Unit – IV

7. a) Write the mechanical properties of materials.
   b) Define the dielectric polarization.

(OR)

8. a) Give an account on piezoelectric and ferroelectric behaviour of materials.
   b) Distinguish between dia, para and ferro magnetic materials.

Unit – V

9. a) What are the applications of metal and alloy materials?
   b) Describe the ferroelectric and piezoelectric materials.

(OR)

10. a) What are the biomedical applications of polymers?
    b) Write the applications of composite materials.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 304 – ELECTIVE PAPER
2. Radar Systems and Satellite Communications
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. To learn about Radar systems, Design and Tracking of Radars.
2. To study about MTI and Pulsed Radar Systems.
3. To study Satellite basics and Satellite communication systems.
4. To learn about satellite link design and multiple access techniques.

Course Outcomes:

On completion of the course, students will be able to

1. Describe the working principle of different RADAR systems and their applications.
2. Identify the various RADAR systems in existence, specify their applications and limitations, and explain the principles of how they work.
3. Describe the most commonly used techniques in processing RADAR signals.
4. Recognize and describe the various technologies used in the design of RADAR systems: antennas, transmitters, duplexers, data display screens, etc.
5. Design simple radar systems and the associated signal processing, at block diagram level.
6. Understand the Satellite fundamentals and types of satellite.
7. Explain the working of a Satellite communication system and its other subsystems.
8. Know the applications of Satellites in different areas.
9. Describe the principles of radio navigation systems (including secondary radar and GPS).
10. Identify the fundamentals of orbital mechanics, the characteristics of common orbits used by communications and other satellites, and be able to discuss launch methods and technologies.
11. Describe the systems required by a communications satellite to function and the trade-offs and limitations encountered in the design of a communications satellite system.
12. Describe the radio propagation channel for Earth station to satellite and satellite to satellite communications links, and the basics of designing antenna systems to accommodate the needs of a particular satellite system.
13. Analyze an accurate link budget for a satellite or other wireless communications link.

Unit – I:

Radar Systems: Fundamental – A simple RADAR – overview of frequencies – Antenna gain Radar Equation – Accuracy and Resolution – Integration time and the Doppler shift

Designing a surveillance radar – Radar and surveillance – Antenna beam – width consideration – pulse repetition frequency – unambiguous range and velocity – pulse length and sampling – radar cross section – clutter noise

Tracking Radar – Sequential lobbing – conical scanning – Mono pulse Radar – Tracking accuracy and Process – Frequency Agility – Radar guidance, Signal and data processing.

UNIT – II:

MTI and Pulse doppler Radar: Introduction to Doppler and MTI radar, MTI and pulse radar, Doppler frequency shift, simple CW Doppler Radar, sweep to sweep subtraction and delay line cancellers, MTI radar block diagram Radar Antenna – Antenna parameters – Antenna Radiation Pattern and aperture distribution – Parabolic reflector – cosecant squared antenna pattern.

UNIT – III:

Satellite Communication: Satellite System – Historical development of satellites – communication satellite systems – communication satellites – orbiting satellites – satellite frequency bands – satellite multiple access formats, Satellite orbits and inclination – Look angles, orbital perturbations, space craft and its subsystems – attitude and orbit control system – Telemetry, Tracking and Command – Power system – Transponder – Reliability and space qualification – launch vehicles

UNIT – IV:

Satellite Link Design: Introduction, General Link Design Equation, System Noise Temperature, C/N and G/T Ratios, Uplink Design, Downlink Design, Downlink Rain Fade Margin, Complete Link Design, Satellite Link Design with Specified (C/N), Dependence of (C/N) Ratio on Earth Station Parameters.

UNIT V:

Multiple Access Techniques – Time division multiple access – Frequency division multiple access – Code division multiple access – Space domain multiple access, Earth Station technology – Subsystem of an earth station – Transmitter – Receiver, Tracking and pointing – Small earth station – different types of earth stations – Frequency coordination – Basic principles of special communication satellites – INMARSAT, VSAT, GPS, RADARSAT, INTELSAT.

Text Books:

1. Understanding Radar Systems – Simon Kingsley and Shaun Quegan.
2. Satellite Communication – Robert M. Gagliardi
3. Satellite Communication – Monojit Mitra

Reference Books

1. Introduction to Radar Systems – MI Skolnik
2. Satellite communications – Timothy Pratt,Carles Bostian and Jeremy Allnutt

Model Question Paper
Andhra University
M.Sc. Degree Examination
Physics

Third Semester
P 304 – ELECTIVE PAPER
2. Radar Systems and Satellite Communications
(Effective from the admitted batch of 2021-2022-CBCS)

Answer one question from each unit
All questions carry equal marks

Time: 3 Hrs. **Max.Marks:80 (16 X 5 = 80)**

Unit – I

1. a) Explain the design of surveillance Radar.
   b) Write a note on Radar cross section of targets.

(OR)

2. a) Explain the unambiguous range and velocity of a Radar.
   b) With a neat block diagram explain the signal and data processing in Radars.

Unit – II

3. a) With a neat block diagram explain the working of MTI Doppler Radar.
   b) Explain in detail about the Doppler frequency shift.

(OR)

4. a) What are the antenna parameters?
   b) Describe the radiation pattern and aperture distribution of antenna.

Unit – III

5. a) Explain the historical development of satellites.
   b) State Kepler's second law of planetary motion, with reference to Geo-stationery Satellites, with necessary illustrations.

(OR)

6. a) Give an account on Look angles and orbital perturbations.
   b) Explain the Reliability and space qualification of satellite systems.

Unit – IV

7. a) Derive the general link equations of satellites.
   b) Explain C/N and G/T ratios.

(OR)

8. a) Write a note on Uplink and Downlink designs.
   b) Explain how the C/N ratio depends on the Earth Station Parameters.

Unit – V

9. a) Discuss about the time and frequency division multiple access techniques.
   b) Explain the working of transmitter and receiver of a system.

(OR)

10. a) What are the basic principles of special communication satellites?
    b) Write a brief note on GPS.

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 305 – Digital Electronics and Microprocessor Laboratory
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. This course will enable the students to learn the basic concepts and techniques and application of knowledge in digital electronic circuits and systems.
2. To acquire the basic knowledge of digital logic levels.
3. The learning objective of this course is to understand the concepts of digital circuits and systems with adequate introduction to both combinatorial and sequential logic circuits, such as, adders, comparator, decode counter, etc.
4. This course introduces the assembly language programming of 8085.
5. The course objective is to introduce the basic concepts of microprocessor and to develop in students the assembly language programming skills and real time applications of Microprocessor as well as microcontroller. It gives a practical training of interfacing the peripheral devices with microprocessor.
6. The objective of this laboratory is to understand various Modulation techniques in time domain and frequency domain to impart hands on experience and train the students to analyze various modulation techniques and understand their performance to comprehend various coding techniques on transmission medium in Digital communications.

Course Outcomes:
After studying this course, the students would gain enough knowledge

1. Have a thorough understanding of the fundamental concepts and techniques used in digital electronics.
2. Identify the various digital ICs and understand their operation.
3. Learn about comparator and decade counter.
4. The ability to identify and prevent various hazards and timing problems in a digital design.
5. Ability to identify basic requirements for a design application and propose a cost-effective solution.
6. The student will be able to design AM, FM, Mixer and analyze the modulation techniques.
7. Design interfacing circuits with 8085.
8. Practice different types of programming keeping in mind technical issues and evaluate possible causes of discrepancy in practical experimental observations in comparison.

LIST OF EXPERIMENTS

1. Adders: Half Adder, Full Adder and Parallel Adder
2. Digital Comparator (IC 7485)
3. Decade Counter (IC 7490)
4. Addition/ Subtraction of 8-bit numbers using 8085.
5. Largest number in an Array, Sum of Series of 8 – bit and Sum of two 16 – bit numbers
6. Interfacing of 8255 PPI: Generation of Square Wave and Rectangular Wave
7. Amplitude Modulation
8. Butterworth First Order Low Pass and High Pass Filters
9. Mixer

Reference Books:

1. Digital Principles and Applications - Malvino and Leach
2. Digital Fundamentals - Thomas L Floyd
3. Digital Logic and Computer Design - M. Morris Mano
4. Digital Design - M. Morris Mano
5. Advanced Microprocessors & Peripherals - A K Ray and K M Bhurchandi
6. 8051 microcontroller and embedded systems - M A Mazidi and J G Mazidi
7. An introduction to analog and digital communications – Simon Haykin
8. Modern Analog and Digital Communication Systems – B P Lathi
9. Basic *Electronics: A Text-Lab Manual* - Paul Zbar & Albert P Malvino
10. Experiments in Electronics - S V Subrahmanyam

M.Sc. Degree Examination
Physics

SYLLABUS

Third Semester

P 306 – Solid State Physics Laboratory
(Effective from the admitted batch of 2021-2022-CBCS)

Course Objectives:

1. This course will concentrate on experiments in solid state physics covering a broad range of topics representative of the field.
2. This course is an upper division lab with some focus on solid state physics.
3. This course integrates theory of Solid-State Physics with experimental demonstrations in the Research Physics Lab.
4. This course will provide a valuable theoretical introduction and an overview of the fundamental applications of the physics of solids.
5. This course includes theoretical description of crystal and electronic structure, lattice dynamics, and properties of different materials (metals, semiconductors, dielectrics, magnetic material), based on the classical and quantum physics principles.
6. However, the student is expected to master the topic of the experiment in depth and produce an experiment procedure before attempting data collection.
7. After the experiment is completed, each student will write a record that includes experimental results, and analysis and discussion of these results.
8. Several advanced experiments like X-ray diffraction, Raman Scattering, etc., will be carried out in the Research Physics Lab followed by their theoretical discussion.

Course Outcomes:

1. Student will be able to observe and analyze physical data relevant to some of the experiments in solid state physics.
2. Provide students with a thorough understanding of the basic concepts of physics and the methods scientists use to explore natural phenomena, including observation, hypothesis development, measurement and data collection, experimentation, evaluation of evidence, and employment of mathematical analysis.
3. Interpreting results through analyzing data and analysis, writing record.
4. Learning more advanced physics topics, not encountered at the introductory level.
5. Students are expected to develop a clear concept of the crystal classes and symmetries.
6. Students will be able to calculate the Braggs conditions for X-ray diffraction in crystals and will calculate the conditions for allowed and forbidden reflections in crystals.
7. Students will learn the basics of the phonons in crystals.
8. Students will become familiar with the free-electron model for metals and use the concept of Fermi energy and Fermi temperature.
9. Basic concepts of the band theory of solids will be given to Students, who will be able to predict the properties of materials and compounds.
10. Students will master their skills for oral presentations on the selected topics of the modern Solid-State Theory.

LIST OF EXPERIMENTS

1. Hall Effect: Determination of Hall coefficient and estimation of carrier concentration and its mobility
2. Coupled Oscillations**:** Study of the frequencies of normal modes of two coupled pendulums, strength of the coupling constant
3. X-ray Diffraction: Study of the X-ray diffraction and determination of lattice parameter and the number of atoms per unit cell in NaCl and KCL
4. Four –probe**:** Determination of energy gap of a semiconductor using four-probe method
5. Magneto resistance**:** Observe the magneto resistance of a semiconductor using four –probe arrangement
6. Thermo electric power**:** Calculation of Thermoelectric power and carrier concentration of a Ferrite material
7. Lattice Dynamics**:** Study of the Phonon dispersion characteristics for mono atomic lattice
8. Measurement of ultrasonic velocity in binary liquid mixtures at different temperatures using ultrasonic interferometer at a fixed frequency.

Reference Books:

1) Solid State Electronic Devices - Ben G. Streetman and Sanjay Kumar Banerjee
2) Semiconductor Physics and Devices - Donald A. Neamen and Dhrubes Biswas
3) Physics for Scientists and Engineers - Raymond A. Serway and John W. Jewett
4) Introduction to Modern Solid-State Physics - Yuri M. Galperin
5) Solid State Physics – Laboratory Manual – Lucian ION
6) Advanced Practical Physics - B.L. Worsnop & H.T. Flint

M.Sc. Physics Programme

Matrix Mapping of PO's vs CO's

(THIRD SEMSTER)

P 301: SOLID STATE PHYSICS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1			✓		
PO-2	✓				
PO-3		✓			
PO-4					
PO-5					

P 302: LASERS & FIBER OPTICS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2	✓				
PO-3			✓		
PO-4					
PO-5					✓

P 303: ELECTIVE PAPER: 1. DIGITAL ELECTRONICS AND MICROPROCESSORS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1					
PO-2		✓			
PO-3			✓		
PO-4				✓	
PO-5					✓

P 303: ELECTIVE PAPER: 2. PRINCIPLES OF ULTRASONICS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3					
PO-4				✓	
PO-5					

P 304: ELECTIVE PAPER: 1. MATERIAL SCIENCE

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2		✓			
PO-3			✓		
PO-4					
PO-5				✓	

P 304: ELECTIVE PAPER:

2. RADAR SYSTEMS AND SATELLITE COMMUNICATIONS

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1	✓				
PO-2					
PO-3		✓	✓		
PO-4				✓	
PO-5					

P 305: DIGITAL ELECTRONICS & MICROPROCESSOR LAB

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1		✓			
PO-2			✓		
PO-3					
PO-4	✓				
PO-5				✓	

P 306: SOLID STATE PHYSICS LAB

	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1			✓		
PO-2	✓				
PO-3					
PO-4		✓			
PO-5					

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

BA Economics Syllabus under CBCS

w.e.f. 2015-16 (Revised in April 2016)

Structure of Syllabus

Table-1:

Semester	*Paper*	*Title*
Semester I (Core)	I	Micro Economics – Consumer Behavior
Semester II (Core)	II	Micro Economics - Production and Price theory
Semester III (Core)	III	Macro Economics - National Income, Employment and Money
Semester IV (Core)	IV	Macro Economics - Banking and International Trade
Semester V (Core)	V	Economic Development and Indian Economy
Semester V (Core)	VI	Indian and Andhra Pradesh Economy
Semester VI *Any one Paper from A,B,C,D,E F and G	VII – (A)	Agricultural Economics
	VII – (B)	Principles of Insurance
	VII – (C)	Financial Markets and Institutions
	VII – (D)	Rural Economics And Social Change
	VII – (E)	Entrepreneurship and Small Business Development
	VII – (F)	Public Finance
	VII – (G)	International Economics
Semester VI ** Any one Cluster from A, B, C, D and E	**Cluster Electives – (A) Agribusiness**	
	VIII	A-1: Agribusiness Environment in Andhra Pradesh
		A-2: Agricultural output Marketing
		A-3: Agricultural Input Marketing.
	Cluster Electives – (B) Insurance Practice	
	VIII	B-1. Practice of General Insurance
		B-2. Agricultural Insurance
		B.-3 Health Insurance
	Cluster Electives – (C) Financial Markets	
	VIII	C-1: Stock Market operations
		C:-2 Securities Market
		C: -**3**Commodities Market
	Cluster Electives – (D) Rural Economy	
	VIII	D.-1 Rural Economy
		D. -2 Rural Industrilisation
		D.-3 Rural Marketing
	Cluster Electives –(E) Entrepreneurship	
	VIII	E.-1 Industrial Economics
		E.-**2** Labour Economics
		E.-3 Industrial Management

*Student has to choose only one paper

** Stsudents are advised to choose Cluster (A) if they have chosen VII (A) and Choose Cluster (B) if they have chosen VII (B) etc. However, it is only suggestive.

Table – 2:

Sl. No	Paper	Name of Paper	Sem	Hours/ Week	Credits	Marks Mid Sem	Marks Sem End
1	I	Micro Economics – Consumer Behavior	I	**5**	**4**	**25**	**75**
2	II	Micro Economics - Production and Price theory	II	**5**	**4**	**25**	**75**
3	III	Macro Economics - National Income, Employment and Money	III	**5**	**4**	**25**	**75**
4	IV	Banking and International Trade	IV	**5**	**4**	**25**	**75**
5	V	Economic Development and Indian Economy	V	**5**	**4**	**25**	**75**
6	VI	Indian and Andhra Pradesh Economy	V	**5**	**4**	**25**	**75**
7	VII – (A)	Agricultural Economics	VI	**5**	**4**	**25**	**75**
	VII – (B)	Principles of Insurance					
	VII – (C)	Financial Markets and Institutions					
	VII – (D)	Rural Economy and Social Change					
	VII – (E)	Entrepreneurship and Small Business Development					
	VII – (F)	Public Finance					
	VII – (G)	International Economics					
8		**Cluster Elective – A: Agribusiness**					
	VIII	A-1. Agribusiness Environment in Andhra Pradesh	VI	**5**	**4**	**25**	**75**
		A-2. Agricultural Output Marketing	VI	**5**	**4**	**25**	**75**
		A-3. Agricultural Input Marketing.	VI	5	4	25	75
		Cluster Elective – B: Insurance Practice					
	VIII	B-1. Practice of General Insurance					
		B-2. Agricultural Insurance					
		B-3. Health Insurance					
		Cluster Elective - C: Financial Markets					
	VIII	C-1. Stock Market operations					
		C-2. Securities Market					
		C-3. Commodities Market					
		Cluster Elective – D: Rural Economy					
	VIII	D-1. Rural Economy					
		D-2. Rural Industrilisation					
		D-3. Rural Marketing					
		Cluster Elective – E: Entrepreneurship					
	VIII	E-1. Industrial Economics					
		E-2. Labour Economics					
		E-3. Industrial Management					

Note: Student Activities like Data/picture analysis, Seminars, Assignments, Group Discussions, Case studies, Fieldwork, Surveys, Study Projects, Models are Part of Curriculum in all papers. The teacher shall identify appropriate activities for each unit and assign them to all the students for improving domain skills.

ANDHRA PRADESH STATE COUNCIL OF HIGHER EDUCATION

BA Economics Syllabus under CBCS

w.e.f. 2015-16 (Revised in April 2016)

I Year B. A. Programme (UG) Courses – Under CBCS

Semester – I

Paper – I (Core Paper)

Micro Economics – Consumer Behavior

Module -1

Nature, definition and scope of Economics - Wealth, Welfare, Scarcity and modern definitions.

Module -2

Methodology in Economics - Micro & Macro; Static and Dynamic analysis; Normative and positive science, Inductive & Deductive methods; Partial and general Equilibrium.

Module - 3

Utility analysis**:** - cardinal approach-The Law of diminishing Marginal utility- The Law of Equi-Marginal Utility- concept of consumer's surplus

Module - 4

Demand analysis - Law of Demand - Elasticity of Demand - Measurement of Elasticity of Demand - Price, Income & Cross Elasticities of Demand**.**

Module - 5

Ordinal Approach**:** Indifference Curve analysis - Properties of Indifference curves - Price or budget line - Equilibrium of the Consumer with the help of Indifference curves – Samuelson's Revealed preference theory.

REFERENCES:

1. R.G. Lipsey and K.A.Chrystal - "Economics", Oxford University Press, 10/e, 2004.
2. P.A.Samuelson & W.D. Nordhaus-"Economics", Tata Mc.Graw Hill, 18/e, 2005.
3. N.Gregory Mankiw-"Principles of Economics", Thompson 2015 .
4. H.L.Ahuja-"Advanced Economic Theory"' S.Chand.
5. M.L.Seth-"Micro Economics", Laxmi Narayana Agarwal, 2015.
6. Bilas, A.-"Micro Economic Theory", International Student Edition, Mc.Graw Hill, 1971.

7. Telugu Academy Publications
8. D.M. Mithani & G.K. Murty - Business Economics, Himalaya Publishing, 2015.

B. A. ECONOMICS

I Year B. A. Programme (UG) Courses – Under CBCS

Semester – II

Paper – II (Core Paper)

Micro Economics - Production and Price Theory

Module - 1

Production function-Concept of homogeneous production function-Cobb- Douglas Production function- Law of variable proportions-Law of Returns to Scale - Different Concepts of Costs – Explicit & Implicit, Opportunity, Total – fixed and Variable Costs, Marginal & Average Costs & its Relationship. Concept of Revenue – Total, Marginal & Average Revenue and Break – Even Point

Module - 2

Analyse different types of Market structures - Perfect Competition - Price determination and equilibrium of firm and industry under perfect competition - Monopoly - Price determination - Price discrimination.

Module - 3

Monopolistic competition - price determination - Oligopoly - Kinked demand curve approach.

Module - 4

Marginal Productivity theory of distribution - Theories of wage determination Subsistence theory of wages, Standard of living theory of wages, Modern theory of wages Wages and collective bargaining - concept of minimum wage.

Module - 5

Theory of Rent: Ricardian theory of rent - Quasi rent concept of Alfred Marshall. Theories of Interest - Classical, Neo-classical and Keynes Liquidity Preference theory - Profit - dynamic, innovations, Risk and Uncertainty theories.

REFERENCES:

1. R.G. Lipsey and K.A.Chrystal - "Economics", Oxford University Press, 10/e, 2004.

2. P.A.Samuelson & W.D. Nordhaus-"Economics", Tata Mc.Graw Hill, 18/e, 2005.
3. N.Gregory Mankiw-"Principles of Economics", Thompson 2015.
4. H.L.Ahuja-"Advanced Economic Theory"' S.Chand, 2004.
5. M.L.Seth-"Micro Economics", Laxmi Narayana Agarwal, 2015.
6. Bilas, A.-"Micro Economic Theory", International Student Edition, Mc.Graw Hill, 1971.
7. Telugu Academy Publications
8. D.M. Mithani & G.K. Murty - Business Economics, Himalaya Publishing, 2015.
9. Bilas, A.-"Micro Economic Theory", International Student Edition, Mc.Graw Hill, 1971.

B. A. ECONOMICS

II Year B. A. Programme (UG) Courses – Under CBCS

Semester – III

Paper – III (Core Paper)

Macro Economics - National Income, Employment and Money

Module - 1

Meaning, definition of Macro Economics - Importance of Macro Economics- Difference between Micro and Macro Economics - Paradox of Macro Economics -Limitations

Module - 2

National Income - Definitions, Concepts of National Income - Measurement of National Income- Circular flow of Income in Two, Three and Four Sector Economy.

Module - 3

Classical theory of Employment - Say's Law of Markets.

Module - 4

Keynesian Theory of Employment - Consumption function – Investment Function - Marginal Efficiency of Capital (MEC)- Concepts of multiplier and accelerator

Module - 5

Meaning and Functions of Money - Classification of money - Gresham's Law - RBI classification of Money. Theories of Money - Fisher's Quantity theory of Money Cambridge approach (Marshall, Pigou, Robertson & Keynes).

REFERENCES:

1. G.Ackley - "Macro Economics Theory and Policy", Collier Macmillan, 1978.
2. E.Shapiro - "Macro Economic Analysis", Galgotia Publications, 1999.
3. Central Statistical Organisations - "National Accounts Statistics".
4. R.Dornbush, s.Fisher and R.Startz - "Macro Economics", Tata Mc.Graw Hill, 9/e, 2004.
5. M.L.Seth-"Macro Economics", Lakshmi Narayana Agarwal, 2015.
6. K.P.M. Sundaram - "Money, banking & International Trade", Sultan Chand, 2010.
7. Dillard, D - "The Economics of John Maynard Keynes", Crossby Lockwood & Sons.
8. M.N.Mish ra & S.B.Mishra - "Insurance Principles & Practice" S.Chand 2012.
9. Bharati V.Pathak "The Indian Financial System Markets. Institutions & Services". Pearson 2008.
10. Telugu Academy Publication

B. A. ECONOMICS

II Year B. A. Programme (UG) Courses – Under CBCS

Semester – IV

Paper – IV (Core Paper)

Banking and International Trade

Module - 1

Trade Cycles - meaning and definition - Phases of a Trade Cycle -Inflation - definition - types of inflation - causes and effects of inflation measures to control inflation.

Module - 2

Banking: Meaning and definition -Functions of Commercial Banks - Concept of Credit creation-Functions of RBI - Recent developments in banking sectors.

Module – 3

Non-Bank Financial Institutions – Types of NBFIs - Factors contributing to the Growth of NBFIs —-Money market – Defects of Indian money market

Module – 4

Concepts of Shares-Debentures - Stock Market - Functions - Primary and Secondary Markets - SEBI - - Insurance - Life Insurance and General Insurance.

Module - 5

Macro Economic Policy - Fiscal, Monetary and Exchange rate policies
Objectives and Significance - Importance of International Trade - Regional and International Trade – Defining Balance of Trade and Balance of Payment.

REFERENCES:

1. G.Ackley - "Macro Economics Theory and Policy", Collier Macmillan, 1978.
2. E.Shapiro - "Macro Economic Analysis", Galgotia Publications, 1999.
3. Central Statistical Organisations - "National Accounts Statistics".
4. R.Dornbush, s.Fisher and R.Startz - "Macro Economics", Tata Mc.Graw Hill, 9/e,2004.
5. M.L.Seth-"Macro Economics", Lakshmi Narayana Agarwal, 2015.
6. K.P.M. Sundaram - "Money, banking & International Trade", Sultan Chand, 2010.
7. Dillard, D - "The Economics of John Maynard Keynes", Crossby Lockwood & Sons.
8. M.N.Mish ra & S.B.Mishra - "Insurance Principles & Practice" S.Chand 2012.
9. Bharati V.Pathak "The Indian Financial System Markets. Institutions & Services".
10. Pearson.
11. D.M.Mithani & G.K.Murty - “Business Economics", Himalaya Publishing House, 2015.
12. M.L.Jhingan - Economic Development - Vikas, 2012.
13. G.Omkarnath - Economics - A Primer for India - Orient Blackswan, 2012.
14. Agarwal, V. (2010) Macroeconomics: theory and Policy, Dorling Kindersley (India)
15. Pvt. Ltd., New Delhi
16. Ahuja, H.L. (2012) Macro Economics, Theory and policy, S. Chand and Company Ltd.,
17. New Delhi

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – V

Paper – V (Core Paper)

Economic Development and Indian Economy

Module - 1

Concept of Economic Growth - Distinction between economic growth and development - Measurement of economic development - Theories of Economic Growth: Adam Smith, Rostow, Karl Marx and Harrod & Domar Models.

Module - 2

Sustainable development - Balanced and unbalanced growth-choice of techniques Labour intensive and capital intensive methods.

Module - 3

Basic features of the Indian Economy - Natural Resources - Important Demographic features- Concept of Population Dividend - Population Policy.

Module - 4

National Income in India - trends and composition-poverty, inequalities and Unemployment - Measures taken by the Government. - MGNREGS

Module - 5

Economic reforms - liberalization, privatization and globalisation - concept of inclusive growth.

REFERENCES:

1. Dhingra, I.C - "Indian Economy", Sultan Chand, 2014.
2. Ruddar Dutt and K.P.M. Sundaram - "Indian Economy", S.Chand & Co., 2015.
3. G.M.Meier -"Leading Issues in Economic Development", Oxford University Press, New York,.
4. M.P.Todaro - "Economic Development", Longman, London 6/e, 1996.
5. Reserve Bank of India - Hand book of Statistics on Indian Economy (Latest).
6. S.K.Misra & V,K,Puri - "Indian Economy", Himalaya Publishing House, 2015.
7. R.S.Rao, V.Hanumantha Rao & N.Venu Gopal (Ed) - Fifty Years of Andhra Pradesh (1956-2006), Centre for Documentation, Research and Communications, Hyderabad, 2007.
8. G.Omkarnath - Economics - A Primer for India - Orient Blackswan, 2012.
9. Benjamin Higgins - Economic Development
10. Telugu Academy Publications.
11. Dr. Ch.S.G.K. Murthy, Indian Economy - Gitam University

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – V

Paper – VI (Core Paper)

Indian and Andhra Pradesh Economy

Module - 1

Indian Agriculture - Importance of Agriculture in India - Agrarian structure and relations- Factors determining Productivity- Agricultural Infrastructure - Rural credit - Micro Finance - Self Help Groups (SHGs) - Agricultural Price policy- concept of Crop Insurance - Food Security.

Module - 2

Structure and growth of Indian Industry - Industrial policies of 1956 & 1991 Meaning of Micro small and Medium Enterprises (MSMEs)- Problems and Prospects of small scale Industries in India.

Module - 3

Disinvestment in India - FEMA - Foreign direct investment - Services Sector in India – Reforms in Banking and Insurance -, IT, Education and Health.

Module - 4

Planning in India Economy - Objectives of Five year plans - Review of Five year Plans - Current Five year plan- NITI Aayog

Module - 5

Andhra Pradesh Economy - Population - GSDP - Sector Contribution and trends - IT – Small Scale Industry - SEZs.

REFERENCES:

1. Dhingra, I.C - "Indian Economy", Sultan Chand, 2014.
2. Ruddar Dutt and K.P.M. Sundaram - "Indian Economy", S.Chand & Co., 2015.
3. G.M.Meier - "Leading Issues in Economic Development", Oxford University Press, New York, 3/e.
4. M.P.Todaro - "Economic Development", Longman, London 6/e, 1996.
5. Reserve Bank of India - Hand book of Statistics on Indian Economy (Latest).
6. S.K.Misra & V,K,Puri - "Indian Economy", Himalaya Publishing House, 2015.
7. R.S.Rao, V.Hanumantha Rao & N.Venu Gopal (Ed) - Fifty Years of Andhra Pradesh (1956-2006), Centre for Documentation, Research and Communications,Hyderabad, 2007.
8. G.Omkarnath - Economics - A Primer for India - Orient Blackswan, 2012.
9. Telugu Academy Publications.
10. Dr.Ch.S.G.K.Murthy, Indian Economy - Gitam University.

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper – VII-(A) (Elective Paper VII-(A)

AGRICUTURAL ECONOMICS

Module-1

Nature and Scope of Agricultural Economics. Factors affecting agricultural development: technological, institutional and general. Interdependence between agriculture and industry.

Module-2

Concept of production function : input-output and product relationship in farm production.

Module-3

Growth and productivity trends in Indian agriculture with special reference to Andhra Pradesh. Agrarian reforms and their role in economic development.

Module-4

Systems of farming, farm size and productivity relationship in Indian agriculture with special reference to Andhra Pradesh- New agriculture strategy and Green revolution : and its Impact

Module-5

Emerging trends in production, processing, marketing and exports; policy controls and regulations relating to industrial sector with specific reference to agro-industries in agri-business enterprises.

RECOMMENDED / REFERENCE BOOKS

1. Sadhu An, Singh Amarjit and Singh Jasbir (2014), Fundamentals of Agricultural Economics, Himalaya Publishing House, Delhi
2. Lekhi RK and Singh Joginder, Agriculatural Economics, Kalyani Publishers
3. Bhaduri, A. (1984), The Economic Structure of Backward Agriculture, Macmillan, Delhi.
4. Bilgrami, S.A.R. (1996), Agricultural Economics, Himalayas publishing house, Delhi.
5. Dantwala, M.L. et.al (1991), Indian Agricultural Development Since Independence, Oxford & IBH, New Delhi.
6. Government of India (1976), Report of the National Commission on Agriculture, New Delhi. 5. Government of India, Economic Survey (Annual), New Delhi.
7. Gualti, A. and T. Kelly (1999), Trade Liberalisation and Indian Agriculture Oxford University Press, New Delhi

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII-(B) (Elective Paper VII(B)

Principles of Insurance

Module 1:

Risk Management: Provides an understanding of risk management – different types of risks – management of risks.

Module 2:

The Concept of Insurance and its Evolution: The basics and nature of insurance – evolution and nature of insurance – how insurance operates today.

Module 3:

Insurance Customers: Understanding insurance customers – different customer needs – importance of customers – customer mindsets.

Module 4:

The Insurance Contract: Terms of an insurance contract - disclosure of all relevant information – principle of utmost good faith – the relevance of proximate cause – the insurance contract.

Module 5:

Insurance Terminology and Development: Common terms used in insurance – terms common to both life and non – life insurance - role of insurance in economic development and social security – contribution of insurance to the society.

References :

1. General Insurance, John Magee & David Bicklhaupt.
2. Operational Transformation of General Insurance Industry during the period 1950 to 1990 & Beyond, R D Samarth.
3. Study on Distribution Functions in General Insurance & Role of Intermediaries, Arun Agarwal / P R Rao
4. General Insurance for Information Technology Professionals, Martin Frappoli.

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII(C) (Elective Paper VII(C)

Financial Markets and Institutions

Module I
Introduction to Financial Market – Types of Financial Markets – Meaning and Definitions of Stock Market, Derivative Market, Commodities Market, and Currency Market.

Module II
Stock Markets - Primary & Secondary Markets - Market Participants - Stock Exchanges - Market Index - Trading Mechanism - Broker/Sub-Brokers - Basic Accounting,

Activity: Practical Trading

Module III
Derivative Markets - Meaning & concept of Derivatives – Futures and Options - Trading Mechanism.

Activity: Practical Trading.

Module IV
Commodities Markets - Commodity Derivatives - Commodity Exchanges – Instruments - Pricing Techniques - Accounting & Taxation .

Activity: Practical Trading.

Module V
Currency Markets - Foreign Exchange Derivatives - Exchange Traded Futures - Regulatory Framework - Accounting & Taxation - Code of Conduct.

Activity: Practical Trading.

References:

1. Vasant Desai - The Indian financial system and Development-, Himalaya Publishing House.
2. Dr. S. Gurusamy - Financial Markets and Institutions-,Tata McGraw Hill.
3. Dr. Bharti Pathak - The Indian Financial System, Pearson.
4. M.Y.Khan - Indian Financial System, Mc.Graw Hill
5. C.Sudarsana Reddy - Financial Management-Principles and Practice, Himalaya Publishing House.
6. Thummuuri Siddaiah - Financial Services, Pearson.

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII(D) (Elective Paper VII(D)

RURAL ECONOMICS AND SOCIAL CHANGE

Module 1 :

Nature and scope of rural Economy, Importance of Agriculture in economic Development of India, Rural Economic problems of India; Nature of land Problems-Evolution of Policy-Land Reforms.

Module 2:

Agricultural Holdings, Fragmentation and Sub-division of Holdings, cooperative Farming-Rural Labour Problems-nature of Rural Unemployment- Employment and Wage Policy-Sources of Technological change and Green Revolution.

Module 3:

Rural Society-its Structure and Change; Village and its Social Organization-Indian Village and its types, Rural-Urban Continuum and Rural-Urban relationships.

Module 4:

Rural social Institutions-family, Property, caste, Class, Agarian structure, indebtedness and Poverty, Jajmani System, Religion, Village, Local Self Government, Panchayat Raj and Community Development Prgrommes.

Module 5:

Social Change in Rural India-Impact of Westernization, Secularization, Modernization of Indian Rural Society-Post Modernization and Globalization and Indian Villages.

References:

1. Carver, The Principles of Rural Economics.

2. Desai, A., Rural Sociology in India.

3. Dube, S.C., India’s changing villages.

4. Nanavati & Anjala, rural problems in India.

5. Ruddar Dutt & K.P.M.Sundaram, Indian Economy.

6. Sachdeva, D.A.& Vidya Bhushan, An Introduction to Sociology.

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII (E) (Elective Paper VII (E)

Entrepreneurship and Small Business Development

Module -1:

Introduction - Entrepreneurship meaning, nature and Characteristics of entrepreneurship, Barriers to entrepreneurship

Module -2:

Establishing a small enterprise: The startup process, project identification, selection of the product -selection of site/location and legal considerations

Module -3:

Small Enterprises and Enterprise Launching Formalities: Definition of Small Scale; Rationale; Objective; Scope; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection

Module -4:

Role of Support Institutions and Management of Small Business: Director of Industries; DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC.

Module -5:

Project Preparation - project formulation, Project Report Preparation; Specimen of Project Report, assessment of project feasibility, analysis's of project, Project Planning and Scheduling using Networking Techniques of PERT / CPM preparation of project report,

Reference:

1. Desai, Vasant (2003). Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi.
2. Kaulgud, Aruna (2003). Entrepreneurship Management. Vikas Publishing House, Delhi. 38
3. Cynthia, L. Greene (2004). Entrepreneurship Ideas in Action. Thomson Asia Pvt. Ltd., Singapore.

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII (F) (Elective Paper VII (F)

Public Finance

Module - 1

Meaning and scope of Public Finance - Distinction between Public and Private Finance. Principle of maximum social advantage

Module – 2

Source of Public Revenue - Taxes - administrative revenues - commercial Revenues - Gift and grants - Concept of VAT. Canons of taxation (Adam Smith's and Modern Economists).

Module

Meaning and classification of public expenditure - principles of public Expenditure Wagner's Law - Peacock - Wiseman Hypothesis.

Module - 4

Public debt - classification of public debt - methods of debt redemption

Module - 5

Budget - Meaning and Definition - Components of Budget - Concepts of Budget Deficits - Indian Union Budget.

References:

1. B.P.Tyagi - "Public Finance", Jai Prakash Nath, 2012.
2. H.D.Bhatia - "Public Finance"' Vikas Publishing House 2013.
3. Reserve Bank of India - Hand book of Statistics on Indian Economy (Latest).
4. S.K.Misra & V,K,Puri - "Indian Economy", Himalaya Publishing House, 2015.
5. Budget at a Glance
6. Economic and Functional Classification of the Budget
7. Telugu Academy Publications.

III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VII (G) (Elective Paper VII (G)

INTERNATIONAL ECONOMICS

Module – 1
Meaning and importance of International Trade - Inter - Regional and International Trade.

Module – 2
Theories of International Trade - theory of absolute advantage - theory of comparative cost and Hecksher - Ohlin theory.

Module – 3
International Trade and Economic growth - Terms of trade - Gross Barter and Net Barter and Income terms of trade.

Module - 4
Tariffs - meanings and definition - Types of tariffs - Concept of optimum tariff Balance of payments - Causes for disequilibrium in balance of payments.

Module - 5
India's Foreign Trade - composition and direction. Recent EXIM policy - changing role IMF, IBRD & WTO. Concept of outsourcing.

References:

1. B.O.Soderston - "International Economics", Macmillan, 1995.
2. C.P.Kindle Berger - "International Economics".
3. 3. J.Bhagawathi - "International Trade - Selected Readings", Cambridg University Press.
4. 4. D.M.Mithani & G.K.Murty - "Business Economics", Himalaya Publishing House, 2015.
5. Salvatore Dominick (2005) International Economics, John Wiley & Sons, Inc
6. Mithani D.M (2003) International Economics, Himalaya Publishing House, Mumbai
7. Mannur H.G (2003) International Economics Vikas publishing House Pvt Ltd, New Delhi
8. Telugu Academy Publications.

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI

Paper – VIII-A; Cluster Elective–A: Agribusiness

Paper VIII-A-1: Agribusiness Environment in Andhra Pradesh

Module-1

Role of agriculture in development process in Andhra Pradesh vis-à-vis other developed states. Economy wide effects of agriculture in Andhra pradesh through trickle down effects. Backward and forward linkages of agriculture with rest of economy.

Module-2

Agricultural finance-importance in modern agriculture- performance of agricultural finance in Andhra Pradesh -problems of agricultural finance – Inter linkages of agricultural credit and other input markets and product markets.

Module-3

Dynamics of agriculture-crop (horticulture, field crops), sector-livestock (poultry dairy and fisheries) sector and inter linkages among the sectors. Agribusiness sector in Andhra Pradesh-salient futures, constraints, sub sectors of agribusiness-input sector, production sector, processing sector.

Module-4

Growth performance of major agricultural commodities in Andhra Pradesh-production and processing trends in exports and imports of major agricultural commodities.

Module-5

Marketing policy- structure of agri markets – regulated markets – need – activities – structure – APMC act – market legislations – Role of Farmer Groups in the marketing of Agricultural Produce.

References:

1. Adhikary M. 1986. Economic Environment of Business. S. Chand & Sons.
2. Aswathappa K. 1997. Essentials of Business Environment. Himalaya Publ.
3. Francis Cherunilam 2003. Business Environment. Himalaya Publ.
4. Agarwal Raj, 2001, Business Environment, Excel Books, New Delhi.

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper – VIII-A; Cluster Elective – A: Agribusiness

Paper VIII-A-2: Agricultural Output Marketing

Module-1

Structure and Model of Agri-Marketing Organizations with functions: Functions of intermediaries, Marketing Practices in Primary and secondary and terminal market, Regulated markets, co-operative marketing.

Module-2

Marketing costs and margins, Marketing Finance. Marketing Structure of Major agricultural commodities, food grains: Rice, and Maize. Cash Crops; Cotton, Oil Seeds, Vegetables and Fruits, Milk, Meat and Poultry products.

Module-3:

Problems and Challenges in Agriculture Marketing - Market Yards - Support prices - Rural Warehousing.

Module-4:

State Intervention in Agricultural Marketing, Role of Various agencies (Andhra Pradesh Agro, MARKEED, State Department, and FCI, Tobacco Board, Cotton Corporation) and its impact on market efficiency. Agriculture Price Commission.

Module-5:

Inter-regional and international trade in agriculture; emerging scenario of international trade in agricultural commodities; concept of terms of trade and balance of payments,. WTO and Indian agriculture with special reference to Andhra Pradesh .

References:

1. C.S.G.Krishnamacharyulu & Lalitha Ramakrishnan, "Rural Marketing: Text and Cases", Pearson Education, New Delhi.
2. Awadhesh Kumar Singh & Satyaprakash Pandey, Rural Marketing: Indian Perspective, New Age International Publishers, New Delhi.
3. Mamoria, C.B. & Badri Vishal: Agriculture Problems in India
4. Arora, R.C., "Integrated Rural Development", S. Chand Limited, New Delhi.
5. Gopalaswamy, T.P., "Rural Marketing: Environment, Problems and Strategies, Vikas Publishing House Pvt. Ltd., New Delhi.
6. Bedi & Bedi, "Rural Marketing", Himalaya Publishing House, New Delhi.

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper – VIII-A; Cluster Elective –A: Agribusiness

Paper VIII-A-3: Agricultural Input Marketing

Module-1
Agri input marketing – Meaning and importance – distinctive features of Agri. Input marketing – Distribution channels of agri. Inputs – Private, Government, Co-operative and Joint sector. Agri inputs promotional programme – concepts and techniques.

Module-2
.
Issues in seed marketing – determinants of seed demand – private sector contribution – public sector support to private sector - Distinctive features of Seed Marketing vis – a – vis other Input Marketing – strengths and weaknesses on Indian seed industry.

Module-3
Fertilizer industry scenario – public, private, co-operative and joint sector role – fertilizer production consumption, and imports – fertilizer marketing characteristics. Biofertilizers – its role and scope – major constraints involved – production level – market level – field level. Marketing network/ channels.

Module-4
Pesticide industry – an overview – nature of industry growth – consumption crop wise, area wise – demand and supply – market segmentation.-IPM concept development – biopesticides – its role and scope.

Module-5
Agricultural mechanization – benefits and importance and future priorities – scenario of farm implements and machinery sector – economic advantage of mechanization – contribution of agricultural mechanization – Need for the development of agricultural machinery and implements to suit the local resource endowments.

References:

1. Acharya SS & Agarwal NL 2004, Agricultural Marketing in India – Oxford & IBH.
2. Sharma Premjit 2008, Marketing of Seeds – gene Tech Books, New Delhi.
3. Marketing of the Agri. Inputs – IIMA publications.
4. State of the Indian Farmer - Input Management, Ministry of Agriculture, GOI, Academic Foundation, New Delhi-2004

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI
Paper – VIII-B; Cluster Elective–B: Insurance Practice

Paper VIII-B-1: PRACTICE OF GENERAL INSURANCE

Module 1:
***Introduction to General Insurance*: Introduction of Indian Insurance Market – Structure, Classification, Salient features of Indian general insurance market.

Module 2:
Policy Documents and forms: Insurance contract & elements – Components of an insurance policy - Interpretation of policies – Contents of insurance proposal form - Certificate of Insurance – Claim forms

Module 3:
Fire, Motor Liability and Personal Accident Insurance: *Fire* insurance Coverage – Exclusions – Conditions of fire insurance policy – Coverage under special polices - Motor insurance policy – Important documents – Types of policies – Liability – Motor claims & procedures - - Personal Accident insurance.

Module 4:
General insurance Products – Part 3 (Engineering & other Insurances): Classes of Engineering insurance - Burglary insurance – Baggage insurance – Fidelity Guarantee insurance – Jeweller's Block insurance – Crime insurance.

Module 5:
Claims: Preliminary procedure – Loss minimization – Procedure – Process of claim management – Arbitration - Modes of settlement – Recoveries - Identifying claim

References:

1. General Insurance, John Magee & David Bicklhaupt
2. Operational Transformation of General Insurance Industry during the period 1950 to 1990 & Beyond, R.D.Samarth
3. Study on Distribution Functions in General Insurance & Role of Intermediaries, ArunAgarwal / P R Rao
4. General Insurance for Information Technology Professionals, Martin Frappoli.

Semester – VI

Paper – VIII-B - Cluster Elective –B: Insurance Practice

Paper VIII-B-2: AGRICULTURAL INSURANCE

Module 1:

Risks in Agriculture: Agricultural Risks – Changing face of Agricultural Risks in India – Climate Change and Agriculture – Managing Agricultural Risks.

Module 2:

Evolution of Crop Insurance in India: Individual based crop insurance – Pilot Crop Insurance Scheme (PCIS) – Comprehensive Crop Insurance Scheme (CCIS) – Experimental Crop Insurance Scheme (ECIS) – National Agricultural Insurance Scheme (NAIS) – Farm Income Insurance Scheme (FIIS) – Types of Agricultural Insurance –Formation of Agriculture Insurance Co of India Ltd.

Module 3:

Module 4:

Crop Insurance - Yield Index based Underwriting and Claims: National Agricultural Insurance Scheme (NAIS) – Components – Nature, Coverage and Integrity – Underwriting – Claims – Yield Data – Yield Estimation Methodology – Actuarial premium rating – Proposed modifications in NAIS.

Module 5:

Weather Based Crop Insurance Model: Comparison between Area Yield and Weather based Crop insurance – Weather Insurance components – Weather data and Indexes – Product Design – Underwriting and Claims considerations – Understanding Crop Insurance Models.

Reference Books

1. Mayet, P - Agricultural Insurance, Forgotten Books,
2. Ray, P. K. – Agricultural Insurance (Theory and Pratice and Applications to Developing Countries), Elsevier,B.A.
3. Poonam Patwardhan, Bhise Vinayak, Narwade Sunil – An Evaluation of National Agricultural Insurance Scheme in Inida, Lambert
4. Raju S S and Ramesh Chand – Agricultural Risk and Insurance in Inida - Problems and Prospects, Academic Foundation

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper – VIII-B; Cluster Elective-B: Insurance Practice

Paper VIII-B-3: HEALTH INSURANCE

Module 1:

Introduction to Health Insurance: What & Why of Health insurance – Evolution and growth of Health insurance in India – Understanding the Health System in India – Constitutional provisions in areas of Public

Module 2:

Health Insurance Products in India: Types of Health Insurance Products in India – Hospitalization Indemnity product – Personal Accident products – Critical Illness product – Daily Hospital Cash benefit – Disease management covers – Outpatient covers

Module 3:

Health Insurance policy forms and clauses: Health insurance contracts – Insurance contracts VS other contracts – Proposal forms used in health insurance – Comparison of proposal forms & questionnaires of health insurance with Personal Accident insurance, Life insurance & Group Insurance…

Module 4:

Regulatory and legal aspects of health insurance: Principles and practice of health insurance regulations – Need for regulations in health insurance – Various kinds of risks in health insurance –

Module 5:

Customer service in health insurance: Consumer protection & policy –holder's protection – Claim servicing – types of cashless claims – Grievance redressal– survey on grievance redressal.

Reference:

1. American Health Insurance Plans , Health Insurance Primer : Study guide Part A-- American Health Insurance Plans , Washington DC.

2. American Health Insurance Plans / Place, Health Insurance nuts and bolts : Study guide part B, American Health Insurance Plans

3. Davis . W. Gregg , Life and health insurance handbook , O.D. Dickerson , Health Insurance

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

VIII-C; Cluster Elective –C: Financial Markets

Paper VIII-C-1: STOCK MARKET OPERATIONS

Module – 1:
Meaning, Nature and Functions of Primary Market - Role of Primary Market– Methods of floatation of capital – Problems of New Issues Market –SEBI measures for primary market.

Module – 2:
Meaning, Nature, Functions of Secondary Market - Organisation and Regulatory framework for stock exchanges in India – Defects in working of Indian stock exchanges.

Module – 3:
Listing of Securities : Meaning – Merits and Demerits – Listing requirements, procedure, fee – Listing of rights issue, bonus issue, further issue – Listing conditions of BSE and NSE.

Module – 4:
Indian Stock Exchanges: BSE – Different trading systems – Share groups on BSE – BOLT System – Different types of settlements – Pay-in and Pay-out – Bad Delivery – Short delivery – Auction – NSE– Market segments.

Module - 5
Market types, Order types and books – De-mat settlement – Physical settlement – Institutional segment – Funds settlement – Valuation debit – Valuation price – Bad and short delivery – Auction.

Suggested Readings:
1.Punithavathy Pandian, Security Analysis and Portfolio Management Vikas Publishing House Pvt. Ltd.

2.V. A. Avadhani, Investment and Securities Market in India, Himalaya Publishing House.

3.Prasanna Chandra, Security Analysis and Portfolio Management, Tata McGraw-Hill.

4.Sanjeev Agarwal, A Guide to Indian Capital Market, Bharat Publishers

5. Ravi Puliani and Mahesh Puliani, Manual of SEBI, Bharat Publicatio

Semester – VI

VIII-C: Cluster Elective –C: Financial Markets

Paper VIII-C-2: Securities Market

Module 1

Securities Market in India - An Overview - Securities market and financial system - Products, participants and functions;

Module 2

Primary Market - Book building - Credit rating; Merchant banking; On-line IPOs; DEMAT issues; Private placement; Virtual debt portals; DRs/GDRs; Other regulations; Public issues;

Module 3

Secondary Market –Membership – Listing - Trading and settlement mechanism; Technology; Trading rules - Insider Trading; Unfair trade practices; Takeovers; Buyback.

Module 4

Government Securities Market Indian debt market; Primary market; Secondary market-NDS; NDS-OM; CCIL; Wholesale debt market (WDM) segment of NSE.

Module 5

Derivatives Market Products, Participants and functions; Trading mechanism; Membership; Contract specification; Clearing & Settlement.

References:

1. Sketch of Stock Market in India with Ref. of BSE 1961
2. Kar, Pratip., Capital Market in 1989 (Securities and Exchange Board of India)
3. Smith, B. Mark., A History Of Global Stock Market (Farrar, Straus And Giroux, Chicago, 2003).
4. Armstrong, F.E., The book of the stock exchange (Pitman Publishing Corporation, London)

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

VIII-C - Cluster Elective –C: Financial Markets

Paper VIII-C-3: Commodities Market

Module 1

Introduction to Derivatives – Types – Products and functions – Exchange – trades versus OTC derivatives.

Module 2

Application of features : Types of instruments (future, options) - Basics and Payoffs; Pricing commodity derivatives – Hedging, Speculation and Arbitrage.

Mould 3

Commodity Derivatives – Difference between Commodity and financial derivatives – Global and Indian commodities exchanges – Evaluation of commodity market in India

Module 4

NCDEX Platform: Structure of NCDEX: Exchange membership; Capital requirements – Commodities traded on NCDEX platform – Instruments available for trading.

Module 5

Regulatory Framework and Taxation: Rules governing commodity derivative exchanges – investor grievance and arbitration – Implications of Sales Tax.

Reference Books:

1. Cirvante, V.R., The Indian Capital Market (Geoffrey Cumberlege Oxford University Press, Bombay, 1956).
2. Salvi, P. G., Commodity Exchange (1947).
3. Markham, Jerry W. (1987). The History of Commodity Futures Trading and Its Regulation. Praeger. p. 305.
4. Niti Nandini : Commodity Markets, Tata McGraw Hill Education Private Limited, 7 West Chatnani Patel Nagar, New Delhi-110008 7.
5. Bharat Kulkarni : Commodity Markets and Derivatives, Excel Books, A-45, Naraina, Phase I, New Delhi-1100028

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III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

VIII-D - Cluster Elective –D: Rural Economy

Paper VIII-D-1: ***Rural Economy***

Module-I
Concept and Nature of Rural Economy; characteristic of rural Economy; Factors affecting rural Economy.

Module- II
Basic Needs of Rural Economy; Housing; Health, education, Training, drinking water supply; Electricity, sanitation, rural Roads, transport and communation, rural statilisation, Utilization of Local Human & Natural Resources.

Module- III:
The Role of Rural Technology – need & important of rural Technology, appropriate rural Technology, Technology for Rural Women, difficulties in adoption of rural technology.

Module-IV
Rural roads and Rural Transport system (Bus, Railways):- Importance of rural roads and transportation problems, various schemes of rural road development. Rural Health and sanitation:- Need of rural health and sanitation, problems, remedies. Rural Electrification:- Sources of energy/ power, progress, problems, policy.

Module– V
Need, sources of rural communication, government policies. Rural Education:- Overview of the education system in India; need, solutions, future agenda. Training and Rural Development:- Meaning of training, types of training, need of rural development training, national training policy.

Reference Books:

Chaudhari, C.M. **Rural Economics**, Jaipur: Subline Publication, 2009

1. Datt, Rudra & Sundharam Indian Economy New Delhi: S. Chand, 2008.

2. Deogirikar, A. B. W.T.O and Indian Economy, Jaipur: ShriNiwas Publications, 2004

4) Acharya,S.S.& **Agricultural Marketing in India** N.L.Agarwal New Delhi: Oxford & IBH ltd.,2004.

5) Khanna,Sulbha & **Rural Development Strategies and Planning** Upna Diwan New Delhi: Sonali Publications, 2003.

6) Prasad, B.K. **Rural Development Concept Approach and Strategy** New Delhi: Sarup and Sons, 2003.

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III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

VIII-D: Cluster Elective –D: Rural Economy

Paper VIII-D-2: ***Rural Industrialization***

Module– I:

Rural Industrilisation :- Need, rural Infrastructure and industrialization, progress and problem of rural industrialization in Andhra Pradesh Rural Approach. Potential areas for rural self-employment with special reference to agro industries. The role of co-operation in Rural Industrialization

Module–II:

The policies & programmes for rural industrial development during planning era.. Important progrmmes for Industrial development of rural areas, micro, small and medium industries in Andhra Pradesh.

Module–III

Rural Environment & Resources - Rural Environment in Andhra Pradesh(water, soil) :-Causes, effect, status of rural environment, rejuvenating rural environment. Rural Human Resources Utilization Programmes.

Module - IV

Industrial Development - Large and Small scale industries Andhra Pradesh - Agro-base Industries-Agro-processing industries:- Importance, problems, solutions. Rural technology:- Need, effect, advantages.

Module - V:

Rural Employment - Rural employment in Andhra Pradesh, characteristics of rural employment -Incidence and type of Unemployment in rural area. Need based education and training for rural youth -Development of Entrepreneurship abilities among rural students

Reference Books:

1. Desai, Vasant**. Rural Development in India.**
New Delhi: Himalaya, 2005.
2. IGNOU. **Rural Development: Indian Context.**
New Delhi: IGNOU, 2005.
3. Narwani, G. S. **Training for Rural Development**,
New Delhi: Rawat Publications, 2002.
4. Rao K. Hanumantha Rural Development Statics – 2007-08, National Institute of Rural Development Ministry of R. D., Govt. of India, Rajendra Nagar, Hyderabad – 30 July, 2008

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III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper VIII-D: Cluster Elective –D: Rural Economy

Paper VIII-D-3: *Rural Marketing*

Module– I

Meaning, concept, definitions, objects, need of Rural Marketing, classification, Structure of Rural Marketing.

Module– II

Marketing Functions:- Meaning, classifications- Packaging, transport, grading, storage and warehousing, buying and selling. Demand and supply meaning, factors affecting demand and supply for farm products.

Module–III

Government intervention and role in rural marketing, characteristics of traditional marketing system. Directorate of Marketing and Inspection. Regulation of Agricultural Marketing:- Definition, objectives, history of Market regulation, progress, quality control, Government Sponsored National Organizations and their role.

Module– IV

Co-operative Marketing:- Meaning, function, history types, structure, membership, source of finance. NAFED :- Objectives, activities, other National co-operative organizations- National co-operative Development corporation (NCDC), Tribal co-operative marketing federation (TRIFED) state level co-operative marketing organization.

Module– V

.Data sources in Agricultural Marketing:- Coverages, Agencies, publications of market statistics. Dissemination of Market statistics, new emerging problems in Agricultural marketing in Andhra Pradesh

1. Acharya, S.S. **Agriculture Marketing in India**, New Delhi : Ford, IBH Publishing Co. Ltd., 2004
2. Chaudhari, C.M. **Rural Economics**, Jaipur: Subline Publication, 2009
3. Desai, Vasant **Rural Development in India,** New Delhi: Himalaya Publication House, 2005
4. Desai, Vasant **Fundamentals of Rural Development**, New Delhi: Rawat Publications, 1991
5. Narwani, G.S. **Training for Rural Development,** New Delhi: Rawat Publications, 2002

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III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

VIII-E; Cluster Elective –E: Entrepreneurship

Paper VIII-E-1: Industrial Economics

Module-1

Industry and economic development industry and sectoral linkages – industrial classification and data information.

Module-2

Public, private joint and co-operative sectors - private corporate sector- MNCs and their role.

Module-3

Industrial productivity - concept - measurement - productivity in Indian industries - industrial sickness - underutilization of capacity - factors accounting for it and its consequences.

Module - 4

Globalization and Indian industry - privatization and issues relating to disinvestment policy.

Module-5

Industrial development in India - industrial policy - Role of the Central and State - Industrial policy and economic reforms - Industrial growth and pattern.

BOOKS FOR REFERENCE:

1. Dhingra, I.c. Indian Industrial Economy

2. Gadgil, P.G. Indian Economy

3. Kuchhal, S.C. Industrial Economy of India

4. Sharma, N.K. Industrial Economics

B. A. ECONOMICS
III Year B. A. Programme (UG) Courses – Under CBCS
Semester – VI

VIII-E: Cluster Elective –E: Entrepreneurship

Paper VIII-E-2: Labour Economics

Module 1:

Introduction - Labour Economics – Concept and definition – Nature, Scope and Importance – Labour as a unique factor of production

Module 2:

Labour Market - Concept of labour Market and its features –Determinants of the supply and the demand for labour – Organized and unorganized labour

Module 3:

Wages - Wage Concept and Definitions – Wage and development – Collecting bargaining – Wage differentials – Wage Ploicy - Objectives and importance

Module 4:

Labour Productivity, State and labour - Concept of Labour Productivity – Measurement and Importance of Labour productivity – Determinants – Causes for Low Labour Productivity and Measures to Increase Labour Productivity – Technology and Labour Productivity

Module 5:

State and labour – Need for State intervention in Labour matters – methods of intervention – Labour Social Security and Labour Welfare Measures – Labour Ploicy, Objectives and Importance – Emerging perception on state intervention.

Reference:

1. Bhagoliwal T.N (2000), Economics of Labour and Industrial relations. Sahitya Bhavan, Agra.

2. McConnel C.R. and S.L. Brue (2002), Contemporary Labour Economics, McGraw Hill, NeYork.

3. Mittal and Sanjay Prakash Sharma (2000), labour Economics, RSBA Jaipur

B. A. ECONOMICS

III Year B. A. Programme (UG) Courses – Under CBCS

Semester – VI

Paper VIII-E: Cluster Elective–E: Entrepreneurship

Paper VIII-E-3: INDUSTRIAL MANAGEMENT

Module – 1

Basics of Management Introduction, Definition of management, characteristics of management, functions of management - Planning, Organising, Staffing, Directing, Co-ordination, Controlling, Motivating, Communication, Decision Making - Administration and management, Nature of management, levels of management, managerial skills, managerial roles,

Module - 2

Forms of Organization- Line , Line –staff etc. Forms of ownerships – Partnership, Proprietorship, Joint stock, Co-operative society, Govt. Sector etc, concept of Globalisation

Module – 3

Strategic Management– Evolution - Concept and Characteristics of strategic management – Defining strategy –Strategic Management Process.

Module – 4

Quality Management Definition of quality, goalpost view of quality, continuous improvement definition of quality, types of quality – quality of design, conformance and performance, phases of quality management, - The ISO 9001:2000 Quality Management System Standard

Module – 5

Financial & Project Management -Capital Structure, Fixed & working capital -Introduction to capital budgeting, - Break even analysis - assumptions, importance - Cost-Benefit analysis.

Reference Books :

1. L.C.Jhamb , Savitri Jhamb , Industrial Management – I , Everest Publishing House .
2. Dinesh Seth and Subhash C. Rastogi, “Global Management Solutions”, Cengage Learning, Second Edition, USA.
3. B. Davis and Margrethe H. Olson, "Management Information Systems", Mc-Graw-Hill International Editions.
4. Azar Kazmi , “Strategic Management & Business Policy “, Tata McGraw Hill, New Delhi
5. Kenneth C. Laudon and Jane P. Laudon, “"Management Information Systems", Eighth Edition, Pearson Education
6. K.Shridhara Bhat, “Materials and Logistics Management”, Himalaya Publishing House, Mumbai
7. M.Y. Khan and P. K. Jain, “Financial Management”, Tata McGraw Hill, New Delhi
8. Ravi M. Kishore, “Project Management”, Tata McGraw Hill, New Delhi