



**KARNATAK UNIVERSITY, DHARWAD
ACADEMIC (S&T) SECTION**

**ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಧಾರವಾಡ
ವಿದ್ಯಾಮಂಡಳ (ಎಸ್&ಟಿ) ವಿಭಾಗ**



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'A' Grade 2014

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No. KU/Aca(S&T)/JS/MGJ(Gen)/2023-24/ 59

Date: 04/09/2023

ಅಧಿಸೂಚನೆ

ವಿಷಯ: 2023-24ನೇ ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಎಲ್ಲ ಸ್ನಾತಕ ಪದವಿಗಳಿಗೆ 5 ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್
NEP-2020 ಪಠ್ಯಕ್ರಮವನ್ನು ಅಳವಡಿಸಿರುವ ಕುರಿತು.

- ಉಲ್ಲೇಖ: 1. ಸರ್ಕಾರದ ಅಧೀನ ಕಾರ್ಯದರ್ಶಿಗಳು(ವಿಶ್ವವಿದ್ಯಾಲಯ 1) ಉನ್ನತ ಶಿಕ್ಷಣ ಇಲಾಖೆ ಇವರ
ಆದೇಶ ಸಂಖ್ಯೆ: ಇಡಿ 104 ಯುಎನ್ಇ 2023, ದಿ: 20.07.2023.
2. ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ನಿರ್ಣಯ ಸಂಖ್ಯೆ: 2 ರಿಂದ 7, ದಿ: 31.08.2023.
3. ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶ ದಿನಾಂಕ: 04/09/2023

ಮೇಲ್ಕಾಣಿಸಿದ ವಿಷಯ ಹಾಗೂ ಉಲ್ಲೇಖಗಳನ್ವಯ ಮಾನ್ಯ ಕುಲಪತಿಗಳ ಆದೇಶದ ಮೇರೆಗೆ, 2023-24ನೇ
ಶೈಕ್ಷಣಿಕ ಸಾಲಿನಿಂದ ಅನ್ವಯವಾಗುವಂತೆ, ಎಲ್ಲ B.A./ BPA (Music) /BVA / BTM / BSW/ B.Sc./B.Sc. Pulp &
Paper Science/ B.Sc. (H.M)/ BCA/ B.A.S.L.P./ B.Com/ B.Com (CS) / BBA & BA ILRD ಸ್ನಾತಕ ಪದವಿಗಳ 5
ಮತ್ತು 6ನೇ ಸೆಮೆಸ್ಟರ್‌ಗಳಿಗೆ NEP-2020ರ ಮುಂದುವರೆದ ಭಾಗವಾಗಿ ವಿದ್ಯಾವಿಷಯಕ ಪರಿಷತ್ ಸಭೆಯ ಅನುಮೋದಿತ
ಕೋರ್ಸಿನ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ www.kud.ac.in ದಲ್ಲಿ ಭಿತ್ತರಿಸಲಾಗಿದೆ. ಸದರ ಪಠ್ಯಕ್ರಮಗಳನ್ನು ಕ.ವಿ.ವಿ.
ಅಂತರ್ಜಾಲದಿಂದ ಡೌನ್‌ಲೋಡ್ ಮಾಡಿಕೊಳ್ಳಲು ಸೂಚಿಸುತ್ತ ವಿದ್ಯಾರ್ಥಿಗಳ ಹಾಗೂ ಸಂಬಂಧಿಸಿದ ಎಲ್ಲ ಬೋಧಕರ ಗಮನಕ್ಕೆ
ತಂದು ಅದರಂತೆ ಕಾರ್ಯಪ್ರವೃತ್ತರಾಗಲು ಕವಿವಿ ಅಧೀನದ/ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ
ಸೂಚಿಸಲಾಗಿದೆ.

ಅಡಕ: ಮೇಲಿನಂತೆ

(Signature)
ಕುಲಸಚಿವರು.

ಗೆ,

ಕರ್ನಾಟಕ ವಿಶ್ವವಿದ್ಯಾಲಯದ ವ್ಯಾಪ್ತಿಯಲ್ಲಿ ಬರುವ ಎಲ್ಲ ಅಧೀನ ಹಾಗೂ ಸಂಲಗ್ನ ಮಹಾವಿದ್ಯಾಲಯಗಳ
ಪ್ರಾಚಾರ್ಯರುಗಳಿಗೆ. (ಕ.ವಿ.ವಿ. ಅಂತರ್ಜಾಲ ಹಾಗೂ ಮಿಂಚಂಚೆ ಮೂಲಕ ಬಿತ್ತರಿಸಲಾಗುವುದು)

ಪ್ರತಿ:

1. ಕುಲಪತಿಗಳ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
2. ಕುಲಸಚಿವರ ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
3. ಕುಲಸಚಿವರು (ಮೌಲ್ಯಮಾಪನ) ಆಪ್ತ ಕಾರ್ಯದರ್ಶಿಗಳು, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
4. ಅಧೀಕ್ಷಕರು, ಪ್ರಶ್ನೆ ಪತ್ರಿಕೆ / ಗೌಪ್ಯ / ಜಿ.ಎ.ಡಿ. / ವಿದ್ಯಾಮಂಡಳ (ಪಿ.ಜಿ.ಪಿ.ಎಚ್.ಡಿ) ವಿಭಾಗ, ಸಂಬಂಧಿಸಿದ
ಕೋರ್ಸುಗಳ ವಿಭಾಗಗಳು ಪರೀಕ್ಷಾ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.
5. ನಿರ್ದೇಶಕರು, ಕಾಲೇಜು ಅಭಿವೃದ್ಧಿ / ವಿದ್ಯಾರ್ಥಿ ಕಲ್ಯಾಣ ವಿಭಾಗ, ಕ.ವಿ.ವಿ. ಧಾರವಾಡ.



Karnatak University, Dharwad
B. Sc Programme

B. Sc in Biochemistry

Syllabus
With Effect From (w. e. f) 2023-24

DISCIPLINE SPECIFIC CORE COURSE
(DSCC) FOR SEM V and VI

SKILL ENHANCEMENT COURSE (SEC)
FOR V SEM

AS PER NEP-2020

Karnatak University, Dharwad
B.Sc. in Biochemistry
Effective from 2023-24

| Sem. | Type of Course | Theory/ Practical | Course Code | CourseTitle | Instructi on hour/ week | Total hours / sem | Duration of Exam | Marks | | | Credits |
|------|----------------|----------------------|-------------|--------------------------------|-------------------------------|-------------------------|------------------------|---------------|---------------|-------|-----------|
| | | | | | | | | Formati ve | Summa tive | Total | |
| V | DSCC-9 | Theory | 035 CHE 011 | Biochemistry of Macromolecules | 04hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | DSCC-10 | Practical | 035 CHE 012 | Biochemistry of Macromolecules | 04 hrs | 56 | 03 hrs | 25 | 25 | 50 | 02 |
| | DSCC-11 | Theory | 035 CHE 013 | Human Physiology | 04hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | DSCC-12 | Practical | 035 CHE 014 | Human Physiology | 04 hrs | 56 | 03 hrs | 25 | 25 | 50 | 02 |
| | Other subject | | | | | | | | | | 04 |
| | Other subject | | | | | | | | | | 04 |
| | SEC-3 | Practical | 035 CHE 061 | MOLECULAR BIOLOGY | 04hrs | 56 | 03 hrs | 25 | 25 | 50 | 02 |
| | Total | | | | | | | | | | 26 |
| VI | DSCC-14 | Theory | 035 CHE 011 | ENZYMOMOLOGY | 04hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | DSCC-15 | Practical | 035 CHE 012 | ENZYMOMOLOGY | 04 hrs | 56 | 03 hrs | 25 | 25 | 50 | 02 |
| | DSCC-16 | Theory | 035 CHE 013 | Bioenergetics And Metabolism | 04hrs | 56 | 02 hrs | 40 | 60 | 100 | 04 |
| | DSCC-17 | Practical | 035 CHE 014 | Bioenergetics And Metabolism | 04 hrs | 56 | 03 hrs | 25 | 25 | 50 | 02 |
| | Other subject | | | | | | | | | | 04 |
| | Other subject | | | | | | | | | | 04 |
| | Internship-1 | | 035 CHE 091 | Internship | | | | 50 | 0 | 50 | 02 |
| | Total | | | | | | | | | | 26 |

B. Sc SEMESTER V
Discipline Specific Course (DSC)-9

B.Sc. Biochemistry

Course Title: Biochemistry of Macromolecules (Theory)

B. Sc: Course Code: 035 CHE 011

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-9 | Theory | 04 | 04 | 56 hrs. | 2 hrs. | 40 | 60 | 100 |

Course Outcomes (COs): At the end of the course the student should be able to:

- CO1** The course provides fundamental insights on the types of macromolecules; and unique structural features, chemical properties and biological importance.
- CO2** These topics will enable the students to understand in detail about Carbohydrates, and their classification, properties and also about Glycosaminoglycans
- CO3** These topics will enable the students to understand in Lipids, Acylglycerols, Phosphoglycerides, Sphingolipid, Plasma lipoproteins
- CO4** These topics will enable the students to understand in Amino acids, Peptides, Proteins and Nucleic acids

| Unit, | Title | 56.hrs/ |
|----------|---|---------------|
| 1 | <p>Carbohydrates Definition, empirical formulae, classification, biological importance. Monosaccharides: Configuration relationship of D-aldoses, D-ketoses. General properties of aldoses and ketoses. Oxidation, reduction, reducing property, formation of glycosides, acylation, methylation, condensation – phenyl hydrazine, addition – HCN. Interconversion of aldoses and ketoses by chemical method. Ascending and descending series by chemical methods. Stereochemistry of monosaccharides, (+) and (-), D and L, epimers, anomers, and diastereoisomers. Elucidation of open chain structure and ring structure of glucose. Conformation of glucose (only structures), mutarotation. Structure of galactose, mannose, ribose and fructose. Structure and biological importance of deoxy sugars and sugar acids. Disaccharides: Establishment of structures of Sucrose and Lactose, Biological Importance and structure of Isomaltose, Trehalose and Maltose. Polysaccharides: Partial structure, occurrence and importance of Starch, Glycogen, Inulin, Cellulose, Chitin, and Pectin. Glycosaminoglycans: Structure of amino sugars, neuraminic and muramic acid. Occurrence, importance and the structure of the repeating units of heparin, hyaluronic acid, teichoic acid and chondroitin sulphate. Bacterial cell wall polysaccharide, peptidoglycans.</p> | 14 Hrs |
| 2 | <p>Lipids Classification and biological role, fatty acids – nomenclature of saturated and unsaturated fatty acids. Acylglycerols: Mono, di and triacylglycerols. Saponification, saponification value, iodine value, acid value and significance. Rancidity, hydrolysis. Phosphoglycerides: Structure of lecithin (phosphatidyl choline), cephalins, phosphatidyl inositol, plasmalogens, and cardiolipin. Biological role of phosphoglycerides. Sphingolipids: Structure and importance of sphingomyelin. Glycerosphingolipids: Composition and importance of gangliosides and cerebroside. Prostaglandins: Types, structure of PGE₂, PGI₂, PGD₂ and PGF₂ Alpha. Biological roles of thromboxanes, leukotrienes and prostaglandins. Plasma lipoproteins: Types and functions.</p> | 14 Hrs |

| | | |
|----------|---|---------------|
| 3 | Amino acids and Proteins Amino acids: Structure and classification of amino acids based on polarity. Reactions of the amino groups with HNO ₂ , LiAlH ₄ . Ninhydrin, Phenyl isothiocyanate, DANSYLChloride, Flurodinitro benzene. Reaction of carboxyl group – Hydrazine. Zwitterionic properties. pKa values, D & L notation. Peptides: Peptide bond, structure and biological importance of glutathione, Valinomycin. Synthetic peptides- polyglutamic acid, polylysine. Proteins: Classification of proteins based on solubility, structure and functions with examples. Forces that stabilise the structure of proteins, Primary structure of proteins, methods of determining N- and C- terminal amino acids, amino acid composition, sequencing by Edman's degradation method. Secondary Structure – α helix. β -sheet, β -bend. Tertiary and quaternary structures- hemoglobin, denaturation and renaturation of proteins. Anfinsen's experiment | 14 Hrs |
| 4 | Nucleic acids: Composition of DNA and RNA. Nucleosides and Nucleotides. Other functions of nucleotides – source of energy, component of coenzyme and second messengers. Chargaff's rule. Watson and Crick model of DNA. Nucleic acid chemistry- UV absorption, Effect of alkali and acid on DNA, Chemical reactions of RNA and DNA. Melting of DNA (T _m). Types of RNA (mRNA, tRNA and rRNA), Secondary structures of tRNA – clover leaf model. | 14 Hrs |

REFERENCES

1. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
2. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
3. Biochemistry- the chemical reactions of living cells, David E Metzler, 2nd Edition, Elsevier Academic Press,
4. Fundamentals of Biochemistry, Jain, J.L, S.Chand publication 6th Edition, 2005.
5. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman and company, 7th Edition, 2010.
6. Harper's Illustrated Biochemistry, Victor W Rodwell, et.al, 31st edition, McGraw Hill Education Lange © 2018.
7. Biochemistry, Lubert Stryer 5th edition 2015

PEDAGOGY:

| Formative Assessment | |
|--------------------------------------|-----------------|
| Assessment Occasion/type | Marks |
| Internal Assessment Test1 | 10 |
| Internal Assessment Test2 | 10 |
| Quiz/Assignment/Small Project report | 10 |
| Seminar | 10 |
| Total | 40 Marks |

SEMESTER V
Discipline Specific Course (DSCC)-10- Practical

Course Title: Biochemistry of Macromolecules (Practical)

B. Sc: Course Code: 035 CHE 012

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-10 | Practical | 02 | 04 | 56 hrs. | 3 hrs. | 25 | 25 | 50 |

Course Outcomes (COs): At the end of the course the student should be able to

- CO1** The practical course will enable the students to learn the principles of qualitative tests for Carbohydrates such as Molisch Test, Iodine Test, Benedict's Test, Barfoed's Test, Seliwanoff's test, Bial's test, DPA Test, Tollen's Test, Fehling's Test, Picric Acid Test, Osazone Test.
- CO2** The practical course will enable the students to learn the principles of Biuret Test, Ninhydrin Test, colour reactions of proteins and many name reactions for amino acids
- CO3** The practical course will enable the students to learn the principles lipids solubility, acrolein test, Salkowski test, Lieberman-Burchard test.
- CO4** The practical course will enable the students to learn the principles quantitative estimation of Nucleic acids such as DNA and RNA.

| Exp | Title | 56 hrs |
|----------|---|---------------|
| 1 | Carbohydrates: mono saccharides (glucose, fructose, galactose) 6iosafety6des (lactose, maltose, sucrose) and polysaccharides (starch, glycogen), ribose, deoxy ribose- Molisch Test, Iodine Test, Benedict's Test, Barfoed's Test, Seliwanoff's test, Bial's test, DPA Test, Tollen's Test, Fehling's Test, Picric Acid Test, Osazone Test. | 14 Hrs |
| 2 | Proteins: Biuret Test, Ninhydrin Test, Precipitation reactions of proteins- Precipitation by salts (half-saturation test), precipitation by organic solvents, precipitation by acidic reagents, precipitation by heavy metal ion, precipitation by heat; colour reactions of proteins (gelatin and albumin) and any five amino acids (tryptophan, tyrosine, cysteine, methionine, arginine, proline and histidine)- Xanthoproteic test, Millon's Test, Sakaguchi Test, Hopkins- Cole Test, Lead acetate test, Sullivan and McCarthy's Test, Isatin Test, Pauly's Diazo Test. | 14 Hrs |
| 3 | Lipids: solubility, acrolein test, Salkowski test, Lieberman-Burchard test. | 14 Hrs |
| 4 | Nucleic acids: diphenylamine test, orcinol test | 14 Hrs |

REFERENCES :

1. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
2. Biochemical methods, S. Sadasivam , A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
3. An Introduction to Practical Biochemistry, David Plummer , 3rd edition 2017
4. Laboratory manual in Biochemistry , J. Jayaraman 2011

PEDAGOGY:

| Formative Assessment | |
|--------------------------------------|--------------------|
| ASSESSMENT OCCASION | WEIGHTAGE IN MARKS |
| RECORD / VIVA VOCE | 10 |
| CONTINUOUS EVALUATION AND CLASS TEST | 15 |
| TOTAL | 25 |

B. Sc SEMESTER V
Discipline Specific Course (DSCC)-11- Theory

Course Title: Human Physiology (Theory)

B. Sc: Course Code: 035 CHE 013

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-11 | Theory | 04 | 04 | 56 hrs. | 2 hrs. | 40 | 60 | 100 |

Course Outcomes (Cos): At the end of the course students will be able to:

- CO1** Describe cell structure and functions, how cells form and divide, and how they differentiate and specialize.
- CO2** Students will be able to describe the cyclical events of cell division and types of cell divisions
- CO3** Student's knowledge with regard to the process of cell death and cell aging will enhance to its core.
- CO4** Physiology involves the study of how living systems function, from the molecular and cellular level to the system level, and emphasizes an integrative approach to studying the biological functions of the human body.

| Unit, | Title | 56.hrs/ 14 Hrs |
|----------|--|-------------------|
| 1 | <p>Basic body plan in humans & Location of organs.</p> <p>Nervous System: Brief outline of nervous system, Neurons – types, structure of multipolar neuron, mechanism of nerve impulse transmission- along axon, across synapse. Action potential & resting potential. Neurotransmitters – Excitatory & Inhibitory with examples.</p> <p>Respiratory system: Anatomy, structure and functions of lungs, mechanism of respiration (Pulmonary ventilation), gas exchange mechanism, biochemical events in the transport of gases & factors affecting, role of lungs in acid-base balance. Hypoxia, emphysema.</p> <p>Cardio-vascular system: Structure and functions of heart. Blood vessels – types, Overview & functions: Cardiac cycle, cardiac output, regulation of</p> <p>Muscular System: Types of muscles and their structure. Ultrastructure of skeletal muscle. Contractile & regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction</p> | 14 Hrs |
| 2 | <p>Basic body plan in humans & Location of organs.</p> <p>Nervous System: Brief outline of nervous system, Neurons – types, structure of multipolar neuron, mechanism of nerve impulse transmission- along axon, across synapse. Action potential & resting potential. Neurotransmitters – Excitatory & Inhibitory with examples.</p> <p>Respiratory system: Anatomy, structure and functions of lungs, mechanism of respiration (Pulmonary ventilation), gas exchange mechanism, biochemical events in the transport of gases & factors affecting, role of lungs in acid-base balance. Hypoxia, emphysema.</p> <p>Cardio-vascular system: Structure and functions of heart. Blood vessels – types, Overview & functions: Cardiac cycle, cardiac output, regulation of</p> <p>Muscular System: Types of muscles and their structure. Ultrastructure of skeletal muscle. Contractile & regulatory proteins of muscle. Sliding filament model of skeletal muscle contraction</p> | 14 Hrs |
| 3 | <p>Bone and Cartilage: Structure and types of bone and cartilage. Long bone – Composition, structure, growth & remodeling, factors affecting.</p> <p>Digestive System and GIT: Anatomy of GIT and accessory organs,</p> | 14 Hrs |

| | | |
|----------|--|---------------|
| | <p>Digestion, absorption & transport of carbohydrates, lipids and proteins. Role of various enzymes involved in digestive process.</p> <p>Hepatic System: Structure of a liver lobule. Role of liver in metabolic, storage and detoxification.</p> <p>Excretory System: Brief outline of excretory system, formation of urine – Glomerular filtration, tubular reabsorption & secretions. Role of kidney in acid-base balance. Regulation of kidney function</p> | |
| 4 | <p>Endocrine System: Brief outline of various endocrine glands and their secretions. Dynamic balance and regulation of hormonal secretions. Classification of hormones based on structure and site of production. Physiological role of hormones of hypothalamus, pituitary, adrenal, thyroid, pancreas and gonads. Regulation of their secretion.</p> <p>General mechanism of hormone action in brief – peptide and steroid hormones. Membrane receptors and secondary messengers (cAMP, DAG, IP3, G- protein). Signal transduction pathway for steroidal and non-steroidal hormones</p> | 14 Hrs |

REFERENCES :

1. Chatterjee C C, Human physiology, Medical allied Agency. New Delhi 2020
2. Gerard J Tortora, Bryan H Derrickson. Principles of anatomy and physiology, 13th edition, John Wiley & Sons 2000
3. Gytton and Hall, Textbook of medical physiology, 10th edition, Elsevier Health Sciences 2015
4. Sembulingam K & Prema Sembulingam, Essentials of medical physiology, 3rd edition, Jaypee Brothers, 2019
5. Thomas D. Pollard, William C. Earnshaw, Jennifer Lippincott-Schwartz and Graham T. Johnson, Cell Biology, 3rd edition, Elsevier 2017
6. Lodish, Berk, Kaiser, Krieger et al, Molecular Cell Biology, 6th edition, 2010
7. Bruce Alberts, Hopkin, Johnson Morgan, Raff, Roberts, and Walter, Essential Cell Biology, 5th edition, W.W. Norton & Company, 2019

PEDAGOGY:

| Formative Assessment | |
|-------------------------------|-----------------|
| Assessment Occasion/type | Marks |
| Internal Assessment Test1 | 10 |
| Internal Assessment Test2 | 10 |
| Quiz/Assignment/Small Project | 10 |
| Seminar | 10 |
| Total | 40 Marks |

B. Sc SEMESTER V
Discipline Specific Course (DSC)-12- Practical

Course Title: HUMAN PHYSIOLOGY (Practical)

B. Sc: Course Code: 035 CHE 014

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-12 | Practical | 02 | 04 | 56 hrs. | 3 hrs. | 25 | 25 | 50 |

Course Outcomes (Cos): At the end of the course students will be able to:

- CO1** The students will be able to determine the blood groups and other physiological parameters
- CO2** The students will be able to identify of microscopical features of various types of cells and tissues
- CO3** The students will be able to understand the anatomy & Physiology of various systems and learn the various cells
- CO4** The students will be able to demonstrate the principle and working of instruments used in cell biology.

| Exp | Title | 56 hrs |
|-----|--|--------|
| 1 | Determination of ABO blood grouping | 5 Hrs |
| 2 | Determination of Blood clotting time | 5 Hrs |
| 3 | Enumeration of RBC and WBC count using Haemocytometer | 5 Hrs |
| 4 | Separation of Serum and Plasma from Blood | 5 Hrs |
| 5 | Estimation of haemoglobin content in blood | 5 Hrs |
| 6 | Study of pulmonary function test using spirometer | 5 Hrs |
| 7 | Determination of blood pressure | 5 Hrs |
| 5 | Understanding principle, working & handling of simple microscope | 5 Hrs |
| 6 | Examination of prokaryotic & eukaryotic cells | 5 Hrs |
| 7 | Study of different stages of mitosis & meiosis in onion root tip – squash preparation method | 6 Hrs |
| 8 | Gram staining | 5 Hrs |
| 9 | Demonstration of Biosafety & sterilization techniques | 5 Hrs |
| 10 | Demonstration of preparation of culture media for bacterial cultivation | 5 Hrs |
| 11 | Demonstration of pure culture techniques – Streak, pour plate and serial dilution | 5 Hrs |

REFERENCES

1. Essentials of Medical Physiology, K. Sembulingam and P. Sembulingam. Jaypee brothers medical publishers, New Delhi., 2019
2. Text book of Medical Physiology- C.Guyton and John.E. Hall. Miamisburg, OH, U.S.A, 12th edition 2011
3. Textbook of Practical Physiology , C.L. Ghai, Jaypee brother's medical publishers, New Delhi, 10th edition 2022
4. A Hand book of practical Microbiology, R. Saravanan , D. Dhachinamoorthi , CH. MM. Prasada Rao , 2019

PEDAGOGY:

| Formative Assessment for Practical | |
|--|-----------------------|
| Assessment | Distribution of Marks |
| Prepare an educational aid on the given topic | 10 |
| Write /present visit report | 5 |
| Assignment /project report | 10 |
| Total | 25 Marks |
| <i>The same shall be used for semester end Examination</i> | |

B. Sc SEMESTER V (SEC-3) Practical

Course Title: MOLECULAR BIOLOGY – 1 (Theory)

B. Sc: Course Code: 035 CHE 061

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|---------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| SEC-3 | Practical | 02 | 04 | 56 hrs. | 3 hrs. | 25 | 25 | 50 |

Course Outcomes (Cos): At the end of the course students will be able to:

- CO1** The students will be able to understand Chromosomal organization in prokaryotes and Eukaryotes to the molecular mechanisms via which genetic information is stored, expressed and transmitted
- CO2** The students will be able to understand Replication DNA damage, repair and mutation,
- CO3** The students will be able to understand Transcription and Regulation of gene expression
- CO4** The students will be able to understand Genetic code, Translation, Regulation

| Unit, | Title | 56.hrs/ |
|----------|---|---------------|
| 1 | Introduction and replication History: Identification of DNA as genetic material- Experiments of Griffith, Hershey and Chase: Overview of structure of DNA. Introduction to Molecular Biology: Chromosomal organization in prokaryotes and Eukaryotes; Gene and gene concept: cistron, muton, and recon. Central dogma of molecular biology and its modification, Replication: Types of replication -Conservative, semi conservative and dispersive: Evidence for semi conservative replication- Meselson and Stahl experiment: Mechanism of semi conservative replication- Steps involved in replication, Enzymes and proteins involved in replication, outline of DNA replication in eukaryotes. | 14 Hrs |
| 2 | DNA damage, repair and mutation DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: Photoreactivation, base excision repair, nucleotide excision repair, mismatch repair Mutation: Concept of mutation, Mutagens – chemical and physical, Molecular basis of mutation: spontaneous and induced mutations, effect of HNO ₂ , alkylating agents, intercalating agents and UV-radiation. Point mutations: Concept of missense, nonsense and frame shift mutations. | 14 Hrs |
| 3 | Transcription, Translation and Regulation of gene expression 12 hours Transcription: Types of RNA, RNA polymerases, promoters, enhancers, silencers, role of sigma factor, Structure of mRNA in prokaryotes, Mechanism- initiation, elongation and termination (Rho - dependent and independent), Overview of eukaryotic transcription, post transcriptional processing: capping, splicing and poly adenylation, reverse transcription. Genetic code: characteristics of genetic code, wobble hypothesis. Translation: Mechanism of translation - amino acid activation, charging of tRNA, initiation, elongation, and termination; Post-translational modification; Inhibition of protein synthesis by antibiotics. Outline of translation in eukaryotes. Regulation : General aspects of regulation, transcriptional regulation - inducible and repressible system, positive regulation, negative regulation : Operon concepts - lactose , tryptophan operons, Regulation of translation, Brief account of Eukaryotic gene expression. | 28 Hrs |

REFERENCES:

1. Molecular Biology - David Friefelder, Narosa Publication- house Pvt. Ltd. New Delhi, 2020
2. A Textbook of Biochemistry: Molecular and Clinical Aspects S. Nagini . 2nd edition . Sci Tech Publ., Chennai, 2007
3. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
4. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
5. Biochemistry , Lubert Stryer , W.H Freeman and Company Limited , 5th edition 2002

PEDAGOGY

| Formative Assessment for Practical | |
|--|------------------------------|
| Assessment | Distribution of Marks |
| Prepare an educational aid on the given topic | 10 |
| Write /present visit report | 5 |
| Assignment /project report | 10 |
| Total | 25 Marks |
| <i>The same shall be used for semester end Examination</i> | |

B. Sc SEMESTER VI
Discipline Specific Course- DSCC-14

Course Title: ENZYMOLOGY (Theory)

B. Sc: Course Code: 0356 CHE 011

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-14 | Theory | 04 | 04 | 56 hrs. | 2 hrs. | 40 | 60 | 100 |

Course Outcomes (COs): At the end of the course the student should be able to

- CO1** These topics will enable the students to understand and describe structure, functions and the mechanism of action of enzymes.
- CO2** These topics will enable the students to learn kinetics of enzyme catalyzed reactions and enzyme inhibitions and regulatory process, Enzyme activity, Enzyme Units, Specific activity.
- CO3** These topics will enable the students to understand Enzyme kinetics and Mechanism of action of enzymes
- CO4** These topics will enable the students to understand Enzyme regulation, inhibition Isolation, purification and applications of enzymes

| Unit, | Title | 56.hrs/ |
|----------|---|---------------|
| 1 | Introduction to enzymes : Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme, IUBMB classification of enzymes with examples. International Units of enzyme activity, specific activity. Monomeric and oligomeric enzymes- Monomeric enzymes, multifunctional enzymes, oligomeric enzymes and multi- enzyme complexes, isoenzymes- lactate dehydrogenase, Features of enzyme catalysis: Catalysis, reaction rates and thermodynamics of reaction. Activation energy and transition state theory, catalytic power and specificity of enzymes (concept of active site), Theories of enzyme catalysis- Fischer's lock and key hypothesis, Koshland's induced fit hypothesis. | 14 Hrs |
| 2 | Enzyme kinetics of single substrate reactions: Michaelis-Menten equation, equilibrium constant – mono substrate reactions, relationship between initial velocity and substrate concentration, Factors affecting the rate of chemical reactions - enzyme concentration, substrate concentration- pH, temperature and metal ions. Lineweaver- Burk plot. Determination of Vmax & Km from L-B plot and their significance, K _{cat} and turnover number. Mechanism of action of enzymes: General mechanisms of action - Acid-base and covalent catalysis (carboxypeptidase A, chymotrypsin and lysozyme) Involvement of coenzymes in enzyme catalyzed reactions: Coenzymes - Definition, structure and role of TPP, NAD and PLP. | 14 Hrs |
| 3 | Enzyme inhibition: Reversible inhibition- competitive, uncompetitive, non-competitive with graphical representations using L-B plots, Evaluation of Km and Vmax in presence of inhibitor mixed and substrate. Irreversible inhibition- Suicide inhibition - antibiotics as inhibitors- penicillin Regulation of enzyme activity: Control of activities of enzymes - end product inhibition, Allosteric enzymes, feedback inhibition (Aspartate Transcarbamoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage - Zymogen. Multienzyme complex as regulatory enzymes (PDH) | 14 Hrs |

| | | |
|----------|--|---------------|
| 4 | Isolation and purification of enzymes : Source, methods of cell disruption, Separation based on : solubility, size or mass, polarity, affinity or ligand based. Enzyme assay, Criteria of purity of enzymes. Applications of enzymes Clinical application of enzymes – SGPT and SGOT, LDH and CPK, Biotechnological and industrial applications of enzymes, Enzyme Immobilization, Methods, properties and applications of Immobilized enzymes. | 14 Hrs |
|----------|--|---------------|

REFERENCES:

1. Cox, Michael M. Lehninger principles of biochemistry. Freeman, 2013.
2. Lubert Stryer. Biochemistry, 5th edition , 2006
3. Palmer, Understanding enzymes, 4th edition, Prentice Hall/Ellis Horward, Landon 2000
4. Price, Nicholas C., and Lewis Stevens. Fundamentals of Enzymology. Oxford Science Publications. Second edition. New York, 2010
5. Buchholz, Klaus, Volker Kasche, and Uwe Theo Bornscheuer. Biocatalysts and enzyme technology. John Wiley & Sons, 2012.
6. Voet, Donald, Judith G. Voet, and Charlotte W. Pratt. "Fundamentals of biochemistry." New York: John Wiley & Sons 2008.
7. Devlin, Thomas M. Textbook of biochemistry: with clinical correlations. John Wiley & Sons, 2011.

PEDAGOGY

| Formative Assessment | |
|--------------------------------------|-----------------|
| Assessment Occasion/type | Marks |
| Internal Assessment Test1 | 10 |
| Internal Assessment Test2 | 10 |
| Quiz/Assignment/Small Project report | 10 |
| Seminar | 10 |
| Total | 40 Marks |

B. Sc SEMESTER VI
Discipline Specific Course- DSCC-15

Course Title: ENZYMOLOGY (Practical)

B. Sc: Course Code: 0356 CHE 012

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-15 | Practical | 02 | 04 | 56 hrs. | 3 hrs. | 25 | 25 | 50 |

Course Outcomes (COs): At the end of the course the student should be able to

- CO1** The practical course will enable the students to learn the isolation assay of enzymes from different sources.
- CO2** The practical course will enable the students to learn in general kinetics of enzymes
- CO3** The practical course will enable the students to learn the factors effecting the rate of enzymatic reactions
- CO4** The practical course will enable the students to learn kinetics parameters such as K_m and V_{max} .

| Expt. No, | Title | 56.hrs/ |
|-----------|---|--------------|
| 1 | Isolation of Urease and demonstration of its activity. | 5 Hrs |
| 2 | Isolation of Acid phosphatase and demonstration of its activity. | 5 Hrs |
| 3 | Isolation of Salivary amylase | 3 Hrs |
| 4 | Construction of Maltose/glucose calibration curve by DNS method and determination of activity of amylase | 5 Hrs |
| 5 | Determination of initial velocity [time kinetics] of Salivary amylase. | 5 Hrs |
| 6 | Determination of specific activity of Salivary amylase | 5 Hrs |
| 7 | Determination of pH optimum of Salivary amylase | 3 Hrs |
| 8 | Determination of K_m and V_{max} of Salivary amylase. | 5 Hrs |
| 9 | Determination of optimum temperature of Salivary amylase. | 5 Hrs |
| 10 | Effect of sodium chloride on Salivary amylase | 5 Hrs |
| 11 | Construction of Maltose/glucose calibration curve by DNS method and determination of activity of Salivary amylase | 5 Hrs |
| 12 | Determination of activity of yeast invertase | 5 Hrs |

REFERENCES:

1. An introduction to Practical Biochemistry, David Plummer, 3rd edition 2017
2. Laboratory manual in biochemistry, Jayaraman J, New Age International publications, 2011
3. Practical Manual of Biochemistry, Sattanathan G., Swaminathan P. and Balasubramanian B. Sky fox press, 2020
4. Practical manual of Biochemistry, S.P Singh, 7th edition, CBS publications, 2013
5. Sawhney, S. K., and Randhir Singh. Introductory practical biochemistry. Alpha Science Int'l Ltd., 2000.

PEDAGOGY

| Formative Assessment for Practical | |
|--|-----------------------|
| Assessment | Distribution of Marks |
| Prepare an educational aid on the given topic | 10 |
| Write /present visit report | 5 |
| Assignment /project report | 10 |
| Total | 25Marks |
| <i>The same shall be used for semester end Examination</i> | |

SEMESTER VI

Discipline Specific Course- DSCC-16

Course Title: Bioenergetics and Metabolism (Theory)

B. Sc: Course Code: 036 CHE 013

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|---------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-16 | Theory | 04 | 04 | 56 hrs. | 2hrs. | 40 | 60 | 100 |

Course Outcomes (COs): At the end of the course students will be able to::

- CO1** Understand the concepts of metabolism, characteristics of metabolic pathways and strategies used to study these pathways.
Gain a detailed knowledge of various catabolic and anabolic pathways and its regulation
- CO2** Systematically learn the breakdown and synthesis of amino acids and nucleotides in humans and recognize its relevance with respect to nutrition and human diseases
- CO3** Acknowledge the role of inhibitors of nucleotide metabolism which are potentially being used as chemotherapeutic drugs
- CO4** Comprehend how the amino acid and nucleotide metabolism are integrated with carbohydrate and lipid metabolism

| Unit | Title | 56 Hrs/ Sem |
|------|--|-------------|
| I | Bioenergetics : Laws of thermodynamics, free energy change, equilibrium constant, energy charge, ATP cycle, phosphorylation potential, and phosphoryl group transfers. Chemical basis of high standard energy of hydrolysis of ATP, Oxidative phosphorylation : Proton gradient generation, redox loop, Q cycle, Proton pumping. The electron transport chain - Peter Mitchell's Chemiosmotic hypothesis and Proton motive force. Fo-F1 ATP synthase, structure and mechanism of ATP synthesis | |
| II | Metabolism : Anabolism and catabolism, compartmentalization of metabolic pathways. Metabolism of Carbohydrates : Reactions and energetics of glycolysis, entry of fructose, galactose, mannose and lactose into glycolytic pathway. Fates of pyruvate - conversion of pyruvate to lactate, alcohol and acetyl CoA. Cori's cycle. Reactions and energetics of TCA cycle, amphibolic and integrating roles of TCA cycle. Anaplerotic reactions. Regulatory steps of glycolysis and TCA cycle, Gluconeogenesis and glycogenolysis. Pentose phosphate pathway and its significance. Metabolism of Lipids: Introduction, hydrolysis of triacylglycerols, transport of fatty acids into mitochondria, β -oxidation of saturated and unsaturated fatty acids, ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids. Fatty Acid Synthase complex, Lipogenesis (De novo synthesis of Fatty acid), Elongation of Fatty acid (Mitochondrial elongation). Biosynthesis of TAG, Phospholipids (Lecithin and Cephalin). Cholesterol metabolism | |
| III | Metabolism of Amino acids: General mechanism of amino acid metabolism: Deamination- oxidative and non – oxidative deamination, transamination, decarboxylation (biologically important amines) and desulphuration. Catabolism of carbon skeleton of amino acids, glycogenic and ketogenic amino acids. Urea cycle and its significance. Synthesis and catabolism of alanine, serine and cysteine Nucleic Acid metabolism: Degradation of nucleic acids, action of nucleases- DNase I and II, RNase and phosphodiesterases. Catabolism of purines and pyrimidines. Salvage pathways. De novo biosynthetic pathways of purine and pyrimidine nucleotides. Conversion of ribonucleotides to deoxy ribonucleotides. | |

REFERENCES

1. Principles of Biochemistry, Donald Voet, Judith G Voet, Charlotte W. Pratt, 4th Edition, John Wiley and Sons Inc, 2012
2. Lehninger- Principles of Biochemistry; DL Nelson and MM Cox [Eds), 6th Edn. Macmillan Publications 2012
3. Biochemistry- the chemical reactions of living cells, David E Metzler, 2nd Edition, Elsevier Academic Press,
4. Fundamentals of Biochemistry, Jain, J.L, S.Chand publication 6th Edition, 2005.
5. Biochemistry, Jeremy M. Berg, John L. Tymoczko, Lubert Stryer, Freeman and company, 7th Edition, 2010.
6. Harper's Illustrated Biochemistry, Victor W Rodwell, et.al, 31st edition, McGraw Hill Education Lange ® 2018.

PEDAGOGY:

| Formative Assessment | |
|--------------------------------------|-----------------|
| Assessment Occasion/type | Marks |
| Internal Assessment Test1 | 10 |
| Internal Assessment Test2 | 10 |
| Quiz/Assignment/Small Project report | 10 |
| Seminar | 10 |
| Total | 40 Marks |

B. Sc SEMESTER VI
Discipline Specific Course (DSCC)-17

Course Title: Bioenergetics And Metabolism (Practical)

B. Sc: Course Code: 036 CHE 014

| Type of Course | Theory /Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|-------------------|-----------|-----------------------|--------------------------|------------------|------------------|-----------|-------------|
| | | | | | | Formative | Summative | |
| DSCC-17 | Practical | 02 | 04 | 56 hrs. | 3 hrs. | 25 | 25 | 50 |

Course Outcomes (COs): At the end of the course students will be able to:

- CO1** The practical course will enable the students to learn the estimation of blood glucose Urea, creatinine and cholesterol
- CO2** The practical course will enable the students to learn the estimation of DNA and RNA
- CO3** The practical course will enable the students to learn the estimation Blood urea nitrogen is a measure of how well the kidneys are working.
- CO4** The practical course will enable the students to learn the estimation of blood substances which tell how well the organs/kidneys are functioning, and glucose, which indicates whether there is a normal amount of sugar in the blood.

| Expt. No, | Title | 56.hrs/ |
|-----------|--|--------------|
| 1 | Estimation of Blood glucose | 6 Hrs |
| 2 | Assay of Digestive enzyme (Salivary amylase) | 6 Hrs |
| 3 | Estimation of Urea | 6 Hrs |
| 4 | Estimation of Uric acid | 6 Hrs |
| 5 | Estimation of DNA | 6 Hrs |
| 6 | Estimation of creatinine | 4 Hrs |
| 7 | Estimation of cholesterol | 6 Hrs |
| 8 | Estimation of RNA | 6 Hrs |
| 9 | Estimation of creatinine | 4 Hrs |
| 10 | Estimation of cholesterol | 6 Hrs |

REFERENCES:

1. Practical Biochemistry, Geetha Damodaran, Jaypee, 2011
2. Biochemical methods, S. Sadasivam , A. Manickam, 3rd Edition, New Age International Pvt Ltd, 2007
3. An Introduction to Practical Biochemistry, David Plummer , 3rd edition 2017
4. Laboratory manual in Biochemistry , J. Jayaraman 2011

PEDAGOGY:

| Formative Assessment for Practical | |
|--|-----------------------|
| Assessment | Distribution of Marks |
| Prepare an educational aid on the given topic | 10 |
| Write /present visit report | 5 |
| Assignment /project report | 10 |
| Total | 25Marks |
| <i>The same shall be used for semester end Examination</i> | |

Internship-1 B.Sc. Biochemistry

Course Title: Internship

Course Code: B. Sc: 036 HSC 091

| Type of Course | Theory/ Practical | Credits | Instruction hour/week | Total No. of Lec/Hrs/Sem | Duration of Exam | Assessment Marks | | Total Marks |
|----------------|----------------------|-----------|--------------------------|-----------------------------|---------------------|------------------|------|----------------|
| | | | | | | Formative | Summ | |
| Internship- I | -- | 02 | -- | --- | --- | 50 | -- | 50 |

Course Outcomes (COs): At the end of the course students will be able to: CO1: Gain Hands on Training
CO 2: Gain knowledge about job opportunities
CO 3: Prepare themselves for employment challenges. CO 4: Prepare themselves for self-employment.

Internship Placements in Institutions and Community

- **Mini Project**
- **Study Report**
- **Industrial Visit**
- **Field Based Studies**