BAGALKOT UNIVERSITY

Mudhol Road, Jamkhandi-587301 Dist: Bagalkot

Open Elective Courses from Science

Stream

As per NEP 2020 and adapted From RCU Belagavi Applicable from the Academic Year 2023-24

Open Elective (OE) Courses

First and second, semesters will have one OE course.In each semester. Every OE course has 3 credits and with no practical component. OE courses are for other subject students (other than major and minor), and the candidate has to choose one OE from the each semester.

Details of Open Elective courses from Science Stream

Sl. No	Subject	Category	Semester	Course code	Title
1	Chemistry	OEC1	I	**126BSC01CHEOEC01T**	Chemistry in daily life
		OEC1	II	**126BSC02CHEOEC02T**	Molecules of life
2.	Physics	OEC1	I	**126BSC01PHYOEC01T**	Energy Sources
		OEC2	II	**126BSC02PHYOEC02T**	Optical Instruments
3	Mathematics	OEC1	I	**126BSC01MATOEC01T**	Mathematics – I
		OEC1	I	**126BSC01MATOEC02T**	Business Mathematics – I
		OEC2	II	**126BSC02MATOEC01T**	Mathematics – II
		OEC2	II	**126BSC02MATOEC02T**	Business Mathematics-II
4	Botany	OEC1	I	**126BSC01BOTOEC01T**	Plants and Human welfare
		OEC 2	II	**126BSC02BOTOEC02T**	Bio-fuels

5	Zoology	OEC1	I	**126BSC01ZOOOEC01T**	Economic Zoology
		OEC 2	II	**126BSC02ZOOOEC02T**	Parasitology
6	Electronics	OEC 1	I	**126BSC01ELEOEC01T**	Basics of Electronics, Computers and PCB Design
		OEC 2	II	**126BSC02ELEOEC02T**	Electronic s for Everyone
7	Statistics	OEC 1	I	**126BSC01STSOEC01T**	Statistical Methods
		OEC 2	II	**126BSC02STSOEC02T**	Business Statistics
8	Biotechnology	OEC 1	I	**126BSC01BITOEC01T**	Biotechnology for Human welfare
		OEC 2	II	**126BSC02BOTOEC02T**	Applications of Biotechnology in Agriculture
9.	Microbiology	OEC 1	I	**126BSC01MIBOEC01T**	Microbial Technology for Human Welfare
		OEC 2	II	**126BSC02MIBOEC02T**	Environmental and Sanitary Microbiology
10	Computer Science	OEC 1	I	**126BSC01CSCOEC01T**	C Programming Concepts
		OEC 2	II	**126BSC02CSCOEC02T**	Web Designing
11	Geography	OEC1	I	**126BSC01GEGOEC01T**	Earth System Dynamics
			I	**126BSC01GEGOEC02T**	Introduction to Natural Resources
			I	**126BSC01GEGOEC03T**	Introduction to Physical Geography
			I	**126BSC01GEGOEC04T**	Fundamentals of Remote Sensing
		OEC2	II	**126BSC02GEGOEC01T**	Introduction to Human Geography

			II	**126BSC02GEGOEC02T**	Fundamentals of Natural Disasters
			II	**126BSC02GEGOEC03T**	Climate change : Vulnerability and Adaptation
			II	**126BSC02GEGOEC04T**	Basics of GIS

Chemistry Open Elective Course

Credit Structure of Chemistry Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

			Marks			Teaching hours/week			Credi tt	Duration of exams (Hrs)
SEMESTER-I										
Category	**Course code**	**Title of the Paper**	IA	SEE	Total	L	T	P		
OEC1	**126BSC01CHEOEC01T**	Chemistry in daily life	40	60	100	3		-	3	2

			Marks			Teaching hours/week			Cre dit	Durati on of exams (Hrs)
SEMESTER-II										
Category	**Course code**	**Title of the Paper**	IA	SEE	Tot al	L	T	P		
OEC2	**126BSCO2CHEOEC02T**	Molecules of life	40	60	100	3	-	-	3	2

Title of the Course: Open Elective (OE-1): CHEMISTRY IN DAILY LIFECourse code: 126BSC01CHEOEC01T

Courses	Credits	No. of Classes /Week	Total No. of Lectures/Hours	Duration of Examin hrs	Internal AssessmentMarks	SemesterEnd Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100
Content of Theory Course 1							**42 Hrs**

Unit – 1   **14 hours**

Dairy Products: Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages.

Food additives, adulterants, and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate.

Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysisof pesticide residues in food.

Unit – 2   **14 hours**

Vitamins: Classification and Nomenclature. Sources, deficiency diseases, and structures ofVitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1.

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil. Testsfor adulterants like argemone oil and mineral oils. Halphen test.

Soaps & Detergents: Definition, classification, manufacturing of soaps and detergents,composition and uses.

Unit – 3   **14 hours**

Chemical and Renewable Energy Sources:

Principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer.

Polymers: Basic concept of polymers, classification and characteristics of polymers.Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.

COURSE OUTCOMES: OEC-1 Chemistry

On completion of the course students will be able to:
- Understand the chemical constituents in various day today materials using by acommon man.
- Understand the chemical constituents in fertilizers, insecticides and pesticides, chemicalexplosives etc.
- Understand the chemical constituents in polymers, surface coatings etc.

References Text Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry- Ashtoush Kar.
3. Analysis of Foods – H.E. Cox: 13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4thed. New AgeInternational (1998)
6. Physical Chemistry – P l Atkins and J. de Paula – 7thEd. 2002, Oxford University Press.

Open Elective Course-Chemistry

Title of the Course: OEC-2: Subject code: 126BSCO2CHEOEC02T; Paper: Molecules of Life

Course	Credits	No. of Classes/ Week	Total No. of Lecture Hours	Duration of Exam inhrs	Internal Assessment Marks	SemesterEnd Exam Marks	Total Marks
Theory	03	03	42	2	40	60	100

UNIT I

Carbohydrates

Sugars, non-sugars, reducing and non-reducing sugars. Occurrence and generalproperties of glucose and fructose. Open chain and Haworth ring structures of glucose and fructose. Epimers, mutarotation and anomers. Disaccaharides: Occurrence of disaacharides (Sucrose, Maltose and Lactose).Glycosidic linkage in disaccharides. Ring structures of sucrose, maltose and lactose.Polysaccharides: Starch – monomer units, glycosidic linkage, components-difference in their structure (explanation only) and solubility in water. Celluloseand glycogen– monosaccharide, glycosidic linkage, structure (explanation only).Biological importance of carbohydrates   **8hrs**

Amino Acids, Peptides and Proteins

α- amino acids , general formula, zwitter ion form of α- amino acid, generalformula .Isoelectric point and its importance. Classification of amino acids as essential and non-essential-examples. Configuration of optically active α-amino acids (found in proteins). Peptide bond. Proteins: classification based on molecular shape–fibrous and globular, examples. Structure of protein – qualitative idea about primary, secondary, tertiary, and quaternary structures (diagrams not required).Denaturation of protein.

8hrs

UNIT II

Enzymes and correlation with drug action

Mechanism of enzyme action, factors affecting enzyme action, Co-enzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereo specificity),Enzyme inhibitors and their importance, phenomenon of inhibition (Competitive and Non-competitive inhibition including allosteric inhibition).   **7hrs**

Drug action- Receptor theory. Structure–activity relationships of drug molecules, binding role of –OH group, -NH_2 group, double bond and aromatic ring.   **4hrs**

Oils and fats

Biological Importance of oils and fats. Fatty acids (saturated, unsaturated fatty acids, formation of triglycerides and general formula of triglycerides. Chemical nature of oils and fats-saponification, acid hydrolysis, rancidity and its prevention methods, refining of oils, hydrogenation of oils, drying of oils. Iodine value .Introduction to lipids, classification. Biological importance of triglycerides, phospholipids,glycolipids, and steroids (cholesterol).

6hrs

UNIT III

Nucleic Acids

Components of nucleic acids: Adenine, guanine, thymine and cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.   **6hrs**

Vitamins and Hormones

Classification and biological significance, source and structure of Vitamin A, B1 (thiamine), B2 (riboflavin), B6 (pyridoxine), α-tocopherol, K1 (phylloquinone), C (ascorbic acid). Deficiency diseases of vitamins,

Hormones: definition, classification with examples, functions and deficiency diseases of hormones.   **5hrs**

Course Outcome / Learning Outcome:

After studying this paper the student would be able to
1. Acquire knowledge about different types of sugars and their chemical structures.
2. Identify different types of amino acids and determine the structure of peptides.
3. Explain the actions of enzymes in our body and interpret enzyme inhibition.
4. Predict action of drugs. Depict the biological importance of oils and fats. Importance of lipids in the metabolism Differentiate RNA and DNA and their replication. Explain production of energy in our body.

Reference Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Nelson, D. L. & Cox, M. M. *Lehninger's Principles of Biochemistry 7th Ed.,*
5. W. H. Freeman. Berg, J.M., Tymoczko, J.L. &Stryer, L. *Biochemistry*, 2002.

Assessment Criteria	40 marks
1st Internal Assessment Test for30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	10
Total	**40**
Assessment Criteria	**25 marks**
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

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Question Paper Pattern:

Duration: 2hr   *I Semester B.Sc.*_____

Sub: **Code:**   **Maximum Marks :60**

a. Answer any SIX Questions from Question 1

b. Answer any Three in each Question from 2,3,4 and 5questions.

Q.No.1.	Answer any SIX Questions (Two question from each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover entire unit-I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12
Q.No.5.	(Should cover Entire Unit-IV) a. b. c. d.	4X3=12

Physics Open Elective course

Credit Structure of Physics Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

SEMESTER-I

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	**126BSC01PHYOEC01T**	Energy Sources	40	60	100	3		-	3	2

SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02PHYOEC02T**	Optical Instruments	40	60	100	3	-	-	3	2

Year	I	Course Code: 126BSC01PHYOEC01T		Credits	03
Sem.	1	Course Title: Energy Sources		Hours	40
Formative Assessment Marks:40		Summative Assessment Marks:60	Duration of ESA: 02hrs.		
Unit No.		Course Content		Hours	
Unit I		**Introduction:** Energy concept-sources in general, its significance & necessity. Classification of energy sources: Primary and Secondary energy, Commercial and Non-commercial energy, Renewable and Non-renewable energy, Conventional and Non-conventional energy, Based on Origin-Examples and limitations. Importance of Non-commercial energy resources.		05	
		Renewable energy sources: Need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, Biogas generation, geothermal energy tidal energy, Hydroelectricity.		05	
Unit II		**Conventional energy sources:** Fossil fuels & Nuclear energy-production & extraction, usage rate and limitations. Impact on environment and their issues & challenges. Overview of Indian & world energy scenario with latest statistics-consumption & necessity. Need of eco-friendly & green energy & their related technology.		10	
Unit III		**Solar energy**: Solar Energy-Key features, its importance, Merits & demerits of solar energy, Applications of solar energy. Solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell –brief discussion of each. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun Tracking systems.		10	
Unit IV		Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power electronic interfaces, and grid interconnection topologies. Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices. Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy.		08	
		Geothermal and hydro energy: Geothermal Resources, Geothermal		02	

	Technologies. Hydropower resources, hydropower technologies, Environmental impact of hydropower sources.	
	Activity 1. Demonstration of on Solar energy, wind energy, etc, using training modules at Labs. 2. Conversion of vibration to voltage using piezoelectric materials. 3. Conversion of thermal energy into voltage using thermoelectric (using thermo couples or heat sensors) modules. 4. Project report on Solar energy scenario in India 5. Project report on Hydro energy scenario in India 6. Project report on wind energy scenario in India 7. Field trip to nearby Hydroelectric stations. 8. Field trip to windenergy stations like Chitradurga, Hospet, Gadag,etc. 9. Fieldtrip to solar energy parks like Yeramaras near Raichur. 10. Videos on solar energy, hydro energy and wind energy.	
	Reference Books: 1. Non-conventional energy sources- G.DRai-Khanna Publishers, New Delhi 2. Solar energy-M P Agarwal- S Chand and Co. Ltd. 3. Solar energy - Suhas P Sukhative Tata McGraw - Hill Publishing Company Ltd. 4. Godfrey Boyle, "Renewable Energy, Power for a sustainable future", 2004, Oxford University Press, in association with The Open University. 5. Dr. P Jayakumar, Solar Energy: Resource Assessment Handbook, 2009 6. J.Balfour,M. ShawandS. Jarosek, Photovoltaics, Lawrence J Goodrich (USA). http://en.wikipedia.org/wiki/Renewable_energy	

OPEN-ELECTIVESYLLABUS:

Year	I	**Course Code: 126BSC02PHYOEC02T**		**Credits**	03
Sem.	2	**Course Title:** Optical instruments		**Hours**	40
Formative Assessment Marks:40		Summative Assessment Marks:60	Duration of ESA:.02hrs.		
Unit No.		**Course Content**		**Hours**	
Unit I		**Basics of Optics** Scope of optics, optical path, laws of reflection and refraction as per Fermat's principle, magnifying glass, Lenses (thick and thin),convex and concave lenses, Lens makers formulae for double concave and convex lenses, lens equation.		10	
Unit II		Focal and nodal points, focal length, image formation, combination of lenses, dispersion of light: Newton's experiment, angular dispersion and dispersion power. Dispersion without deviation . (Expressions need not be derived, but have to be discussed qualitatively).		10	
Unit III		**Camera and microscopes** Human eye (constitution and working),Photographic camera (principle, construction and working), construction, working and utilities of Simple microscopes, Compound microscope, Electron microscopes, Binocular microscopes **Self-study** Experimental determination of magnifying power of a microscope.(Construction part can be discussed through block diagrams)		10	

Unit IV	**Telescopes and Spectrometer** Construction, working and utilities of Astronomical telescopes Terrestrial telescopes Reflecting telescopes, Construction, working and utilities of Eyepieces or Oculars (Huygen, Ramsden's, Gauss) Spectrometer Construction, working and utilities, measurement of refractive index. **Self-study** Telescopes used at different observatories in and outside India. Hydropower resources, hydropower technologies, environmental impact of hydro power sources. Carbon captured technologies, cell, batteries, power consumption	10	
	Activities: 1) Find position and size of the image in a magnifying glass and magnification. 2) Observer a in bows and understand optics. 3) Create a rainbow. 4) Find out what makes a camera to be of good quality. 5) Observe the dispersion of light through prism. 6) Make a simple telescope using magnifying glass and lenses. 7) Learn principle of refraction using prisms. 8) Check bending of light in different substances and find out what matters here. 9) Learn about different telescopes used to see galaxies and their ranges. 10) Many more activities can be tried to learn optics by going through you tubes and website's such as https://spark.iop.org,http://www.yenka.com,https://publiclab.org etc.		

ASSESSMENT METHODS

Theory : Evaluation Scheme for Internal Assessment:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	05
Activity	05
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment/Activity	05
Total	**25**

Sub: **Code:**   **Maximum Marks: 60**

Q.No.1.	**Answer any Six Questions** *(Two question from Each Unit to be asked)* **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**6X2=12**
Q.No.2.	**(Questions from Unit-I)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.3.	**(Questions from Entire Unit-II)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.4.	**(Questions from Unit-III)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**
Q.No.5.	**(Questions from Unit-IV)** **a.** **b.** **OR** **c.** **d.**	 **08** **04** **08** **04**

Note:
1. There should be a problem of marks from each unit and may be asked in either b or din questions 2 to 5.
2. If necessary, sub questions a and c from 2 to 5 may be subdivided in to i. and ii.Without exceeding maximum 08 marks.

Mathematics

Open Elective Course

w.e.f.

AcademicYear2023-24 and onwards

Mathematics Open Elective course

Credit Structure of Mathematics Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

SEMESTER-I										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
			25	25	50	-	-	4	2	4
OEC1	**126BSC01MATOEC01T** **126BSC01MATOEC02T**	Mathematics – I Business Mathematics – I	40	60	100	3		-	3	2

SEMESTER-II										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02MATOEC01T** **126BSC02MATOEC02T**	Mathematics – II Business Mathematics-II	40	60	100	3	-	-	3	2

Question Paper Pattern:
Department of Mathematics
I Semester B.Sc (Mathematics)
Sub: **Code:**   **MaximumMarks: 70**

    a.   **Answer any Six Questions from Question 1**

    b.   **Answer any Three Questions from Question 2,3,4 and 5**

Q.No.1.	**Answer any Five Questions (Two question from Each Unit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	2X6=12
Q.No.2.	**(Should cover Entire Unit-I)** **a.** **b.** **c.** **d.**	4X3=12
Q.No.3.	**(Should cover Entire Unit-II)** **a.** **b.** **c.** **d.**	4X3=12
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	4X3=12

ASSESSMENT METHODS

Theory : Evaluation Scheme for Internal Assessment:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	05
Activity	05
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment/Activity	05
Total	**25**

OPEN-ELECTIVE SYLLABUS (Ist Semester):

A: For students of Science stream who have not chosen Mathematics as one of Core Subjects

Year	I	Course Code: 126BSC01MATOEC01T		Credits	03
Sem.	I	**Course Title:** Mathematics – I		**Hours**	42
Course Pre-requisites, ifany		NA			
Formative AssessmentMarks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		
Course Outcomes	This course will enable the students to • Learn to solve system of linear equations. • Solve the system of homogeneous and non-homogeneous m linear equations by using the concept of rank of matrix, finding eigen values and eigen vectors. • Students will be familiar with the techniques of differentiation of function with real variables. • Identify and apply the intermediate value theorems and L' Hospital rule. • Learn to trace some standard curves.				

Unit No.	Course Content	Hours
Unit I	**Matrices:** Recapitulation of Symmetric and Skew Symmetric matrices, Cayley- Hamilton theorem, inverse of matrices by Cayley-Hamilton theorem(Without Proof). Algebra of Matrices; Row and column reduction, Echelon form. Rank of a matrix; Inverse of a matrix by elementary operations; Solution of system of linear equations; Criteria for existence of non-trivial solutions of homogeneous system of linear equations. Solution of non-homogeneous system of linear equations. Eigen values and Eigen vectors of square matrices, real symmetric matrices and their properties, reduction of such matrices to diagonal form.	14
Unit II	**Differential Calculus:** Limits, Continuity, Differentiability and properties. Intermediate value theorem, Rolle's Theorem, Lagrange's Mean Value theorem, Cauchy's Mean value theorem and examples. Taylor's theorem, Maclaurin's series, Indeterminate forms and examples.	14
Unit III	**Successive Differentiation**: nth Derivatives of Standard functions e^{ax+b}, $(ax + b)^m$, $\log(ax + b)$, $\sin(ax + b)$, $\cos(ax + b)$, $e^{ax}\sin(bx + c)$, $e^{ax}\cos(bx+c)$, Leibnitz theorem and its applications. Tracing of curves (standard curves)	14
	References: 1. University Algebra - N.S. Gopala Krishnan, New Age International (P)Limited 2. Theory of Matrices - B S Vatsa, New Age International Publishers. 3. Matrices – A. R. Vasista, Krishna Prakashana Mandir. 4. Applications of Calculus, Debasish Sengupta, Books and Allied (P) Ltd.,2019. 5. Differential Calculus - Shanti Narayan, S. Chand & Company, New Delhi. 6. Calculus – Lipman Bers, Holt, Rinehart & Winston. 7. Calculus – S. Narayanan & T. K. Manicavachogam Pillay, S.Viswanathan Pvt. Ltd.,vol. I & II. 8. Schaum's Outline of Calculus - Frank Ayres and Elliott Mendelson, 5th ed. USA: Mc.Graw. 9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.	

B: For Students of other than Science Stream

Year	I	**Course Code: 126BSC01MATOEC02T**		**Credits**	03
Sem.	I	**Course Title:** Business Mathematics – I		**Hours**	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course Outcomes		This course will enable the students to • Translate the real word problems through appropriate mathematical modellling. • Explain the concepts and use equations, formulae and mathematical expression and relationship in a variety of context. • Finding the extreme values of functions. • Analyze and demonstrate the mathematical skill require in mathematically intensive areas in economics and business.			
Unit No.		**Course Content**		**Hours**	
Unit I		**Algebra** – Set theory and simple applications of Venn Diagram, relations, functions, indices, logarithms, permutations and combinations. Examples on commercial mathematics.		14	
Unit II		**Matrices**: Definition of a matrix; types of matrices; algebra of matrices. Properties of determinants; calculations of values of determinants upto third order; Adjoint of a matrix, elementary row and column operations; solution of a system of linear equations having unique solution and involving not more than three variables. Examples on commercial mathematics.		14	
Unit III		**Differential Calculus**: Constant and variables, functions, Limits & continuity. Differentiability and Differentiation, partial differentiation, rates as a measure, maxima, minima, Partial Derivatives up to second order; Homogeneity of functions and Euler's Theorem; Total Differentials; Differentiation of implicit function with the help of total differentials, Maxima and Minima; cases of one variable involving second or higher order derivatives; Cases of two variables involving not more than one constraint		14	
Recommended Leaning Resources					

Print Resources	**References:** 1. Basic Mathematics, Allel R.G.A, Macmillan, New Delhi. 2. Mathematics for Economics, Dowling, E.T. , Schaum's Series, McGraw Hill, London. 3. Quantitative Techniques in Management, Vohra, N.D., Tata McGraw Hill, New Delhi.

OPEN-ELECTIVE SYLLABUS (IInd Semester) :
A: For students of Science stream who have not chosen Mathematics as oneof Core Subjects

Year	I	Course Code: 126BSC02MATOEC01T		Credits	03
Sem.	II			Hours	42
		Course Title: Mathematics – II			
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		
Course Outcomes		This course will enable the students to • Recognize the mathematical objects called Groups. • Link the fundamental concepts of groups and symmetries of geometrical objects. • Explain the significance of the notions of Cosets, normal subgroups and factor groups. • Understand the concept of differentiation and fundamental theorems in differentiation and various rules. • Find the extreme values of functions of two variables. • To understand the concepts of multiple integrals and their applications.			
Unit No.		Course Content		Hours	
Unit I		**Groups**: Definition of a group with examples and properties, congruence, problems. Subgroups, center of groups, order of an element of a group and its related theorems, cyclic groups, Coset decomposition, Factor groups, Lagrange's theorem and its consequences. Fermat's theorem and Euler's ϕ function.		14	
Unit II		**Partial Derivatives**: Functions of two or more variables-explicit and implicit functions, partial derivatives. Homogeneous functions- Euler's theorem, total derivatives, differentiation of implicit and composite functions, Jacobians and standard properties and illustrative examples. Taylor's and Maclaurin's series for functions of two variables, Maxima-Minima of functions of two variables.		14	
Unit III		**Integral Calculus**: Recapitulation of definite integrals and its properties. Line integral: Definition of line integral and basic properties, examples on evaluation of line integrals. Double integral: Definition of Double integrals and its conversion to iterated integrals. Evaluation of double integrals by changing the order of integration and change of variables. Computation of plane surface areas, volume underneath a surface of revolution using		14	

	double integral. Triple integral: Definition of triple integrals and evaluation-change of variables, volume as triple integral. Differentiation under the integral sign by Leibnitz rule.	
	Recommended Leaning Resources	
Print Resources	**References:** 1. Topics in Algebra, I N Herstein, 2nd Edition, Wiley Eastern Ltd., New Delhi. 2. Higher algebra, Bernard & Child, Arihant Pub. 3. Modern Algebra, Sharma and Vasishta, Krishna Prakashan Mandir, Meerut, U.P. 4. A Course in Abstract Algebra, Vijay K Khanna and S K Bhambri, Vikas Publications. 5. Differential Calculus, Shanti Narayan, S. Chand & Company, New Delhi. 6. Integral Calculus, Shanti Narayan and P K Mittal, S. Chand and Co. Pvt. Ltd., 7. Schaum's Outline Series, Frank Ayres and Elliott Mendelson, 5th ed. USA: McGraw Hill., 2008. 8. Mathematical Analysis, S C Malik, Wiley Eastern. 9. Text Book of B.Sc. Mathematics, G K Ranganath, S Chand & Company.	

B: For Students of other than Science Stream

Year	I	Course Code: 126BSC02MATOEC02T		Credits	03
Sem.	II	**Course Title:** Business Mathematics – II		**Hours**	42
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60		Duration of ESA:.02 hrs.	
Course Outcomes		This course will enable the students to • Integrate concept in international business concept with functioning of global trade. • Evaluate the legal, social and economic environment of business. • Apply decision-support tools to business decision making. • Will be able to apply knowledge of business concepts and functions in an integrated manner.			
Unit No.		**Course Content**		**Hours**	
Unit I		**Commercial Arithmetic**: Interest: Concept of Present value and Future value, Simple interest, Compound interest, Nominal and Effective rate of interest, Examples and Problems Annuity: Ordinary Annuity, Sinking Fund, Annuity due, Present Value and Future Value of Annuity, Equated Monthly Instalments (EMI) by Interest of Reducing Balance and Flat Interest methods, Examples and Problems.		14	
Unit II		**Measures of central Tendency and Dispersion**: Frequency distribution: Raw data, attributes and variables, Classification of data, frequency distribution, cumulative frequency distribution, Histogram and give curves. Requisites of ideal measures of central tendency, Arithmetic Mean, Median and Mode for ungrouped and grouped data. Combined mean, Merits and demerits of measures of central tendency, Geometric mean: definition, merits and demerits, Harmonic mean: definition, merits and demerits, Choice of A.M., G.M. and H.M. Concept of dispersion, Measures of dispersion: Range, Variance, Standard deviation (SD) for grouped and ungrouped data, combined SD, Measures of relative dispersion: Coefficient of range, coefficient of variation. Examples and problems.		14	
Unit III		**Correlation and regression**: Concept and types of correlation, Scatter diagram,		14	

	Interpretation with respect to magnitude and direction of relationship. Karl Pearson'scoefficient of correlation for ungrouped data. Spearman's rank correlation coefficient. (with tie and without tie) Concept of regression, Lines of regression for ungrouped data, predictions using lines of regression. Regression coefficients and their properties (without proof). Examples and problems.	
Recommended Leaning Resources		
Print Resources	**References:** 1. Practical Business Mathematics, S. A. Bari New Literature Publishing Company New Delhi. 2. Mathematics for Commerce, K. Selvakumar Notion Press Chennai 3. Business Mathematics with Applications, Dinesh Khattar & S. R. Arora S. Chand Publishing New Delhi 4. Business Mathematics and Statistics, N.G. Das &Dr. J.K. Das McGraw Hill New Delhi 5. Fundamentals of Business Mathematics, M. K. Bhowal, Asian Books Pvt. Ltd New Delhi 6. Mathematics for Economics and Finance: Methods and Modelling, Martin Anthony and Norman, Biggs Cambridge University Press Cambridge 7. Financial Mathematics and its Applications, Ahmad Nazri Wahidudin Ventus Publishing APS Denmark 8. Fundamentals of Mathematical Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi. 9. Statistical Methods, Gupta S. P.: Sultan Chand and Sons, New Delhi. 10. Applied Statistics, Mukhopadhya Parimal New Central Book Agency Pvt. Ltd. Calcutta. 11. Fundamentals of Statistics, Goon A. M., Gupta, M. K. and Dasgupta, B. World Press Calcutta. 12. Fundamentals of Applied Statistics, Gupta S. C. and Kapoor V. K.:, Sultan Chand and Sons, New Delhi.	

Botany Open Elective course

Credit Structure of Botany Open Elective Course for B.Sc./B.A./B.Com Undergraduate Honours Programme with effect from 2023-24.

SEMESTER-I										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	**126BSC01BOTOEC01T**	Plants and Human welfare	40	60	100	3		-	3	2

SEMESTER-II										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams(Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02BOTOEC02T**	Bio-fuels	40	60	100	3	-	-	3	2

ASSESSMENT   METHODS
Evaluation Scheme for Internal Assessment:

Theory

Assessment Criteria	40marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2ndInternal Assessment Test for 30 marks 1hr after 15weeks .Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25marks
1stInternal Assessment Test for 20 marks 1 hr after 8weeks and 2nd Internal Assessment Test for 20marks 1 hr after 15weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Question Paper Pattern:

Botany
BSc (botany)

Sub: Code: Maximum Marks: 60
 a.   Answer any Six Questions from Question 1
 b.   Answer any Three each Questions from Question 2,3,4 and

Q.No.1.	Answer any Six Questions (Atlest Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit- I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-IV) a. b. c. d.	4X3=12

Open Elective Syllabus

Year	I	**Course Code: 126BSC01BOTOEC01T**		**Credits**	03
		Course Title: PLANTS AND HUMAN WELFARE			
Sem.	I			**Hours**	40

Course Pre-requisites, if any	NA	
FormativeAssessmentMarks:40	SummativeAssessmentMarks:60	DurationofESA:.02hrs.

Course Outcomes	Attend of the course the student should be able to: 1. To make the students familiar with economic importance of diverse plants that offers our ces to human life. 2. To make the students known about the plant subsides-food, medicinal value and also plant source of different economic value. 3. To generate interest amongst the students on plants importance in day today life, conservation, ecosystem and sustainability.

Unit No.	Course Content	Hours
Unit I	Origin of Cultivated Plants. Concept of Centres of Origin, their importance with reference to Vavilov's work. Examples of major plant introductions. Crop domestication and loss of genetic diversity (Only conventional plant breeding methods). Importance of plant bio-diversity and conservation. **Cereals**: Wheat and Rice(origin, evolution, morphology, post-harvest Processing &uses). Green revolution. Brief account of millets and their nutritional importance.	10
Unit II	**Legumes:** General account (including chief pulses grown in Karnataka-red gram , green gram, chick pea, soybean). Importance to man and ecosystem. **Cash crops:** Morphology, new varieties and processing of sugarcane, products and by- products of sugarcane industry. Natural Rubber–cultivation, tapping and processing.	10
Unit III	**Spices:** Listing of important spices, their family and parts used, economic importance with special reference to Karnataka. Study of fennel, clove, black pepper and cardamom. **Fruits:** Mango, grapes and Citrus(Origin, morphology, cultivation ,processing and uses)	10
Unit IV	**Oils and fats:** General description, classification, extraction, their uses and health implications; groundnut, coconut, sunflower and mustered (Botanical name, family & uses). Nonedible oil yieldingtrees and importance as bio fuel. Neem oil and applications. **Beverages:** Tea, Coffee (morphology, processing & uses)	10

Recommended Leaning Resources	
Print Resources	**Text Books:** 1. Kochhar,S.L.(2012).Economic Botany in Tropics. MacMillan & Co. New Delhi. 2. Wickens,G.E.(2001).Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers. Netherland. 3. Chrispeels, M.J. and Sadava, D.E. (1994) Plants, Genes and Agriculture. Jones & Bartlett- Publishers. Lincoln, United Kingdom

SEMESTER-II

Year	I	Course Code: 126BSC02BOTOEC02T		Credits	03
Sem.	II	**Course Title:** Bio-fuels		Hours	40
Course Pre-requisites, if any		NA			
FormativeAssessmentMarks:40		SummativeAssessmentMarks:60		DurationofESA:.02hrs.	
Course Outcomes		At the end of the course the student should be able to: 1. To make the students familiar with Bio-fuel plant species cultivation for commercial exploitation. 2. TomakethestudentsknownabouttheBio-fuelusedinautomobileindustriesandsolvingfuelproblemsinfeature. 3. TogenerateinterestamongstthestudentstoknowtheimportanceofBio-fuelindaytodaylifeandeconomicwellbeing.			

Unit No.	Course Content	Hours
Unit I	Introduction, definition, scope and Importance of Bio-fuel with respect to climate change and environmental issues. Public awareness. Biofuels scenario in India and world. History of Biofuels. Advantages and disadvantages of biofuels. Developmental generation of biofuels: first, second, third and fourth generation of biofuels and present status.	10

Unit II	Biofuel feed stocks: Agricultural waste, farm waste, forestry waste, organic wastes from the residential, institutional and industrial waste and its importance. (Biomass-plant, animal and microbial based waste).Algal biofuel.	10
Unit III	Biodiesel species: *Pongamia pinnata, Simarouba gluca, Jatropha curcas,Azardirachtaindia,Madhucaindica*and*Callophylluminnophyllum*.Seedharvesting,processing,oilextraction, and characterization.	10
Unit IV	Introduction to biodiesel ,bioethanol, biogas andbiohydrogen.Productiontechnologyofbiofuels(Biodiesel,ehanolandbiogas).Quality analysis of biodiesel, bioethanol and biogas and its comparison with national and international standards. Biofuel sustainability; BiofuelPolicyinKarnatakaandIndia.Biofuelproductionstatistics.Fuel Against food security concepts.	10
Recommended Leaning Resources		
Print Resources	**Text Books and References** 1) TheBiodieselHandbook(2005).JurgenKrahl,JonHarlanVanGerpen.AOCSPress. 2) BioenergyandBiofuels(2017).OzcanKonur.CRCPress,Taylor&Franci'sgroup. 3) https://mnre.gov.in/biofuels	

Zoology Open Elective Course

Credit Structure of Zoology Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

SEMESTER-I

Category	Course code	Title of thePaper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	**126BSC01ZOOOEC01T**	Economic Zoology	40	60	100	3	-	-	3	2

SEMESTER-II

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02ZOOOEC02T**	Parasitology	40	60	100	3	-	-	3	2

OPEN ELECTIVE SYLLABUS

Year	I	Course Code: 126BSC01ZOOOEC01T	Credits	03
Sem.	1	Course Title: Economic Zoology	Hours	42
Unit No.		Course Content	Hours	

Unit No.	Course Content	Hours
Unit I	**1. Sericulture:** • History and present status of sericulture in India • Mulberry and non-mulberry species in Karnataka and India • Mulberry cultivation • Morphology and life cycle of *Bombyxmori* • Silkworm rearing techniques: Processing of cocoon, reeling • Silkworm diseases and pest control **2. Apiculture:** • Introduction and present status of apiculture • Species of honey bees in India, life cycle of *Apisindica* • Colony organization, division of labour and communication • Bee keeping as an agro based industry; methods and equipments: indigenous methods, extraction appliances, extraction of honey from the comb and processing • Bee pasturage, honey and bees wax and their uses Pests and diseases of bees and their management	14
Unit II	**3. Live Stock Management:** **Dairy:** • Introduction to common dairy animals and techniques of dairy management • Types, loose housing system and conventional barn system; advantages and limitations of dairy farming • Establishment of dairy farm and choosing suitable dairy animals-cattle • Cattle feeds, milk and milk products • Cattle diseases **Poultry:** • Types of breeds and their rearing methods • Feed formulations for chicks • Nutritive value of egg and meat • Disease of poultry and control measures **4. Aquaculture:** • Aquaculture in India: An overview and present status and scope of aquaculture Types of aquacultures: Pond culture: Construction, maintenance and management; carp culture, shrimp culture, shellfish culture, composite fish culture and pearl culture	14
Unit III	**5. Fish culture:** • Common fishes used for culture.	14

	• Fishing crafts and gears. • Ornamental fish culture: Fresh water ornamental fishes-biology, breeding techniques • Construction and maintenance of aquarium: Construction of home aquarium, materials used, setting up of freshwater aquaria, aquarium plants, ornamental objects, cleaning the aquarium, maintenance of water quality. control of snail and algal growth. • Modern techniques of fish seed production **6. Prawn culture:** • Culture of fresh and marine water prawns. • Preparation of farm. • Preservation and processing of prawn, export of prawn. **7. Vermiculture:** • Scope of vermiculture. • Types of earthworms. • Habit categories - epigeic, endogeic and anecic; indigenous and exotic species. • Methodology of vermicomposting: containers for culturing, raw materials required, preparation of bed, environmental pre-requisites, feeding, harvesting and storage of vermicompost. • Advantages of vermicomposting. • Diseases and pests of earthworms. **8.Lac Culture:** • History of lac and its organization, lac production in India. • Life cycle, host plants and strains of lac insect. • Lac cultivation: Local practice, improved practice, propagation of lac insect, inoculation period, harvesting of lac. • Lac composition, processing, products, uses	

Text Books: Suggested Readings:

1. Eikichi, H. (1999). Silkworm Breeding (Translated from Japanese). Oxford & IBH Publishing Co.Pvt. Ltd., New Delhi.
2. Ganga, G. (2003). Comprehensive Sericulture Vol-II: Silkworm Rearing and Silk Reeling.
3. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Mahadevappa, D., Halliyal, V.G., Shankar, D.G. and Bhandiwad, R., (2000). Mulberry Silk
5. Reeling Technology Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
6. Roger, M (1990). The ABC and Xyz of Bee Culture: An Encyclopedia of

Beekeeping, Kindle Edition.

7.   Shukla and Upadhyaya (2002). Economic Zoology, Rastogi Publishers
8.   YadavManju (2003). Economic Zoology, Discovery Publishing House.
9.   JabdePradip V (2005). Textbook of applied Zoology, Discovery Publishing House, New Delhi.
10. Cherian &Ramachandran Bee keeping in-South Indian Govt. Press, Madras.
11. Sathe, T.V. Vermiculture and Organic farming.
12. Bard. J (1986). Handbook of Tropical Aquaculture.
13. Santhanam, R. A. Manual of Aquaculture.
14. Zuka. R.1 and Hamiyn (1971). Aquarium fishes and plants
15. Jabde, P.V. (2005) Text Book of Applied Zoology: Vermiculture, Apiculture, Sericulture, Lac culture.
16. Animal Disease- Bairagi K. N. Anmol Publications Pvt.Ltd 2014
17. Economics of Aquaculture - Singh (R.K.P) - Danika Publishing Company 2003
18. Applied and Economic Zoology (SWAYAM) web
https://swayam.gov.in/nd2_cec20_ge23/preview Course Books published in English and Kannada may be prescribed by the Universities and College

Pedagogy: Chalk and Talk, PPT, Group discussion, Seminar, Field vis

OPEN-ELECTIVE SYLLABUS:

Year	I	Course Code: 126BSC02ZOOOEC02T **Course Title: Parasitology**	**Credits**	03
Sem	**II**		**Hours**	42
Unit No.		**Course Content**	**Hours**	
Unit I		**1. General Concepts** • Introduction, Parasites, parasitoids, host, zoonosis • Origin and evolution of parasites • Basic concept of Parasitism, symbiosis, phoresis, commensalisms and mutualism • Host-parasite interactions and adaptations • Life cycle of human parasites • Occurance, mode of infection and prophylaxis **2. Parasitic Platyhelminthes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Fasciolopsisbuski* • *Schistosomahaematobium* • *Taeniasolium* • *Hymenolepis nana* **3. Parasitic Protists** Study of morphology, life cycle, pathogenicity, prophylaxis and control *measures* of • *Entamoeba histolytica* • *Giardia intestinalis* • *Trypanosomagambiense* *Plasmodium vivax* **4. Parasitic Nematodes** Study of morphology, life cycle, pathogenicity, prophylaxis and control measures of • *Ascarislumbricoides* • *Ancylostomaduodenale* • *Wuchereriabancrofti* • *Trichinellaspiralis* • Nematode plant interaction ; Gall formation **5. Parasitic Arthropods** Biology, importance and	14	

	control of	
	• Ticks (Soft tick *Ornithodoros*, Hard tick *Ixodes*) • Mites (*Sarcoptes*) • Lice (*Pediculus*) • Flea (*Xenopsylla*) • Bug (*Cimex*) • Parasitoid (Beetles) **6. Parasitic Vertebrates** • Cookicutter Shark • Hood Mocking bird and	
Unit II	Vampire bat and their parasitic behavior and effect on host	14
Unit III	**7. Molecular diagnosis & clinical parasitology** • General concept of molecular diagnosis for parasitic infection • Advantages and disadvantages of molecular diagnosis • Fundamental techniques used in molecular diagnosis of endoparasites • Immunoassay or serological techniques for laboratory diagnosis of endoparasites on the basis of marker molecules like G.intestinalis, B. coli, E. histolytica, L. donovani, Malarial parasite using • ELISA, RIA Counter Current Immuno electrophoresis (CCI) Complement Fixation Test (CFT) PCR, DNA, RNA probe	14

Suggested Readings:

1. Arora, D. R and Arora, B. (2001) Medical Parasitology. II Edition. CBS Publications andDistributors.
2. E.R. Noble and G.A. Noble (1982) Parasitology: The biology of animal parasites. V Edition,Lea&Febiger.
3. Ahmed, N., Dawson, M., Smith, C. and Wood, Ed. (2007) Biology of Disease. Taylor andFrancis Group.
4. Parija, S. C. Textbook of medical parasitology, protozoology & helminthology (Text andcolour Atlas), II Edition, All India Publishers & Distributers, Medical Books Publishers,Chennai, Delhi.
5 Meyer, Olsen & Schmidt's Essentials of Parasitology, Murray, D. Dailey, W.C. BrownPublishers.
5. K. D. Chatterjee (2009). Parasitology: Protozoology and Helminthology. XIII Edition, CBSPublishers & Distributors (P) Ltd.
6. Gunn, A. and Pitt, S.J. (2012). Parasitology: an Integrated Approach. Wiley Blackwell.
7. Noble, E. R. and G.A.Noble (1982) Parasitology: The biology of animal

parasites. V thEdition, Lea &Febiger.

8. Paniker, C.K.J., Ghosh, S. [Ed} (2013). Paniker's Text Book of Medical Parasitology.Jaypee, New Delhi.
9. Parija,S.C. Text book of medical parasitology,protozoology&helminthology (Textand colorAtlas),II Edition, All India Publishers & Distributers, Medical Books Publishers, Chennai, Delhi.
10. Roberts, L.S and Janovy, J. (2009). Smith & Robert's Foundation of Parasitology. 8th. Edn.McGraw Bogitsh, B. J. and Cheng, T. C. (2000). Human Parasitology. 2nd Ed. Academic Press, New York.
11. Chandler, A. C. and Read. C. P. (1961). Introduction to Parasitology, 10th ed. John Wileyand Sons Inc.
12. Cheng, T. C. (1986). General Parasitology. 2nd ed. Academic Press, Inc. Orlando.U.S.A.
13. Schmidt, G. D. (1989). Essentials of Parasitology. Wm. C. Brown Publishers (Indianprint1990, Universal Book Stall).
14. John Hyde (1996) Molecular Parasitology Open University Press.

ASSESSMENT   METHODS
Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1hr after 15weeks .Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25marks
1st Internal Assessment Test for 20 marks 1 hr after 8weeks and 2nd Internal Assessment Test for 20marks 1 hr after 15weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Question Paper Pattern:

BSc

Sub: Code: Maximum Marks: 60

    a.   Answer any Six Questions from Question 1

    b.   Answer any Three each Questions from Question 2,3,4 and 5

Q.No.1.	Answer any Six Questions (Atlest Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit- I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12

Electronics Open Elective Course

Credit Structure of Electronics Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

SEMESTER-I										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P	tt	
OEC1	**126BSC01ELEOEC 01T**	Basics of Electronics, Computers and PCB Design	40	60	100	3		-	3	2

SEMESTER-II										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02ELEOE C02T**	Electronics for Everyone	40	60	100	3	-	-	3	2

Year	I	**Course Code: 126BSC01ELEOEC01T**		**Credits**	**03**
Sem.	1	**Course Title: Basics of Electronics, Computers and PCB Design**		**Hours**	**40**

Course Pre-requisites, if any	NA		
Formative Assessment Marks: 40	Summative Assessment Marks: 60		Duration of ESA: 2 hrs.

Unit No.	Course Content	Hours
Unit- I	**Basics Electronics:** Basic circuit elements (Resistor, Inductor & Capacitor), Basic principle of Transformer. Wave form types (Sine, Square, Triangular, Trigger pulses & Saw tooth). Voltage & Current sources. Ohms law, Kirchhoff's laws- Statement. Basics of SemiconductorDiode, Zener diode, LED, Transistor (Symbol and types only), Basics of IC. **COMPUTER CONCEPTS:** Introduction to computer, brief history of computer generations, block diagram of Computer system, central processing unit (CPU), ALU, Control Unit, main memory, Secondary memory, Cache memory. **Hardware:** Input devices (Key board, mouse and scanner). Output devices (various types of printers). Secondary storage devices (CDROM, optical disk). **Software:** System software, Operating system & Application software. Machine Language, Assembly Language & High-Level Language. Assembler, Compiler and Editor. Algorithm, Characteristics of an algorithm and flow charts. **Inverter:** Inverter, Uninterrupted Power supply (UPS) – online and off line UPS, SMPS.	**10**
Unit- II	**PCB Design:** Types of PCB, Single sided board – double sided – Multilayer boards – Plated through holes technology – Benefits of Surface Mount Technology (SMT) – Limitation of SMT – Surface mount components: Resistors, Capacitor, Inductor, Diode and IC's. **LAYOUT AND ARTWORK:** Layout Planning – General rules of Layout – Resistance, Capacitance and Inductance – Conductor Spacing – Supply and Ground Conductors – Component Placing and mounting–Cooling requirement and package density–Layout check. Basic artwork approaches– Artwork taping guideline–General artwork rules– artwork check and Inspection.	**10**
Unit –III	**LAMINATES AND PHOTO PRINTING:** Manufacture of copper clad laminates – Properties of laminates – Types of Laminates – Manual cleaning process – Basic printing process for double sided PCB's – Photo resists – wet film resists – Coating process for wet film resists – Exposure and further process for wet film resists – Dry film resists.	**10**

Unit -IV	**ETCHING AND SOLDERING:** Introduction – Etching machine – Etchant system. Soldering: Principles of Solder connection – Solder joints – Solder alloys – Soldering fluxes. **Soldering Tools:** Soldering, Desoldering tools and Techniques – Man Soldering – Solder mask – Safety, health and medical aspects in Soldering practice.	**10**
Laboratory Demonstration	1. Unboxing and assembling of desktop computers, 2. Types of PCB and fabrication process.	
Recommended Leaning Resources		

Reference Books	1. Computer fundamentals - Anita Goel, Pearson Edition. 2. Fundamentals of Computers - V Rajaram, NeeharikaAdabala - PHI. 3. Computer Fundamentals - Peter Norton, McGraw-Hill Education 4. Walter C. Bosshart "PCB Design and Technology" Tata McGraw Hill, Publications, Delhi. 1983. 5. Clyde F. Coombs "Printed circuits Handbook" III Edition McGraw-Hill Kraig Mitzner, "Complete PCB Design Using OrCAD Capture and Layout," Elsevier, Amsterdam, 6. Walter C Bosshart, "Printed Circuit Board Design and Technology",1st ed., McGraw Hill Education

OPEN ELECTIVE

Year	I	Course Code: 126BSC02ELEOEC02T		Credits	03
Sem.	1	**Course Title: Electronics for Everyone**		**Hours**	**40**

Course Pre-requisites, if any	NA	
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA: 2 hrs.

Unit No.	Course Content	Hours
Unit- I	**Timer (IC 555):** Introduction, Block diagram, Astable and Monostable multivibrator circuits and its application **Phase Locked Loop (PLL):** Functional block diagram – Phase detector / Comparator, Voltage Controlled Oscillator, Low pass filter. **Applications of PLL:** Frequency multiplier / Division, AM detection.	**10**
Unit- II	**Operational Amplifier:** Introduction to Differential Amplifier, Block diagram of Op-Amp, Schematic symbol, Equivalent circuit for ideal op-amp, ideal voltage transfer curve, Characteristics Op-Amp, Op-Amp parameters, Op-Amp configurations (Open and closed loopconfiguration), Concept of Virtual Ground. **Op-Amp Applications:** Inverting and non-inverting amplifier, Summing Amplifier, Difference Amplifier, Integrator, Differentiator, Instrumentation Amplifier, Phase-shift and Wein bridge oscillator.	**10**
Unit -III	**Transducers (Basic Working):** Introduction, types of transducer, Displacement transducers - Resistive (Potentiometric, Strain Gauges – Types, Gauge Factor, bridge circuits, Semiconductor strain gauge) Capacitive (diaphragm), Hall effect sensors, Magneto- strictive transducers, Microphone, Touch Switch, Piezoelectric sensors, Opto- Electronic transducer (Photo conductive or LDR, Photo emissive, Photo voltaic, Semiconductor Photo diode, Photo transistor), Temperature sensor (electrical and non-electrical), Pressure sensor.	**10**
Unit -IV	**Data Acquisition using Arduino:** Arduino--Birth, Open-Source community, Functional Block Diagram, Functions of each Pin, Arduino Development Boards: IDE, I/O Functions, Looping Techniques, Decision Making Techniques, Designing of 1st sketch, Programming of an Arduino (Arduino ISP), Serial port Interfacing, Basic Interfacing and I/O Concept, Interfacing LED, Switch,7seg LED, different sensors.	**10**
Laboratory Demonstration	1. Study of basic Monostable / Astable multivibrator. 2. Light detection using 555 timers. 3. Study of basic inverting and non-inverting amplifier. 4. Study of basic integrator / differentiator circuit. 5. Test the different Arduino Boards, Open-Source and Arduino Shields. 6. Install Arduino IDE and its development tool. 7. Develop a program to Blink LED for 1second. 8. Interfacing of various sensors with Arduino development board.	

Recommended Leaning Resources	
Reference Books	1.R.P. Bali, Consumer Electronics, Pearson Education (2008) 2.R.G. Gupta, Audio and Video systems, Tata McGraw Hill (2004)

ASSESSMENT METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40 marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks. Average of two tests should be considered.	30
Assignment	05
Activity	05
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for 20 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1 hr after 15 weeks. Average of two tests should be considered.	20
Assignment/Activity	05
Total	**25**

Question Paper Pattern:
I /II Semester B.Sc.

Sub: Code: Maximum Marks: 60

Q.No.1.	**Answer any Six Questions** *(Two question from Each Unit to be asked)* **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**6X2=12**
Q.No.2.	**(Questions from Unit-I)** **a.** **b.** **OR** **c.** **d.**	**08** **04** **08** **04**
Q.No.3.	**(Questions from Entire Unit-II)** **a.** **b.** **OR** **c.** **d.**	**08** **04** **08** **04**
Q.No.4.	**(Questions from Unit-III)** **a.** **b.** **OR** **c.** **d.**	**08** **04** **08** **04**
Q.No.4.	**(Questions from Unit-IV)** **a.** **b.** **OR** **c.** **d.**	**08** **04** **08** **04**

Note:

There should be a problem of marks from each unit and may be asked in either b or d in questions 2 to 5.
If necessary, sub questions a and c from 2 to 5 may be subdivided in to i. and ii.Without exceeding maximum 08 marks.

Statistics Open Elective Course

Credit Structure of Statistics Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

SEMESTER-I										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit tt	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	**126BSC01STSOEC01T**	Statistical Methods	40	60	100	3		-	3	2

SEMESTER-II										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	**126BSC02STSOEC02T**	Business Statistics	40	60	100	3	-	-	3	2

1. Statistical Methods (Open Elective)

Year	I	Course Code: 126BSC01STSOEC01T		Credits	03
Sem.	1	Course Title: Statistical Methods		Hours	40
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		

Course Objectives

1. This is an open elective course for other than statistics students.

2. The students will learn the elements of descriptive statistics, probability, statistical methods such as tests of hypotheses, correlation and regression.

Course Outcomes

Students will be able to;

CO1. Acquire knowledge of statistical methods.

CO2. Identify types of data and visualization, analysis and interpretation.CO3.

Know about elementary probability and probability models.

CO4. Employ suitable test procedures for given data set.

Contents

Unit 1: Introduction   **10 Hours**

Definition and scope of Statistics. Data: quantitative and qualitative, attributes, variables, scales of measurement - nominal, ordinal, interval and ratio. Presentation: tabular and graphic, including histogram and ogives. Concepts of statistical population and sample. Sampling from finite population - Simple random sampling, Stratified and systematic random sampling procedures (definitions and methods only). Concepts of sampling andnon-sampling errors.

Unit 2: Univariate and Bivariate Data Analysis   **10 Hours**

Measures of Central Tendency: mathematical and positional. Measures of Dispersion: range, quartile deviation, mean deviation, standard deviation, coefficient of variation, moments, skewness and kurtosis.

Bivariate data, scatter diagram, Correlation, Karl-Pearson's correlation coefficient, Rank correlation. Simple linear regression, principle of least squares and fitting of polynomialsand exponential curves.

Unit 3 : Probability and Distributions   10 Hours

Random experiment, trial, sample space, events-mutually exclusive and exhaustive events Classical, statistical and axiomatic definitions of probability, addition and multiplication theorems, Bayes theorem (only statements). Discrete and continuous random variables, probability mass and density functions, distribution functions, expectation of a random variable.

Standard univariate distributions: Binomial, Poisson and Normal distributions (Elementary properties and applications only).

Unit 4: Sampling Distributions and Testing of Hypothesis   10 Hours

Distribution of sample mean from a normal population, Chi-square, t and F distributions (No derivations) and their applications. Statistical Hypothesis – null and alternative hypothesis, simple and composite hypothesis. Type I and Type II errors, level of significance, critical region, P-value and its interpretation. Test for single mean, equality of two means, single variance, and equality of two variances for normal populations

References 1. Daniel, W. W. (2007 Biostatistics - A Foundation for Analysis in the Health Sciences, Wiley

2. T.W. Anderson and Jeremy D. Finn(1996). The New Statistical Analysis of Data, Springer.

3. Mukhyopadyaya P(1999). Applied Statistics, New Central book Agency, Calcutta.
4. Ross, S.M.(2014) Introduction to Probability and Statistics For Engineers and Scientists.

5. Cochran, W G (1984): Sampling Techniques, Wiley Eastern, New Delhi

2. Business Statistics (Open Elective)

Year	I	Course Code: 126BSC02STSOEC02T		Credits	03
Sem.	II	Course Title: **Business Statistics**		Hours	40
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		

Course Objectives 1. Provide an introduction to basics of statistics within a financial context.

2.To enable students to use statistical techniques for analysis and

interpretation of business data.

Course Outcomes (CO) Upon the completion of this course students should be able to:

CO1.Frame and formulate management decision problems.

CO2. Understand the basic concepts underlying quantitative analysis.

CO3. Use sound judgment in the applications of quantitative methods to management decisions

Pedagogy 1. The course is taught using traditional chalk and talk method using problem solving through examples and exercises.

2. Students are encouraged to use resources available on open sources

Contents

Unit 1: Statistical Data and Descriptive

Statistics   10 Hours

Nature and Classification of data: univariate, bivariate and multivariate data; time-series and cross- sectional data. Measures of Central Tendency: mathematical averages including arithmetic mean geometric mean and harmonic mean, properties and applications. Positional Averages Mode and Median (and other partition values including quartiles, deciles, and percentiles). Measures of Variation: absolute and relative. Range, quartile deviation, mean deviation, standard deviation, and their coefficients, Properties of standard deviation/variance Skewness: Meaning, Measurement using Karl Pearson and Bowley's measures; Concept of Kurtosis.

Unit 2: Simple Correlation and Regression Analysis   10 Hours

Correlation Analysis: Meaning of Correlation: simple, multiple and partial; linear and non-linear, Correlation and Causation, Scatter diagram, Pearson's co-efficient of correlation; calculation and properties (Proof not required). Correlation and Probable error; Rank Correlation.

Regression Analysis: Principle of least squares and regression lines, Regression equations and estimation; Properties of regression coefficients; Relationship between Correlation and Regression coefficients; Standard Error of Estimate and its use in interpreting the results.

Unit 3: Index Numbers   10 Hours

Definition, Problems involved in the construction of index numbers, methods of constructing index numbers of prices and quantities, simple aggregate and price relatives method, weighted aggregate and weighted average of relatives method, important types of weighted index numbers: Laspeyre's, Paasche's, Bowley's, Marshall□Edgeworth, Fisher's, method of obtaining price and quantity index numbers, tests consistency of index numbers, time reversal test and factor reversal test for index numbers, Uses and limitations of index numbers. Consumer price index number: Problems involved in the construction of cost of living index number, advantages and disadvantages, Aggregative expenditure method and Family budget method for the construction of consumer price index numbers. Applications of Cost of Living Index numbers. Definition and measurement of Inflation rate – CPI and GNP Deflator.

Unit 4: Time Series Analysis   10Hours

Introduction, definition and components of Time series, illustrations, Additive, Multiplicative and mixed models, analysis of time series, methods of studying time series: Secular trend, method of moving averages, least squares method – linear, quadratic, exponential trend fittings to the data. Seasonal variation - definition, illustrations, measurements, simple average method, ratio to moving average method, ratio of trend method, link relatives method, Cyclical variation- definition, distinction from seasonal variation, Irregular variation- definition, illustrations.

References

1. Levin, Richard, David S. Rubin, Sanjay Rastogi, and H M Siddiqui. Statistics for Management. 7th ed., Pearson Education.

2. David M. Levine, Mark L. Berenson, Timothy C. Krehbiel, P. K.Viswanathan, Business Statistics: A First Course, Pearson Education.

3. Siegel Andrew F. Practical Business Statistics. McGraw Hill Education

4. Gupta, S.P., and Archana Agarwal. Business Statistics, Sultan Chand and Sons, New Delhi.

5. Vohra N. D., Business Statistics, McGraw Hill Education.

6. Murray R Spiegel, Larry J. Stephens, Narinder Kumar. Statistics (Schaum's Outline Series), Mc-Graw Hill Education.

7. Gupta, S.C. Fundamentals of Statistics. Himalaya Publishing House.

8. Anderson, Sweeney, and Williams, Statistics for Students of Economics and Business, Cengage Learning

ASSESSMENT   METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2ndInternal Assessment Test for 30 marks 1hr after 15weeks .Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25marks
1stInternal Assessment Test for 20 marks 1 hr after 8weeks and 2nd Internal Assessment Test for 20marks 1 hr after 15weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Question Paper Pattern:

Statistics

I Semester B.Sc Statistics

Sub: Code: Maximum
Marks: 60

a.   **Answer any Six Questions from Question 1   b.**
Answerany Three each Questions from Question
2,3,4 and 5

Q.No.1.	**Answer any Six Questions (At least Two question from EachUnit)** **a.** **b.** **c.** **d,** **e.** **f.** **g.** **h.**	**2X6=12**
Q.No.2.	**(Should cover Entire Unit-I)a.** **b.** **c.** **d.**	**4X3=15**
Q.No.3.	**(Should cover Entire Unit-II)a.** **b.** **c.** **d.**	**4X3=15**
Q.No.4.	**(Should cover Entire Unit-III)** **a.** **b.** **c.** **d.**	**4X3=15**

Biotechnology Open Elective Course

Credit Structure of Biotechnology Open Elective Course for the B.Sc./B.A./B.Com Undergraduate Honors Programme with effect from 2023-24.

Semester- I

SEMESTER-I										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SE E**	**Tot al**	**L**	**T**	**P**		
OEC1	**126BSC01BITOEC01T**	Biotechnology forHuman welfare	40	60	100	3	-	-	3	2

SEMESTER-II										
Category	**Course code**	**Title of the Paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration of exams (Hrs)**
			IA	**SE E**	**Tot al**	**L**	**T**	**P**		
OEC1	**126BSC02BOTOEC02T**	Applications of Biotechnology in Agriculture	40	60	100	3	-	-	3	2

Title of the Course: Open Elective (OE-1): Biotechnology for Human Welfare

Course code: 126BSC01BITOEC01T

Unit No.	Course Content	Hours
Unit I	**Industry** Application of biotechnology in industry: Industrial production of alcoholic beverage (wine), antibiotic (Penicillin), enzyme (lipase) Protein engineering applications in food , detergent and pharmaceutical industr**y**	14
Unit II	**Environment** Application of biotechnology in environmental aspects : Degradation organic pollutants - chlorinated and non-chlorinated compounds; degradation of hydrocarbons and agricultural wastes, PHB –production and its futuristic applications	14
Unit III	**Forensic science** Application of biotechnology in forensic science: Solving crimes of murder and rape; solving claims of paternity and theft by using DNA finger printing techniques **Health** Application of biotechnology in health: Genetically engineered insulin, recombinant vaccines, gene therapy, molecular diagnostics using ELISA, PCR; monoclonal antibodies and their use in cancer; human genome project	14

Reference:

1. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology.2nd edition. Panima Publishing Co. New Delhi.
2. Patel AH. (1996). Industrial Microbiology. 1st edition, Macmillan India Limited.
3. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology. 2nd edition, Elsevier Science Ltd.
4. Environmental Biotechnology, Pradipta Kumar Mohapatra

5. Environmental Biotechnology – Concepts and Applications, Hans-Joachim Jordening and Jesef Winter
6. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
7. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).
8. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
9. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G.Eckert (ED.), CRC Press, Boca Raton (1997).

OPEN-ELECTIVE SYLLABUS
Title of the Course: OEC-2: Subject code: 126BSC02BOTOEC02T

Paper: Applications of Biotechnology in Agriculture

B.Sc. Semester – II

Unit No.	Course Content	Hours
Unit I	**Agricultural Biotechnology** Concepts and scope of biotechnology in Agriculture. Plant tissue culture, micro propagation, entrepreneurship in commercial plant tissue culture. Banana tissue culture - primary and secondary commercial setups ,Small scale bio enterprises: Mushroom cultivation	14
Unit II	**Transgenic plants** The GM crop debate – safety, ethics, perception and acceptance of GM crops GM crops case study :Bt cotton, Bt brinjal Plants as biofactories for molecular pharming : edible vaccines, plantibodies, nutraceuticals.	14
Unit III	**Bt based pesticides** Baculo virus pesticides, Mycopesticides, Post-harvest Protection : Antisense RNA technology for extending shelf life of fruits and shelf life of flowers. Genetic Engineering for quality improvement: Seed storage proteins, Flavours–capsaicin, vanillin	14

Text Books / References

1. Prescott, Harley, Klein"s Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark- 12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, PelczarJr,Chan, Krieg, International ed, McGraw Hill.

8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. JohnWiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.
9. Atlas, R.M. 1984. Basic and practical microbiology. Mac Millan Publishers, USA. 987pp.
10. Black, J.G. 2008. Microbiology principles and explorations. 7edn. John Wiley and SonsInc., New Jersey 846 pp.
11. Pommerville, J.C. Alcamo"s Fundamentals of Microbiology. Jones and BartlettPub..Sudburry, 835 pp.
12. Schlegel, H.G. 1995.General Microbiology. Cambridge University Press, Cambridge, 655pp.
13. Toratora, G.J., Funke, B.R. and Case, C.L. 2007. Microbiology 9th ed. Pearson EducationPte. Ltd., San Francisco. 958pp.

ASSESSMENT   METHODS

Evaluation Scheme for Internal Assessment:

Theory:

Assessment Criteria	40marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2ndInternal Assessment Test for 30 marks 1hr after 15weeks .Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25marks
1stInternal Assessment Test for 20 marks 1 hr after 8weeks and 2nd Internal Assessment Test for 20marks 1 hr after 15weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Question Paper Pattern:

Biotechnology
BSc

Sub: Code: Maximum Marks: 60

      a.   Answer any Six Questions from Question 1

      b.   Answer any Three each Questions from Question 2,3,4 and 5

Q.No.1.	Answer any Six Questions (Atlest Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit- I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12

Microbiology Open Elective Course

Credit Structure of Microbiology Open Elective Course the B.Sc./B.A./B.Com

Undergraduate Honors Programme with effect from 2023-24

SEMESTER-I										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	126BSC01MIBOEC01T	Microbial Technology for Human Welfare	40	60	100	3	-	-	3	2

SEMESTER-II										
Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	126BSC02MIBOEC02T	Environmental and Sanitary Microbiology	41	60	100	3	-	-	3	2

Open elective-Microbiology (OEC1)   Course code: **126BSC01MIBOEC01T**

Title of the paper: Microbial Technology for Human Welfare

	42Hrs
Unit – 1: Food and Fermentation Microbial Technology	14Hrs
Fermented Foods – Types, Nutritional Values, Advantages and Health Benefits Prebiotics, Probiotics, Synbiotics and Nutraceutical Foods Fermented Products – Alcoholic and nonalcoholic beverages, fermented dairy products, Fruit fermented drinks,	
Unit – 2: Agriculture Microbial Technology	14Hrs
Microbial Fertilizers, Microbial Pesticides, Mushroom Cultivation, Biogas Production	
Unit – 3: Pharmaceutical Microbial Technology	14Hrs
Microbial Drugs – Types and Development of Drug Resistance Antibiotics – Types, Functions and Antibiotic Therapy Vaccines – Types, Properties, Functions and Schedules	

Pedagogy:

The general pedagogy to be followed for theory and practicals are as under. Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling, Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

Active learning as per LSSSDC (NSDC) LFS/Q0509 guidelines, at skill training Level Case studies about application of microbial biomolecules in various industries. Seminar on topics of microbial biochemistry

Title of the paper: Environmental and Sanitary Microbiology

	42 Hrs
Unit – 1: Soil and Air Microbiology	14 Hrs
Soil and Air as a major component of environment. Types, properties and uses of soil and air, Distribution of microorganisms in soil and air, Major types of beneficial microorganisms in soil, Major types of harmful microorganisms in soil	
Unit – 2: Water Microbiology	14 Hrs
Water as a major component of environment. Types, properties and uses of water. Microorganisms of different water bodies, Standard qualities of drinking water	
Unit – 3: Sanitary Microbiology	14 Hrs
Public health hygiene and communicable diseases. Survey and surveillance of microbial infections. Airborne microbial infections, waterborne microbial infections , Food borne microbial infections. Epidemiology of microbial infections, their detection and control.	

Text Books / References

1. Prescott, Harley, Klein''s Microbiology, J.M. Willey, L.M. Sherwood, C.J. Woolverton, 7th International, edition 2008, McGraw Hill.
2. Foundations in Microbiology, K. P. Talaro, 7th International edition 2009, McGraw Hill.
3. A Textbook of Microbiology, R. C. Dubey and D. K. Maheshwari, 1st edition, 1999, S. Chand & Company Ltd.
4. Brock Biology of Microorganisms, M.T.Madigan, J.M.Martinko, P. V. Dunlap, D. P. Clark-12th edition, Pearson International edition 2009, Pearson Benjamin Cummings.
5. Microbiology – An Introduction, G. J.Tortora, B. R.Funke, C. L. Case, 10th ed. 2008,Pearson Education.
6. General Microbiology, Stanier, Ingraham et al, 4th and 5th edition 1987, Macmillan education limited.
7. Microbiology- Concepts and Applications, PelczarJr,Chan, Krieg, International ed, McGraw Hill.
8. Alexopoulos, C.J., Mims, C.W., and Blackwell, M. 2002. Introductory Mycology. John Wiley and Sons (Asia) Pvt. Ltd. Singapore. 869 pp.

Pedagogy:

The general pedagogy to be followed for theory and practicals are as under.
Lecturing, Tutorials, Group/Individual Discussions, Seminars, Assignments, Counseling,Remedial Coaching. Field/Institution/Industrial visits, Hands on training, Case observations, Models/charts preparations, Problem solving mechanism, Demonstrations, Project presentations, Experiential documentation and Innovative methods.

ASSESSMENT   METHODS
Evaluation Scheme for Internal Assessment:

Theory

Assessment Criteria	40marks
1st Internal Assessment Test for 30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1hr after 15weeks .Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25marks
1st Internal Assessment Test for 20 marks 1 hr after 8weeks and 2nd Internal Assessment Test for 20marks 1 hr after 15weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Question Paper Pattern:

Biotechnology
BSc

Sub: Code: Maximum Marks: 60

    a.   Answer any Six Questions from Question 1

    b.   Answer any Three each Questions from Question 2,3,4 and 5

Q.No.1.	Answer any Six Questions (Atlest Two question from Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit- I) a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II) a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III) a. b. c. d.	4X3=12

Computer Science Open Elective Course

Credit Structure of Microbiology Open Elective Course the B.Sc./B.A./B.Com

Undergraduate Honors Programme with effect from 2023-24

Semester-I										
Category	**Course code**	**Title of paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration exams (Hrs)**
			IA	SEE	Total	L	T	P		
OEC1	**126BSC01CSCOEC01T**	C Programming Concepts	40	60	100	3	-	-	3	2

Semester-II										
Category	**Course code**	**Title of paper**	**Marks**			**Teaching hours/week**			**Credit**	**Duration exams (Hrs)**
			IA	SEE	Total	L	T	P		
OEC 2	**126BSC02CSCOEC02T**	Web Designing	40	60	100	3	-	-	3	2

Year	I	Course Code: 126BSC01CSCOEC01T		Credits	03
Sem.	1	**Course Title:** C Programming Concepts		Hours	40
Course Pre-requisites, if any		NA			
Formative Assessment Marks: 40		Summative Assessment Marks: 60	Duration of ESA:.02 hrs.		
Course Outcomes		At the end of the course the student should be able to: 1. Read, understand and trace the execution of programs written in C language 2. Write the C code for a given problem 3. Perform input and output operations using programs in C 4. Write programs that perform operations on arrays 5. Write user defined functions to perform a task			

Unit No.	Course Content	Hours
Unit I	**Introduction to C Programming:** Overview of C; History and Features of C; Structure of a C Program with Examples; Creating and Executing a C Program; Compilation process in C. **C Programming Basic Concepts:** C Character Set; C tokens - keywords, identifiers, constants, and variables; Data types; Declaration & initialization of variables; Symbolic constants.	10
Unit II	**Input and output with C:** Formatted I/O functions – *printf* and *scanf*, control stings and escape sequences, output specifications with *printf* functions; Unformatted I/O functions to read and display single character and a string - *getchar, putchar, gets* and *puts* functions **C Operators & Expressions:** Arithmetic operators; Relational operators; Logical operators; Assignment operators; Increment & Decrement operators; Bitwise operators; Conditional operator; Special operators; Operator Precedence and Associatively; Evaluation of arithmetic expressions; Type conversion. **Control Structures:** Decision making Statements - S*imple if, if_else, nested if_else, else_if ladder, Switch Case, goto, break &continue* statements	10

Unit III	Looping Statements - Entry controlled and exit controlled statements, *while, do-while, for* loops, Nested loops. **Derived data types in C:** Arrays: One Dimensional arrays - Declaration, Initialization and Memory representation; Two Dimensional arrays - Declaration, Initialization and Memory representation. **Strings:** Declaring & Initializing string variables; String handling functions - *strlen, strcmp, strcpy and strcat;* Character handling functions - *toascii, toupper, tolower, isalpha, isnumericetc*	10
Unit IV	**User Defined Functions:** Need for user defined functions; Format of C user defined functions; Components of user defined functions - return type, name, parameter list, function body, return statement and function call; Categories of user defined functions - With and without parameters and return type.	10
	Recommended Leaning Resources	
Print Resources	**Text Books:** 1. C: The Complete Reference, By HerbertSchildt. 2. C Programming Language, By Brain W.Kernighan 3. Kernighan & Ritchie: The C Programming Language(PHI) **References** 1. E. Balaguruswamy: Programming in ANSI C(TMH) 2. Kamthane: Programming with ANSI and TURBO C (PearsonEducation) 3. V. Rajaraman: Programming in C (PHI –EEE) 4. S. Byron Gottfried: Programming with C(TMH) 5. YashwantKanitkar: Let usC	

OPEN-ELECTIVE SYLLABUS:

Year	I	Course Code: 126BSC02CSCOEC02T	Credits	03
Sem.	II		Hours	40
		Course Title: Web Designing		

Course Pre-requisites, if any	NA		
Formative Assessment Marks: 40	Summative Assessment Marks: 60	Duration of ESA:.02 hrs.	

Course Outcomes	At the end of the course the student should be able to: 1. Read, understand and trace the execution of programs 2. Write the code for a given problem 3. Perform input and output operations using programs 4. Write user defined functions to perform a task

Unit No.	Course Content	Hours
Unit I	History of Internet, The World Wide Web, Web Browser, Web Server, URL, Working of Web, Web Page, Types of Web Pages, Web Content, Websites, Home Pages, Building Website, Website building tools; Web graphics design, basic tips for graphics design, Web Designing tools: Gimp-image resize, crop, edit background, save with different file types. Introduction to web programming: what is web programming? , web programming languages.	10
Unit II	Introduction to XHTML- Basic Syntax, Standard structure, Basic text markup, Images, Hypertext, Links, Lists, Tables, Forms- <form>,<input>,<label>,<select>,<textarea> tags and action buttons(submit and reset). CSS- Introduction, Levels of style sheets, Selector forms, Property value forms, Font properties, List properties, Color, Alignment of text, The box model, Background images, The <span> and <div>tags.	10
Unit III	JavaScript: Object orientation and JavaScript; General syntactic characteristics; Primitives, operations, and expressions; Screen output and keyboard input; Control statements; Object creation and modification; Arrays; Functions; Constructor; Pattern matching using regular expressions; Errorsin scripts; Examples.	10

Unit IV	Introduction to XML, Syntax of XML , XML document structure, Displaying raw XML documents, Displaying XML documents with CSS,XSLT Stylesheets and Displaying XML documents with XSLT. Web Design: Concepts of effective web design, Web design issues including Browser, Bandwidth and Cache, Display resolution, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation	10
	Recommended Leaning Resources	

Print Resources	**Text Books:**
	    1. Robert W. Sebestra, "Programming the World Wide Web", 7th Edition /4th edition Addison Wesley Publication,2013.
	References:
	    1. Developing Web Applications, Ralph Moseley and M. T. Savaliya, Wiley-India
	    2. Web Technologies, Black Book, dreamtech Press
	    3. HTML 5, Black Book, dreamtech Press
	    4. Web Design, Joel Sklar, Cengage Learning
	    5. Developing Web Applications in PHP and AJAX, Harwani, McGrawHill
	    6. Internet and World Wide Web How to program, P.J. Deitel& H.M. Deitel, Pearson	

Assessment method Evaluation Scheme for
Internal Assessment:

Assessment Criteria	40 marks
1st Internal Assessment Test for30 marks 1 hr after 8 weeks and 2nd Internal Assessment Test for 30 marks 1 hr after 15 weeks . Average of two tests should be considered.	30
Assignment	10
Total	**40**

Assessment Criteria	25 marks
1st Internal Assessment Test for20 marks 1hr after 8 weeks and 2nd Internal Assessment Test for 20 marks 1hr after 15 weeks. Average of two tests should be considered.	20
Assignment	05
Total	**25**

Practical:

Assessment Criteria	25 marks
Semester End Internal Assessment Test for 20 marks 2 hrs	20
Journal (Practical Record)	05
Total	**25**

Question Paper Pattern:

Department of Computer Science

BSc(Computer Science)

Sub: Code: Maximum Marks: 60

   a.   Answer any Six Questions from Question 1   b. Answer any Threeeach
       Questions from Question 2,3,4 and 5

Q.No.1.	Answer any Six Questions (Atlest Two questionfrom Each Unit) a. b. c. d, e. f. g. h.	2X6=12
Q.No.2.	(Should cover Entire Unit-I)a. b. c. d.	4X3=12
Q.No.3.	(Should cover Entire Unit-II)a. b. c. d.	4X3=12
Q.No.4.	(Should cover Entire Unit-III)a. b. c. d.	4X3=12

Geography   Open Elective Course

Credit Structure of Geography Open Elective Course the B.Sc./B.A./B.Com

Undergraduate Honors Programme with effect from 2023-24

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC1	126BSC01GEG OEC01T	Earth System Dynamics	40	60	100	3	-	-	3	2
	126BSC01GEG OEC02T	Introduction to Natural Resources	40	60	100	3	-	-	3	2
	126BSC01GEG OEC03T	Introduction to Physical Geography	40	60	100	3	-	-	3	2
	126BSC01GEG OEC04T	Fundamentals of Remote Sensing	40	60	100	3	-	-	3	2

SEMESTER-I *(table header above)*

Category	Course code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
			IA	SEE	Total	L	T	P		
OEC2	126BSC02GEGOEC01T	Introduction to Human Geography	40	60	100	3	-	-	3	2
	126BSC02GEGOEC02T	Fundamentals of Natural Disasters	40	60	100	3	-	-	3	2
	126BSC02GEGOEC03T	Climate change : Vulnerability and Adaptation	40	60	100	3	-	-	3	2
	126BSC02GEGOEC04T	Basics of GIS	40	60	100	3	-	-	3	2

SEMESTER-II *(table header above)*

OPEN ELECTIVE (OE) - 1
THEORY

Title of the Course: Earth System Dynamics   **Code : 126BSC01GEGOEC01T**

Number of Theory Credits	Number of lecture hours/ semester	Number of Theory classes per week Number of practical hours/ semesters
3	56 hrs	3 hrs

Course Outcomes:
1. This course is to make understand the basic concepts of earth and to impart necessary skills of earth system, and dynamics to the students. So that, students acquire basic understanding of the mother earth
2. To articulate the synergies and trade-offs of earth system and interconnected subs stems to the students of interdisciplinary students.

Course Objectives
This course aims to
1. Understand the concepts in Earth Sciences
2. To study the global issues in the Earth system
3. To stud application of geoinformatics to solve the disaster and hazards

Content of Theory Course	56Hrs
Unit — 1 Earth System Dynamics	10
Origin of Earth and its forms, plate tectonics, layers of earth and composition, geological epochs, evolution of species, extinctions, ice ages, continental drift theory, Process of atmosphere, hydrosphere, biosphere, lithosphere, and their interaction. Trajectories of the Earth System in the Anthropocene.	
Unit — 2 Issues in Earth System	14
Global warming, greenhouse effect, carbon cycle, nitrogen cycle, water cycle, ozone depletion, floods, droughts, weather variations, sea level rise, changing ecosystems, snow / glaciers melting and impact of pollution.	
Unit — 3 Climate Change	14
The physical science of climate system and change, concepts, causes, effects, measures, climate change; Land — Climate interactions and climatic zones of world and India; Climate change and linkages with energy, emerging diseases, community response.	
Unit — 4 Geoinformatics Applications: Concepts of hazards, risks and vulnerability; their analysis relating climate projections and their uncertainties; global warming, floods and droughts, and weather variations, ecosystems changes, and snow/glaciers melting, energy studies, health and diseases studies and other case studies.	14

References

1. The Dynamic Earth System (2012), Prentice Hall India Learning Private Limited; Third edition (2012) A.M. Patwardhan
2. Earth's Dynamic Systems (2003), Pearson; 10th edition (2003), W. Kenneth Hamblin & Eric H. Christiansen
3. Planet Earth: Cosmology, Geology, and the Evolution of Life and Environment (1992) Cesare Emiliani
4. Earth: Evolution of a Habitable World, 2nd edn., Cambridge, UK: Cambridge University Press (2013) Jonathan l. Lunine.
5. Evolution of the Earth, McGraw-Hill Education; 8th edition (2009) Donald Prothero, Robert Dott, Jr.
6. A Tex tbook of Climatology, Wisdom Press (2015) Tapas Bhattacharya

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Case studies	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 2
THEORY

Title of the Course: Introduction to Natural Resources   **Code: 126BSC01GEGOEC02T**

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	**42 hrs**	**3 hrs**

Course Outcomes: At the end of the course the students will:
1. Understand concepts of different natural resources, its use, overuse, with its solution by natural resource management methods.
2. Appreciate the need for managing land and water resources for sustainable growth and development, managerial skills such as land evaluation and landclassification.
3. Also, able to understand the causes and consequences of water stress and draw water conservation and management plans.

Course Objectives: This course aims to
1. Explain the types of natural resources that exist.
2. Study the role of government and different agencies in the natural resource management
3. Stud the threat to the natural resources and the polycies to solve it.

Content of Theory Course	42Hrs
Unit — 1 Concept of Resources	12
Meaning, Definition, importance and classification of Resources, Appraisal of Natural Resources, Natural Resources Economics, History of Conservation, needfor conservation and Management of Natural Resources —Role of Government and NGO Agencies, Resource Creating Factors. Environmental Risk- types, wildlife, forest risk and its impact on environment and its management.	
Unit — 2 Land Resources	10
Land Evaluation Methods, Land classification Methods, Land use and Land cover Mapping changes. Issue related to land use change —Land use and population, Land use pattern in the world. Land source at stress, land use planning and development. Soil erosion, soil degradation, methods of conservation.	
Unit — 3 Water Resources	10
Importance of water, Recent trends in water use in the world and in India, water crises, (stress) causes and consequences of water stress or crises, methods of water conservation, watershed management, coastal and ocean Resources management, Fisheries Management	
Unit — 4 Minerals Resources	10
Types of minerals, classifications of Major Minerals, their distribution and production. Such as Petroleum, Coal, Iron ore, Bauxite and Copper etc, and its uses. Mineral exploration methods, Mining, and its effects on environment. Mineral's conservation and mining policy	

References

1 . Dr.Alka Gautham: Geography of Resources: Exploitation, Conservation and Mangement, Sharada Pustak Bhavan, Allahabad.
2. Dr.P.S.Negi: Geography of Resources: Kedarnath Ramnath Publishers, New Delhi
3. Dr.Rajashekara Shetty(2009): An Analysis of World Resources with reference to India, Sarala Raj, Ria Publishers, Mysore
4. Khanna K.K and Gupta V.K.(1993): Economic and Commercial Geography, Sultan Chand, New Delhi
5. Prof. Zimmerwan — World Resources and Industries
6. Roy, P.R(2001) Economic Geography — A Study of Resources, New Central Book Agency, Calcutta.

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Case studies	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 3
THEORY

Title of the Course: Introduction to Physical Geography   **Code : 126BSC01GEGOEC03T**

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	**42 hrs**	**3 hrs**

Course Outcomes:
1. Students will be able to understand the fundamental concepts in Earth Sciences
2. Understands basic terminology used to describe physical processes and landscape forms.
3. Describe elements of the atmosphere and the oceans

Course Objectives:
This course aims to
1. Study basic principles of the Earth Sciences
2. Understand the landforms, atmospheric elements and structure and basics of oceanography

Content of Theory Course	42Hrs
Unit - 1	12
Origin, Shape and Size of the Earth, Movement of the Earth- Rotation and Revolution, Effects of the movement of Earth, Coordinates -Latitude, Longitude and Time. Structure of the Earth,	
Unit— 2	10
Rocks - types, significance, Weathering —types. Agents of Denudation - River, Glacier, Wind and Under Ground water. Volcanicity, Earthquakes and Tsunamis	
Unit -3	10
Structure and Composition of Atmosphere, Weather and Climate. Atmospheric Temperature, Heat Budget of the atmosphere Atmospheric Pressure, Winds and Precipitation	
Unit — 4	10
Distribution of Land and Sea, Submarine Relief of the Ocean, Temperature and Salinity of Sea Water. Ocean Tides, Waves and Deposits, Ocean currents - Atlantic, Pacific and IndianOceans. Marine Resources: Biotic, mineral and energy resources	

References

1 . B.S. Negi (1993) Physical Geography. S.J. Publication, Meerut

2. D.S. Lal (1998) Climatology. Chaitnya publishing house, Allahabad

3. K. Siddhartha (2001) Atmosphere, Weather and Climate. Kisalaya publication, New Delhi

4. R.N. Tikka (2002) Physical Geography. Kedarnath Ramnath & co, Meerut

5. Willian D. Thornbury (1997) Principle of Geomorphology. New Age International (Pvt Ltd.) New Delhi.

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Case studies	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 4
THEORY

Title of the Course: Fundamentals of Remote Sensing   **Code : 126BSC01GEGOEC04T**

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	42 hrs	3 hrs

Course Outcomes:
1. This course is to make understand the basic concepts of Remote Sensing and to impart necessary skills of remote sensing analysis, and image interpretation to the students. So that, students acquire employable skills in remote sensing.
2. Students will learn how to handle and process the satellite images for understanding of bio physical phenomena of the earth s stem.

Course Objectives:
1. To congregate the basic concepts and fundamentals of physical principlesof remote sensing
2. To create a firm basis for successful integration of remote sensing in any field of application.
3. To study basics of digital image processing and image interpretation techniques.
4. To stud the applications of the remote sensing to solve the real-world problems.

Content of Theory Course	42Hrs
Unit— I Introduction	10
Definition of Remote Sensing, developmental stages, Laws of Physics, electromagnetic waves, spectrum, regions, wavelength, frequencies, and applications. Types-Satellites, Sensors, Payloads, Orbits, telemetry of satellites.	
Unit – 2 Process and types of Remote Sensing	12
Process of remote sensing, interaction of radiation with atmosphereand targets, atmospheric noises, attenuation in radiance, resolutionsof remote sensing, optical remote sensing, visible region of the spectrum, thermal remote sensing, microwave remote sensing, Hyperspectral remote sensing, LiDAR, and other remote sensing platforms.	
Unit — 3 Image Classification and Interpretation	10
Satellite products and its spectral characteristics, composite images, band ratios; Land use land cover classification schemes-Anderson andNRSC; Visual image interpretation, elements, stages of interpretation and interpretation keys. Image classification- supervised, unsupervised, and principal component analysis (PCA) and accuracy assessment.	

Unit — 4 Applications of Remote Sensing	10
Disaster Management, Meteorological Studies, Agricultural and Irrigation Studies, Forestry Studies, Hydrological Studies, NaturalResource, Oceanic and Coastal mapping, Soil resource mapping, Urban and Rural Mapping and Management.	

References:

1. Remote Sensing of the Environment: An Earth Resource Perspective (Prentice Hall Series in Geographic Information Science) – Second Edition (2006), John Jensen
2. Remote Sensing and GIS, Second Edition (201 1), Bhatta, B.
3. Introduction to Remote Sensing and Image Interpretation (2003); Lillesand T.M.
4. Remote sensing and image interpretation (2015); Chipman, Jonathan W., Kiefer, Ralph W., Lillesand
5. Introduction to Remote Sensing, Fifth Edition (2011); James B. Campbell, Randolph H. Wynne
6. Practical handbook of remote sensing, First Edition (2016) – Lavender, Andrew, Lavender, Samantha
7. Introductory Digital Image Processing: A Remote Sensing Perspective, Fourth Edition (2015) – John R. Jensen
8. Image processing and GIS for remote sensing: techniques and applications; Second Edition (2016) – Liu, Jian-Guo, Mason, Philippa J

1 . https://onlinecourses.nptel.ac.in/noc19 e41/preview

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Case studies	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) – 2 THEORY

Title of the Course: Introduction to Human Geography   **Code : 126BSC02GEGOEC01T**

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/week
3	42 hrs	3 hrs

Course Outcomes:
1. Students will learn how human, physical, and environmental components of the world interact.
2. Students will be familiarized with economic processes such as globalization, trade and their impacts on economic, cultural and social activities.
3. the student will Describe what geography and human geography are.
4. Understand population dynamics and migration.

Course Objectives:

This course aims to
1. Understand the basics concepts of human geography
2. Study population attributes and dynamic nature of it
3. Introduce economic, cultural, and trade activities and their impact on the development of the region

Content of Theory Course	56Hrs
Unit — 1 Introduction to Human Geography	10
Nature and scope, Development Environmental Determinism and Possiblism, Neo determinism (stop and go determinism) Approaches to human geography: Exploration and Descriptive approach, regional analysis Approach, Areal Differentiation Approach, Spatial organization Approach. Modern approaches: Welfare or Humanistic Approach, Radical Approach, Behavioral Approach, Post Modernism in geography Fields and sub fields in Human geography	
Unit — 2 Geographical Analysis of Population	16
Distribution and Growth of Population Density of population: meaning and Types: Arithmetic Density and Physiological Density. Regional distribution of Density of Population. Carrying capacity and sustainability, population Pyramid. Population Theories: Malthus Theory of Population, Demographic Transition Theory Population Movement: Migration, Raventein's Law of Migration, Factors of population Migration, Economic Push and Pull factors, Cultural Push and Pull Factors, Environmental Push and Pull Factors. Migration Types: Immigration and Emigration, Internal and International Migration	
Unit — 3 Cultural Patterns and Processes	15
Concept of Culture, Material and Non material culture Cultural Regions, cultural Traits and Complexes, cultural Hearths, cultural	

Diffusion. Languages of the World: Types, Classification and Distribution. Language Extinction Religions: Types and Classification. Distribution. Universalizing Religions: Christianity, Islam, Buddhism. Ethnic Religions: Hinduism, the Chinese religion, Shintoism, Judaism. The Major tribal population of the world.	
Unit — 4 Human Economic Activities, Development and Settlements	15
Primary Economic Activities — Agriculture, Types: Primitive Subsistence, Intensive subsistence, Plantation Agriculture, Extensive Commercial grain cultivation, Mixed Farming, Dairy Farming Secondary and Tertiary Activities: Manufacturing, classification — based on size — Small Scale and Large scale. Based on Raw material — Argo-based, Mineral based, Chemical Based and Forest based. Industrial Regions of the world. Tertiary Activities: Types: Trade and commerce, Retail Trading services, Wholesale trading. Transport and communications: Factors, communication services — Telecommunication. Services: Informal and Non formal sector. Information technology and service. Human Settlements: Factors, Classification, Types and Patterns: Rural, Urban. Compact or Nucleated and Dispersed settlements. Rural settlementPatterns: linear, rectangular, circular, star shaped, T shaped. Urban settlements: urbanism, classification — population size, occupation structure, Administration. functional classification of urban centres, types ofurban settlements: towns, city, conurbation, Megalopolis, Million cities.	

References

1 . Hartshorne, T. A., & Alexander, J. W. (2010). Economic Geography. New Delhi: PHI Learning.
2. Knox, P., Agnew, J., & McCarthy, L. (2008). The Geography of the World Economy. London: Hodder Arnold.
3. Lloyd, P., & Dicken, B. (1972). Location in Space: A Theoretical Approach to Economic Geography. New York: Harper and Row.
4. Siddhartha, K. (2000). Economic Geography: Theories, Process and Patterns, New Delhi: Kisalaya Publications.
5. Smith, D. M. (1971). Industrial Location: An Economic Geographical Analysis, New York: John Wiley and Sons.

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 2
THEORY

Title of the Course: Fundamentals of Natural disasters

Code : 126BSC02GEGOEC02T

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	**42 hrs**	**3 hrs**

Course Outcomes:
Students will be able to
1. Understand the basics concepts in natural disasters
2. Stud t es of natural disasters and their effects

Course Objectives:
1 . The paper is intended to provide a general concept in the dimensions ofdisasters caused by nature beyond the human control.
2. Introduce a holistic classification of natural disasters considering the Earth Sciences
3. Demonstrate the devastating effect of natural disasters to society ,

Content of Theory Course 1	42 Hrs
Unit — 1 Introduction to Natural Disaster	10
Meaning, definition, and scope. Lithosphere and Natural Disasters Earthquakes and volcanoes, Landslides and Avalanches	
Unit — 2 Atmosphere and Natural Disasters	10
Heat wave and wildfire, Cloud burst, hailstorm, Drought and famines	
Unit – 3 Hydrosphere and Natural Disaster	10
Tsunami, Hurricanes and cyclones, Floods and flash floods	
Unit – 4 Biosphere and Natural Disasters	12
Epidemics and pandemics, Covid -19 and its effects Techniques and technology to mitigate natural disasters	

References

1 . Dr. Mrinalini Pandey Disaster Management Wiley India Pvt. Ltd.
2. Tushar Bhattacharya Disaster Science and Management McGraw Hill Education (India) Pvt. Ltd.
3. Jagbir Singh Disaster Management: Future Challenges and Opportunities K W Publishers Pvt. Ltd.
4. J. P. Singhal Disaster Management Laxmi Publications.
5. Shailesh Shukla, Shamna Hussain Biodiversity, Environment and Disaster Management Unique Publications

6. C. K. Rajan, Navale Pandharinath Earth and Atmospheric Disaster Management: Nature and Manmade B S Publication

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 3
THEORY

Title of the Course: Climate Change: Vulnerability and Adaptation

Code : 126BSC02GEGOEC03T

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	42 hrs	3 hrs

Course Outcomes:
1. This course is to make understand the basic concepts of Climate-Weather systems and to impart necessary skills of Climate change, and its impact on earthsystems to the students. So that, students acquire basic understanding of the climate systems of the earth and to study the applications of the Geoinformatics to study the climate change.

Course Objectives:
1 . to provide a sound understanding of the economics of climate change from multiple viewpoints
2. Demonstrate knowledge of the projected impacts of climate change and potential strategies
3. for alleviating their negative impacts.
4. Define key terms (e.g., adaptation, resilience, vulnerability, mainstreaming)
5. Study application of the Geoinformatics in the Climate Chan e and Adaptation

Content of Theory Course	42 Hrs
Unit — 1 Introduction to Climate Change Meaning and concept of climate change. Origin of atmosphere. Concepts of weather and climate. Evidence of Climate Change: Historical and current weather and climate events: Meteorological, Lithogenic and biological, Greenhouseeffect, Greenhouse Gases, Global Warming. Extreme weather and climate event: Drought, Extreme Heat, Extreme precipitation, Hurricanes, Tornadoes and Wildfire.	10
Unit — 2 Causes and Effect of climate change Natural cause: Solar variation, Volcanic eruption, ocean currents, Earth orbital change and internal variability Human causes: Burning fossil fuel, Deforestation, Intensive Agriculture,and industries. Impacts of climate change: Water resources, agriculture, human health, vegetation, economy and El nino, La Nina and Arctic Oscillation International efforts to control the climate change: UNFCC its policy framework and provisions, Earth Summit Rio-de-Janeiro, World summit, Kyoto Protocol, Copenhagen summit and Doha Conference	10

Unit — 3 Climate change Vulnerability and Adaptation Meaning and type of vulnerability Meaning, Definition, and types of adaptation Approaches of adaptation and Adaptation Strategies. Adaptation in different sectors: Agriculture, Forest, Water resources, Biodiversity, Disaster Risk Management	10
Unit — 4 Vulnerability Assessment and climate change mitigation Climate change vulnerability assessment Global Initiatives to climate change mitigation: Kyoto Protocol, carbon trading, clean development mechanism, COP. Indian initiative to support climate change mitigation: Improving energy efficiency, Diversification of energy sources, Modifying industrial processes, a multipronged strategy for sustainable development and Clean Development Mechanism (CDM) in India. Case studies: MGNREGA (Mahatma Gandhi National Rural Employment16 Guarantee Act) potential of generating co-benefits, Vertical Shaft Brick Kiln (VSBK) or Ecokiln	12

References

1 . Earth: Evolution of a Habitable World, 2nd edn., Cambridge, UK: Cambridge University Press (2013) Jonathan l. Lunine.
2. Evolution of the Earth, McGraw-Hill Education; 8th edition (2009) DonaldProthero, Robert Dott, Jr.
3. A Textbook of Climatology, Wisdom Press (2015) Tapas BhattacharyaGlobal Warming: The Complete Briefing, Cambridge University Press; 4th edition (2009), John Houghton
4. K.Siddahartha (2020): Climatology, Atmosphere, Weather and Climate. Kitaba Mahal Publication, New Delhi.
5. K.Siddahartha and others (2014): Basic Physical Geography Kishalaya Publications Pvt, Publication , New Delhi.
6. Satapathy. S: Adaptation to Climate Change with a Focus on Rural Areas and India. Indian Ministry of Environment and Forests, Director of the Climate Change Division.
7. Patricia Butler, Chris Swanston, Maria Janowiak, Linda Parker, Matt St. Pierre, and Leslie Brandt:Adaptation strategies and Approaches.
8. Ministry of Environment and Forest Government of India: Adaptation to Climate Change with a Focus on Rural Areas and India.
9. Neelam Rana, Anand Kumar, Kavita Syal and Mustafa Ali Khan: Climate Change Mitigation in India

Web Resources

1 . IEA Training Material: Vulnerability and Climate Change Impact Assessment for Adaptation.
2. http://www.iisd.org/pdf/2010/iea_training_vol_2_via.pdf
3. Guidance on Integrating Climate Change Adaptation into Development Co-operation.
4. http://www.oecd.org/dac/43652123.pdf
5. Mainstreaming Climate Change Adaptation into Development Planning: A Guide for

Practitioners.

6. http://www.unep.org/pdf/mainstreaming-cc-adaptation-web.pdf
7. CGE Climate Change Training Materials.
8. http://unfccc.int/national_reports/nonannex_i_natcom/training_material/methodol ogical_documents/items/349.php
9. Compendium on Methods and Tools to Evaluate Impacts of, and Vulnerability and Adaptation to, Climate Change.
10. http://unfccc.int/adaptation/nairobi_work_programme/knowledge_resources_and_ publications/items/5457.php
1 1 . Centre for climate and Energy solutions.
    https://www.c2es.org/content/extremeweather-and-climate-change/
12. https://www.history.com/topics/natural-disasters-and-environment/history-of-climatechange
13. ghttp://www.ozcoasts.org.au/glossary/images/VulnerabilityDiag_AllenConsulting
14. ghttp://ccafs.cgiar.org/news/media-centre/climatehotspots
15. ghttp://pmindia.nic.in/Pg01-52.pdf

Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

OPEN ELECTIVE (OE) - 4
THEORY

Title of the Course: Basics of Geographic Information Systems (GIS)

Code : 126BSC02GEGOEC04T

Number of Theory Credits	Number of lecture hours/ semester	Number of lecture hours/ week
3	**42 hrs**	**3 hrs**

Course Outcomes:
1. Students are trained to adapt the theoretical concepts in a practical way through the mathematical models of geography.
2. Students will have the hands-on training on various modes of spatial and non- spatial data collection, data storage, data analytics, data interpretation and data display through the thematic maps.
3. Students are exposed on spatial thinking to solve the geographical problems with range of proven mathematical and statistical models.
4. Students can employ in various corporate and government organisation where they deal to solve Geographical problems.

Course Objectives: This course aims to:
1. Understand the concept and techniques of the Geographic Information Systems.
2. Define the GIS data types and structures.
3. Study geo processing and visualization concepts and techniques in GIS.

Content of Theory Course	42Hrs
Unit— I Introduction	10
Emergence of Gl Science, Milestone and Developmental stages in GIS, Definition, scope, role of GIS in digital world; Components, functionalities,merits and demerits, global market, interdisciplinary domains, and its integration with GIS.	
Unit — 2 Geodesy and Spatial Mathematics	10
Cartesian coordinates, latitude, longitudes, formats of angular units, geographical coordinates, Datum: WGS84, vs NAD32. U TM, Aerial Distance measurement using Geographic and projected coordinates, Area, Perimeter, length by coordinates and various international measures.	
Unit - 3 GIS Data and Scale	10
Spatial Data and its structures; sources and types of data collection; data errors, topology of data and relationship. Large Scale vs Small Scale, generalization; precision and accuracy of data-logical consistency and non- spatial data integration	
Unit — 4 Geoprocessing and Visualization	12

Spatial and Non-Spatial Queries, proximity analysis, Preparation of Terrain and Surface models. Hotspot and density mapping. Types of maps, thematic maps andits types, relief maps, flow maps and cartograms. Tabulations: Graphs and Pivot tables.

References

1. An Introduction to Geographical Information Systems - Ian Heywood (2011)
2. Geographic Information Systems: A Management Perspective - Aronoff, S. (1989).
3. GIS - Fundamentals, Applications, and Implementations - Elangovan, K. (2006)
4. Introduction to Geographical Information Systems - Chang, Kang-Tsung (2015)
5. Remote Sensing and GIS - Bhatta, B. (2011)
6. Mathematical Modelling in Geographical Information System, Global Positioning System and Digital Cartography - Sharma, H.S. (2006)
7. Spatial analysis and Location-Allocation Models - Ghosh, A. and G. Rushton (1987)
8. Geographic Information Systems and Cartographic Modelling - Tomlin, C.D. (1990)
9. Geographic Information Systems and Science - Paul A. Longley, et. al. (2015)
10. Geographic Information Systems and Environmental Modelling - Clarke, C., K. (2002)

Reference Websites
1. I IRS MOOC programme: https://isat.iirs.gov.in/mooc.php

Pedagogy

FormativeAssessment	
Assessment Occasion/ type	Weightage in Marks
Quiz	30%
Assignment	20%
CIA	50%
Total	100%

INTERNAL ASSESSMENT FOR THEORY

Maximum Marks : 40

S.No.	Particulars	Details	Marks
1	Two Case studies	a. Introduction	
		b. Identification of problem	
		c. Collection of data/Field visit/ Photos	
		d. Analysis and Findings	
		e. Suggestions/Recommendation/Conclusion	
		Total	20
2.	Two Internal Test	(2 x 10) Total	20
		Grand Total	**40**

Area of Case Study

The student should carry out their case study by selecting one of the below mentioned field within the vicinity of 20 kms from their institute.

1. Agricultural region (rainfed / irrigated)   2. Urban area

3. Rural area   4. Watershed area

5. Industrial region   6. Forest region

7. Population   8. Landscape

9. Tourism   10. Natural elements

11. Global warming   12. Market study

Question Paper Pattern for Theory

Department of Geography

Sub: **Code:**

Maximum Marks: 60 hours **Duration : 2**

Instructions:

Answer the questions from every Section i.e. A, B and C

Section A	Answer any **Ten** Questions out of **Twelve** questions (Minimum two questions from each unit)	2 X 10 = 20 Marks
Section B	Answer any **Four** Questions out of **Six** questions (Minimum one question from each unit)	5 X 4 = 20 Marks
Section C	Answer any **Two** Questions out of **Four** questions (One Question from Each Unit)	10 X 2 = 20 Marks
	Total	**60 Marks**

Question Paper Pattern for Practical

Department of Geography

Sub: **Code:**

Maximum Marks: 25 hours **Duration : 2**

Instructions: Answer all the sections

Section A	Answer any **Two** Questions out of **Four** questions	4 X 2 = 8 Marks
Section B	Answer any **Two** Questions out of **Four** questions	5 X 2 = 10 Marks
Section C	Answer any **One** Question out of **Three** questions	7 X 1 = 7 Marks
	Total	**25 Marks**