School of Nanoscience and Technology

(5 year integrated multidisciplinary course)

Shivaji University, Kolhapur

Course commences from June 2012

On the eve of

Golden Jubilee Celebration of the University

Structure, Course Curriculum, Nature of question paper

M.Sc. 5 Year Integrated Nanoscience and Technology (B.Sc.-M.Sc.)

Guidelines and rules for semester system

Implemented from Academic year 2012-2013 under the Faculty of Sciecne M.Sc. 5 year integrated (B. Sc. -M. Sc.) Programme

R. Nano:1

Eligibility Criteria

- a. The candidate passed in 10 + 2 science examination with minimum 45% marks for open category and 40% marks for the reserved categories are eligible. He/She must qualify the entrance examination of school of Nanoscience and Technology of Shivaji University, Kolhapur.
- b. The merit list will be prepared considering 50% marks of board exam.
 (XIIth std.) and 50% marks of entrance exam.
- c. Reservation quota for admission will be as per the rules of the State Government for 2012-13
- d. The entrance examination will be of 100 marks (1 mark per question) and multiple choice question based on XIIth Standard Physics, Chemistry, Mathematics, Biology Syllabi.

Eligibility Conditions for foreign Students:

- a. A Foreign student can get provisional admission in the month of June every year with Provisional Eligibility Certificate from the University.
- b. The provisional eligibility fee for foreign students is Rs. 200/- only.
- c. Foreign students seeking admission will have to appear and pass the Entrance Examination to be conducted by the University. The fees prescribed for this Entrance examination is \$ 100/- and for Re-entrance Examination it is \$ 50. The amount is to be remitted in the UCO Bank Vidyanagar, Kolhapur.
- d. Provisional Eligibility Certificate is not the Final Eligibility Certificate. The Final Eligibility Certificate will not be issued unless he/she appears and passes the Entrance Examination.

e. The final eligibility certificate fee is as under :-

i.	Without late fee	Rs. 500/-
ii.	Late fee	Rs. 100/- After due date
iii.	Super late fee	Rs. 300/- After due date

- iv. Extra super late fee Rs. 500/- After due date
- f. He/She will have to produce the following documents along with their eligibility application:

i. Students visa / passport.

ii. Qualifying examination certificates / mark list in original along with attested Xerox copies.

iii. Extension letter from D.S.P. office of the concerned region.

- g. The Entrance Examination will be held in the University premises.
- h. The last date for receipt of application for admission to Entrance Examination will be communicated later on to the Principals / Heads of all the concerned Colleges/Departments. i. Besides above conditions, other eligibility conditions as laid down under Ordinance 0.16 to 0. 23 under section 53 of Maharashtra Universities Act 1994 are applicable.
- R. Nano: 2

There shall be the Semester system of examination. The course structure will be as per 80:20 pattern, Each paper in each semester shall Carry 100 marks wherein 80:20 pattern is accepted [80 marks for university (theory) examination and 20 marks for internal assessment (CIE). Nature of Question Paper for theory examination will be as mentioned in syllabus-

a) The following shall be the scheme for internal assessment

i. There will be continuous internal assessment for B.Sc.-M.Sc. Degree course. Internal Examination will be compulsory for all students. If a student fails/absent in internal Examination then he/she will have to clear the internal Examination in subsequent attempt/s in following semester. For this purpose following shall be the pattern for internal assessment scheme:

- (ii) B.Sc.-M. Sc. Sem-I to Sem.-VIII: There will be internal continuous evaluation of 20 marks (home assignments, unit test, seminar, tutorial) in each semester (I to VIII) for each paper.
- (iii) B.Sc.-M. Sc. Semester IX and X: There will be internal evaluation of 20 marks for project and seminar.
- **(iv)** The evaluation of non credit course will be carried out by the school internally and subsequent gradation will be given to the University.

b) The practical examination will be conducted by the school by a panel of two examiners at the end of each semester.

R. Nano:3

(i) Standard of passing

- a) The Standard of passing shall be 40% where the student will have to score 32 marks out of 80 and 8 Marks out of 20.
- **b)** Rules of ATKT are as mentioned below.

Internal Examination will be compulsory for all students. If the student is absent/fail in internal examination then he/she will have to clear the internal examination in subsequent attempts in following semester. There will be a separate head of passing in Theory, internal assessment (CIE) and Practical. However, ATKT rules will be followed in respect of Theory & practical papers only. The student is allowed to keep term in the third, fifth, seventh and nineth semester even if he/she has failed in three or less than three heads (i.e. theory & practical) of passing earlier two semesters taken together. However he/she shall have to clear all the papers of semester I & II before taking admission to the fifth semester.

(ii) In the final semester every student has to undertake a project, which is based on the specialization, he/she opts for amongst the areas like Nan materials, Nano-physics, Nano-chemistry and Nano-biotechnology. (iii) The course has new B. Sc. and M.Sc. structure with 5 papers in each semester having 3 credits each and 6th paper is non-credit based paper. In addition, each semester will have practical examination.

R. Nano: 4 Award of Degree:

i) M.Sc. Nanoscience and technology (B.Sc.-M.Sc.) is a ten semester integrated course spread over the period of five years. The course of Nanoscience and Technology will be five year integrated course commencing from the years as mentioned below:

B.Sc.-M.Sc. (Semester I and II) from Academic year 2012-13 B.Sc.-M.Sc. (Semester III and IV) from Academic year 2013-14 B.Sc.-M.Sc. (Semester V and VI) from Academic year 2014-15 B.Sc.-M.Sc. (Semester VII and VIII) from Academic year 2015-16 B.Sc.-M.Sc. (Semester IX and X) from Academic year 2016-17.

The candidate may take exit after 3 years of successful completion of the course. After successful completion of first three years (Semester I to VI), the candidate will get 'B.Sc. Nanoscience and Technology' degree. The students those who have completed the entire five years integrated course shall be awarded B.Sc.-M.Sc. Nanoscience and Technology degree.

- ii) The students passing 'B.Sc. Nanoscience and Technology' are also eligible for admission to M.Sc. degree in the subjects such as Physics and Chemistry under the Faculty of Science
- iii) If seats become vacant after VIIth semester, fresh admissions will be given to B.Sc. students in the subjects such as Physics and Chemistry under the Faculty of Science on the basis of entrance examination. such students those who have admitted to the VII semester and have successful completed last

two years (Semester VII to X), shall be awarded M.Sc. Nano Science and Technology degree.

STRUCTURE

Semester-I

Course	Title	Cr	edits	Ex	Examination/Evaluation of Marks			
No.		L	Р		Т		Р	Total
				Int.	Final	Int.	Final	
SNST-	Physical Sciences-I	3	-	20	80	-	-	100
101T								
SNST-	Chemical Sciences-I	3	-	20	80	-	-	100
102T								
SNST-	Life Sciences-I	3	-	20	80	-	-	100
103T								
SNST-	Mathematical Science	3	-	20	80	-	-	100
104T								
SNST-	Computer Fundamentals	3	-	20	80	-	-	100
105T	_							
SNST-	Basic concepts in	-	-	-	-	-	-	-
106T	communication							
	(non Credit Course)							
SNST-	Laboratory-course I (PS)	-	2	-	-	-	50	50
111P								
SNST-	Laboratory-course II (CS)	-	2	-	-	-	50	50
112P								
SNST-	Laboratory-course III (LS)		2				50	50
113P								
SNST-	Laboratory-course IV (MS,CS)		2				50	50
114P								

Total Marks for Semester-I: 700

Semester-II

Course	Title	Cr	edits	Exa	aminatio	ı/Evaluat	ion of Ma	arks
No.		L	Р	,	Г]	Р	Total
				Int.	Final	Int.	Final	
SNST- 201T	Physical Sciences-II	3	-	20	80	-	-	100
SNST- 202T	Chemical Sciences-II	3	-	20	80	-	-	100
SNST- 203T	Life Sciences-II	3	-	20	80	-	-	100
SNST- 204T	Descriptive Statistics and Probability Distributions	3	-	20	80	-	-	100
SNST- 205T	Electronics	3	-	20	80	-	-	100
SNST- 206T	Communication in Practice (non Credit Course)	-	-	-	-	-	-	-
				•	•		•	•
SNST- 211P	Laboratory-course I (PS)	-	2	-	-	-	50	50
SNST- 212P	Laboratory-course II (CS)	-	2	-	-	-	50	50
SNST- 213P	Laboratory-course III (LS)		2				50	50
SNST- 214P	Laboratory-course IV (SS, E)		2				50	50

Total Marks for Semester-II: 700

Course	Title	Cr	edits	Exa	aminatio	ı/Evaluat	Evaluation of Mark			
No.		L	Р	,	Г]	Р	Total		
				Int.	Final	Int.	Final			
SNST-	Physical Sciences-III	3	-	20	80	-	-	100		
301T										
SNST-	Chemical Sciences-III	3	-	20	80	-	-	100		
302T										
SNST-	Life Sciences-III	3	-	20	80	-	-	100		
303T										
SNST-	Basic Instrumentation	3	-	20	80	-	-	100		
304T										
SNST-	Computational methods-I	3	-	20	80	-	-	100		
305T	_									
SNST-	Environmental Science	-	-	-	-	-	-	-		
306T	(non Credit Course)									
SNST-	Laboratory-course I	-	2	-	-	-	50	50		
311P										
SNST-	Laboratory-course II	-	2	-	-	-	50	50		
312P										
SNST-	Laboratory-course III		2				50	50		
313P										
SNST-	Laboratory-course IV		2				50	50		
314P										

Semester-III

Total Marks for Semester-III: 700

Course	Title	Cre	edits	Examination/Evaluation of Ma			ion of Ma	rks
No.		L	Р		Т]	Р	Total
				Int.	Final	Int.	Final	
SNST-	Physical Sciences-IV	3	-	20	80	-	-	100
401T								
SNST-	Chemical Sciences-IV	3	-	20	80	-	-	100
402T								
SNST-	Life Sciences- IV	3	-	20	80	-	-	100
403T								
SNST-	Advanced Instrumentation	3	-	20	80	-	-	100
404T								
SNST-	Computational methods-II	3	-	20	80	-	-	100
405T								
SNST-	Personality Development	-	-	-	-	-	-	-
406T	(non Credit Course)							
SNST-	Laboratory-course I	-	2	-	-	-	50	50
411P								
SNST-	Laboratory-course II	-	2	-	-	-	50	50
412P								
SNST-	Laboratory-course III		2				50	50
413P								
SNST-	Laboratory-course IV		2				50	50
414P	-							

Semester-IV

Total Marks for Semester-IV: 700

Course	Title	Cr	edits	Examination/Evaluation of Marks				arks
No.		L	Р	1	Т		Р	Total
				Int.	Final	Int.	Final	
SNST-	Physical Sciences-V	3	-	20	80	-	-	100
501T								
SNST-	Chemical Sciences-V	3	-	20	80	-	-	100
502T								
SNST-	Life Sciences- V	3	-	20	80	-	-	100
503T								
SNST-	Science at the Nanoscale	3	-	20	80	-	-	100
504T								
SNST-	Environmental	3	-	20	80	-	-	100
505T	Science/Earth/Geoscience							
SNST-	Scientific and Technical	-	-	-	-	-	-	-
506T	writing-I (non credit course)							
SNST-	Laboratory-course I	-	2	-	-	-	50	50
511P								
SNST-	Laboratory-course II	-	2	-	-	-	50	50
512P								
SNST-	Laboratory-course III		2				50	50
513P								
SNST-	Laboratory-course IV		2				50	50
514P								

Semester-V

Total Marks for Semester-V: 700

Course	Title	Cre	edits	Examination/Evaluation of Marks				arks
No.		L	Р	,	Т		Р	Total
				Int.	Final	Int.	Final	
SNST-	Physical Sciences-VI	3	-	20	80	-	-	100
601T								
SNST-	Chemical Sciences-VI	3	-	20	80	-	-	100
602T								
SNST-	Life Sciences- VI	3	-	20	80	-	-	100
603T								
SNST-	Properties of Nanomaterials	3	-	20	80	-	-	100
604T	_							
SNST-	Nanobiology and Nanomedicine	3	-	20	80	-	-	100
605T								
SNST-	Scientific and Technical	-	-	-	-	-	-	-
606T	writing-II (non credit course)							
SNST-	Laboratory-course I	-	2	-	-	-	50	50
611P								
SNST-	Laboratory-course II	-	2	-	-	-	50	50
612P								
SNST-	Laboratory-course III		2				50	50
613P								
SNST-	Laboratory-course IV		2				50	50
614P								

Semester-VI

Total Marks for Semester-VI: 700

Course	Title	Cr	edits	Ex	aminatio	ion/Evaluation of Marks			
No.		L	Р	,	Т		Р	Total	
				Int.	Final	Int.	Final		
SNST-	Quantum Mechanics and	3	-	20	80	-	-	100	
701T	Statistical Mechanics								
SNST-	Mathematical Physics	3	-	20	80	-	-	100	
702T									
SNST-	Chemistry of nanomaterials	3	-	20	80	-	-	100	
703T									
SNST-	Nanocomposites for	3	-	20	80	-	-	100	
704T	applications								
SNST-	Nanobiotechnology-I	3	-	20	80	-	-	100	
705T									
SNST-	Open source tools and webinars	-	-	-	-	-	-	-	
706T	in nanoscience								
SNST-	Laboratory-course I	-	2	-	-	-	50	50	
711P									
SNST-	Laboratory-course II	-	2	-	-	-	50	50	
712P									
SNST-	Laboratory-course III		2				50	50	
713P									
SNST-	Laboratory-course IV		2				50	50	
714P	_								

Semester-VII

Total Marks for Semester-VII: 700

Course	Title	Cre	edits	Ex	kaminatio	n/Evaluati	ion of Ma	rks
No.		L	Р	,	Г]	Р	Total
				Int.	Final	Int.	Final	
SNST-	Electromagnetics and	3	-	20	80	-	-	100
801T	spectroscopy							
SNST-	Supramolecular and surface	3	-	20	80	-	-	100
802T	nano chemistry							
SNST-	Nanobiotechnology-II	3	-	20	80	-	-	100
803T								
SNST-	Nanotechnology for energy	3	-	20	80	-	-	100
804T								
SNST-	Nanotechnology for chemical	3	-	20	80	-	-	100
805T	sensors							
SNST-	Societal implications of	-	-	-	-	-	-	-
806T	Nanoscience and							
	Nanotechnology (non credit							
	course)							
SNST-	Laboratory-course I	-	2	-	-	-	50	50
811P								
SNST-	Laboratory-course II	-	2	-	-	-	50	50
812P								
SNST-	Laboratory-course III		2				50	50
813P								
SNST-	Laboratory-course IV		2				50	50
814P								

Semester-VIII

Total Marks for Semester-VIII: 700

Semester-IX

Course	Title	Credits	Examination/Evaluation of Marks
No.			
SNST-	Research Project and	6	200
901PD	dissertation Phase-I		
	Seminar based on project work-I	3	100

Total Marks for Semester-IX: 300

Semester-X

Course	Title	Credits	Examination/Evaluation of Marks
No.			
SNST-	Research Project and	6	200
901PD	dissertation Phase-II		
	Seminar based on project work-	3	100
	Π		

Total Marks for Semester-IX: 300

Paper No: SNST-101T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Physical Sciences-I

(Mechanics, Properties of matter and Optics)

Topic	Credits: 3	Lectures
No.		45
1	Unit- I (Mechanics-I)	12
	1) Elementary Dynamics of Rigid Bodies : Analogy of rotational	
	motion with translational motion, Moment of inertia of a spherical	
	shell, solid cylinder (only about axis of symmetry), formulae for	
	Moment of Inertia of different geometrical objects.	
	2) Oscillatory and Wave Motion: Damped oscillations, case i) Over	
	damped ii) Critically damped and iii) Damped, forced oscillations,	
	amplitude resonance and Q factor (statement only). Theory of	
	simple pendulum, Kater's pendulum, conical pendulum, Bifilar	
	pendulum.	
2	Unit- II (Mechanics-II)	11
	1) Wave motion, Differential equation of progressive wave, Group	
	velocity and phase velocity	
	2) Gravitation: Newton's inverse square law of gravitation,	
	Concept of Gravitational field intensity and potential due to solid	
	sphere.	
	3) Fluid Dynamics: General concepts of fluid flow, Streamline and	
	turbulent flow, the equation of continuity, Bernoulli's Theorem, its	
	application - venturimeter.	

3	Unit- III (Properties of matter)	12
	1) Elasticity: Review of elasticity and modulus of elasticity,	
	Bending of beam, Bending moment, Cantilever (Qualitative	
	treatment only)	
	2) Surface Tension : Surface tension, Angle of contact and	
	wettability, Relation between surface tension, excess of pressure	
	and radius of curvature, Experimental determination of surface	
	tension Capillary rise method and Jaeger's method, Factors	
	affecting surface tension, Applications of surface tension.	
	3) Viscosity: Viscous fluids, Flow of liquid through capillary tube,	
	Poiseuille's equation, Experimental determination of coefficient of	
	viscosity of liquid by Poiseuille's method, effect of temperature	
	and pressure on viscosity of liquid.	
	4) Thermal Properties: Modes of heat transfer, specific heat,	
	Debye Theory	
4	Unit- IV (Optics)	10
	1) Geometrical optics: Aberration: Chromatic aberration,	
	achromatic combination of two thin lenses separated by finite	
	distance, Spherical aberration, methods to minimize it.	
	2) Optical instruments: Entrance and exit pupils, Common types of	
	eyepieces, Huygen's eyepiece and Ramsden's eyepiece.	
	3) Fiber Optics: Introduction, Some historical remarks, Total	
	Internal Reflection, The optical fiber, Attenuation in optical fiber.	

Main references:

1. Elements of Properties of Matter – D.S. Mathur, Shamlal Charitable trust New Delhi.

- 2. Optics B.K.Mathur
- 3. Optics Ajoy Ghatak

Add on References (Useful throughout the integrated course)

1. Berkeley Physics Course Vol.I -Vol.V

- 2. The M.I.T. introductory Physics Series
- 3. Lectures in Physics Vol. I, II and III Feynman, Leighton, Sands
- 4. University Physics 9th edition Young and Freedman.
- 5. Fundamentals of Physics Vol. I and Vol. II David Halliday and Robert Resnik
- 6. Mathematical Methods for Physicists Arfken
- 7. Mathematical Methods in Physical Sciences,- Mary . L. Bose
- 8. Mathematical Physics Ghatak, Goyal and Chua
- 9 Foundations of Electromagnetic Theory Ritz and Milford.

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Laboratory-course I (PS)

Sr. No.	(Credit 2)
1	Moment of inertia of a disc using auxiliary annular ring.
2	Difiler Dendulum Determination of MI of a red
2	Binnar Pendulum – Determination of M.i. of a fou.
3	Kater's Pendulum.
4	Poission ratio for rubber using rubber tube.
5	Y -by uniform bending.
6	Surface Tension of Liquid by Jaeger's method.
7	Viscosity of a liquid by Poiseuille's method.
8	Frequency of a.c. mains by sonometer.
9	Calibration of Spectrometer – unknown wavelength measurement.
10	Liquid Lens

Reference Books for Laboratory Course

- 1. College Practical Physics Khanna and Gulati (S. Chand and Co. Ltd, Delhi).
- 2. Practical Physics Gupta and Kumar (Pragati Prakation Meerat)
- 3. Advanced Level Practical Physics- J.M. Nelcon, J.M. Ogloom (EIBS).
- 4. Advanced Practical Physics–Worsnop and Flint.
- 5. A Text Book of Practical Physics-Shrinivasan and Balasubramanyam.
- 6. A Text Book of Practical Physics Indu Prakashan and Ramkrishna.

Paper No: SNST-102T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Chemical Sciences-I

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	
	A) Chemistry of S-block Elements	(5)
	Introduction to S-block elements, Preparation, properties and	
	applications of oxides, halides of Li, Na, K, Be, Mg, Ca.	
	B) Chemical Bonding	(5)
	Types of chemical bonding (Ionic, covalent, co-ordinate, metallic	
	and hydrogen bond), Radius ratio and types of crystal geometry	(2)
	C) Polymorphism in Carbon	
2	Unit- II	
	A) Stereochemistry in Organic Compounds	(5)
	Introduction to stereochemistry, types of isomerism with	
	examples, optically active organic compounds.	
	B) Aliphatic and aromatic electrophilic substitution reactions	(6)
	Friedel Crafts acylation and arylation reactions, Mechanism of	
	nitration, sulphonation and halogenations reactions in aliphatic	
	and aromatic compounds.	
3	Unit- III	
	A) Chemical Kinetics	(5)
	Rates of chemical reactions, kinetics of first, second and third	(-)
	order reactions, methods of determination of rate laws, order and	
	molecularity, concepts, theories of reaction rates.	
	B) Homogeneous catalysis	(7)
	Specific general acid-base catalysis, surface phenomenon and	

	homogeneous catalysis, adsorption free energy relation at	
	interfaces, Gibb's adsorption isotherm, physiosorption and	
	chemisorptions, Adsorption isotherm and measurement of surface	
	area, semiconductor catalysis.	
4	Unit- IV	
	Electroanalytical Techniques	(10)
	Theory of eletrogravimetric analysis, electrode reactions,	
	overpotential, completeness of deposition, electrolytic separation	
	of metals, pH metry, conductometry, potentiometry, voltametry,	
	and amperometric techniques.	

Reference Books:

- 1. Concise Inorganic Chemistry, J. D. Lee.
- 2. Fundamental Concepts of Inorganic Chemistry, Asim R. Das.
- 3. Physical Chemistry, P. W. Atkins
- 4. Physical Chemistry, W. J. Moore.
- 5. Advanced Organic Chemistry, Jerry March.
- 6. Organic Chemistry, Morrison & Boydes.
- 7. Chemical Kinetics, Gurudeep Raj.
- 8. Instrumental methods of chemical analysis, H. Kaur.
- 9. Electroanalytical Chemistry, Allen J. Bard.

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

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Semester-I

SYLLABUS

Title of the paper: Laboratory Course II (CS) (Credit 2)

Sr. No.	(Credit 2)
1	Use of analytical or chainometric or. Digital balance with 1mg sensitivity is
	allowed.
2	Determination of viscosity of given liquids A and B (Density data of liquids
_	viscosity of water to be given) [Any two liquids from:
	[Acetone, CCl4, Chloroform, Ethyl alcohol. Benzyl alcohol, Ethylene glycol
	and n-propyl alcohol].
3	Determination of equivalent weight of Mg by Eudiometer.
4	Study of specific reaction rate of hydrolysis of methyl acetate in presence of
	HCl.
5	Estimation of aniline.
0	Identification of at least three organic compounds with reactions including
	one from acids, one from phenols, one from bases and one/two from
	neutrals from the list of compounds given below :
	Acids : Oxalic acid, Benzoic acid and Cinnamic acid.
	Phenols : β-Naphthol, Resorcinol.
	Bases : Aniline, p-Toluidine.
	Neutrals : Acetone, Ethyl acetate, Glucose, Chloroform, Chlorobenzene, m-
	Dinitrobenzene, Thiourea.
	Note : A systematic study of an organic compound involves the following
	operations which should be taught in details with reactions the detection of

	elements and functional group.		
	Preliminary tests and Physical examination.		
	Physical constant.		
	Detection of Elements.		
	Detection of Functional group.		
	A Search into the literature.		
	Special Test.		
	Summary.		
	Result.		
7	Determination of amount of acetic acid in commercial vinegar using NaOH.		
8	Water analysis :		
9	To determine alkalinity of water sample by using phenolphthalein and		
	methyl orange indicator. Standard HCl solution to be supplied.		
10	Volumetric Analysis :		
	To prepare standard solution of Potassium dichromate and determine		
	strength of Ferrous Ammonium Sulphate solution in terms of normality and		
	Kg/dm3. (Use internal indicator)		

Reference Books:

- 1. Practical book of Physical Chemistry: Nadkarni, Kothari & Lawande.
- 2. Experimental Physical Chemistry: A. Findlay.
- 3. Systematic Experimental Physical Chemistry: S. W. Rajbhoj, Chondhekar. (Anjali Publ.)
- 4. Experiments in Physical Chemistry: R. C. Das and B. Behra. (Tata Mc Graw Hill)
- 5. Advanced Practical Physical Chemistry: J. B. Yadav (Goel Publishing House.)
- 6. Practical Physical Chemistry: B. D. Khosala. (R. Chand & Sons)
- 7. Experiments in Chemistry: D. V. Jagirdar.
- 8. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.) (ELBS)

- 9. Vogel's Text Book of Quantitative Chemical Analysis. (Longmann) ELBS Edition.
- 10. Vogel's Text Book of Qualitative Chemical Analysis. (Longmann) ELBS Edition.
- 11. Hand book of Organic Qualitative Analysis : Clarke.
- 12. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia, Sunita Dhingra. University Press. Distributor – Orient Longman Ltd.
- 13. Vogel's Text Book of Inorganic Quantitative Chemical Analysis (Longman) ELBS Edition.
- 14. Vogel's Text Book of Inorganic Qualitative Chemical Analysis (Longman) ELBS Edition.
- 15. Basic Concepts in Analytical Chemistry (Wiley Eastern Ltd.) : S. M. Khopkar.

Paper No: SNST-103T

Total Marks: 100

SHIVAJI UNIVERSITY, KOLHAPUR

(80+20)

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Life Sciences-I

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	11
	Plant sciences:	
	General characters, classification and economic importance.	
	1.1 General Classification of Plant Kingdom.	
	1.2 Algae	
	1.3 Fungi	
	1.4 Lichens	
	1.5 Bryophytes	
	1.6 Pteridophytes	
	1.7 Gymnosperms	
	1.8 Angiosperms	
2	Unit- II	12
	Animals sciences:	
	General classification of animal kingdom.	
	Non-chordates –Study of phylum Porifera, Coelenterata,	
	Platyhelminthes, Nemathelminthes, Arthropoda, Mollusca &	
	Echinodermata–General characters with representative examples-	
	Sycon, Hydra, Liver fluke/ Taenia, Earthwarm / Nereis, Cockroach,	
	Pearl oyster / Pila, Starfish	
	Chordates:-	
	Study of class Pisces, Amphibia, Reptilia, Aves & Mammalia -	
	General characters with representative examples – Labeo, Frog,	
	Cobra, Parrot, Human	
3	Unit- III	12
	History and scope of microbiology	
	Microscopy-Antony Van Leeuwenhock, Robert Hooke	
	Spontaneous generation theory	
	Important contributions of -Louis Pasteur, Robert Koch, Joseph	

	Lister, Alexzander Flemming, Edward Jenner, John Tyndall	
	Cytology of typical bacterial cell	
	Morphology, size & arrangement of bacteria	
	Strutures and funtions of capsule and slime layer, flagella, pilli, cell	
	wall, cytoplasmic membrane, nucleus, ribosomes,	
	mesosomes, bacterial endospores	
	Microscope: bright field microscopy, compound microscope	
	resolving power, angular and numerical aperture oil immersion,	
	Dark field microscopy, ultra violet microscopy, phase contrast	
	microscopy, techniques in light microscopy, staining.	
4	Unit- IV	10
	Cell theory-Definition, discovery, three assumptions of cell	
	theory, exceptions, organism theory, protoplasm theory	
	Prokaryotic and eukaryotic cell, general structures of	
	mycoplasma and blue green algae.	
	Bacterial cell wall and structure	
	Plant cell wall: structure	
	Ultra structure and functions of cell organelles	
	Plasma membrane	
	Mitochondria	
	Chloroplast	
	Endoplsmic reticulum	
	Golgi apparatus	
	Lysosome	
	Peroxisome	
	Ribosomes	
	Proteosomes.	
	Cytoskeleton : Microtubules, microfilaments and intermediate	
	filaments	
	Ultra structure of nucleus	
	Chromosomes-organization, chromatin-euchromatin and	
	heterochromatin	
	Nucleosome- unit of chromatin	

Reference Books:

- 1. Devlin R.M. Fundamentals of plant physiology (MacMillan)
- 2. Malik C.P. Plant physiology, Kalyani publisher
- 3. Dube H.C. Text of fungi, bacteria and viruses.
- 4. Bold H.C. The Plant kingdom, Prentice Hall India

- 5. Chopra G.L. i. Class book of algae, ii. Class book of fungi
- 6. Dutta A.C. A Class book of botany, Oxford University Press
- 7. Kumar H.D. Biodiversity and sustainable development (Oxford & IBH)
- 8. Mukherji H. Plant groups (New central book depot)
- 9. Kotpal Invertebrates
- 10. Kotpal Chordates
- 11. Shukla and U. Pandey- Applied Zoology.
- 12. Biochemistry Stryer
- 13. Enzymes Trevor Palmer
- 14. Biochemistry J. L. Jain
- 15. Basic Biophysics- M. Daniel
- 16. Biochemistry Powar and Chatwal

Paper No: SNST-113P

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Laboratory-course III (LS)

Sr.	Credit 2
No.	
1.	Animals sciences:
	Classification of animal kingdom with respect to structural organization
	using specimens of Sycon, Hydra, Liver fluke/ Taenia,
	Earthwarm/Nereis, Cockroach, Pearl oyster/Pila, Starfish,
	Balanoglossus, Petromyzon, Labeo, Frog, Cobra, Parrot, Human
2.	Study of algae (Nostoc, Sargassum, Spirulina)
	Fungi (Yeast, Penicillia, Tricoderma)
	Bryophyte (Funaria, Riccia, Anthoceros)
	Pteridophyte (Selaginella)
	Gymnosperms (Pinus)
	Angiosperms (Sunflower, Maize)
	Plant anatomy – Dicot and monocot root, stem, leaf.
	Introduction to microscopy

Paper No: SNST-104T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Mathematical Sciences

Topic	Credits: 3	Lectures
No.		45
		45
1	Unit- I: (Differential Calculus and Integral Calculus)	16
	(A) Differential Calculus	
	(i) Rolle's Theorem,	
	(ii) Lagrange's Mean Value theorem, their geometrical	
	interpretation,	
	(iii) Cauchy Mean Value theorem,	
	(iv) Taylor's theorem,	
	(v) Taylor's series and Maclaurian's series,	
	(vi) Series expansion of cosx, sinx, log(1+x), (1+x)n	
	(vii) Extremum values of a function of two variables, Lagrange's	
	method of undetermined multipliers.	
	(B) Integral Calculus	
	(1) Gamma and beta functions,	
	(ii) Double integrals, evaluation of double integrals,	
	(iii) Change of order of integration for two variables,	
	(IV) I riple integrals, evaluation of triple integral,	
	(v) Jacobians, change of variables,	
	(vi) Applications to areas and volumes.	
2	Unit- II (Differential Equations)	12
	Differential equations of first order and first degree,	
	(ii) Variable separable form,	
	(iii) Homogeneous differential equations and exact differential	
	equations, examples of non-homogeneous equations,	
	(iv) Condition for exactness,	
	(v) Integrating factor, rules of finding integrating factors,	

	 (vi) Linear differential equations of constant coefficients, (vii) Homogeneous linear differential equations, (viii) General solutions (ix) Applications of differential equations, Newton's law of Cooling, Kirchoff's law of electrical circuits, motion under gravity, 	
		0
3	Unit- III (Complex Numbers)	9
	i) Rectangular, polar and exponential forms of complex	
	numbers,	
	(ii) De-Moivre's Theorem,	
	(iii) Powers, roots and log of complex numbers,	
	(iv) Hyperbolic and circular functions and their relations	
	(v) Properties of hyperbolic functions,	
	(vi) Inverse circular functions.	
4	Unit- IV (Linear Algebra)	8
	i) Eigen values and Eigen vectors,	
	(ii) Characteristic equation,	
	(iii) Cayley-Hamilton Theorem,	
	(iv) System of homogeneous and non-homogeneous linear	
	equations,	
	(v) Condition for consistency.	

Books:

- 1. Differential Calculus: Shanti Narayan, S. Chand and Company, 2005
- 2. Integral Calculus: Shanti Narayan, S. Chand and Company, 2005
- 3. Differential Equations: G. S. Diwan and D. S. Agashe, Popular Prakashana, 4th Ed., 1975.
- 4. Introductory Course in Differential Equations: D. A. Murry, Orient Longman India, 1967.
- 5. Complex Numbers, Algebra and Geometry: G. V. Kumbhojkar and H. V. Kumbhojkar, C. Jamnadas and Com. Bombay, 1982
- 6. Text Book of Matrices: Shanti Narayan and P. K. Mittal, S. Chand and Company, 2011
- 7. Higher Engineering Mathematics: B. S. Grival, Khanna Publishers, 2001.

Problem Session on above syllabus :(8+8+4+4 =24 hrs.)

Paper No: SNST-105T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Computer Sciences

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	11
	Introduction- Characteristics of computers, computer evolution,	
	computer generations, Basic computer organization – Input unit,	
	output unit, storage unit, ALU, control unit, CPU, computer system.	
	Number systems - positional number systems, number system	
	conversions, fractional numbers. Computer codes - BCD code,	
	EBCDIC code, ASCII code. Computer Arithmetic – Binary	
	arithmetic operations – addition, subtraction	
2	Unit- II	11
	Boolean algebra and logic circuits – fundamentals, theorems of	
	Boolean algebra, Boolean functions - minimization, complement,	
	canonical forms, Logic gates – AND, OR, NOT, NAND, NOR, Logic	
	circuits - building logic circuits from expressions, universal	
	NAND/NOR gates, Ex-OR gate, flip flops, shift registers, counters.	
	Design of combinational circuits – half adder, full adder, a parallel	
	binary adder. CPU - control unit, ALU, instruction set, registers,	
	processor types, Memory - main memory, storage, memory	
	organization, types, cache memory.	
	Secondary memory – types of secondary storage memories viz.	
	magnetic tape, magnetic disc, optical disc, Mass storage devices,	
	Storage hierarchy.	

3	Unit- III	11
	 I/O devices – input devices such as keyboards, point-to-draw devices, data scanning devices, digitizer, electronic-card reader, voice recognition devices. Output devices- such as monitors, printers, voice response systems. Computer software – relationship between HW and SW, types of software, acquiring software, software development steps, Computer program planning, Algorithm, flowcharts: symbols and rules, advantages and limitations of flowcharts. 	
4	Unit- IV	12
	Computer Languages, Analogy of natural languages, Machine language, Assembly language, macro instructions, High-level language (HLL), compiler, linker, interpreter, Object oriented languages, advantages and limitations of languages, Characteristics of a good programming language. System implementation, testing and debugging, program errors, debugging a program for syntax/logic errors. Difference between testing and debugging, Documentation needs forms of documentation, changeover to a new system, - operations and methods, System evaluation, maintenance. Operating systems, functions of O.S., system performance measurement, Process management, multiprogramming, multitasking, multiprocessing, time-sharing, memory management, memory models, file management, security, command interpretation, popular O.S. examples. Application software, word processing, spreadsheets, presentation package.	

Reference Books:

- 1) Computer fundamentals, Pradeep K.Sinha, BPB Publications.
- 2) Computer Fundamentals (Fourth Edition), Rajaraman, PHI
- 3) Digital Computer Fundamentals, Thomas Bartee, TMH
- 4) Logic and Computer Design Fundamentals, Third Edition, Morris Mano, PHI
- 5) IBM PC and Clones, B. Govindrajalu, TMH

Paper No: SNST-114P

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Laboratory-course IV (MS, CS)

Sr. No.	(Credit 2)
1	Study of Basic gates
2	De-Morgan's theorem
3	Study of flip-flops (RS, D and JK)
4	Study of counters
5	Study of MS-words
6	Study of MS-power point
7	Use of Excel in graphical presentation
	Five experiments from Maths

Paper No: SNST-106T

Total Marks: 100

SHIVAJI UNIVERSITY, KOLHAPUR

(80+20)

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-I

SYLLABUS

Title of the paper: Basic concepts in communication

Topic	(non Credit Course)	Lectures
No.		10
1	Unit- I (Communication Skills)	
	Introduction to Communication – Meaning and definition.	
	a. Nature and Importance of Communication	
	b. Characteristics of Communication	
	c. Communication Cycle	
	d. Barriers of Communication	
2	Unit- II (Types of Communication)	
	a. Types of Communication	
	Verbal Communication – Oral and Written	
	• Non-Verbal Communication – Aspects of Body Language	
	and Graphic Communication	
	Formal Communication	
	Informal Communication	
	b. Technical communication and General Communication	
3	Unit- III (Language Skills)	
	a. Listening Skills	
	b. Reading Skills	
	c. Writing skills	
4	Unit- IV (Grammar)	
	a. Parts of Speech	
	b. Tense	
	c. Voices	

d	Direct and Indirect Speech	
e.	Transformation of Sentences	
f.	Word Formation	

Reference Books:

- 1. *English for Technical Communication*, K.R. Lakshminarayanan, (Scitech Publications, Chennai.)
- 2. *Body Language*, Allan Pease, (Sheldon Press, London)
- 3. *A Communicative Grammar of English*, Geoffrey Leech, Jan Swartvik (ELBS with Longman)
- 4. *Communication Skills for Engineers*, Sunita Mishra, C, Murali Krishna (Pearson Education).

Paper No: SNST-201T

Total Marks: 100

SHIVAJI UNIVERSITY, KOLHAPUR

(80+20)

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Physical Sciences-II

(Optics; Kinetic Theory, Transport Phenomena and Thermodynamics; Electricity and Magnetism)

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	10
	1) Interference: Interference in thin parallel films (reflected light	
	only), Wedge shaped films, Newton's rings, its application for	
	determination of wavelength of light.	
	2) Diffraction: Types of diffraction, Elementary theory of plane	
	diffraction grating (qualitative treatment only).	
	3) Polarization: Production of polarized light, Malus Law,	
	Phenomenon of double refraction	
2	Unit- II	15
	1) Thermometry: Principle of thermometry, Mercury	
	thermometer, Platinum resistance thermometer, thermocouple	
	and thermopile, concept of cryogenics.	
	2) Ideal and Real gas: Interpretation of temperature, Degree of	
	freedom, Maxwell's law of equipartition of energy. Andrew's	
	curve, critical constants, Relation between critical constants and	
	Vander Waal's constants, reduced equation of state.	
	3) Transport Phenomena : Molecular collisions, mean free path	
	and collision cross section, Estimation of molecular diameter	
	and mean free path (Elementary method), Clausius and	
	Maxwell's equation for mean free path. Transport of momentum	
	(viscosity), energy (thermal conduction), mass (diffusion).	

3	Unit- III	10
	1) Thermodynamics-I:Thermodynamical state, Thermodynamic	
	equilibrium, Zeroth law of thermodynamics, First law of	
	thermodynamics, reversible and irreversible changes,	
	isothermal and adiabatic changes, Adiabatic relations, Work	
	done during isothermal and adiabatic changes.	
	2) Thermodynamics-II: Second law of thermodynamics	
	(different statements), Entropy, principle of increase of entropy	
	in natural processes (conduction and free expansion of gas),	
	Third law of thermodynamics.	
4	Unit- IV	10
	1) Dielectrics:Polarisation of dielectrics and polarisation vector,	
	Displacement vector, Electric vector, Relation between E, P and D	
	vectors, Electric susceptibility of dielectrics.	
	2) A.C.Circuits: Series LCR circuit, analysis of complex impedance,	
	Reactance, Admittance, and Susceptance, Resonance in series	
	_	
	circuit, Q-factor (definition only), A.C.Bridge-Owen's Bridge.	
	circuit, Q-factor (definition only), A.C.Bridge-Owen's Bridge. 3) Ballistic Galvanometer: Ballistic galvanometer, construction,	
	circuit, Q-factor (definition only), A.C.Bridge-Owen's Bridge.3) Ballistic Galvanometer: Ballistic galvanometer, construction, theory, Damping correction, constants of B.G. (definitions only).	
	 circuit, Q-factor (definition only), A.C.Bridge-Owen's Bridge. 3) Ballistic Galvanometer: Ballistic galvanometer, construction, theory, Damping correction, constants of B.G. (definitions only). 4) Magnetostatics: Statement of Biot and Savert's law, 	
	 circuit, Q-factor (definition only), A.C.Bridge-Owen's Bridge. 3) Ballistic Galvanometer: Ballistic galvanometer, construction, theory, Damping correction, constants of B.G. (definitions only). 4) Magnetostatics: Statement of Biot and Savert's law, Ampere's theorem, Magnetic induction due to straight solenoid 	

Main References:

- 1. Optics B.K.Mathur
- 2. Treaties on Heat Saha and Shrivastav.
- 3. Heat and Thermodynamics Brijlal and Subramanyam S. Chand and Co. Ltd, Delhi.
- 4. Kinetic Theory of gases V.N. Kelkar.
- 5. Electricity and Magnetism Yarwood
- 6. Electricity and Magnetism Khare and Shrivastav

Paper No: SNST-211P

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Laboratory-course I (PS)

Sr. No.	(Credit 2)
11	Calibration of Spectrometer – unknown wavelength measurement.
12	Newton's rings – measurement of wavelength.
13	Plane diffraction grating.
14	Verification of Kirchhoff's laws.
15	Impedance of series LCR circuit.
16	Bridge rectifier with Pi filter.
17	Zener diode as voltage regulator.
18	Output characteristics of transistor –CE mode
19	Liquid lens.
20	Thevenin's theorem. Note: Students should perform at least eight experiments from each group.

Reference Books

- 1. College Practical Physics Khanna and Gulati (S. Chand and Co. Ltd, Delhi).
- 2. Practical Physics Gupta and Kumar (Pragati Prakation Meerat)
- 3. Advanced Level Practical Physics– J.M. Nelcon, J.M. Ogloom (EIBS).
- 4. Advanced Practical Physics–Worsnop and Flint.

- 5. A Text Book of Practical Physics-Shrinivasan and Balasubramanyam.
- 6. A Text Book of Practical Physics Indu Prakashan and Ramkrishna.

Paper No: SNST-202T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Chemical Sciences-II

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	
	A) Theories of Bonding	(6)
	Introduction to theories of bonding.	
	Valence bond theory (VBT), Valence Shell Electron Pair Repulsion	
	(VSEPR), Molecular Orbital Theory (MOT), Molecular Orbital	
	diagrams of homonuclear diatomic molecules $C_2,\ N_2,\ O_2$ and	
	heteroatimic molecules Viz. CO & NO.	(6)
	B) Chemistry of p-Block elements	
	Introduction to p-block elements, Chemistry of individual	
	elements, Chemistry of B, Al, In, C, Si, Ge, N, P, As, O, S, Se,	
	interhalogens, compounds of Xenon.	
2	Unit- II	
	A) Amino acids, Proteins & Nucleic acids	(c)
	Synthesis of amino acids and polypeptides, primary and	(6)
	secondary structure of a protein, enzymes and co-enzymes,	
	structure and synthesis of nucleotides and nucleosides.	
	B) Heterocyclic Compounds	
	Structure, synthesis and reactions of following systems: Indole,	(7)
	Quinoline, Isoquinoline, Carbazole, Purines, Peniciline &	(7)
	Sulphadrug.	
3	Unit- III (Thermodynamics, Microstates and Macrostates)	10
	Pagia postulatos of thermodynamics, fundamental valation and	10
	basis postulates of thermouynamics, fundamental relation and	
	definition of variables, intensive variables in the entropic	

	formulation, first, second and third law of thermodynamics,	
	thermodynamic potentials and extensively properties, Maxwell	
	relations, microstates and macrostates, Ideal gas microstates and	
	macrostates in quantum systems, Density of states.	
4	Unit- IV (Manufacturing of Heavy Chemicals)	10
4	Unit- IV (Manufacturing of Heavy Chemicals) Manufacturing of following heavy chemical with reference to	10
4	Unit- IV (Manufacturing of Heavy Chemicals) Manufacturing of following heavy chemical with reference to physic-chemical principles, instrumentation, reactions and uses,	10

References:

- 1. Fundamental concepts of Inorganic Chemistry, Volume I & II, Asim K. Das.
- 2. Advanced Inorganic Chemistry, Cotton and Wilkinson.
- 3. Chemistry of Elements, Greenwood.
- 4. Organic Chemistry, I. L. Finar
- 5. Introduction to Heterocyclic Compounds, E. I. Eliel
- 6. A text book of chemical technology Vol. 1, S.D. Shukla & G N Pandey.
- 7. Chemical Technology (Pergamon), F A. Henglein.
- 8. Physical Chemistry, W. J. Moore.
- 9. Physical Chemistry, A. W. Atkins.

Paper No: SNST-212P

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Laboratory-course II (CS)

Sr. No.	(Credit 2)
1	Study of reaction between $K_2S_2O_8$ and KI (Equal concentrations).
2	Determination of heat of ionization of weak acid by using polythene bottle.
3	Preparation and standardization of HCl and H ₂ SO ₄ solutions from bulk.
4	Estimation of acetamide.
5	Identification of at least three organic compounds with reactions including
	one from acids, one from phenols, one from bases and one/two from
	neutrals from the list of compounds given below:
	(exempt those mixtures which were identified for Semester-I)
	Acids : Oxalic acid, Benzoic acid and Cinnamic acid.
	Phenols : β-Naphthol, Resorcinol.
	Bases : Aniline, p-Toluidine.
	Neutrals : Acetone, Ethyl acetate, Glucose, Chloroform,
	Chlorobenzene, m-Dinitrobenzene, Thiourea.
	Note : A systematic study of an organic compound involves the
	following operations which should be taught in details with reactions
	the detection of elements and functional group.
	Preliminary tests and Physical examination.
	Physical constant.
	Detection of Elements.

	Detection of Functional group.
	A Search into literature.
	Special Test.
	Summary.
	Result.
6	Qualitative Analysis: Spot Tests :
	Detection of following cations using spot tests : Cu ²⁺ , Co ²⁺ , Ni ²⁺ , Fe ³⁺ ,
	Zn ²⁺ , Mg ²⁺ , Al ³⁺ , Pb ²⁺ , Mn ²⁺ and Hg ²⁺
7	Chromatography :
	Separation and identification of cations by Paper Chromatographic
	technique from the following mixtures:
	a) $Ni^{2+} + Cu^{2+}$
	b) Ni ²⁺ + Co ²⁺
	c) Cu ²⁺ + Co ²⁺

Reference Books:

- 1. Practical book of Physical Chemistry: Nadkarni, Kothari & Lawande.
- 2. Experimental Physical Chemistry: A. Findlay.
- 3. Systematic Experimental Physical Chemistry: S. W. Rajbhoj, Chondhekar. (Anjali Publ.)
- 4. Experiments in Physical Chemistry: R. C. Das and B. Behra. (Tata Mc Graw Hill)
- 5. Advanced Practical Physical Chemistry: J. B. Yadav (Goel Publishing House.)
- 6. Practical Physical Chemistry: B. D. Khosala. (R. Chand & Sons)
- 7. Experiments in Chemistry: D. V. Jagirdar.
- 8. A Text Book of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis: A.I. Vogel (Third Ed.) (ELBS)
- 9. Vogels Text Book of Quantitative Chemical Analysis. (Longmann) ELBS Edition.
- 10. Vogels Text Book of Qualitative Chemical Analysis. (Longmann) ELBS Edition.

- 11. Hand book of Organic Qualitative Analysis: Clarke.
- 12. Comprehensive Practical Organic Chemistry Qualitative Analysis by V. K. Ahluwalia, Sunita Dhingra. University Press. Distributor – Orient Longman Ltd.
- 13. Vogels Text Book of Inorganic Quantitative Chemical Analysis (Longman) ELBS Edition.
- 14. Vogels Text Book of Inorganic Qualitative Chemical Analysis (Longman) ELBS Edition.
- 15. Basic Concepts in Analytical Chemistry (Wiley Eastern Ltd.): S. M. Khopkar.

Paper No: SNST-202T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology

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(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Life Sciences-II

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	
	Pure cultures techniques	11
	a] selective methods-chemical, physical & biological methods of selection	11
	b] methods of isolating pure cultures-streak, pour& spread plate Control of microorganisms	
	a] definition of sterilization, disinfectant, antiseptics, germicide, antimicrobial agents	
	b] physical agents-temperature-dry heat, moist heat, desiccation, osmotic pressure, radiations, filteration	
	c] Chemical agents-phenol & phenolic compounds, alcohols,	
	halogens, heavy metals & their compounds, gaseous agents	
2	Unit- II	
	Introductory History - Cellular totipotency, techniques in plant	12
	tissue culture.	12
	Infrastructure & Organization of Plant Tissue Culture	
	Laboratory- General and aseptic laboratory- different work	
	areas, equipments and instruments required, other requirements.	
	Aseptic Techniques- Washing and preparation of glassware's,	
	packing and sterilization, media sterilization, surface sterilization,	
	aseptic workstation, precautions to maintain aseptic conditions.	
	Culture Medium- Nutritional requirements of explant, PGR and	
	their invitro roles, basal MS medium composition and media	
	preparation.	
	Callus Culture Techniques- Introduction, principle, protocol,	
	factors affecting, morphology and internal structure, genetic	

	variations, applications, limitation.			
	Micropropogation- Introduction, stages of Micropropogation,			
	factors affecting, applications, problems & limitations.			
3	Unit- III			
	History and Introduction of Animal Cell culture- History of			
	animal cell culture			
	Requirements of Animal cell culture- Characteristics of animal			
	cell in culture, substrate for cell growth, Equipments required for			
	animal cell culture (Laminar air flow, Co2 incubator, Centrifuge,			
	Invertedmicroscope)			
	Sterilization of Glassware's, Equipments & culture media-			
	Glassware sterilization, reagent and media sterilization, sterility			
	testing.			
	Culture media- Natural media, synthetic media (serum containing			
	media, serum free media, balanced salt solution, media			
	constituent, complete culture media, physicochemical properties			
	of media)			
	Cultured cells- Biology and Characterization- Characteristics of			
	cultured cells, cell adhesion, cell proliferation, cell differentiation,			
	metabolism of cultured cells, Initiation of cell culture, Evolution			
	and development of cell lines.			
	Characterization of cultured cells- Morphology of cells, species of			
	origin of cells, Identification of tissue of origin, transformed cells,			
	Identification of specific cell lines			
4	Unit- IV	10		
	Viruses: structure and classification of viruses			
	General characteristics of viruses, cultivation of viruses			
	life cycle of bacteriophages			
	lytic cycle of T4 phage Plant and animal viruses			
4	cultured cells, cell adhesion, cell proliferation, cell differentiation, metabolism of cultured cells, Initiation of cell culture, Evolution and development of cell lines. Characterization of cultured cells- Morphology of cells, species of origin of cells, Identification of tissue of origin, transformed cells, Identification of specific cell lines Unit- IV Viruses: structure and classification of viruses General characteristics of viruses, cultivation of viruses life cycle of bacteriophages lytic cycle of T4 phage Plant and animal viruses	10		

Reference Books:

- 1. General microbiology-Stanier
- 2. Introduction to microbiology-Ingraham
- 3. Brock biology of microorganisms-Madigan et al
- 4. Fundamentals of microbiology-Frobisher
- 5. Microbiology-Pelczar
- 6. General microbiology Pawar & Daginawal
- 7. Text book of microbiology-Ananthanaraya
- 8. Introduction to plant tissue culture- M.K. Razdan
- 9. Plant tissue culture-Theory & practice-S.S.Bhojwani & M.K. Razdan
- 10. Micropropgation- Deberg & Zimmermann
- 11. Plant tissue culture-Kalyankumar Dey
- 12. Biotechnology- B.D. Singh
- 13. A text book of Biotechnology- R.C. Dubey
- 14. Plant tissue culture-U.Kumar
- 15. Animal tissue culture- Paul
- 16. Culture of animal cell 3rd edition-R Ian Freshney
- 17. Animal cell culture- R.W.Masters
- 18. Animal biotechnology-M.M.Ranga
- 19. Animal biotechnology-R.Sasidhara
- 20. Animal cell culture technique-Ed. Martin Clynes Springe

Paper No: SNST-213T

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology (5 year integrated multidisciplinary 10 semester course) Semester-II

SYLLABUS

Title of the paper: Laboratory-course III (LS)

Sr.	(Credit 2)		
No.			
1.	Microscopic examination of bacteria		
	Monochrome staining, Gram staining, Negative staining, Capsule		
	staining, Cell wall staining.		
	Preparation of culture media.		
	a. Bacteria		
	Peptone water, Nutrient broth, Nutrient agar, Mac Conkey's agar.		
	Isolation & enumeration of bacteria		
	Streak plate technique, Spread plate technique, Pour plate technique		
	Observation of motility by hanging drop techniques.		
	To study growth curve of bacteria.		
	Isolation, colony character, Gram staining & motility of <i>E</i> .		
	coli, Bacillus.		
2.	Demonstration (Principle, working, constriction, &		
	application) of		
	1. Hot air oven		
	2. Autoclave		
	3. Incubator		
	4. pH meter		
	5. Calorimeter		
	6. Seitz filter/syringe filter		
	7. Laminar air flow		
	8. Quebec colony counter.		
	9. Sterilization		

3.	Plant tissue culture:
	Laboratory Organizations & general techniques.
	Stock solutions & media preparations
	Callus culture technique- Initiation of culture, callus morphology
	Suspension culture technique-Initiation of culture, growth
	measurement.
	Micropropogation stage I-Initiation of micropropagation -Shoot
	tip & axillary bud culture technique

Paper No: SNST-204T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR

School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Descriptive Statistics and Probability Distributions

Topic	Credits: 3	Lectures
No.		45
1	Unit- I	
	Meaning and scope of statistics in industry and physical sciences, population and sample, census method, sampling method. Primary and secondary data, ungrouped and grouped data, qualitative data (attributes) and quantitative data (variables), frequency distribution. Histogram, frequency curve, Box plot. Concept of central tendency, criteria for good measures of central tendency. Arithmetic mean, median, mode and their properties, Computations of mean, median and mode for ungrouped and grouped data.	08
2	Unit- II	
	Concept of dispersion, measures of dispersion, absolute and relative measures of dispersion, range, mean deviation, standard deviation and their relative measures. Variance, coefficient of variation. Concepts and measures of skewness and kurtosis Correlation and regression (for ungrouped data) : Bivariate data, concept of correlation, scatter diagram, Karl Pearson's coefficient of correlation, Spearman's Rank Correlation coefficient. Regression: concept, lines of regression, least square method, regression coefficients, relation between correlation and regression coefficients.	12
3	Unit- III Concept of experiment with random outcome, sample space, finite and countably infinite sample space, discrete sample space, events, types of events, power set, Classical (apriori) definition of probability of an event, axiomatic definition of probability. Theorems on probability: i) $P(\Phi) = 0$, ii) $P(Ac) = 1 - P(A)$ iii) $P(A \cup B) = P(A) + P(B) - P(A \cap B)$, iv) If A is subset of B then $P(A) \le P(B)$ v) $0 \le P(A \cap B) \le P(A) \le P(A \cup B) \le P(A) + P(B)$ simple examples.Conditional probability and independence of events: Independence of two events properties and examples. Definition	12

	of conditional probability, Bayes theorem and applications.	
4	Unit- IV	13
-	Univariate probability distributions: Discrete random variable, probability mass function (pmf), cumulative distribution function (cdf), properties of c.d.f., and examples. Definition of expectation of random variable, properties of expectation, expectation of function of random variable, definition of mean and variance of univariate distribution. Definitions of discrete uniform distribution, Bernoulli distribution, Binomial distribution Poisson distribution, exponential distribution and Normal distribution. Mean and variance of these distributions, Important properties of these distributions.	10
	Applications of these distributions.	

Reference Books –

1. Bhat B. R., Srivenkatramana T. and Madhava Rao K. S. (1996): Statistics: A Beginner's Text, Vol. 1, New Age International (P) Ltd.

2. Edward P. J., Ford J. S. and Lin (1974): Probability for Statistical Decision Making, Prentice Hall.

3. Goon A.M., Gupta M.K., and Dasgupta B.: Fundamentals of Statistics Vol. I and II, World Press, Calcutta.

4. Hogg R. V. and Crag R. G.: Introduction to Mathematical Statistics Ed.4.

5. Hoel P. G. (1971): Introduction to Mathematical Statistics, Asia Publishing House.

6. Meyer P. L. (1970): Introductory Probability and Statistical Applications, Addision Wesley.

7. Mood A. m., Graybill F. A. and Boes D. C. (1974): Introduction to the Theory Of Statistics, McGraw Hill.

8. Rohatgi V. K. and Saleh A. K. Md. E. (2002): An Introduction to probability and statistics. John wiley & Sons (Asia)

9. Snedecor G.W. and Cochran W. G. (1967): Statistical Methods, Lowa State University Press.

10. Waiker and Lev.: Elementary Statistical Methods.

Paper No: SNST-214T

Total Marks: 50

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology (5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Laboratory-course IV (SS, E)

Sr. No.	(Credit 2)
	Statistics
1	Graphical presentation of the freq. distribution
2	Measures of central tendency and dispersion
3	Skewness & Kurtosis
4	Correlation and regression
5	Applications of binomial and Poisson distribution.
6	Applications of exponential and normal distribution.
	Electronics:
1	Colour code of resistor and capacitor
2	I-V characteristics of PN-Junction diode
3	Input and output common emitter (CE) configuration
4	Bridge rectifier
5	Single stage CE amplifier
6	Two stage transistor amplifier
7	Hartly oscillator
8	Wein-bridge oscillator
9	Transistorized astable multivibrator

10	Op-amp as inverting and non-inverting amplifier
11	Op-amp as adder and subtractor
12	Op-amp as integrator and differentiator

Paper No: SNST-205T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Electronics

Topic	Credits: 3	Lectures
No.		
1	Unit- I (Passive components and Power sources)	
	Colour code for resistors and capacitors, resistor specifications	11
	and types, Inductor specifications and types, capacitor	
	specifications and types, Transformer and its types, Relays	
	AC/ DC sources: concept of constant current and constant voltage	
	sources, parallel and series connections of sources.	
2	Unit- II (Semiconductor Devices)	
	PN-Junction: Forward & reverse biasing, Specifications and types	11
	of diodes (Zener, LED, point contact and photo diode), 7-segment	
	display and LCD.	
	BJT: Transistor working, Basic configurations (CB, CE & CC), I/O	
	characteristics of CEC, applications as an amplifier and switch.	
	Transistor specifications	
	FET: JFET, MOSFET, IGBT (construction, working and I-V	
	Characteristics)	
	Switching devices: SCR and UJT (construction, working and I-V	
	Characteristics)	
3	Unit- III (Electronic Circuits)	11
	Rectifiers: Half wave, Full wave and bridge rectifier, Filters: L, C,	
	and CLC (π -filter), Transistor amplifier (CE amplifier), single	
	stage and multistage amplifiers, FET amplifier (high input	
	impedance concept),	
	Oscillators: Transistorized LC, RC and crystal oscillators	

	Multivibrators: - Transistorized astable, monostable, and bistable	
	multivibrators.	
4	Unit- IV (Operational amplifier and its applications)	12
	Ideal difference amplifier, difference gain, common mode gain (CMRR), equivalent circuit of op-amp, block diagram of op-amp, ideal and practical characteristics, op-amp IC741 (case study), concept of virtual ground, Inverting and non-inverting amplifiers, voltage follower, adder, subtractor, comparator, integrator and differentiator.	

Reference Books:

- 1. Electronic Principles Malvino, Tata Mc-graw Hill publication, 7th edition
- 2. A Text Book of Applied Electronics -R. S. Sedha, S. Chand Publication, Multicolour Edition
- 3. Electronic Devices and Circuits -Millman and Halkies, Tata Mc-graw Hill Publication
- 4. Electronic Devices and Circuits Allen Mottershead, Tata Mc-graw Hill Publication

Paper No: SNST-206T

Total Marks: 100

(80+20)

SHIVAJI UNIVERSITY, KOLHAPUR School of Nanoscience and Technology

(5 year integrated multidisciplinary 10 semester course)

Semester-II

SYLLABUS

Title of the paper: Communication in Practice

Topic	(non Credit Course)	Lectures			
No.					
1	Unit- I (Communication Skills)				
	a. Introduction to Communication – Meaning and definition.				
	b. Nature and Importance of Communication				
	c. Characteristics of Communication				
	d. Communication Cycle				
	e. Barriers of Communication				
2	Unit- II (Types of Communication)				
	a. Types of Communication				
	• Verbal Communication – Oral and Written				
	• Non-Verbal Communication – Aspects of Body				
	Language and Graphic Communication				
	Formal Communication				
	Informal Communication				
	b. Technical communication and General Communication.				
3	Unit- III Language Skills:				
	a. Listening Skills				
	b. Reading Skills				
	c. Writing skills				
4	Unit- IV (Grammar)				
	a. Parts of Speech				
	b. Tense				
	c. Voices				
	d. Direct and Indirect Speech				

e.	Transformation of Sentences	
f.	Word Formation	

NATURE OF QUESTION PAPER

SCHOOL OF NANOSCIENCE AND TECHNOLOGY

All Questions are compulsory

Time duration (3 hours)

Total Marks: 80

Q.1 Attempt the following (any four)	16
i.	
ii.	
iii.	
iv.	
v .	
Q.2 a)	12
b)	4
Or	
Q.2. a)	
b)	
Q.3 a)	12
b)	4
Or	
Q.3a)	
b)	
Q.4 a)	12
b)	4
Or	
Q.4 a)	

b)

- Q.5.
- a)
- b)
- or
- .
- a)
- b)