Course Name: **Bachelor of Vocational**
Discipline: **Environmental Assessment and Remediation**
(FOR THOSE WHO JOIN IN JUNE 2022 AND AFTER)
Duration of the Course: Three Years

1. Course Objectives

The objective is to recognize that curriculum, course content and assessment of academic achievement play complementary roles in shaping education. The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e. water, air and soil. The course will also be dealing with the sources of pollution in water, air, soil, solid-waste, thermal and noise and the impacts these sources on the environment and health. In addition, the students will be given the training to develop the particular skills required in pollution related structured study and conservation methods.

➢ To study sources and classification of water pollutants.
➢ To study air pollution: sources and effects.
➢ To study sources of soil contamination and management of solid waste.
➢ To develop skill in practical work, experiments, equipments and laboratory use along with collection of sample and interpretation of data for environmental Assessment.
➢ Make aware of natural resources and environment and the importance of conservation.

2. Eligibility for admission:

A pass in the Higher Secondary with Biology background / other streams also and its equivalent as per Madurai Kamaraj University rules.

COURSE SCHEME:

| Sem | Part | Subject | Hrs/ Week | Credits | | | Int+Ext =Total | Subject Code | Focus on Employability/ Entrepreneurship/ Skill Development | Revised / New / No Change / Interchanged & Percentage of revision |
				Theory	Skill	Total				
I	Allied-1	Communicative English - Paper I	6	2	2	4	25+75=100	**EV22E11**/ EV15E1	Skill Development	No change
	Allied-2	Mathematics-I	6	2	2	4	25+75=100	**EV22M11**/ EV15M1	Skill Development	No change
	Part-IV	Value education	-	3	0	3	25+75=100	**U22VE11**		
	Core-1	Environmental Science	5	3	2	5	25+75=100	**EV22C11**	Skill Development	Revised – 50%
	Core-2	Environmental Pollution- I	5	3	2	5	25+75=100	**EV22C12**	Skill Development	Revised – 30%
	Core 1 Lab	LAB: Environmental Chemistry	6	0	4	4	40+60=100	**EV22CP11**	Skill Development	Revised – 20%
		Internship		0	5	5	100 (Internal)	**EV22IS11**/ EV15TV1	Skill Development	No change
		Total	**30**	**13**	**17**	**30**				

Sem	Part	Subject	Hrs/ Week	Credits			Int+Ext =Total	Subject Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised / New / No Change / Interchanged & Percentage of revision
				Theory	Skill	Total				
II	Allied-3	Communicative English – Paper II	6	2	2	4	25+75=100	**EV22E21/** EV15E2	Skill Development	No change
	Allied-4	Mathematics-II	6	2	2	4	25+75=100	**EV22M21/** EV15M2	Skill Development	No change
	Allied-5	Basics of Computers for Reports Maintenance	2	2	1	3	25+75=100	**EV22CS21**	Skill Development	New
	Core-3	Water Quality Assessment	5	3	2	5	25+75=100	**EV22C21/** EV15T21	Skill Development	No change
	Core-4	Water and wastewater remediation techniques	5	3	2	5	25+75=100	**EV22C22**	Skill Development	Revised – 10%
	Core 2 Lab	LAB: Water analysis	6	0	5	5	40+60=100	**EV22CP21**	Skill Development	Revised – 20%
		Industrial Visit		0	4	4	100 (Internal)	**EV22IV11/** EV15TV2	Skill Development	No change
		Total	**30**	**12**	**18**	**30**				

Sem	Subject	Hours/ Week	Credits			Int + Ext =Total	Subject Code
			Theory	Skill	Total		
III	Soft Skills Development	4	2	1	3	25+75=100	EV16T31
	Human impact on the Environment	4	2	1	3	25+75=100	EV16T32
	Environmental Pollution- II	4	2	1	3	25+75=100	EV16T33
	Air Quality Assessment & Remediation	5	3	1	4	25+75=100	EV16T34
	Climate change and Carbon Sequestration	5	3	1	4	25+75=100	EV16T35
	LAB: Air Quality Assessment I	10	0	5	5	40+60=100	EV16P31
	Internship	8	0	4	4	50(Internal)	EV16ISP3
	Industrial Visit	2	0	1	1	20(Internal)	
	Project Work	6	0	3	3	30(Internal)	
	Total	**48**	**12**	**18**	**30**		

Sem	Subject	Hours/ Week	Credits			Int+Ext =Total	Subject Code
			Theory	Skill	Total		
IV	Remote sensing and GIS	4	2	1	3	25+75=100	EV16T41
	Air Pollution Control Technologies	4	2	1	3	25+75=100	EV16T42
	Hazardous Waste Management	4	2	1	3	25+75=100	EV16T43
	Bioremediation	5	3	1	4	25+75=100	EV16T44
	Indoor Environment Monitoring	5	3	1	4	25+75=100	EV16T45
	LAB: Air Quality Assessment II	10	0	5	5	40+60=100	EV16P41
	Internship	8	0	4	4	50(Internal)	EV16ISP4
	Industrial Visit	2	0	1	1	20(Internal)	
	Project Work	6	0	3	3	30(Internal)	
	Total	**48**	**12**	**18**	**30**		

Sem	Subject	Hours/ Week	Credits			Int + Ext =Total	Subject Code
			Theory	Skill	Total		
V	Solid Waste Recycling and Processing	5	3	1	4	25+75=100	EV16T51
	Bioremediation-II	5	3	1	4	25+75=100	EV16T52
	Ecotoxicology and Human Health	4	2	1	3	25+75=100	EV16T53
	Circular Economy	4	2	1	3	25+75=100	EV16T54
	Workplace Hazardous and Occupational Health	4	2	1	3	25+75=100	EV16T55
	LAB: V Solid Waste Assessment and Remediation-I	10	0	5	5	40+60=100	EV16P51
	Internship	8	0	4	4	50(Internal)	EV16ISP5
	Industrial Visit	2	0	1	1	20(Internal)	
	Project Work	6	0	3	3	30(Internal)	
	Total	**48**	**12**	**18**	**30**		

Sem	Subject	Hours/ Week	Credits			Int+Ext =Total	Subject Code
			Theory	Skill	Total		
VI	Applied Pyrolysis and Gasification	5	3	1	4	25+75=100	EV16T61
	Waste to product Conversion Techniques	5	3	1	4	25+75=100	EV16T62
	Industrial Hazardous Waste Management	4	2	1	3	25+75=100	EV16T63
	Natural Resources and Conservation	4	2	1	3	25+75=100	EV16T64
	Environmental Nanotechnology	4	2	1	3	25+75=100	EV16T65
	LAB: VI Solid Waste Assessment and	10	0	5	5	40+60=100	EV16P6

Remediation-II						
Internship	8	0	4	4	50(Internal)	EV16ISP6
Industrial Visit	2	0	1	1	20(Internal)	
Project Work	6	0	3	3	30(Internal)	
Total	**48**	**12**	**18**	**30**		

SEMESTER – I

COMMUNICATIVE ENGLISH - PAPER I

Contact Hours per week   : 6   **Subject Code: EV22E11**/ EV15E1
Contact Hours per semester: 90 (Theory 60 + Skill 30)   **Credits:** 4 (2 Theory + 2 Skill)

Section- A: Theory (2 credits)

Course Outcomes (CO):
On successful completion of the course, the learners will be able to

   CO1: provide the vital information required to understand the concepts underlying
            various communication skills.
   CO2: cover the several aspects of communication in oral and written modes.
   CO3: facilitate acquisition of necessary language skills.
   CO4: learn the basic grammar of English language
   CO5: apply knowledge of word power and grammar rules in formal and
            informal letter writings

Unit I – Grammar   **12 hours**
   i.   Parts of Speech
   ii. Tenses – Present, Past, Future

Unit II – Reading Skill   **12 hours**
   i.   Comprehension of a Passage / Story / News

Unit III – Writing Skill   **12 hours**
   i.   Narration of story
   ii. Translation of sentences, short passages
   iii. Letter writing (Informal Letters)

Unit IV – Phonetics   **12 hours**
   i.   Vowels, Consonants, Diphthongs
   ii. Transcription of words

Unit V – Speaking Skill   **12 hours**
   i.   Introducing oneself and others
   ii. Situational Communication – Greeting, Complimenting, Requesting etc.

Note: 2, 4 units are considered as a Language laboratory
        (Allocation: 12 hours Laboratory, 18 Hours theory)

TEXTBOOK:
1. V.JeyaSanthi and R. Selvam, 2015. *Advanced Skills for Communication in English*: Book I, New Century Book House

REFERENCE BOOKS:

1.	G.Radhakrishna Pillai	-	*Emerald English Grammar & Composition*, Emerald Publishers
2.	Board of Editors	-	*Synergy – Communication in English and Study Skills*, Orient Blackswan
3.	Dr.S.Vincent	-	*Let's Speak English (A Course in Spoken English)*Soundra Publications
4.	K.R.Lakshminarayanan, T.Murugavel	-	*Communication Skills in English*, SciTech Publications, Chennai.
5.	G.Radhakrishna Pillai, K.Rajeevan	-	*Spoken English for You: Level One* Emerald Publishers
6.	Bikram K.Das	-	*Functional Grammar and Spoken and Written Communication in English*, Orient Longman Pvt., Ltd.
7.	A.R.Thorat, B.S.Valke, S.B.Gokhale	-	*Enriching Your Competence in English* Orient Longman Pvt. Ltd.

Section –B Skill Component
Contact Hours per semester: 30   **Credits: 2**
1. To impart and enhance communicative competency for professional mobility
2. To equip the student with necessary skills for employment
3. To prepare students for career in media
4. To develop ability of all students to read, write, listen, speak and think critically
5. To produce students with advanced skills in writing, reading and reasoning.

MATHEMATICS – I
Contact Hours per week   :   6   **Subject Code: EV22M11/** EV15M1
Contact Hours per semester: 90 (Theory 60 + Skill 30)   **Credits:** 4 (2 Theory + 2 Skill)

Section- A: Theory (2 credits)
COURSE OUTCOMES (CO):
On successful completion of the course, the learners will be able to

CO1: understand basic mathematics, data interpretations.
CO2: learn about effective presentation of data.
CO3: acquire knowledge about applications of Differentiation
CO4: enrich the knowledge about methods of data collection
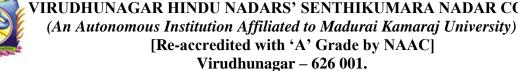**CO5**: demonstrate the Computations

Unit-I: **12 hours**
Methods of collection of data - primary-secondary – sampling: classification and tabulation: tabulation of data – rules for tabulation - diagrammatic and graphic representation.

Unit-II: **12 hours**
Arithmetic mean – median – mode Range – quartile deviation – mean deviation – standard deviation – co-efficient of variation (combined standard deviation excluded)

Unit-III: **12 hours**

Correlation - Regression analysis – regression equations.

Unit-IV: **12 hours**

Forecasting Introduction - Finding missing data using Lagrange Interpolation Formulae and Lagrange's Inverse interpolation formula

Unit-V: **12 hours**

Computations using worksheet formula, Interpreting data using spread sheet – A Simple presentation of your data.

Note: (Allocation: 18 hours Laboratory, 72 Hours theory)

[All units are from text books only. Include the theory parts without proof and derivations. Problems only]

TEXTBOOKS:
1. R.S.N. Pillai and V. Bagavathi, 2016. *Statistics*, S Chand Publishing
2. S.Arumugam, A.Thangapandi Isaac, A. Somasundaram, 2010. *Numerical Method*, Second Edition, SCITECH Publications.

REFERENCE BOOKS:
1. S. Narayanan and T.K. Manicavachagom, 2009. *Differential Equations and Its Applications*, S. Viswanathan (Printers & Publishers), Pvt. Ltd.
2. S.P. Gupta, 2018. *Business statistics*, SBPD Publications
3. D. C. Sancheti, V. K. Kapoor, 2010. *Statistics: Theory, Methods & Application* 7th Edition, Sultan Chand And Sons
4. J. H. Mathews, 1987. *Numerical Methods for Mathematics, Science and Engineering,* Prentice Hall, New Delhi, 2001.

Section –B Skill Component

Contact Hours per semester: 30   **Credits: 2**
1. Properties of mean
2. Arithmetic mean
3. Median
4. Mode
5. Frequency table
6. Standard deviation
7. Rank correlation
8. Correlation
9. Regression equation
10. Lagrange's method

ENVIRONMENTAL SCIENCE

Contact Hours per week   : 5   **Subject Code: EV22C11**
Contact Hours per semester: 75 (Theory 45 + Skill 30)   **Credits:** 5 (3 Theory + 2 Skill)

Section- A: Theory (3 credits)

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1: recognize the importance of environment and role of Individuals in its protection.

CO2: explain the key concepts of Ecosystem, Food Web and Bio geochemical.

CO3: apply the right measures for the sustainable use of natural resources.

CO4: analyze the ethical, cross-cultural, and historical context of environmental issues and the links between Human and Natural Systems.

CO5: examine the impact of human action on the biological environment

Unit – I: Concept and scope   **9 hours**

Environmental science: Concept, Scope and importance – Environmental segments: Atmosphere, Hydrosphere, Lithosphere and Biosphere – Renewable and non-renewable resources

Unit – II: Eco system and Energy flow   **9 hours**

Ecosystem: Structure and Function – Classification of Ecosystem: Terrestrial (Forest & Grassland) and Aquatic (Fresh water & marine) – Energy flow in the Ecosystem: Food chain & Food web – Ecological pyramids. Biogeochemical cycle: water cycle – carbon cycle and nitrogen cycle.

Unit-III: Biodiversity and conservation   **9 hours**

Biodiversity: Introduction and Definition – Types: Genetic, Species and Ecosystem diversity. Indian Biodiversity Hotspots – Endemic species – Threats to biodiversity – Conservation of Biodiversity – *In-situ* and *Ex-situ* conservation strategies. IUCN Red list Categories.

Unit – IV: Atmosphere   **9 hours**

Atmosphere structure – composition of atmosphere – evolution of the atmosphere – particles, ions and radicals in the atmosphere – Chemical and photo chemical reactions in the atmosphere: oxygen and ozone chemistry – Biological components of atmosphere.
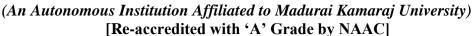
Unit – V: Environmental Policy and Law   **9 hours**

Climate change – Global warming – Ozone layer depletion – Environment (Protection) Act, (1986) and Rules – Water Prevention and Control of Pollution act, 1974 – Air prevention and control of pollution Act, 1981 – Salient features of wildlife (Protection) Act 1972 – Kyoto protocols and Convention on Biological Diversity (CBD) – Industrial regulation act.

TEXTBOOKS:

1. Dharmaraj, J, 2008. *Text book of Environmental studies*, S. Chand and Co. New Delhi.
2. Singh, YK. 2006. *Environmental Science*. New Age International Pub. New Delhi
3. Bharucha, E, 2021. *Textbook of Environmental Studies*. Orient Blackswan Pvt Ltd

4. A.K.De, 2010. *Environmental chemistry*, 7th edition, New age International Publishers New Delhi.

REFERENCE BOOKS

1. Benny Joseph, 2006. *Environment science and engineering*, Tata McGraw-Hill publishing Company limited, New Delhi.
2. Stanley E.Manahan, *Environmental Chemistry*, Seventh Edition, Lewis Publishers, Newyork.
3. Trivedi, R.K. 2010. *Handbook of Environmental Laws, Acts, Guidelines, Compliance and Standards,* Vol I & II, B.S. Publications, Hyderabad.

Section –B Skill Component

Contact Hours per semester: 30   **Credits: 2**

1. Determination of soil texture
2. Effect of light intensity on the growth of plants
3. Survey of flora and fauna in an area
4. Domestic waste segregation
5. Estimation of dust pollution

ENVIRONMENTAL POLLUTION-I

Contact Hours per week   : 5   **Subject Code: EV22C12**
Contact Hours per semester: 75 (Theory 45 + Skill 30)   **Credits:** 5 (3 Theory + 2 Skill)
Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1: focus the impact and monitoring of Air pollution
CO2: understand various types of water pollution and analysis of water quality.
CO3: know the effect of heavy metals and their interactions with soil components.
CO4: discuss the effect of noise pollutants on human beings.
CO5: simplify pollution control method

Unit-I   **9 hours**
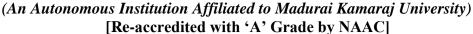Environmental Pollution: Definition, Causes – population, resource consumption, deforestation, industrialization, agriculture, urbanization and transport. Air pollution: Sources of pollution (Natural and anthropogenic) – Classification of air pollutants: primary and secondary pollutants – carbon monoxide, oxides of sulphur and nitrogen, suspended particulate matter (SPM), transport, acid rain, global warming.

Unit-II   **9 hours**
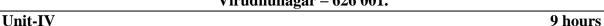Water pollution – sources of surface and groundwater pollution, types and impacts; Eutrophication - causes and effects and control. Wastewater Treatment: Primary, Secondary and Advanced treatment methods. Effects of water pollutants on physicochemical and biological parameters of water bodies.

Unit-III   **9 hours**
Marine Pollution – sources (point and non point sources), effects, - pollution caused by Oil exploration, dredging offshore structures and agriculture impacts of pollution on water quality – algal blooming.

Unit-IV   **9 hours**

Soil Pollution – causes of soil pollution, effects of soil pollution on environment; soil quality parameter, sampling, physicochemical and microbiological analysis of soil pollution, soil pollution control, industrial effluents and heavy metals and their interaction with soil components – Bioremediation of contaminated soil.

Unit-V   **9 hours**

Thermal and Noise Pollution, measurement and indices, permissible ambient noise levels – Noise Act – Effects of thermal and noise pollution on human beings, plants, animals and climate – Remedial measures, Green belt.

TEXTBOOKS:
1. Sharma, P.D. 1990. *Ecology and Environment*. Rastogi Publications. Meerut.
2. Verma, P.S. and V.K. Agarwal (1996) *Principles of Ecology*. S.Chand& Co. New Delhi.
3. GowrikrishnaDasmohapatra (2009) *Environment and Ecology* (III Edn) VIKAS Publishing House Pvt Ltd, New Delhi.
4. Misra, S.P and Pandey, S.N. (2009) *Essential Environmental Studies,* Ane Books Pvt Ltd, New Delhi.

REFERENCE BOOKS:
1. K.V.S.G. Murlikrishan, 2016. *Air pollution and control* Laxmi Publications Pvt. Ltd.
2. Southwick,C.H. 1976.*Ecology and the quality of Environment*. D.VasNostrand Co.
3. Odum,E.P. (1971) *Fundamentals of Ecology*, W.B. Saunder's Co. Philadelphia.
4. Ahluswalia, VK & Sunita M, 2009. *Environmental Sciences*, Ane Books, New Delhi.
5. Agarwal, S.K. *Water Pollution*, APH Publishing Corporation.

Section –B Skill Component

Contact Hours per semester: 30   **Credits: 2**
1. Determination of moisture content of soil
2. Determination of pH value of different water samples
3. Collection and analysis of freshwater plankton
4. Effect of light on plankton
5. Sampling of animal population by using Quatrad method

LAB: ENVIRONMENTAL CHEMISTRY

Contact Hours per week : 6   **Subject Code: EV22CP11**
Contact Hours per semester: 90   **Credits:** 4 (Skill)

(Practical exam – to be conducted at the end of first semester)
1. Preparation of solutions and standardization.
2. Separation of mixtures by physical and chemical methods.
3. Colour Identifications of various water samples.
4. pH determination (pH meter and Universal indicator) of various samples.
5. Conductance measurement of various samples.
6. Determination of Dissolved Oxygen (DO) in water by Winklers method.
7. Determination of Total Dissolved Solids (TDS) in water.
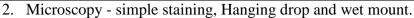8. Determination of Alkalinity of water samples.

Microbiology Laboratory-I
1. Microbiological laboratory safety procedures.

2. Microscopy - simple staining, Hanging drop and wet mount.
3. Preparation of bacteriological Media – Nutrient Agar and Broth.
4. Serial dilution method.
5. Pure culture technique – Spread, Pour, Streak
6. Isolation and Identification of Microbes from air using air sampler.

SEMESTER - II
COMMUNICATIVE ENGLISH – PAPER II

Contact Hours per week : 6   **Subject Code: EV22E21/** EV15E2
Contact Hours per semester: 90 (Theory 60 + Skill 30)   **Credits:** 4 (2 Theory + 2 Skill)

Section- A: Theory (2 credits)

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

CO1: develop in students the proficiency in speaking and writing for different purposes.
CO2: demonstrate communication skills in English.
CO3: understand the nuances of the language.
CO4: classify the business English
CO5: use the situational speech

Unit I – Grammar   **12 hours**
     i. Concord, Voice, Speech, Article, Preposition
     ii. Error Spotting

Unit II – Conversational English   **12 hours**
     i. Dialogue building on various situations

Unit III – Business English   **12 hours**
     i. Letter writing (Formal Letters & Resume)
     ii. Memo / Notice / Agenda / Minutes Writing
     iii. Report writing

Unit IV – Situational Speech   **12 hours**
     i. Welcome address / Vote of thanks
     ii. Group Discussion

Unit V – Writing Skill   **12 hours**
     i. Describing a thing / place / person
     ii. Writing Stories from outline

Note: (Allocation: 24 hours Laboratory, 36 hours theory)

TEXT BOOK
1. V.JeyaSanthi and A. Sankar- *Advanced Skills for Communication in English*: Book II:

REFERENCE BOOKS:
1. G.Radhakrishna Pillai   -   *Emerald English Grammar & Composition*, Emerald Publishers
2. Board of Editors   -   *Synergy – Communication in English and Study*

			Skills, Orient Blackswan
3.	Dr.S.Vincent	-	*Let's Speak English (A Course in Spoken English)*Soundra Publications
4.	K.R.Lakshminarayanan, T.Murugavel	-	*Communication Skills in English*, SciTech Publications, Chennai.
5.	G.Radhakrishna Pillai, K.Rajeevan	-	*Spoken English for You: Level One* Emerald Publishers
6.	Bikram K.Das	-	*Functional Grammar and Spoken and Written Communication in English*, Orient Longman Pvt., Ltd.
7.	A.R.Thorat, B.S.Valke, S.B.Gokhale	-	*Enriching Your Competence in English* Orient Longman Pvt. Ltd.

Section –B Skill Component
Contact Hours per semester: 30   **Credits: 2**
1. To enrich the students knowledge in the English language.
2. To equip the student with necessary skills for employment
3. To prepare students for career in media
4. To develop ability of all students to read, write, listen, speak and think critically
5. To produce students with advanced skills in writing, reading and reasoning.

MATHEMATICS - II
Contact Hours per week   :   6   **Subject Code: EV22M21/** EV15M2
Contact Hours per semester: 90 (Theory 60 + Skill 30)   **Credits:** 4 (2 Theory + 2 Skill)

Section- A: Theory (2 credits)
Course Outcomes (CO)

On successful completion of the course, the learners will be able to

    CO1: learn about Algebra of matrices, basics of sampling techniques

    CO2: understand basic test of significance

    CO3: demonstrate the effective presentation of data.

    CO4: define the statistical hypothesis

    CO5: appraise the test of significance

Unit-I: **12 hours**
Matrices: Types of Matrices – Addition and multiplication of matrices – simple properties

Unit-II: **12 hours**
Statistical Inference: Introduction – procedure of testing hypothesis - standard error and sampling distribution- estimation

Unit-III: **12 hours**
Test Of Significance For Small Samples: Student's t- distribution – To test the significance of the mean of a random sample –Testing difference between means of 2 samples (independent)- Testing difference between means of 2 samples (dependent samples)

Unit-IV: **12 hours**
Theoretical distribution: Binomial distribution – Poisson distribution

Unit-V: **12 hours**
Chi-square test: Degrees of freedom – Test of goodness of fit – Test of independence – Yates correction
[All units are from text books only. Include the theory parts without proof and derivations. Problems only]

TEXT BOOKS:
1. R.S.N. Pillai and V. Bagavathi, 2016. *Statistics*, S Chand Publishing
2. S.Arumugam, A.Thangapandi Isaac, A. Somasundaram, 2010. *Numerical Method*, Second Edition, SCITECH Publications.

REFERENCE BOOKS:
1. S.P. Gupta, 2018. *Business statistics*, SBPD Publications
2. D. C. Sancheti, V. K. Kapoor, 2010. *Statistics: Theory, Methods & Application* 7th Edition, Sultan Chand And Sons
3. J. H. Mathews, 1987. *Numerical Methods for Mathematics, Science and Engineering,* Prentice Hall, New Delhi, 2001.

Section –B Skill Components
Contact Hours per semester: 30   **Credits: 2**
1. Binomial distribution (4 coins)
2. Binomial distribution (6 coins)
3. Poisson distribution (one book)
4. Poisson distribution (well packed blade packet)
5. Chi-square test (one dice-120 times)
6. Chi-square test (one dice-150 times)
7. Fitting a Poisson distribution (100 car radios)
8. Fitting a Poisson distribution (200 car radios)
9. Student t-test (5 person IQ test)
10. Student t-test (6 person IQ test)

SBE 2: BASICS OF COMPUTERS FOR REPORTS MAINTENANCE
Contact hours per week: 2   **Subject Code: EV22CS21**
Contact hours per semester: 30 (20 Theory + 10 Skill)   **Credits: 3** (2 Theory + 1 Skill)

Course Outcomes (CO)
On successful completion of the course, the learners will be able to
   CO1: demonstrate the ability to produce a quality manual.
   CO2: understand the knowledge of certification and accreditation.
   CO3: discuss the knowledge and insight of different quality management systems i.e.
                 product quality management, safety and environmental management.
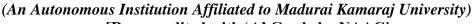   **CO4**: appraise the knowledge of auditing and auditing systems.
   CO5: critique the current state of the art in Quality Management

Section- A: Theory
Unit I   **4 hours**
Introduction to Computers: History of Computers – generation of Computers – Characteristics of Computers – Classification of Computers – Components of Computers –

Block Diagram – Hardware Vs Software – System Software Vs Application Software – Programming Language.

Unit II **4 hours**

Input Devices: Key board - Mouse – Touch Pad / Touch Screen Magnetic Ink Character Recognition (MICR) – Optical Character Recognition (OCR) – Optical Mark Recognition (OMR) – Output Devices: Monitor – Printers – Plotter Storage Devices: Magnetic tape – Hard Disk – Floppy Disk –Pen drive - CD-ROM, DVD Blue Ray Disc etc., - System Memory – RAM – ROM – PROM– EPROM.

Unit III **4 hours**

Open office- MS office- Word Processing – Spread sheet – Power point presentation – Introduction to internet - Browsers- Search engines- Email- Google educational applications.

Unit IV **4 hours**

Interpretation – Meaning of interpretation – Technique of interpretation – Precaution in interpretation – Interpretation of tables and figures.

Unit V **4 hours**

Reporting – Significance of report writing – Different steps in writing report – Types of reports – Mechanics of writing reports – Precautions of writing research reports.

REFERENCE BOOK:
1. Barbara Kasser, 1998. "*Using the internet*" Fourth edition, EE Edition, New Delhi.
2. Dinesh Maidasani, 2008. "*Learning Computer fundamentals, MS Office and Internet and Web Technology*", Firewall media.
3. Alexis Leon Mathews Leon, 2012. "*INTERNET for EVERONE*", Leon Vikas Press, Chennai.

Section- B: Skill components
Contact hours per semester: 10 **Credits: 2**
1. To learn the basic anatomy of a computer.
2. To connect the hardware components in a computer.
3. To type a report on the word document.
4. To store the data in Microsoft excel.
5. To learn the management of E-mail in a computer.

WATER QUALITY ASSESSMENT
Contact Hours per week : 5 **Subject Code : EV22C21/**EV15T21
Contact Hours per semester: 75 (Theory 45 + Skill 30) **Credits:** 5 (3 Theory + 2 Skill)

Section- A: Theory (3 credits)

Course Outcomes (CO)
On successful completion of the course, the learners will be able to

CO1: provide adequate knowledge about water.
CO2: study the chemical composition of water.
CO3: get knowledge about control measure of water pollutants
CO4: define the fundamentals idea about water analysis.
CO5: demonstrate the water analysis

Unit – I: **9 hours**
Types of Water – Structure of liquid water – Sources of water – water quality, drinking water standards – comparison of chemical composition of mineral water, ground water and sea water.

Unit – II: **9 hours**
Water Pollutants – Contents of domestic sewage water – Industrial wastewater: Paper & Pulp, Distilleries, Fertilizer, Electroplating, Cement, Detergents, Dye, Tanning, Oils, Hazardous chemicals and radioactive wastes.

Unit – III: **9 hours**
Sampling of water for analysis: Bacteriological test, complete mineral analysis, and dissolves gas determinations – Water analysis units – Methods of analysis of water: Hardness, Alkalinities, Chlorides, Caustic alkalinity, Nitrate, Sulphate, Phosphate, Sulphite, Dissolved CO_2, Dissolved O_2, Dissolved H_2S.

Unit – IV: **9 hours**
Nutrients analysis of water: Nitrates, Nitrite, Ammonia, Phosphate, Silicates, Alkalinity, Hardness, Salinity, Microbiological methods of analyses of water – MPN count and Serological test. Ozonation of water.

Unit – V: **9 hours**
Marine Oil Pollution – Fate of oil spills in the marine environment – Photochemical oxidation – Microbial degradation – Biodegradation mechanisms – Biofouling.

TEXTBOOKS:
1. Kaur, K, 2007. Handbook of Water and Wastewater Analysis. Atlantic Publishers
2. Khanna, DR., Bhutiani, R, 2008. Laboratory Manual of Water and Wasteland Analysis. Daya Publishing House

REFERNCE BOOKS:
1. Escher, B., Neale, P., and Leusch, F. 2021. Bioanalytical Tools in Water Quality Assessment., IWA Publishing
2. Raven Spoon, 2021. Water Quality: Assessment and Treatment. States Academic Press
3. Chapman, D., 1996. Water Quality Assessments: A guide to the use of biota, sediments and water in environmental monitoring, Second Edition. CRC Press
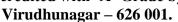

Section –B Skill Component
Contact Hours per semester: 30   **Credits: 2**
1. Determination of Acidity of given water sample
2. Determination of Alkalinity of given water sample
3. Determination of hardness of given water sample
4. Determination of presence of carbonate and bicarbonate in a water sample
5. Determination of presence of dissolved nutrients in a water sample

WATER AND WASTEWATER REMEDIATION TECHNIQUES

Contact Hours per week : 5   **Subject Code : EV22C22**
Contact Hours per semester: 75 (Theory 45 + Skill 30)   **Credits:** 5 (3 Theory + 2 Skill)

Section- A: Theory (3 credits)

Course Outcomes (CO)

On successful completion of the course, the learners will be able to

    CO1: outline adequate knowledge about water treatment process.
    CO2: explain the various methods of sewage treatment.
    CO3: get awareness about natural water purification.
    CO4: understand the fundamentals idea about instrument methods of water analysis.
    CO5: asses the Instrumental method of analysis

Unit – I: **9 hours**

Potable water – Sources and Characteristics – Drinking water quality standards – WHO – ISI – CPCB –USEPA – Water Softening techniques – Disinfection techniques – Chlorination – UV irradiation – Ozonization – Packaged drinking water – Mineral water.

Unit – II: **9 hours**

Wastewater treatment – Primary treatment, Screening and Grit removal – Sedimentation – secondary treatment – Chemical treatment, Coagulation – Precipitation and Disinfection – Biological treatment – Aerobic methods – Activated sludge process – anaerobic method – Up flow anaerobic sludge bed (UASB).

Unit – III   **9 hours**

Tertiary treatment, advanced waste water treatment – nutrient removal – Chemical methods – Precipitation – biological nutrient removal system.

Unit – IV   **9 hours**

Removal of Dissolved inorganic pollutants – Electro dialyses – Ion exchange – Reverse osmosis – sludge removal – water reuse and recycling.

Unit – V   **9 hours**

Instrumental method of analysis – Instrument working and application of pH meter, colorimeter, dissolved oxygen measuring kit – Absorption spectroscopy.

TEXTBOOKS:

1. Maulik, 2018. Water Supply, Waste Water Treatment and Sewage Disposal. Standard Book house
2. Srivastava, 2018. Waste Water Treatment and Water Management. Notion Press, Chennai
3. Modi, 2020. Sewage Treatment & Disposal & Waste Water Engineering. Standard Book House

REFERENCE BOOKS:

1. Peirce, J.J., Vesilind, P.A. and Weiner, R.F. 1997. *Environmental Pollution and Control*, 4th Edition, Elsevier Science and Technology Books.
2. Saravanan, K., Ramachandran, S. and Baskar, R. 2005. *Principles of Environmental Science & Technology*. New Age International (P) Ltd., Publishers, New Delhi
3. Droste, 2009. Theory and Practice of Water and Wastewater Treatment, Wiley

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Section –B Skill Component

Contact Hours per semester: 30 **Credits: 2**

1. Sludge digestion and treatment
2. Find out the sources of waste water nearby your area
3. Study the techniques used in mineral water units
4. Study the major pollutants in the water resources of your place
5. Study the how the wastewater recycles in the industries in your area

LAB: WATER ANALYSIS

Contact Hours per week   :   6   **Subject Code : EV22CP21**
Contact Hours per semester   :   90   **Credits:** 5 (Skill)

(Practical exam – to be conducted at the end of second semester)

1. Determination of Total hardness of water by Versenate (EDTA) method.
2. Determination of Calcium contents in water by Versenate method.
3. Determination of Chemical Oxygen Demand (COD).
4. Determination of Total phosphate content in water.
5. Determination of Turbidity in water.
6. Determination of Carbonates and Bicarbonates (total alkalinity) of water.
7. Determination of sulphate in water.
8. Determination of Fluoride content in water.

Microbiology laboratory-II

1. Water sampling methods for microbiological analysis.
2. Isolation of indicator organisms from water by membrane-filtration Method
3. Most probable number (MPN) method – water analysis
4. Water analysis by Single-application (disposable) test kits.