

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-401: FOOD AND DAIRY MICROBIOLOGY
(Syllabus of theoretical portion)
(Total Teaching Hours=30, Credit=02)

UNIT : 1. Food microbiology	09 hrs
<ul style="list-style-type: none">● Microbial flora of fresh foods.● Microbial spoilage of food : role of microorganisms in food spoilage, spoilage of fresh and canned foods.● food poisoning : sources of contamination and introduction to food poisoning. Role of <i>Clostridium botulinum</i>, <i>Salmonella spp.</i>, <i>Staphylococcus aureus</i> and <i>Bacillus cereus</i> as Food poisoning agents.● Preservation of food : general principles, methods of preservation- Use of aseptic handling high temperature, Pasteurization, sterilization, canning, low Temperature dehydration, Osmotic pressure, developed and added preservatives, Radiations.	
UNIT : 2. Fermented food	08 hrs
<ul style="list-style-type: none">● Introduction to Fermented Foods : Pickles, Sauerkraut, Bread● Introduction to Indian fermented foods: Idli, Dhokla● Microbes as food: Mushrooms, Spirulina and Yeasts	
UNIT : 3 Dairy microbiology	08 hrs
<ul style="list-style-type: none">● Microbiology of starter cultures● Cheese: Types, curdling, processing, ripening● Other fermented dairy products: Yogurt, cultured buttermilk, acidophilus milk, Kefir and cultured sour milk● Introduction to probiotics, prebiotics and synbiotics● Milk borne Pathogen (<i>Mycobacterium</i>, <i>Coxiella</i>)	
UNIT : 4 The HACCP System and Food Safety	05 hrs
<ul style="list-style-type: none">● HACCP, Hazard analysis of critical control point (HACCP) -Principles, flow diagrams, Applications, limitations.● Microbiological Criteria for Food Safety <p>(a) ● Microbial standards for food</p> <p>(b) ● FDA, BIS, Food Safety and Standard Act of India</p> <p>(c) ● Food certification marks in India: ISI, Ag mark, FPO, BIS, FSSAI</p>	

REFERENCE BOOKS

REFERANCE BOOKS

1. Adams MR and Moss MO. (1995). Food Microbiology. 4th edition, New Age International (P)Limited Publishers, New Delhi, India.
2. Banwart JM. (1987). Basic Food Microbiology. 1st edition. CBS Publishers and Distributors, Delhi, India.
4. Frazier WC and Westhoff DC. (1992). Food Microbiology. 3rd edition. Tata McGraw-Hill Publishing Company Ltd, New Delhi, India.
5. Jay JM, Loessner MJ and Golden DA. (2005). Modern Food Microbiology. 7th edition, CBS Publishers and Distributors, Delhi, India.
6. Indian Standards: Food Hygiene-Microbiological Criteria-Principles for Establishment and Application
7. Fssai: Manual of methods of analysis of foods- food safety and standards authority of India, Ministry of health and family welfare, Government of India, New Delhi, 2015
8. Internet and Pamphlet for BIS standards for common foods .

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-401: FOOD AND DAIRY MICROBIOLOGY
(Syllabus of Practical portion)
(Total Teaching Hours=45, Credit=02)

1. Microbiological analysis of food
 - A. Standard plate count
 - B. Determination of MPN of coliforms

2. Microbiological analysis of milk
 - A. Standard plate count
 - B. Determination of microbial load by use of MBRT and RRT of raw, boiled and pasteurized milk
 - C. Detection of fecal coliforms
 - D. Detection of Acid fast bacteria in milk

3. Alkaline phosphatase test to check the efficiency of pasteurization of milk.

4. Isolation of fungi from bread.

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-402: AIR AND WATER MICROBIOLOGY
(Syllabus of theoretical portion)
(Total Teaching Hours=30, Credit=02)

UNIT I. Air microbiology	08 hrs
<ul style="list-style-type: none">● Air flora● i. Transient nature of air flora● ii. Droplet, droplet nuclei, and aerosols● Air pollution: Chemical pollutants, their sources in air and effects on human health● Methods of Air sampling and types of air samplers● A. Impact on solids● B. Impingement in liquid● C. Sedimentation● D. Centrifugation● E. Precipitation● F. Thermal Precipitation● Air sanitation: Physical and chemical methods● Air borne infections	
UNIT 2. Water microbiology-i	08 hrs
<ul style="list-style-type: none">● Types of water: surface, ground, stored, distilled, mineral and de-mineralized water● Bacteriological standards of potable water, Bureau of Indian standards (BIS) World health Organization (WHO)● Water borne diseases● Indicators of faecal pollution;● i. <i>Coliforms</i>● ii. <i>Streptococcus faecalis</i>● iii. <i>Clostridium perfringens</i>	
UNIT 3 Water microbiology-ii	07 hrs
<ol style="list-style-type: none">1 ● Bacteriological analysis of Drinking Water<ul style="list-style-type: none">● i. Presumptive coliform count● ii. Confirmed test● iii. Completed test● iv. Eijkman test● v. Membrane filter technique2 ● Quantitative analysis of Drinking water: MPN,SPC	
UNIT 4. Waste water microbiology	07 hrs
<ul style="list-style-type: none">● Sewage and Waste Water● i. Physic chemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand(C.O.D.)● ii. Biological parameters: B.O.D., Toxicity	

- iii. Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication)
- 1 Characteristics of waste water
 - i. Physico chemical parameters: pH, temperature, total solids, Suspended solids, Chemical Oxygen Demand (C.O.D.)
 - ii. Biological parameters: B.O.D, Toxicity
 - iii. Industrial water pollutants, their ecological effects and health hazards (Biomagnification and eutrophication)
 - 2 Methods of waste water treatment
 - i. Primary treatment and secondary treatment: Principles and role of microorganisms in: Septic tank, Imhoff tank, trickling filters, activated sludge process and oxidation ponds
 - ii. Advanced treatment and final treatment
 - iii. Solid waste processing: Anaerobic sludge digestion and composting

REFERENCE BOOKS:

1. Daniel Lim., Microbiology, 2nd Edition; McGraw-Hill Publication
2. Ingraham J.L. and Ingraham C.A. (2004) Introduction to Microbiology. 3rd Edition. Thomson Brooks / Cole.
3. Madigan M.T, Martinko J.M. (2006) Brock's Biology of Microorganisms. 11th Edition. Pearson Education Inc.
4. Salle A.J. (1971) Fundamental Principles of Bacteriology. 7th Edition. Tata MacGraw Publishing Co.
5. Tortora G.J., Funke B.R., Case C.L. (2006) Microbiology: An Introduction. 8th Edition.
6. Stanier R. Y. (1985) General Microbiology. 4th and 5th Edn Macmillan Pub. Co. NY
7. Pelzar M. J., Chan E. C. S., Krieg N. R. (1986) Microbiology. 5th Edition, McGraw-Hill Publication
8. Prescott, Lancing M., John, P. Harley and Donald, A. Klein (2006) Microbiology, 6th Edition, McGraw Hill Higher Education
9. Hans G. Schlegel (1993) General Microbiology, 8th Edition, Cambridge University Press
10. Martin Frobisher (1937) Fundamentals of Microbiology, 8th Edition, Saunders, Michigan University press
11. Standard Methods for the Examination of Water and Wastewater (2005) 21st edition, Publication of the American Public Health Association (APHA), the American Water Works Association (AWWA), and the Water Environment Federation (WEF); edited by Andrew D. Eaton, Mary Ann H. Franson.

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-402: AIR AND WATER MICROBIOLOGY
(Syllabus of Practical portion)
(Total Teaching Hours=45, Credit=02)

1. Microbiological analysis of drinking water
 - A. Standard plate count
 - B. Detection of fecal pollution of water by performing presumptive, confirmed and completed test
 - C. Determination of MPN of coliforms in water

- 2 Study of skin flora

3. Study of Air flora by settling plate technique

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-403: Enzymes and Introduction to Metabolism
(Syllabus of theoretical portion)
(Total Teaching Hours=30, Credit=02)

Unit 1.Enzymes	07 hrs
<ul style="list-style-type: none">● General introduction● Physical and chemical properties● Structure of enzymes: Prosthetic group, apoenzyme, coenzymes, cofactors● Localization of enzymes: Extra cellular and intra cellular● Nomenclature and classification of enzymes, IUB system of enzyme classification● Enzyme action● Active sites of enzymes● Mechanism of enzyme action● Factors affecting enzyme activity	
Unit 2.Regulation of Enzymes	08 hrs
<ul style="list-style-type: none">● Activation energy● Michaelis- Menten equation,● Irreversible and reversible inhibition: competitive and non-competitive inhibition.● Enzyme regulation. Synthesis: introduction of enzyme induction and repression. Activity: allosteric,covalent modification and feedback inhibition	
Unit 3.Introduction to Metabolism	07 hrs
<ul style="list-style-type: none">● Introduction to microbial metabolism● Catabolism● Anabolism● Types of Metabolites● Primary metabolism● Secondary metabolism	

- Intermediary metabolism
- Precursor metabolites
- Role of energy rich compounds and reducing power

Unit 4. Membrane Transport

08 hrs

- Introduction
- Structure of membrane
- Mechanism of Membrane transport
- Secondary active transport
 - a. symport
 - b. Antiport .
 - c. uniport
- Phosphate bond linked active transport
- Group Translocation
 - a. Phosphotransferase system.
 - b. Acyl coA synthetase system.
 - c. Phosphoribosyl transferase
- Utilization of substrates that cannot enter the cell

Reference books:

1. Pelczar Jr, M J, Chan E C S., Krieg N R, (1986) Microbiology, 5th edn, McGraw- Hill Book Company, NY
2. Ingraham J L, and Ingraham, C L, (2000) Introduction to Microbiology, 2nd edn, Brooks/Cole, Singapore
3. Black J G, (2002) Microbiology: Principles and Explorations, 5th edn, John Wiley and Sons, Inc. NY
4. P.J.Soni .Introduction to microbial Physiology, Nirav Prakashan.

Department of Microbiology
Semester-IV
(In Force from June-2017)
MIC-403: Enzymes and Introduction to Metabolism
(Syllabus of Practical portion)
(Total Teaching Hours=45, Credit=02)

1. Effect of pH on enzyme activity (4,7,9)
2. Effect of Temp. On enzyme activity (0⁰ C, 15⁰ C ,30⁰ C ,45⁰ C ,60⁰ C)
3. Study of Biochemical reactions

Department of Microbiology
Semester-IV
(In Force from June-2017)
EC-401: Bio gas Technology
(Syllabus of theoretical portion)
(Total Teaching Hours=30, Credit=02)

Unit I. Bio gas **15 hrs**

- Introduction: Definition, History of bio gas
- How bio gas is produced? (Biochemistry)
- Use of different raw materials for bio gas production
- Factor affecting the production of bio gas
- Qualitative (by Orset apparatus) and quantitative (by flow meter) analysis of bio gas production

Unit II Bio gas Plant **15 hrs**

- Types of bio gas plant models (Design)
- How operate the bio gas plants?
- Maintenance of bio gas plants
- Uses of bio gas
- Lightning
- Cooking
- Vehicle fuel
- Electricity generation
- Utilization of digested slurry
- Economics of bio gas plant

References

1. Biogas Systems: Principle and Applications, K.M.Mital, New Age International(P) Limited, New Delhi, (1996)
2. Handbook of Biogas Technology, Prateek Shilpkar and Deepti Shilpkar, Agrotech Publishing Academy, Udaipur (2009).

Board of Studies (Microbiology)

1	Dr.S.R.Dave		5	Dr.Pradip Acharya	
2	Dr.S.A.Bhatt		6	Mrs.Preeti Shukla	
3	Dr.Rakesh Patel		7	Dr. Niraj Seth	
4	Dr.Devayani Tipre		8	Dr. Pratik Shilpakar	
5	Dr.Nupur Modi		9	Mr.Arvind Dungarachiya	
7	Dr. Srinivas Duggirala				

GUJARATVIDYAPEETH : AHMEDABAD
M.D. GramsevaMahavidyalaya, Sadra, Dist: Gandhinagar
Department of Microbiology
B.Sc. Semester-IV
CHEM-401:Organic Chemistry
(Syllabus of theoretical portion) (In force from December, 2017)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=30, Credit=02)

Unit-1: Heterocyclic compounds (20 Marks) (15 Hours)

1.1 Introduction (1hour)

1.2 Nomenclature of heterocycles: (3hours)

-systematic nomenclature system for naming three to ten membered monocyclic hetero cycles of various unsaturation containing one or more hetero atoms

-system of nomenclature is based on the trivial and semitrivial names of heterocycles [Pyrrole, Furan, Thiophene, Selenophene, Pyrazole, Imidazole, Isoxazole, Pyridine, Pyridazine, Pyrimidine, Pyrazine, Pyrene, Indole, Isoindole, Purine, Quinoline, Isoquinoline]

-nomenclature systems for fused heterocycles

Five membered heterocyclic compounds [Pyrrole, Furan, Thiophene]

1.3 Source of pyrrole, furan and thiophene(1hour)

1.4 Aromaticity and orbital structure of pyrrole, furan and thiophene(1hour)

1.5 Preparation of pyrrole, furan and thiophene(1hour)

1.6 Orientation of electrophilic substitution in pyrrole, furan and thiophene(1hour)

1.7 Relative reactivity toward electrophilic aromatic substitution in pyrrole, furan, thiophene and benzene(1hour)

Six membered heterocyclic compounds [Pyridine]

1.8 Source of pyridine compound (1hour)

1.9 Aromaticity and orbital structure of pyridine (1hour)

1.10 Basicity of pyridine including comparison with basicity of pyrrole and aliphatic amine (1hour)

1.11 Orientation of electrophilic and nucleophilic substitution in pyridine (2hours)

1.12 Relative reactivity toward electrophilic aromatic substitution in benzene, pyridine (1hour)

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi, (1999)
2. Organic Chemistry (second edition), Paula Yurkanis Bruice, Prentice-Hall, Inc., New Jersey (1998)

Unit-2: Carbohydrates-I**(50% Marks) (15 Hours)**

- 2.1 Definition and classification **(0.5hour)**
- 2.2 Nomenclature **(0.5hour)**
- 2.3 D and L notation **(0.5hour)**
- 2.4 Configuration of aldose and ketose containing three through six carbon atoms **(2hours)**
- 2.5 General properties of monosaccharide (Glucose and Fructose): colour, taste, physical state, solubility **(0.5hour)**
- 2.6 Chemical properties of monosaccharide (Glucose and Fructose): acetylation, oxidation, reduction, cynohydrin formation, oxime formation, osazone formation **(2.5hours)**
- 2.7 Epimers, epimers of D-glucose, conversion of an aldohexose into its C-2 epimer (mannose) **(1hour)**
- 2.8 Methods of interconversion of sugars **(2hours)**
 - Lengthening the carbon chain of aldoses (The Kiliani Fischer synthesis: aldohexose from aldopentose)
 - Shortening the carbon chain of aldoses (The Ruff degradation: aldopentose from aldohexose)
- 2.9 Configuration of (+) glucose: The Fischer proof **(2hours)**
- 2.10 Cyclic structure of glucose **(2hours)**
- 2.11 Structure of disacharrides (sucrose, cellobiose, maltose, lactose) and polysacharrides (starch and cellulose) excluding their structure elucidation. **(1.5hour)**

References

1. Organic Chemistry (sixth edition), Robert Thornton Morrison and Robert Neilson Boyd, Prentice-Hall of India Pvt. Ltd., New Delhi,(1999)
2. Principles of Microbiology (second edition), Ronald M. Atlas, Wm.C. Brown Publisher, Iowa, pp.1159-1185 (1997)

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Board of Studies(Chemistry)

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| (1) Dr. Nikhil Bhatt | (5) Dr. Mallika Sanyal |
| (2) Dr. Pranav Shrivastav | (6) Dr. Hitesh J. Shah |
| (3) Dr. Dasharath P. Patel | (7) Dr. Mayur C.shah |
| (4) Dr. Yogesh S. Patel | |

GUJARATVIDYAPEETH : AHMEDABAD
M.D. GramsevaMahavidyalaya, Sadra, Dist: Gandhinagar
Department of Microbiology
B.Sc. Semester-IV
CHEM-401: Organic Chemistry
(Syllabus of practical portion) (In force from December, 2017)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=02)

(A) Qualitative analysis of organic mixture (33 Hours)

Separation of two components from the mixture of organic compounds using semi-micro method, identification of compounds by lassaigne's test, functional group test, melting point / boiling point test

- (1) Acids: Benzoic acid, Salicylic acid, Cinnamic acid, Phthalic acid, Anthranilic acid, Oxalic acid, Tartaric acid, p-nitrobenzoic acid
- (2) Phenols: α -Naphthol, β -Naphthol, o-Nitrophenol, p-Nitrophenol, Resorcinol
- (3) Amines: p-Toluidine, o-Nitroaniline, m-Nitroaniline, p-Nitroaniline
- (4) Neutral: Urea, Thiourea, Acetamide, Benzamide, Acetanilide, Glucose, Naphthalene

(B) Preparation of organic compounds and its confirmation by function group test and M.P (with mole ratio calculation) (12Hours)

- (1) Oxidation: Benzoic acid from benzaldehyde by KMnO_4
- (2) Nitration: p-nitroacetanilide from acetanilide

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GUJARATVIDYAPEETH : AHMEDABAD
M.D. GramsevaMahavidyalaya, Sadra, Dist: Gandhinagar
Department of Microbiology
B.Sc. Semester-IV
CHEM-402: Analytical Chemistry
(Syllabus of theoretical portion) (In force from December, 2017)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=30, Credit=02)

Unit-1: Introduction to separation techniques (50% Marks) (15 Hours)

- 1.1 Filtration, distillation and solvent extraction **(2hours)**
- 1.2 Chromatography: principle, classification of chromatographic methods **(2hours)**
- 1.3 Paper chromatography: principle, experimental technique **(2hours)**
- 1.4 Column chromatography: principle, experimental technique **(2hours)**
- 1.5 Thin layer chromatography: principle, experimental technique **(2hours)**
- 1.6 Ion exchange chromatography: principle, experimental technique **(1hour)**
- 1.7 Gas chromatography: principle, experimental technique (except types of detector) **(2hours)**
- 1.8 Applications of chromatography in qualitative and quantitative analysis **(2hours)**

References

- 1. Fundamental of Analytical Chemistry (seventh edition), Douglas A. Skoog, Donald M. West and F. James Holler, Saunders college publishing, New York, pp. 660-700(1996)
- 2. Experimental Organic Chemistry Harcourt (second edition), John C. Gilbert and Stephen F. Martin, Harcourt college publishers, New York, 24-86 and 154-175 (1998)

Unit-2: Gravimetric analysis and precipitation equilibrium (50% Marks) (15Hours)

- 2.1 Introduction **(1hour)**
- 2.2 How to perform a successful gravimetric analysis?
 - Preparation of the solution **(1hour)**
 - Precipitation **(1hour)**
 - Digestion **(1hour)**
 - Filtration **(1hour)**
 - Washing **(1hour)**
 - Drying or igniting **(1hour)**
 - Weighing **(0.5hour)**
 - Calculation **(0.5hour)**
- 2.3 Gravimetric calculation: How much analyte is there? **(1hour)**
- 2.4 Organic precipitants **(2hours)**
 - [Definition, only name and structure of three organic precipitants (Dimethylglyoxime, 8-hydroxyquinoline, Quinaldic acid), advantages and disadvantages of organic precipitants]
- 2.5 Application of gravimetric analysis **(2hours)**
- 2.6 Numericals based on 2.3 **(2hours)**

References

1. Analytical Chemistry (sixth edition), Gray D.Christain, John Wiley and Sons,Inc., Singapore, pp.318-388(2003)
2. Quantitative analysis (sixth edition), R.A.Day, JR.; A.L.Underwood, Prentice-Hall of India Pvt.Ltd., New Delhi, pp.68-91(2003)

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Board of Studies(Chemistry)

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M.D. GramsevaMahavidyalaya, Sadra, Dist: Gandhinagar
Department of Microbiology
B.Sc. Semester-IV
CHEM-402: Analytical Chemistry
(Syllabus of practical portion) (In force from December, 2017)
(External Evaluation: 60% + Internal Evaluation: 40%)
(Total Teaching Hours=45, Credit=02)

(A) Separation techniques (21 Hours)

(1) Crystallization (6hours)

- Concept of induction of crystallization
- Phthalic acid from hot water
- Acetanilide from boiling water
- Benzoic acid from water
- Naphthalene from ethanol

(2) Distillation (6hours)

- Simple distillation of acetone-water mixture using water condenser
- Distillation of nitrobenzene and chlorobenzene using air condenser
- Separation of azeotropic mixture

(3) Chromatography (Any three experiments) (9hours)

- To separate Pb^{2+} , Ag^+ and Hg^{2+} ions present in a mixture by paper chromatography
- To separate Zn^{2+} , Pb^{2+} and Cd^{2+} ions present in a mixture by paper chromatography
- Separation of a mixture of phenylalanine and glycine, alanine and aspartic acid, leucine and glutamic acid by paper and thin layer chromatography
- Separation of drug mixture by TLC

(B) Gravimetric analysis (24 Hours)

- (1) Iron as ironoxide
- (2) Ni as $Ni(DMG)_2$
- (3) Ba as $BaSO_4$
- (4) Al as Al_2O_3

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**Department of Microbiology
Gujarat Vidyapith, Sadra**

**Proposed Syllabus for Bachelor of Science (B.Sc)
Core Paper – English**

Semester 4: ENG 401: English

Credit: 2

Number of Hours per Semester: 30

Objectives:

1. To develop the analytical skill while comprehending texts.
2. To develop scientific vocabulary generally used at the undergraduate levels.
3. To familiarize the students with grammatical category generally used in scientific writing.
4. To develop the scientific writing skills.
5. To familiarize students with different kinds of reading strategies based on the reading needs.

Unit 1: Comprehension (Weightage – 40%)

8 Hours

1. A Letter to Indira on her Birthday by Jawaharlal Nehru
2. An Irresistible Fund Raiser by Louis Fischer
3. It Takes a Thief by Arthur Miller
4. Thirst by Bibhuti Bhushan Bandopadhyay

Comprehension Pattern:

1. Short questions
2. Short descriptive questions
3. Short notes
4. Fill in the blanks
5. Multiple choice questions based on the text

NB: The questions asked will be of informative kind as well as analytical kind where a student has to think through the question keeping in mind the context of the text.

Unit 2: Vocabulary (Weightage – 10%) **2 Hours**

1. Antonyms/Synonyms (Based on the text)
2. Use of Scientific Vocabulary and Phrases
3. Linking words

Unit 3: Grammar (Weightage – 10%) **4 Hours**

1. Passive Voice

NB: This unit should use scientific writing such as journal writings to explain the importance and function of Passive Voice.

Unit 4: Writing Skills (Weightage – 30%) **6 Hours**

1. Reporting Events
2. Describing the Process
3. Describing Charts/Pie-charts/Tables

NB: These writing skills should be done keeping in mind grammatical categories of tenses, prepositions, passive voice as well as linking words. .

Unit 5: Academic Skills: Reading Skills (Weightage – 10%) **5 Hours**

1. Extensive Reading
2. Intensive Reading
3. Skimming
4. Scanning
5. SQ3R

NB: Each of the reading techniques is to be demonstrated by relevant reading material made available to the students beforehand.

Seminar/Presentation **5 Hours**

List of Reference Books:

Nagraj, Dr. Geetha. *Comprehend and Compose*. New Delhi: Foundation Books, 2003.

National Open School. *English: Senior Secondary Course*. Despatch 8. New Delhi: National

Open School, 1995.

National Open School. *English: Senior Secondary Course*. Despatch 9. New Delhi: National Open School, 1995.

Rizvi, M. Ashraf. *Effective Technical Communication*. New Delhi: Tata McGraw Hill Publishing Company Limited, 2005.

Wren, P. C. and H. Martin. *High School English Grammar and Composition*. (Gujarati). Trans. Dr. Usha Upadhyay and Jegeesha Upadhyay. New Delhi: S. Chand, 2013.