UG MICROBIOLOGY

UCMBC20 – CORE PRACTICAL I: BASIC TECHNIQUES IN MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: II	UCMBC20	Basic techniques in Microbiology	Practical	Core	3	4	100

Course Objective: The candidate will gain hands-on training and acquire adequate skill required to identify microorganism through staining techniques, sterilize and prepare culture media, inoculate observe and distinguish the growth patterns of microorganisms in different media.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Perform cleaning, sterilization of glasswares and prepare culture media.

CO2: Examine the different morphological forms of microbes.

CO3: Analyze and employ different staining methods for the identification of bacteria.

CO4: Competently cultivate bacteria in different types of media and identify their sensitivity and resistance.

CO5: Use Classical techniques for the identification of bacteria based on their biochemical properties.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	M	H	M	M
CO3	M	M	L	H	L	L
CO4	M	L	M	H	M	L
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	H	L	M
CO3	H	H	H	H	L	M
CO4	H	H	H	H	L	M
CO5	H	H	H	H	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. Sterilization: Principle & Methods –Dry heat, Moist heat, Filtration, fumigation and radiation.
2. Microscopy – Bright field Microscope.
3. Smear Preparation and simple staining technique.
4. Differential staining - Gram Staining and Acid fast staining.
5. Negative staining for capsule.
6. Motility Demonstration in Hay infusion broth.
7. Culture media preparation - Basal media, Enriched media, Differential media and selective media.
8. Pure culture techniques – Serial dilution, pour plate, spread plate & streak plate techniques.
9. Demonstration of Bio-chemical Characteristics - Indole, Methyl red, Voges Proskauer, Citrate, TSI test, Urease test and Sugar fermentation test.
10. Antibiotic sensitivity test – Kirby Bauer Disc Diffusion method.
11. Morphology of Fungi - LPCB wet mount preparation.
12. Examination of pond water sample – algae and protozoa.

REFERENCE BOOKS:

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007). Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology. 13th edition, Mosby Publishers, United states.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6th edition, Published by Pearson Education, United States.
4. Monica Cheesbrough. (2005) District Laboratory Practice in Tropical Countries –Part I and II. 2nd edition, Cambridge University Press, New Delhi.

OER:

VIRTUAL LABS/ INTERACTIVE SIMULATIONS:

1. www.vlab.co.in
2. www.aview.in/aview
3. www.pbs.org
4. www.micro.magnet.fsu.edu/primer/java/scienceopticsu

UCMBF20 – CORE PRACTICAL II: BASIC AND APPLIED IMMUNOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	UCMBF20	Basic and Applied Immunology	Practical	Core	3	4	100

Course Objective: To impart hands on training on various agglutination and precipitation reaction and to provide an insight in identifying the cells of immune system.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Identify the ABO blood groups and its Rh types.

CO2: Enumerate and observe various granulocytic and agranulocytic cells of immune system.

CO3: Perform serological diagnosis for the detection of typhoid, syphilis, rheumatoid factor and anti streptolysin 'o'.

CO4: Demonstrate the direct and indirect pregnancy testing procedure.

CO5: Quantitate the antigens and antibodies by performing immunodiffusion techniques.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	L	M	L	L	H
CO3	H	M	L	M	M	H
CO4	H	L	M	H	M	H
CO5	H	L	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	L	H	L	L	L
CO2	H	L	H	M	M	L
CO3	H	H	H	M	M	L
CO4	H	M	H	L	L	L
CO5	H	H	H	L	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. Blood Grouping & Rh typing.
2. Differential counting.
3. Enumeration of WBC using Haemocytometer.
4. Enumeration of RBC using Haemocytometer.
5. Isolation of Buffy coat by wintrobes tube.
6. Widal test (Qualitative slide test and Quantitative tube test).
7. Rapid Plasma Reagin test.
8. Pregnancy test –Direct dip stick method and Indirect slide test.
9. Latex Agglutination- Anti Streptolysin 'o' test.
10. Latex Agglutination-Rheumatoid factor.
11. Treponema Pallidum Haemagglutination test (TPHA).
12. Precipitation reaction in Gel -Ouchterlony Double Diffusion.
13. Precipitation reaction in Gel - Radial Immuno Diffusion.

REFERENCE BOOKS:

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007) Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13th edition, Mosby Publishers, United States.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. Sixth edition, Published by Pearson Education, United States.
4. Monica Cheesbrough (2005). District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition, Cambridge University Press, New Delhi.

OER:

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2. www.aview.in/aview
3. www.pbs.org
4. www.micro.magnet.fsu.edu/primer/java/scienceopticsu

UCMBL20- CORE PRACTICAL III: MEDICAL MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UCMBL20	Medical Microbiology	Practical	Core	3	4	100

Course Objective: To provide hands on training on laboratory skills in the field of Diagnostic Microbiology.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Demonstrate collection, transport and processing of clinical specimens.
CO2: Perform staining techniques for the identification of bacteria.
CO3: Isolate and identify the bacterial pathogens from various clinical specimens.
CO4: Prepare culture media for the cultivation of microorganisms.
CO5: Analyze the clinical specimens for the examination of pathogenic fungi and parasites.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	M	L	H
CO2	H	H	H	L	L	M
CO3	H	H	H	H	M	H
CO4	H	H	H	H	M	H
CO5	H	H	H	M	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	M	L	M
CO3	H	H	H	L	L	H
CO4	H	H	H	M	L	H
CO5	H	H	H	M	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. General requirements of collections transport of clinical specimens – Direct examinations – Staining of specimens – Methods of enriched, Selective and enrichment culture techniques used to isolate organisms from clinical materials.
2. Simple, differential and special staining of clinical materials ie., Throat Swab, vaginal Swab, pus, urine, sputum, stool etc.,
3. Quantitative urine analysis.
4. Isolation and identification of bacterial pathogens from clinical specimens their biochemical reactions- catalase, oxidase, coagulase, IMViC, TSI, urease and MMTP.
5. Antimicrobial Sensitivity testing and determination of MIC and quality control.
6. Wet mount examinations of stool for parasites (saline and iodine).
7. KOH and LPCB preparation for skin and nail scrapings, for fungi.
8. Estimation of worm burden in stool. Floatation and sedimentation techniques of stool examination.
9. Germ tube test, Assimilation, fermentation tests for yeasts.
10. Identification of pathogenic microbes including viruses in slides \ smears \ Specimens as Spotters.

REFERENCE BOOKS:

1. Collee J.G, Fraser A.G, Marmion B.P, Simmons A (2007). Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers, London.
2. Tille P. Bailey and Scott (2013). Diagnostic Microbiology, 13th edition, Mosby Publishers, United States.
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UCMBM20 - CORE PRACTICAL IV: ECOLOGY, FOOD AND DAIRY MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: VI	UCMBM20	Ecology, food and Dairy Microbiology	Practical	Core	3	4	100

Course Objective: To provide hand on experience on isolation and characterization of microbes from different food sources, agricultural and environmental samples.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Assess the microbiological quality of raw milk by MBRT and Standard Plate Count test.

CO2: Identify and enumerate bacteria and fungi from the spoiled foods and Rhizosphere soil.

CO3: Apply the technique for the isolation of yeast from food sources.

CO4: Analyze the potability of water by MPN test.

CO5: Perform the microbial test to detect soil fertility and isolate, cultivate Rhizobium from root nodule.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	L	L	H
CO2	H	H	H	M	L	M
CO3	H	H	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	H	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	H
CO2	H	H	H	M	L	M
CO3	H	H	H	M	L	M
CO4	H	H	H	M	L	H
CO5	H	H	H	H	M	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

1. Isolation of microorganisms from air by Settle plate technique.
2. Isolation and counting of faecal bacteria from water.
3. Water analysis by MPN technique
    i. Presumptive coli form test
    ii. Confirmed coli form test
    iii. Completed coli form test.
4. Enumeration of number of bacteria in milk by Standard plate count method.
5. Methylene blue reductase test to assess the quality of milk.
6. Isolation of Lactobacilli and Staphylococcus from curd.
7. Examination of common house hold mold – LPCB wet mount.
8. Isolation of bacteria and fungi from Spoiled food.
9. Isolation of yeast from food sources – Grapes and Sugarcane juice.
10. Isolation & Enumeration of bacteria and fungi from Rhizosphere soil.
11. Microbial test for Soil fertility – Phosphate Solubilization and Nitrate reduction test.
12. Isolation of *Rhizobium* from root nodule.

REFERENCE BOOKS:

1. Dubey R.C and Maheswari D.K (2004). Practical Microbiology 1st edition, S.Chand & Company Ltd., New Delhi.
2. Kannan N (2003). Handbook of Laboratory Culture Media, Reagents, Stains and Buffers. Panima Publishing Corporation, New Delhi.
3. James G Cappuccino and Natalie Sherman (2004). Microbiology: A laboratory manual. 6th edition, Published by Pearson Education, United States.
4. Monica Cheesbrough (2005) District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition, Cambridge University Press, New Delhi.

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3. www.pbs.org
4. www.micro.magnet.fsu.edu/primer/java/scienceopticsu

USMBB20 – SKILL BASED ELECTIVE: BIOINSTRUMENTATION

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: IV	USMBB20	Bioinstrumentation	Theory	Skill Based Elective	2	2	100

Course Objective: To provide an in depth knowledge on handling various laboratory instruments with a keen idea about its principle of working.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Outline the working principles of various laboratory equipment.

CO2: Demonstrate various types of centrifugation.

CO3: Discuss on the different techniques of gel electrophoresis and comprehend the methods of blotting

CO4: Compile the techniques of chromatography.

CO5: Explain principle and usage of various spectrophotometres.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	L	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	L	L	M
CO5	H	H	H	L	L	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	L	M
CO2	H	H	H	L	L	M
CO3	H	H	H	L	L	M
CO4	H	H	H	L	L	M
CO5	H	H	H	L	L	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Basic science equipments and its uses. (6 hours)

1.1 Buffers, molars and normal solutions. (K1,K2)

1.2 pH meter, pH electrodes - calomel and glass electrodes. (K1, K2)

1.3 Hot Air oven, Autoclave. (K1, K2, K3)

1.4 Incubator. (K1, K2, K3)

1.5 Water bath shaker. (K1, K2, K3)

1.6 Laminar air flow- its application and uses. (K1, K2, K3)

UNIT II: Centrifuge and its application. (6 hours)

1.1 Centrifugation- Definition- Principle. (K1, K2, K3)

1.2 Types of centrifuges - low speed and high speed. (K1, K2, K3)

1.3 Ultra centrifuge. (K1, K2, K3)

1.4 Differential centrifugation. (K1, K2, K3)

1.5 Density gradient centrifugation. (K1, K2, K3)

1.6 Applications of centrifuge. (K1, K2, K3)

UNIT III: Electrophoresis. (6 hours)

3.1 Electrophoresis - SDS – PAGE. (K1, K2, K3)

3.2 Agarose gel electrophoresis. (K1, K2, K3)

3.3 Southern blotting. (K1, K2, K3)

3.4 Northern blotting. (K1, K2, K3)

3.5 Western blotting. (K1, K2, K3)

3.6 DOT blotting. (K1, K2, K3)

UNIT IV: Chromatographic techniques. (6 hours)

1.1 Chromatography – paper. (K1, K2, K3)

1.2 Thin layer chromatography. (K1, K2, K3)

1.3 Column chromatography. (K1, K2, K3)

1.4 Ion exchange chromatography. (K1, K2, K3)

1.5 Gas chromatography. (K1, K2, K3)

1.6 HPLC- its application and uses. (K1, K2, K3)

UNIT V: Spectrophotometry. (6 hours)

5.1 Colorimetry, (K1, K2, K3)

5.2 Spectrometry – Principle of work. (K1, K2, K3)

5.3 Types- UV and visible spectrophotometer. (K1, K2, K3)

5.4 Flame photometry. (K1, K2, K3)

5.5 FACS. (K1, K2, K3)

5.6 Biosensors – its application and uses. (K1, K2, K3)

TEXT BOOKS:

1. Bajpai P.K (2010). Biological Instrumentation and Methodology. Revised edition, S.Chand & Co.Ltd., New Delhi.
2. John G Webster (2004). Bioinstrumentation. Student edition. John Wiley and Sons, Ltd., New Delhi.

REFERENCE BOOKS:

1. Palanivelu P (2004). Analytical Biochemistry and Separation techniques. 3rd edition, MKU Coop,Press Ltd., Palkalai Nagar, Madurai.
2. Gurumani N (2006). Research Methodology for Biological Sciences. 1st edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
3. Subramanian M.A (2005). Biophysics - Principles and Techniques. 1st edition, MJP Publishers, A Unit of Tamil Nadu Book House, Chennai.
4. Ravishankar S (2001). A Text Book of Pharmaceutical Analysis. 3rd edition. Rx Publications,Tirunelveli.

OER:

WEB RESOURCES:

E-books

1. www.gutenberg.org
2. www.free-ebooks.net
3. www.e-booksdirectory.com

Video lessons

1. www.learnerstv.com
2. www.webcast.berkeley.edu
3. www.cosmolearning.org

USMBC20 – SKILL BASED ELECTIVE: DIAGNOSTIC MICROBIOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V & VI	USMBC20	Diagnostic Microbiology	Theory	Skill Based Elective	2	2	100

Course Objective: To provide the learners an overview on clinical Microbiology, laboratory organization and various diagnostic approaches from traditional to molecular methods.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Explain general safety regulations and guidelines of microbiology laboratory.

CO2: Apply procedures in the collection and transport of clinical specimens.

CO3: Examine and identify the pathogenic microorganisms from clinical specimens.

CO4: Perform serological and molecular methods for the diagnosis of diseases.

CO5: Determine the sensitivity and resistance pattern of bacterial pathogens to various antibiotics.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	M	M
CO3	H	H	H	L	M	M
CO4	H	H	H	L	M	M
CO5	H	H	H	L	M	M

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	H	H	L	H	H
CO2	H	H	H	L	M	M
CO3	H	H	H	L	M	M
CO4	H	H	H	L	M	M
CO5	H	H	H	L	M	M

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Philosophy of Diagnostic Microbiology. (5 hours)

1.1 Purpose and philosophy of Diagnostic Microbiology. (K1,K2)
1.2 Organization of clinical microbiology laboratory. (K1,K2)
1.3 Responsibility of clinical microbiology laboratory. (K1,K2)
1.4 Laboratory safety: General safety considerations – biohazards. (K1,K2)
1.5 Practices specific to Microbiology. (K1,K2)
1.6 Classification of biological agents on the basis of hazards. (K1,K2)

UNIT II: Collection of clinical specimens. (5 hours)

2.1 Collection of bacterial, viral, fungal and protozoan diseases associated clinical specimens- An overview.(K2,K3,K4)
2.2 Oral cavity and throat swab. .(K2,K3,K4)
2.3 Skin Scrapping. .(K2,K3,K4)
2.4 Blood. .(K2,K3,K4)
2.5 CSF.(K2,K3,K4)
2.6 Urine and faeces. (K2,K3,K4)

UNIT III: Examination and processing of clinical samples. (5 hours)

3.1 Examination of clinical sample by staining - Gram stain. (K2,K3,K4)
3.2 Ziehl – Neelson staining for tuberculosis. (K2,K3,K4)
3.3 Giemsa stained thin blood film for malaria. (K2,K3,K4)
3.4 LPCB for fungal identification (K2,K3,K4)
3.5 Culture based techniques- processing of various clinical specimens. (K2,K3,K4)
3.6 Culture for the growth of fungi. (K2,K3,K4)

UNIT IV: Serological and Molecular diagnosis. (9 hours)

4.1 Serological Methods – Agglutination based methods: WIDAL. (K2,K3,K4)
4.2 Automated methods: ELISA. (K2,K3,K4)
4.3 Immunodiffusion. (K2,K3,K4)
4.4 Immunoelectrophoresis. (K2,K3,K4)
4.5 Western blotting. (K2,K3,K4)
4.6 Nucleic acid based methods - PCR. (K2,K3,K4)

UNIT V: Antimicrobial sensitivity. (6 hours)

5.1 Importance and determination of resistance/sensitivity of bacterial pathogens using disc diffusion method. (K2,K3,K4)
5.2 Determination of minimal inhibitory concentration (MIC) of an antibiotic by serial double dilution method and E test – importance of MIC determination. (K2,K3,K4)
5.3 Antimycotic susceptibility testing –reporting and resulting. (K2,K3,K4)
5.4 Computerization. (K1,K2,K3)
5.5 Quality assurance. (K1,K2,K3)
5.6 Safe disposal of specimens and biohazards. (K1,K2,K3)

TEXT BOOKS:

1. Tille P. (2013). Bailey's and Scott's Diagnostic Microbiology, 13th edition, Mosby publishers, United States.
2. Collee J.G, Fraser, A.G, Marmion B.P and Simmons A (2007). Mackie and Mccartney Practical Medical Microbiology, 14th edition, Elsevier publishers. London.

REFERENCE BOOKS:

1. Ananthanarayan R and Paniker C.K.J (2009). Textbook of Microbiology, 8th edition, Universities Press Private Ltd. Hyderabad.
2. Brooks G.F, Carroll K.C, Butel J .S, Morse S.A and Mietzner T. A (2013). Jawetz, Melnick and Adelberg's Medical Microbiology. 26th edition. McGraw Hill Publication.
3. Betty A Forbes, Daniel F Sahm and Alice S Weissfeld (2007). Bailey and Scott's Diagnostic Microbiology, 12th edition, Mosby publishers, United States.
4. Monica Cheesbrough (2003). District Laboratory Practice in Tropical Countries - Part I and II. 2nd edition, Cambridge University Press, New Delhi.

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E-BOOKS:

1. http://www.gutenberg.org/
2. http://www.free-ebooks.net/
3. http://www.bookrix.com
4. http://www.e-booksdirectory.com/
5. http://bookboon.com/
6. http://www.freebooks.com/ebooks/

USMBE20 – SKILL BASED ELECTIVE: COSMETOLOGY

Year 2020	Course Code	Title Of The Course	Course Type	Course Category	H/W	Credits	Marks
SEM: V & VI	USMBE20	Cosmetology	Theory	Skill Based Elective	2	2	100

Course Objective: To provide adequate knowledge on cosmeceuticals, personal care and hygiene products and familiarize with the skills in formulation science required to scientifically design and develop products.

Course Outcomes (CO):

At the end of the course, the learners will be able to;

CO1: Give information about significance of cosmetics and adulteration of natural products.

CO2: Formulate face packs, hair oils for different types of skin and hair.

CO3: Analyze the structure, function and types of skin.

CO4: Outline the biology of hair, hair growth cycle and scalp hygiene and utilize the natural herbs for skin, hair and oral care preparations.

CO5: Communicate the cosmeceutical applications of micro and macroalgae.

CO/PSO	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	H	M	H	L	L	H
CO2	H	M	H	L	L	H
CO3	H	M	H	L	L	H
CO4	H	M	H	L	L	H
CO5	H	M	H	L	L	H

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6
CO1	H	M	H	L	L	H
CO2	H	M	H	L	L	H
CO3	H	M	H	L	L	H
CO4	H	M	H	L	L	H
CO5	H	M	H	L	L	H

H – HIGH (3)
M – MODERATE (2)
L – LOW (1)

COURSE SYLLABUS

UNIT I: Cosmetics and its significance. (6 hours)

1.1 Cosmetics – Definition and purpose. (K1,K2)

1.2 Classification of cosmetics. (K1,K2)

1.3 Significance and its importance. (K1,K2)

1.4 Stability of product forms and quality control. (K1,K2)

1.5 Adulteration of Natural products: Qualitative method of detection. (K1,K2)

1.6 Quantitative methods of detection of adulteration. (K1,K2)

UNIT II: Role of cosmetics in facial skin care. (6 hours)

2.1 Structure and function of skin. (K1,K2)

2.2 Types of Skin. (K1,K2)

2.3 Differences between baby's skin and adult skin. (K1,K2)

2.4 Formulations of face packs for dry, oily and normal skins. (K1,K2, K3)

2.5 Herbal remedy for skin disorders- pimple, acne, boils, black heads, white heads, and open pores. (K1,K2, K3)

2.6 Skin care in different seasons. (K1,K2, K3)

UNIT III: Hair Care. (6 hours)

3.1 Structure and function of hair. (K1,K2)

3.2 Types of hair and Hair growth cycles. (K1,K2)

3.3 Defects in hair shaft. (K1,K2)

3.4 Processes involved in hair growth and color formation in hair. (K1,K2)

3.5 Role of scalp hygiene. (K1,K2)

3.6 Formulations of hair oils and hair tonics- remedy for dandruff, premature greying and hair loss. (K1,K2,K3)

Unit IV: Role of Herbs in Cosmetics / Herbal cosmetics. (6 hours)

4.1 Hair care preparation: Henna, Amla (K1,K2,K3)

4.2 Hibiscus, Bhringaraj. (K1,K2,K3)

4.3 Skin Care preparation: Aloe vera. (K1,K2,K3)

4.4 Turmeric, Sandal wood. (K1,K2,K3)

4.5 Oral care preparation: Babool. (K1,K2,K3)

4.6 Neem, Clove. (K1,K2,K3)

UNIT V: Algae in Cosmetics. (6 hours)

5.1 Microalgae and macroalgae- An introduction. (K1,K2)

5.2 Chlorophyceae (green algae). (K1,K2)

5.3 Phaeophyceae (brown algae). (K1,K2)

5.4 Rhodophyceae (red algae). (K1,K2)

5.5 Applications of algae in cosmetics: sunscreen, moisturizer, anti-aging,whitening and hair care. (K1,K2,K3)

5.6 Cosmetic products using algal metabolites. (K1,K2)

TEXT BOOKS:

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