

**BHAKTA KAVI NARSINH MEHTA UNIVERSITY
JUNAGADH 362263**

SYLLABUS



DEPARTMENT OF CHEMISTRY AND FORENSIC SCIENCE

M.Sc. Forensic Science Semester III & IV

Under Choice Based Credit System (CBCS)

Effective from July 2021

M.Sc. Forensic Science

Course Framework

Semester III

Course Type	Course Code	Course Title	Hrs of Instruction/ Week	Exam Duration in Hrs.	Component of Marks			Credits
					Internal	External	Total/ Passing	
					Total/ Passing	Total/ Passing	Total/ Passing	
Core Courses	MSC20FSC301	Forensic Chemistry	4	2.30	30/12	70/28	100/40	4
	MSC20FSC302	Forensic Toxicology	4	2.30	30/12	70/28	100/40	4
	MSC20FSC303	Pharmacology And Drugs Analysis	4	2.30	30/12	70/28	100/40	4
	MSC20FSC304	Forensic Engineering	4	2.30	30/12	70/28	100/40	4
Practical Courses	MSC20FSC305	Practicals	16	10	-	100/40	100/40	6
	MSC20FSC306	Viva voce	-	-	-	50/20	50/20	2
	Total		28				550	24

**M.Sc. Forensic Science
Course Framework
Semester IV**

Course Type	Course Code	Course Title	Hrs of Instruction/ Week	Exam Duration in Hrs.	Component of Marks			Credits
					Internal	External	Total/ Passing	
					Total/ Passing	Total/ Passing		
Core Courses	MSC20FSC401	Advanced Forensic Chemistry	4	2.30	30/12	100/40	100/40	4
	MSC20FSC402	Dissertation/ Project Work	24	-	-	400/160	400/160	18
	MSC20FSC403	Viva voce	-	-	-	50/20	50/20	2
	Total		28				550	24

SEMESTER-III			
MSC20FSC301	Forensic Chemistry	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Quality Management and Lab Accreditation I. Introduction to Quality Assurance and quality control, Technical requirements, Aim of achieving Quality, Consistency, Accuracy and Precision, Reproducibility. Developing of Quality system in laboratory. Quality Audit (Internal and External Audit), Objectives of Audit and Management Review Meeting. II. Definition of Accreditation (NABL), Process of Lab Accreditation, Significance of Accreditation in Forensic Science Laboratory. Court Systems. ISO III. Laboratory Management System: Calibration of Instruments and test methods, Handling of Instruments, Validation of Methods, Proficiency Testing, Monitoring of Performance.	10	
Unit.2	Narcotic Drugs : I. Clandestine Laboratories. Range of Operations in Clandestine Laboratories, manufacture of drugs in such laboratories. II. Introduction to Drugs and Controlled Substances. Scheduled Drugs : Schedule I, Schedule II, Schedule III, Schedule IV and Schedule V drugs III. Collection of Evidence in Drug Cases (Documentation, Safety, Packaging, Custody). Laboratory Capabilities and Accreditation. IV. Sample Preparation, Extraction Techniques - Chemical - color test, Chromatographic technique, Micro-crystal techniques and other instrumental techniques for analysis of scheduled drugs.	12	
Unit.3	Chemistry of Explosives I. Explosive Devices - Types of IEDs, Components of IED - Switch, Initiating Systems, Main charge and containers. Mechanism of working of IEDs. Detection and location of IEDs. Five C's of IED management guidelines. II. Thermochemistry of Explosives - Introduction and assessment of explosives , Oxygen balance, Explosive Power Index, Heat and Temperature of Explosion, Pressure of explosion, Mechanism of Ignition and hot spot formation. Thermal decomposition , physical and chemical aspects of combustion, Deflagration and Detonation, Kinetics of Explosive Reactions. III. Chemical Analysis, Chromatographic analysis and Instrumental detection of	12	

	organic and inorganic explosives.	
Unit.4	Chemistry of Petroleum Products I. Introduction to Petroleum Products : Process of obtaining petroleum products from Crude oil and their classification. Aliphatic and Aromatic Hydrocarbons (P, I, O, N & A), Solvents, Furnance Oil/Black Oil, Lubricating Grease, Organo - Metallic Hydrocarbons. II. Parameters to examine petroleum products as per BIS specifications: Physical and Chemical parameters. III. Analytical Techniques: Quantitative and Qualitative analysis of Petroleum products. IV. Fire Scene Investigation - National fire protection association (NEPA 921 and NEPA 1033). Chemistry and behavior of fire. State of matter and behavior of gases, liquids and solids accelerants. Separation and analytical techniques of ignitable liquid residues. Scientific approach to fire investigation and modern fire analysis. Interpretation of Data Obtained from Fire Debris, Quality Assurance in Fire debris Analysis, Report Writing and Court Testimony. Scientific Investigation of Fire.	13
Unit.5	Food Chemistry : I. Introduction to Adulteration : Different types of Adulterants commonly used. The Prevention of Food Adulteration Act, 1954. II. Types of food additives : Direct food additives, Substance intended for use in food, Serve a particular functional effect, Indirect food additives and their analysis. III. Analysis of Lipids and fats: Physical examination of lipids, Chemical examination of lipids (Acid value, Saponification value, Ester value, Acetyl value, Iodine value), Test for hydrogenated oils and fats, Detection and Determination of rancidity, Analysis of butter and butter fats, Analysis of adulterated and non-adulterated oils.	13
Reference Book 1. Fundamentals of Forensic Science; Author: Max. M Houck, Jay A. Siegel; Publisher: Elsevier; ISBN: 978-0-12-374989-5. 2. Ethics and Practices in Forensic Science; Author: Steven A. Koehler, Peggy A. Brown; ISBN: 9781420088939. 3. 4. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3rd ed., Pharmaceutical Press 2004. 5. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000. 6. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt / Churchill Livingstone, 2000.		

7. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.
8. Budhiraja, R.D.: Elementary Pharmacology and Toxicology, Popular Prakashan, 2nd ed., 1999.
9. Wiseman, H and Henry J.: Management Of Poisoning, A Handbook for Healthcare workers, 1st ed., A.I.T.B.S, 2002.
10. Hardman, J. G. and Limbird, L. E.,: Goodman and Gilman's The Pharmacological basis of Therapeutics, 9th edn., McGraw-Hill, 1996
11. Laboratory procedure Manual, Forensic Toxicology: DFS, 2005
12. Sunshine, I ; Methods for Analytical Toxicology, CRC Presss USA (1975)
13. Cravey, R.H; Baselt, R.C.: Introduction to Forensic Toxicology , Biochemical Publications, Davis, C.A. (1981)
14. Stolmen, A.; Progress in Chemical Toxicology: Academic Press, New York (1963)
15. Modi, Jaisingh, P.; Textbook of Medical Jurisprudence & Toxicology, M. M. Tripathi Publication (2001)
16. Eckert; An Introduction to Forensic Science, CRC Press
17. Pillay, V. V.; Handbook of Forensic Medicine and Toxicology, Paras Pub., 2001
18. Curry, A. S: Poison Detection in Human Organ
19. James, S. H. and Nordby, J. J.: Forensic Science: An Introduction to Scientific and Investigative Techniques, 2003.
20. Saferstein, R: Criminalistics - An Introduction to Forensic Science, Prentice Hall, 1995.
21. Sarkar, S: Fuels and Combustion, Orient Longman, 1990

SEMESTER-III			
MSC20FSC302	ADVANCE FORENSIC TOXICOLOGY	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	General Principles of Toxicology I. History, scope and applications of toxicology. Types of Toxicology II. Principle and Mechanism of Toxicology. III. Risk and Hazards, Risk Characterization and Safety evaluation of chemicals.	10	
Unit.2	Introduction to various Toxicants : I. Toxic effects of Inorganic and Organic Poisons – Pesticides (Endosulfan, Malathion, Carbaryl) – Metallurgical toxicants (Pb, Hg, Cu, As, Cd) – Plant and Animal Poisons– Industrial Chemicals: Sulphuric - Organic Solvents (Volatile) like Methanol, Ethanol and Acetone – Organic Chemicals like with reference to Forensic Samples.	14	
Unit.3	Toxicity and Management I. Characteristics of Exposure - Route and Site of Exposure, Duration and Frequency of Exposure, Translocation of Toxicants, Bioaccumulation of Xenobiotics, Biotransformation of Xenobiotics. II. Dose – Response Relationship - Individual or Graded Dose – Response Relationships, Quantal Dose – Response Relationships. Shape of the Dose – Response Curve. Factors affecting dose response curve. III. Management and Medicolegal aspects of poisoning cases, Antidotal therapy. Postmortem findings in poisoning cases.	14	
Unit.4	Forensic Toxicology I. Introduction to Forensic Toxicology. Death Investigation Toxicology (Postmortem Toxicology). Role of Forensic Toxicologist. II. Sample collection, transport, storage and preservation of viscera, body fluids,	10	

	gastric contents, faeces, hair, vitreous humor, tissue, etc., their toxicological significance. III. Interpretation of postmortem toxicology results - qualitative and quantitative.	
Unit.5	Analytical Toxicology I. Introduction, Provision of analytical toxicology services. II. Extraction of active constituents, Purification of active constituents, Selection of analytical method. Method implementation, development and validation. IV. Interpretation of toxicological data, limitations of methods, Limits of detections: residue levels, toxic levels, and therapeutic levels, fatal levels of commonly encountered poisons in blood, urine and tissues. V. Quality control and quality assurance.	12
Reference Books 1. Curry: Analytical Methods in Human Toxicology, Part II, 1986. 2. Casarett & Doll Toxicology: The Basic Science of poisons. 3. Clark, E.G.C.: Isolation and identification of Drugs, 1966. 4. Curry, A.S.: Poison Detection in Human Organs, 1976. 5. Curry, A.S.: Advances in Forensic Chemical Toxicology, 1972 6. Holfmann, F.G.: Handbook of Drug and Alcohol Abuse. 7. Turner: Drugs & Poisons. 8. Samford : Poisons Their Isolation Identification 9. Stoleman: Progress in Chemical Toxicology. 10. Sunshine, I: Guidelines for Analytical Toxicology Programme, Vol-I, CRC press, 1950. 11. Sunshine, I: Handbook of Analytical Toxicology, press, 1969. 12. Mule, S. J. et al. : Immunoassays for Drugs subjects to ab, CRC Press, 1974 13. Connors, K.: A text book of Pharmaceuticals analysis, Interscience, New York, 1975		

SEMESTER-III			
MSC20FSC303	Pharmacology and Forensic Drugs Analysis	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Introduction to Pharmacology I. Introduction to Pharmacology - Drug, Cosmetics and Patent or Proprietary medicine. Drugs Technical Advisory Board (DTAB). Drugs and Cosmetics Act of India 1940. Drugs and Cosmetics Rules, 1945. Indian, British & U. S. Pharmacopeias. II. Routes of Drug Administration - Enteral, Parental and Topical	10	
Unit.2	Pharmacokinetics I. Drug Absorption, Factors affecting drug absorption II. Drug Distribution - Lipophilic, Lipophobic and Protein binding. The blood–brain barrier. Drug ionisation and distribution. Volume of distribution. Factors affecting drug distribution. III. Drug Metabolism - Phases of metabolism — Phase I and Phase II. Hepatic first-pass effects. Bioavailability and Bioequivalence, Bioaccumulation. Dose response relationship. IV. Drug Excretion- Organs involved in drug excretion. Drug dosage and blood levels. Drug half-life.	14	
Unit.3	Pharmacodynamics I. Site of Drug Action II. Drug Receptor Mechanism - Types of receptors. Factors affecting the effects of Drug. III. Structure Activity Relationship (SAR). Postmortem redistribution. Affinity, specificity, efficacy and potency. IV. Drug Interactions: Drug–drug interactions, Drug–environment interactions and Drug–food interactions. ADRs (Adverse drug reactions). Drug dependence and drug abuse.	12	
Unit.4	General concepts of Pharmacogenomics • Introduction to Pharmacogenetics	14	

	• Variants and SNPs □ • Personalized medicine • Pharmacokinetics and Pharmacodynamics in pharmacogenetics □ • Clinical significance & practice. Benefits and limitations	
Unit.5	Pharmaceutical drug Analysis - I. Immunoassays: Basic principles, separation of bound and unbound drug , different Techniques: optical - immunoassays, enzyme - immunoassays, fluoroimmunoassays, their basic principles and applications in drug detection. II. Extraction and isolation of the active constituents of drugs from the matrices using various chemical and instrumental methods, QuEChERS. III. Analysis of drugs using - Tlc, GC-MS, LC - MS, HPLC / UHPLC.	10
Reference Books 1. Klaassen, C. D., :Casarett and Doull's Toxicology: The Basic Science of Poisons, 5th ed, McGraw-Hill, 1995. 2. Moffat, A.C. : Osselton, D. M. Widdop, B. : Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3rd ed., Pharmaceutical Press2004. 3. Bogusz, M. J.,: Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science ,2000. 4. Siegel, J.A., Saukko, P. J., Knupfer, G.,: Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000. 5. Rang, P.H., Dale, M.M., Ritter, M.J.: Pharmacology, 4th ed., Harcourt/Churchill Livingstone, 2000. 6. Paranjape, H.M., Bothara, G.K., Jain, M.M.: Fundamentals of Pharmacology, 1st ed., Nirali Prakashan, 1990.		

SEMESTER- III			
MSC20FSC304	Forensic Engineering	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Introduction to forensic engineering and scientific investigation Investigation and observation of structural collapse and causes of failure Examination of structural parameters (beam, column, slab, foundation, ties, reinforcements and reinforcement cover etc.), with reference to building code of construction applicable at the time of construction of structures and I.S standards. Examination of the basic materials like cement, sand, brick, grit, steel, quality of water, cube test and curing etc. Sampling of the materials with relevant information required for the investigation (column, beam, slab, mortar, bricks, reinforcement steel, soil and basic materials used in the construction), Case studies.	12	
Unit.2	Motor vehicle accident Introduction. Primary causes of accidents Analytical tools used to evaluate accidents, Background Information, Headlight Perception, Daylight Perception Converting scene data into event sequence, Measurement of speed of the vehicle, Reconstruction of the scene, Tire marks, tread marks, Windshield marks. Collection and preservation of the evidences. Examination of body parts paint analysis. Transportation Disaster Investigation Introduction, History, Accident Investigation Methodology-Witness Questioning Procedures, Compilation and Use of the Evidence. Reconstruction and report writing	12	
Unit.3	Machinery Failures Introduction. Large Scale Machineries, Small Scale Machineries. Basic concepts of failures and process of failures. Examination of specific components involved. Types of equipment tested - Mechanical, Physical or Thermal, Electrical installations, Diagnostic Analysis, Physical or Morphological, Morphometry (microscopy). Elemental composition and their influences and interpretation. Traditional methods of analysis. Advanced Techniques Used: Leaktightness, Wear and Tear and Loss and Detection. Causes and types of failures: Sudden, Intermediate and Gradual, Human Errors.	14	

	Reconstruction and report writing	
Unit.4	Fire Investigation Protocols Definition of fire, Fire triangle, Fire tetrahedron, Patterns of fire, Types of fire propagation. Parameters of fire investigations. Scientific Investigative protocols. Fire Residue Analysis - Various Chemical and Instrumental Methods	10
Unit.5	Post Blast Investigations Pre-Blast and Post-Blast Surveys, Types of Damages Caused by Blasting, Flyrock Damage, Surface Blast Craters, Air Concussion Damage and Air Shock Wave Damage. Ground Vibrations, Blast Monitoring with Seismographs.	12
Reference Books 1. Dahiya. M.S. (2009): Crime scene management –A scientific approach 2. Kirk (2000): Vehicular accident Investigation and reconstruction 3. Noon (2000): Forensic Engineering Investigation 4. Carper (2000): Forensic Engineering 5. James, Nordby (2005): Forensic Science an introduction to scientific investigative techniques		

SEMESTER-III			
MSC20FSC305	Forensic Chemistry Practical	12 hrs./Wk	6 Credits
SR. No.	Practical Detail	Lab Hours	
1	Unit I	4	
	1. Quantification of calcium and magnesium in milk through titration. 2. Separation of lipids and fats by TLC 3. Analysis of adulterated and non-adulterated oil by chemical/Color Test and TLC method. 4. Separation of alkaloids, glycosides, tryptamines by TLC 5. Separation of Psychotropic substance by TLC 6. Separation of Cannabis/Opium by TLC 7. Analysis of inorganic and organic explosives by color test and TLC. 8. Extraction of caffeine from tea leaves, characterization by IR. 9. Analysis of accelerants by TLC 10. Analysis of dye in petrol and kerosene by UV spectrophotometry and TLC. 11. Estimation of nitrite/nitrate in water samples. 12. Analysis of NDPS drugs and explosives by instrumental techniques.		
2	Unit II	3	
	1. Extraction, isolation, purification and identification of pesticides by various analytical techniques from various food samples. 2. Systematic extraction, isolation, purification and identification of volatile, acidic, basic and neutral drugs by various analytical techniques. 3. Extraction and detection of metallic poisons from biological and non biological matrices. 4. Identification of plant poisons by chemical and microscopic methods. 5. Separation and identification of plant poisons using TLC and instrumental methods.		

3	Unit III	3
	1. Qualitative and quantitative analysis of neutral drugs by various chemical and instrumental techniques. 2. Qualitative and quantitative analysis of acidic drugs by various chemical and instrumental techniques. 3. Qualitative and quantitative analysis of basic drugs by various chemical and instrumental techniques. 4. Qualitative and quantitative analysis of narcotic drugs by various chemical and instrumental techniques.	
4	Unit IV	2
	1. Physical examination of cement, mortar and concrete. 2. Examine the cement content in mortar (mixture of cement and sand) i.e. the ratio of cement and sand in mortar. 3. Examine the cement content in concrete i.e. the ratio of cement, sand and aggregate in concrete.	

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SYLLABUS



DEPARTMENT OF CHEMISTRY AND FORENSIC SCIENCE

M.Sc. Forensic Science Semester IV

Under Choice Based Credit System (CBCS)

Effective from December 2021

SEMESTER-IV			
MSC20FSC401	ADVANCE FORENSIC CHEMISTRY	4 hrs./Wk	4 Credits
Sr. No.	Course Detail	Inst. Hrs.	
Unit.1	Nuclear Chemistry Early History of Radioactivity, Radioactive Decay and Growth, Naturally Occurring Radioactive Substances, Artificially Produced Radioactive Substances. Introduction to nuclear forensics, nuclear threats, Nuclear explosive devices. Radioactivity, Radioactive decay rates and Half lives, Radioactive Decay Processes : Instability of Nuclei, Alpha Decay, Spontaneous Fission, Beta Decay and Gamma Transitions. Methods of detection and measurement of radio active compounds (G.M and Scintillation Counter). Activation analysis: Neutron activation analysis, principle, technique, applications and steps involved in neutron activation analysis. Radio-chemical Applications.	14	
Unit.2	Chemical Warfare Agents Introduction to Chemical Warfare Agents and Biological Agents. Classification of Chemical Warfare Agents - Herbicides, Blister Agents, Nerve Agents, RCOAs, etc.. Physical and Biochemical properties, toxic effects. Detection of warfare agents using Biosensors and various instrumental Techniques. Protection and management from Chemical warfare agents.	10	
Unit.3	Environmental Chemistry Introduction to Environmental Pollutants and toxicants. Water Pollution - Classification of Water pollutants : Oxygen demanding waste, Synthetic organic chemicals, Pesticides, Pathogens, Plant nutrients. Analysis of water quality : Calculation of BOD, DO, COD, TOC, etc.. Soil Pollution - Introduction, Classification of soil pollutants like Fertilizers, Pesticides , Plastic and Metals. Air Pollution - Causes of air pollution. Photochemical reaction in atmosphere and smog formation. Oxides of Nitrogen, Sulphur, Carbon and their effects. Air Pollutants : Chemicals, petroleum and Chlorofluorocarbon	14	

Unit.4	Metals And Alloys Metals and Alloys: Scope & Significance of metal and alloy analysis in forensic science. Identification & composition of metals and alloys, purity of metals including precious metals such as gold, silver and platinum. Different types of metals and alloys commonly encountered for forensic analysis. Hall marking of precious metal according to BIS. Detection of adulteration in different precious metals.	10
Unit.5	Chemistry of Dyes and Fibers Types of fibers : Natural, Synthetic and Semi synthetic. Physical and Chemical Properties of fibers: Number of fibers, colour of fibers, type if fiber, Burning Test , Floating Test. Chemical and Instrumental analysis of fibers. Difference between dye and pigments. Types of dyes: Natural Dyes and Synthetic dyes. Classification of dyes on the basis of their processes: Forensic analysis of dyes. Introduction to detective dyes: Physical and Chemical Properties of Phenolphthalein and Anthracene, IPC sections - 171B and 171E. Chemical: PH and Acid-Alkaline test, Thin Layer Chromatographic analysis and Instrumental analysis of detective dyes.	12
Reference Books 1. Moffat, A.C.: Osselton, D. M. Widdop, B.: Clarke's Analysis of Drugs and Poisons in Pharmaceuticals, body fluids and postmortem material, 3rd ed., Pharmaceutical Press 2004. 2. Bogusz, M. J., Hand Book of Analytical Separations, Vol. 2: Forensic Science, 1st ed., Elsevier Science, 2000. 3. Siegel, J.A., Saukko, P. J., Knupfer, G.,: Encyclopedia of Forensic Sciences (Vol3), Academic Press, 2000. 4. Townsends, A. (Ed): Encyclopedia of Analytical Science, Academic Press, 2005. 5. Beveridge, A: Forensic Investigation of Explosives, Taylor & Francis, 2000. 6. Yallop, H. J: Explosion Investigation, Forensic Science Society & Scottish Academic Press, 1980. 7. Narayanan, T. V: Modern Techniques of Bomb Detection and Disposal, R. A. Security System, 1995.		

8. H. J. Arnikar Essentials of Nuclear Chemistry, 4th Edition Wiley Eastern (1987).
9. H. J. M. Bowen. Buttler and Tanner Chemical Applications of Radioisotopes, (1969).
10. G Friedlander, T. W. Kennedy, E. S. Macias and J. M. Miller, Introduction of Nuclear and Radiochemistry, 3rd Edition, John Wiley (1981).
11. P.D.Vowels and D.W: Experiments in Environmental chemistry.

SEMESTER- IV			
MSC20FSC402	DISSERTATION/PROJECT WORK	24 hrs./Wk	18 Credits
	Course Detail		
	Every student will have to undertake a dissertation based on the option and the actual work carried out on the problem under the guidance of his/her supervisor. The supervisor will be allotted by the HOD to each of the student. The supervisor will be the faculty member of the institute. The institution may decide to send the student to the external institutions for completion of the experimental work/consultation with the scientist and library for their dissertation work. In that case the HOD of the concerned external institute will allot one of its faculty member/scientist as co supervisor to the student. If a student goes to any external institute for the completion of dissertation work he/she has to submit one certificate duly signed by the allotted co-supervisor and HOD of the external institution. The student will have to submit minimum two copies (02) of his/her dissertation before the last date specified by the department. The dissertation will be evaluated in terms of quality of written work, experimental and performance in the viva voce by the internal and external examiners.		

Bhakta Kavi Narsinh Mehta University Junagadh

M.Sc. Forensic Science SEM- 3 and SEM- 4

Question Paper Pattern (Effective from July 2021)

Unit-1 [14 marks]

Answer **ALL** questions

Q.1 (a)	1 Question of 4 Marks OR 2 Questions of 2 Marks Each.	4 Marks
Q.1 (b)	Answer any two question out of three.	10 Marks
(1)		5
(2)		5
(3)		5

Unit-2 [14 marks]

Answer **ALL** questions

Q.2 (a)	1 Question of 4 Marks OR 2 Questions of 2 Marks Each.	4 Marks
Q.2 (b)	Answer any two question out of three.	10 Marks
(1)		5
(2)		5
(3)		5

Unit-3 [14 marks]

Answer **ALL** questions

Q.3 (a)	1 Question of 4 Marks OR 2 Questions of 2 Marks Each.	4 Marks
Q.3 (b)	Answer any two question out of three.	10 Marks
(1)		5
(2)		5
(3)		5

Unit-4 [14 marks]

Answer **ALL** questions

Q.4 (a)	1 Question of 4 Marks OR 2 Questions of 2 Marks Each.	4 Marks
Q.4 (b)	Answer any two question out of three.	10 Marks
(1)		5
(2)		5
(3)		5

Unit-5 [14 marks]

Answer **ALL** questions

Q.5 (a)	1 Question of 4 Marks OR 2 Questions of 2 Marks Each.	4 Marks
Q.5 (b)	Answer any two question out of three.	10 Marks
(1)		5
(2)		5
(3)		5
