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Semester I USBO101		**L**	**Cr**
Paper I -- Plant Diversity 1		**45**	**2**
UNIT I		**15**	
ALGAE			
1	Structure, life cycle and systematic position of *Nostoc* and *Spirogyra*.		
2	Economic importance of Algae.		
UNIT II		**15**	
FUNGI			
1	Structure, life cycle and systematic position of *Rhizopus* and *Aspergillus*		
2	Economic importance of Fungi.		
3	Modes of nutrition in Fungi (Saprophytism and Parasitism).		
UNIT III		**15**	
BRYOPHYTA			
1	General characters of Hepaticae		
2	Structure, life cycle and systematic position of *Riccia*.		

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Semester I USBO102		**L**	**Cr**
Paper II – Form and Function 1		**45**	**2**
UNIT I		**15**	
CELL BIOLOGY			
1	General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)		
2	Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast		
UNIT II		**15**	
ECOLOGY			
1	Energy pyramids, energy flow in an ecosystem.		
2	Types of ecosystems: aquatic and terrestrial.		
UNIT III		**15**	
GENETICS			
1	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.		
2	Epistatic and non epistatic interactions; multiple alleles.		

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	Semester I USBOP1	**L**	**Cr**
	PRACTICAL Paper I – Plant Diversity 1	30	1
1	Study of stages in the life cycle of *Nostoc* from fresh/ preserved material and permanent slides.		
2	Study of stages in the life cycle of *Spirogyra* from fresh/ preserved material and permanent slides.		
3	Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Neutraceutical), *Gelidium* (Agar)		
4	Study of stages in the life cycle of *Rhizopus* from fresh/ preserved material and permanent slides.		
5	Study of stages in the life cycle of *Aspergillus* from fresh/ preserved material and permanent slides.		
6	Economic importance of Fungi: Mushroom , Yeast, wood rotting fungi (any bracket fungus).		
7	Study of stages in the life cycle of *Riccia* from fresh/ preserved material.		
8	Study of stages in the life cycle of *Riccia* with the help of permanent slides.		
	PRACTICAL PAPER II- FORM AND FUNCTION 1	30	1
1	Examining various stages of mitosis in root tip cells (*Allium)*		
2	**Cell inclusions:** Starch grains (Potato and Rice); Aleurone Layer (Maize)		
3	Cystolith (*Ficus*); Raphides (*Pistia*); Sphaeraphides (*Opuntia*).		
4	Identification of cell organelles with the help of photomicrograph: Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus		
4	**Identification of plants adapted to different environmental conditions:** Hydrophytes: Floating: Free floating (*Pistia*/*Eichornia*); Rooted floating (*Nymphaea*); Submerged (*Hydrilla*)		
5	Mesophytes (any common plant); Hygrophytes (*Typha*/*Cyperus*)		

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6	Xerophytes : Succulent (*Opuntia*); Woody Xerophyte (*Nerium*); Halophyte (*Avicennia* pneumatophore) No sections in ecology, only identification and description of specimens. Morphological adaptations only.		
7	Calculation of mean, median and mode.		
8	Calculation of standard deviation.		
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart.		
10	Study of Karyoptypes: Human: Normal male and female, *Allium cepa* .		

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	Semester II USBO201	**Hrs**	**Cr**
	Paper I -- Plant Diversity 1	**45**	**2**
UNIT I		**15**	
PTERIDOPHYTES			
1	Structure life cycle, systematic position and alternation of generations in *Nephrolepis*		
2	Stelar evolution		
UNIT II		**15**	
GYMNOSPERMS			
2	Structure life cycle systematic position and alternation of generations in *Cycas*		
3	Economic importance of Gymnosperms		
Unit III			
ANGIOSPERMS		**15**	
1.	Leaf: simple leaf, types of compound leaves, Incisions of leaf, venation, phyllotaxy, types of stipules, leaf apex, leaf margin, leaf base, leaf shapes. Modifications of leaf: spine, tendril, hooks, phyllode, pitcher, *Drosera* or insectivorous plants.		
2	Inflorescence: Racemose: simple raceme, spike, catkin, spadix, panicle. Cymose: monochasial, dichasial, polychasial. Compound: corymb, umbel, cyathium, capitulum, verticellaster, hypanthodium.		
3	Study of following families: Malvaceae, Amaryllidaceae.		

	Semester II USBO202	**Hrs**	**Cr**
	Paper II – Form and Function 1	**45**	**2**
UNIT I		**15**	
ANATOMY			
1	Simple tissues, complex tissues.		
2	Primary structure of dicot and monocot root, stem and leaf.		
3	Epidermal tissue system: types of hair, monocot and dicot stomata.		

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UNIT II		**15**	
PHYSIOLOGY			
1	Photosynthesis: Light reactions, photolysis of water, photophosphorylation (cyclic and non cyclic), carbon fixation phase (C_3, C_4 and CAM pathways).		
UNIT III		**15**	
MEDICINAL BOTANY			
1	Concept of primary and secondary metabolites, difference between primary and secondary metabolites.		
2	Grandma's pouch: Following plants have to be studies with respect to botanical source, part of the plant used, active constituents present and medicinal uses: *Oscimum sanctum, Adathoda vasica, Zinziber officinale, Curcuma longa, Santalum album, Aloe vera*.		

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	Semester II USBOP2	**Cr**
	PRACTICAL Paper I – Plant Diversity 1	**1**
1	Study of stages in the life cycle of *Nephrolepis* : Mounting of ramentum, hydathode, T.S. of rachis.	
2	T.S. of pinna of *Nephrolepis* passing through sorus.	
3	Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele.	
4	*Cycas:* T.S of leaflet (*Cycas* pinna)	
5	Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of *Cycas* – all specimens to be shown.	
6	Economic importance of Gymnosperms: *Pinus* (turpentine, wood, seeds)	
7	Leaf morphology : as per theory	
8	Types of inflorescence: as per theory	
9	Malvaceae	
10	Amaryllidaceae	
	PRACTICALPaper II – Form and Function 1	**1**
1	Primary structure of dicot and monocot root.	
2	Primary structure of dicot and monocot stem.	
3	Study of dicot and monocot stomata.	
4	Epidermal outgrowths: with the help of mountings Unicellular: *Gossypium*/Radish Multicellular: *Lantana*/Sunflower Glandular: *Drosera* and Stinging: *Urtica* – only identification with the help of permanent slides. Peltate: *Thespesia* Stellate: *Erythrina*/*Sida acuta*/*Solanum/Helecteris*	

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	T-shaped: *Avicennia*	
5	Separation of chlorophyll pigments by strip paper chromatography.	
6	Separation of amino acids by paper chromatography.	
7	Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage	
8	Test for tannins: tea powder/catechu.	
9	Identification of plants or plant parts for grandma's pouch as per theory.	

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DISTRIBUTION OF TOPICS AND CREDITS
F Y B Sc. BOTANY SEMESTER I

Course	Nomenclature	Credits	Topics
USBO1O1	PLANT DIVERSITY 1	02	1. Algae
			2. Fungi
			3. Bryophyta
USBO1O2	FORM AND FUNCTION I	02	1. Cell Biology
			2. Ecology
			3. Genetics
USBOP1	Plant Diversity I, form and Function I (Practical I & II)	02	

F Y B Sc BOTANY SEMESTER II

Course	Nomenclature	Credits	Topics
USBO2O1	PLANT DIVERSITY I	02	1. Pteridophytes
			2. Gymnosperms
			3. Angiosperms
USBO2O2	FORM AND FUNCTION I	02	1. Anatomy
			2. Physiology
			3. Medicinal Botany
USBOP2	Plant Diversity I, Form and Function I (Practical I & II)	02	

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References

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises
2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.
3. Genetics by Russel. Wesley Longman inc publishers. (5th edition)
4. Plant Physiology by Taiz and Zeiger Sinauer Associates inc. publishers
5. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
6. Cell Biology by De Robertis

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Scheme of Examinations

Internal and External Assessment as per CBSS of University of Mumbai

Note:

- Two short field excursions for habitat studies are compulsory.
  Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.
- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of F.Y.B.Sc. Botany or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of F.Y.B.Sc. Botany as per the minimum requirements. In case of loss of journal a candidate must produce a certificate from the Head of the department /Institute that the practicals for the academic year were completed by the student. However such a candidate will be allowed to appear for the practical examination but the marks allotted for the journal will not be granted.

UNIVERSITY OF MUMBAI
No. UG/02of 2016-17

CIRCULAR:-

A reference is invited to the Syllabi relating to the B.Sc. degree course , **vide** this office Circular No. UG/130 of 2009, dated 4th May, 2009 and the Principals of affiliated Colleges in Science and the Heads of recognized Institutions concerned are hereby informed that the revised syllabus approved in the Academic Council meeting held on 11th March, 2016 **vide** item No. 4.7 and that in accordance therewith, the revised syllabus as per the Credit Based Semester and Grading System for S.Y. B.Sc. Zoology (Sem.III & IV) degree programmes, which are available on the University's web site (www.mu.ac.in) and that the same has been brought into force with effect from the academic year 2016-17.

Sd/-
REGISTRAR

MUMBAI – 400 032
21st April, 2016

To,

The Principals of the affiliated Colleges in Arts & Science and the Heads of Recognized Institutions concerned.

A.C/4.7/11.03.2016

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No. UG/02-A of 2016 MUMBAI-400 032 21st April, 2016

Copy forwarded with Compliments for information to:-

1) The Deans, faculties of Science,
2) The Chairman, Board of Studies in Zoology,
3) The Professor-cum-Director, Institute of Distance & Open Learning (IDOL)
4) The Director, Board of College and University Development,
5) The Co-Ordinator, University Computerization Centre,
6) The Controller of Examinations.

Deputy Registrar
Under Graduate Studies

...PTO

UNIVERSITY OF MUMBAI

Program: S.Y.B. Sc.

Course: Zoology

(Credit Based Semester and Grading System

with effect from the academic year 2016–2017)

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Mr Ajay R.Tripathi	Member (Teacher)
Dr Bindu Acharya	Member (Teacher)
Dr Lalna Khot	Member (Teacher)
Ms Jariya Khan	Student
Ms Pranjali Tripathi	Student
Mr Nishant Gupta	Student
Ms Tanuja Amasa	Student

Syllabus for

S.Y.B.Sc.

Course – ZOOLOGY

To be implemented from Academic year 2016-17

SEMESTER - III

COURSE CODE	UNIT	TOPIC	CREDITS	LECTURES/ WEEK
USZO301	I	Fundamentals of Genetics,	2	1
	II	Chromosomes and Heredity,		1
	III	Nucleic acids		1
USZO302	I	Study of Nutrition and Excretion	2	1
	II	Study Respiration and circulation,		1
	III	Control and coordination, Locomotion and Reproduction		1
USZO303	I	Ethology	2	1
	II	Parasitology		1
	III	Economic Zoology		1
USZOP3	Practical based on all three courses		03	**9**

SEMESTER - IV

COURSE CODE	UNIT	TOPIC	CREDITS	LECTURES/ WEEK
USZO401	I	Origin and evolution of Life,	2	1
	II	Population genetics and evolution,		1
	III	Scientific Attitude methodology , writing and ethics		1
USZO402	I	Cell Biology,	2	1
	II	Endo membrane System		1
	III	Biomolecules		1
USZO403	I	Comparative Embryology,	2	1
	II	Aspects of Human Reproduction,		1
	III	Pollution and its effect on organisms		1
USZOP4	Practical based on all three courses		03	**9**

Syllabus for
S.Y.B.Sc
Course – ZOOLOGY

1. Syllabus Semester III & IV (Theory and Practical)
2. References and Additional Reading
3. Scheme of Examination and Paper Pattern (Thoery and Practical)
4. Model Question bank

S.Y.B.Sc. ZOOLOGY UNIT WISE DISTRIBUTION

Semester III			Semester IV		
Course 5	**Course 6**	**Course 7**	**Course 8**	**Course 9**	**Course 10**
Unit 1 Fundamentals of Genetics	**Unit 1** Study of Nutrition & Excretion	**Unit 1** Ethology	**Unit 1** Origin & Evolution of Life	**Unit 1** Cell Biology	**Unit 1** Comparative Embryology
Unit 2 Chromosome & Heredity	**Unit 2** Study of Respiration & circulation	**Unit 2** Parasitology	**Unit 2** Population Genetics & Evolution	**Unit 2** Endomembrane System	**Unit 3** Aspects of human Reproduction
Unit 3 Nucleic Acids	**Unit 3** Control and Coordination Locomotion & Reproduction	**Unit 3** Economic Zoology	**Unit 3** Scientific Attitude, Methodology, Writing & Ethics	**Unit 3** Biomolecules	**Unit 3** Pollution & Effects on Animals
Practical (USZO P3)	**Practical (USZO P3)**	**Practical (USZO P3)**	**Practical (USZO P4)**	**Practical (USZO P4)**	**Practical (USZO P4)**

S.Y.B.Sc SYLLABUS DRAFT

SEMESTER III

Sr. No	USZO301 COURSE-5	No of lect allotted	Learning pleasure
	Fundamentals of Genetics, Chromosomes and Heredity, Nucleic acids		
	Unit 1: Fundamentals of Genetics	**15L**	**25hrs**
	***Objectives* :** ➢ *To Introduce basic terms of genetics* ➢ *To study Mendelian principles of inheritance and other forms pattern of inheritance*		
.	**Desired *outcomes :*** ➢ *Understand and apply the principles of inheritance.* ➢ *Understand the concept of multiple alleles, linkage and crossing over.*		
1.1	**Introduction to genetics** ➢ Definition, scope and importance of genetics. ➢ Classical and Modern concept of Gene (Cistron, muton, recon). ➢ Brief explanation of the following terms: Allele, wild type and mutant alleles, locus, dominant and recessive traits, homozygous and heterozygous, genotype and phenotype, genome.	**2L**	**2hrs**
1.2	**Mendelian Genetics** ➢ Mendelian Genetics**:** Monohybrid cross, Dihybrid cross, test cross, back cross, Mendel's laws of Inheritance, Mendelian traits in man. ➢ Exceptions to Mendelian Inheritance: Incomplete dominance, Co-dominance, Lethal alleles, Epistasis - Recessive, Double recessive, dominant and double dominant. ➢ Chromosome theory of inheritance. ➢ Pedigree analysis-Autosomal dominant and autosomal recessive, X-linked dominant, and X-linked recessive	**8L**	**12hrs**
1.3	**Multiple Alleles and Multiple Genes** ➢ Concept of multiple alleles, Coat colour in rabbit, ABO and Rh blood group systems ➢ Polygenic inheritance with reference to skin colour and eye colour in man. ➢ Concept of pleiotropy.	**3L**	**06hrs**
1.4	**Linkage and Crossing Over** ➢ Linkage and crossing over, types of crossing over, cytological basis of crossing over.	**2L**	**05hrs**
	Unit: 2: Chromosomes and Heredity	**15 L**	**26hrs**
	Learning objectives:		

	➢ *To familiarize the learners with the structure, types and classification of chromosomes.* ➢ *To introduce the concept of sex determination and its types, sex influenced and sex limited genes.*		
	Desired Outcomes: ➢ *Learners would understand the structure and types of chromosomes.* ➢ *Learners would understand mechanisms of sex determination.* ➢ *Learners would be able to correlate the disorders linked to a particular sex chromosome.*		
2.1	**Chromosomes** ➢ Types of chromosomes–Autosomes and Sex chromosomes ➢ Chromosome structure - Heterochromatin, Euchromatin ➢ Classification based on the position of centromere ➢ Endomitosis, Giant chromosomes- Polytene and Lamp brush chromosomes and significance of Balbiani rings.	**4L**	**8hrs**
2.2	**Sex- determination** ➢ Chromosomal Mechanisms: XX-XO, XX-XY, ZZ-ZW. ➢ Sex determination in honey bees- Haplodiploidy, ➢ Sex determination in *Drosophila*-Genic balance theory, intersex, gynandromorphs. ➢ Parthenogenesis. ➢ Hormonal influence on sex determination-Freemartin and sex reversal. ➢ Role of environmental factors- Bonellia and Crocodile ➢ Barr bodies and Lyon hypothesis	**7L**	**10hrs**
2.3	**Sex linked, sex influenced and sex limited inheritance.** ➢ X-Linked: Colourblindness, Haemophilia ➢ Y-linked: Hypertrichosis ➢ Sex-influenced genes ➢ Sex limited genes	**4L**	**8hrs**
	Unit: 3 Nucleic acids	**15 L**	**30hrs**
	***Objectives*:** ➢ *To introduce to the learners the classical experiments proving DNA as the genetic material.* ➢ *To make the learner understand the structure of nucleic acids and the concept of central dogma of molecular biology.* ➢ *To familiarize the learner with the concept of gene regulation.*		
	Desired Outcomes: ➢ *Learner would understand the importance of nucleic acids as genetic material.* ➢ *The learners would understand and appreciate the regulation of gene expressions.*		

3.1	**Genetic material** ➢ Griffith's transformation experiments, Avery-Macleod and McCarty, Hershey Chase experiment of Bacteriophage infection ➢ Chemical composition and structure of nucleic acids. ➢ Double helix nature of DNA, Solenoid model of DNA. ➢ Types of DNA – A, B, Z & H forms. ➢ DNA in Prokaryotes -chromosomal and plasmid. ➢ Extra nuclear DNA -mitochondria and chloroplast. ➢ RNA as a genetic material in viruses. ➢ Types of RNA: Structure and function.	**7L**	**14hrs**
3.2	**Flow of genetic information in a Eukaryotic cell** ➢ DNA Replication ➢ Transcription of mRNA ➢ Translation ➢ Genetic code	**5L**	**08hrs**
3.3	**Gene Expressions and regulation** ➢ One gene-one enzyme hypothesis /one polypeptide hypothesis ➢ Concept of operon ➢ Lac operon	**3L**	**08hrs**

Sr. No	**USZO302 COURSE-6**	**No of lect allotted**	**Learning pleasure**
	Study of Nutrition and Excretion , Respiration and circulation, Control and coordination, Locomotion and Reproduction		
	Unit: 1 Study of Nutrition and Excretion	**15L**	**23hrs**
	Objective : ➢ *To introduce the concepts of physiology* of nutrition, excretion and osmoregulation. ➢ *To expose the learners to various nutritional apparatus, excretory and osmoregulatory structures in different classes of organisms.*		
	Desired Outcome : ➢ *Learners would understand the increasing complexity of nutritional, excretory and osmoregulatory physiology in evolutionary hierarchy.* ➢ *Learners would be able to correlate the habit and habitat with nutritional, excretory and osmoregulatory structures.*		
1.1	➢ Comparative study of Nutritional Apparatus (structure and function): Amoeba, Hydra, Earthworm, Cockroach, Bivalve, Amphioxus, Pigeon, Ruminants.	5L	06hrs
1.2	➢ Physiology of digestion in man	2L	04hrs

1.3	➢ Comparative study of Excretory and Osmoregulatory structures and function a. Amoeba -contractile vacuoles b. Planaria -Flame cells c. Earthworm -Nephridia d. Cockroach-Malphigian tubules and green gland e. Bivalve -Organ of Bojanus	5L	08hrs
1.4	➢ Categorization of animals based on principle nitrogenous excretory products	1L	01hrs
1.5	➢ Structure of kidney, Uriniferous tubule and physiology of urine formation in man.	2L	04hrs
	Unit: 2 Study of Respiration and circulation	**15L**	**27hrs**
	***Objective* :** ➢ *To introduce the concepts of physiology of respiration and circulation* ➢ *To expose the learners to various respiratory and circulatory structures in different classes of organisms.*		
	Desired Outcome: ➢ *Learners would understand the increasing complexity of respiratory and circulatory physiology in evolutionary hierarchy.* ➢ *Learners would be able to correlate the habit and habitat with respiratory and circulatory structures.*		
2.1	➢ Comparative study of Respiratory organs (structure and function) Earthworm, Spider, Rohu, Frog and Pigeon.	**3L**	**06hrs**
2.2	➢ Accessory respiratory structures: Anabas /Clarius	**1L**	**02hrs**
2.3	➢ Structure of lungs and physiology of respiration in man	**2L**	**04hrs**
2.4	➢ Comparative study of circulation: Open and closed - single and double .	**1L**	**02hrs**
2.5	➢ Types of circulating fluids- Water, coelomic fluid, haemolymph, lymph and blood.	**2L**	**02hrs**
2.6	➢ Comparative study of Hearts (Structure and function) Earthworm, Cockroach, Shark, Frog, Crocodile and Pigeon.	**4L**	**07hrs**
2.7	➢ Structure and mechanism of working of heart in man	**2L**	**04hrs**
	Unit: 3 Control and coordination, Locomotion and Reproduction	**15L**	**25hrs**
	***Objective* :** ➢ *To introduce the concepts of physiology of control and coordination and locomotion and reproduction* ➢ *To expose the learners to various locomotory and reproductive structures in different classes of organisms*		
	***Desired Outcome**:*		

	➢ *Learners would understand the process of control and coordination by nervous and endocrine regulation.* ➢ *Learners would be fascinated by various locomotory structures found in the animal kingdom.* ➢ *Learners would be acquainted with various reproductive strategies present in animals.*		
3.1	**Control and coordination** ➢ Irritability –Paramoecium , Nerve net in Hydra, Nerve ring and nerve cord in earthworm ➢ Types of neurons on the basis of structure and function ➢ Conduction of nerve impulse: Resting potential, action potential and refractory period ➢ Synaptic transmission ➢ Endocrine regulation: Hormones as chemical messengers, feedback mechanisms	**5L**	**08hrs**
3.2	**Movement and Locomotion** ➢ Locomotory organs -structures and functions a. Pseudopodia in Amoeba (sol gel theory), Cilia in Paramecium b. Wings and legs in Cockroach c. Tube feet in Starfish d. Fins of fish	**4L**	**08hrs**
3.3	➢ Structure of Striated muscle fibre in human and Sliding filament theory	**2L**	**02 hrs**
3.4	**Reproduction** a. Asexual Reproduction- Fission, fragmentation, gemmule formation, budding b. Sexual reproduction i. Gametogenesis ii. Structure of male and female gametes in human iii. Types of fertilization iv. Oviparity, viviparity, ovo-viviparity	**4L**	**07hrs**
	USZO 303 COURSE-7		
	Ethology , Parasitology, Economic Zoology	**15L**	**26hrs**
	Unit: 1 Ethology		
	Objective: ➢ *To equip learners with a sound knowledge of how animals interact with one another and their environment.* ➢ *To enable the learners to understand different behavioural patterns.*		
	Desired Outcome: ➢ *Learners would gain an insight into different types of animal behaviour and their role in biological adaptations.* ➢ *Learners would be sensitized to the feelings instrumental in social behavior.*		

1.1	**Introduction to Ethology** ➢ Definition, History and Scope of Ethology ➢ Animal behaviour - Innate and Learned behaviour ➢ Types of learning -Habituation, Imprinting and types of imprinting -filial and sexual, Classical conditioning, Instrumental learning and insight learning.	**4L**	**06hrs**
1.2	**Aspects of animal behaviour** ➢ Communication in Bees and Ants ➢ Mimicry and colouration ➢ Role of hormones and pheromones in sexual behaviour ➢ Displacement activities, Ritualization ➢ Migration in fish, schooling behaviour ➢ Habitat selection, territorial behaviour, food selection and foraging behaviour in African ungulates	**6L**	**12hrs**
1.3	**Social behaviour** ➢ Social behaviour in primates -Hanuman langur ➢ Elements of Socio-biology: Selfishness, cooperation, altruism, kinship and inclusive fitness	**5L**	**08hrs**
	Unit: 2 Parasitology	**15L**	**27hrs**
	Objective: ➢ *To acquaint learners with the concepts of parasitism, their relationship with environment.* ➢ *To make learners aware about the modes of transmission of parasites.*		
	Desired Outcome: ➢ *Learners would understand the general epidemiological aspects of parasites that affect humans and apply simple preventive measures for the same.* ➢ *Learners would comprehend the life cycle of specific parasites, the symptoms of the disease and its treatment.*		
2.1	**Introduction to Parasitology and types of parasites** ➢ Definitions: parasitism, host, parasite, vector-biological and mechanical ➢ **Types of parasites-** Ectoparasites, Endoparasite and their subtypes ➢ Parasitic adaptations in Ectoparasites and Endoparasites ➢ Types of hosts: intermediate and definitive, reservoir	**2L**	**06hrs**
2.2	**Host-parasite relationship-Host specificity** ➢ Definition, structural specificity, physiological specificity and ecological specificity.	**2L**	**06hrs**
2.3	**Life cycle, pathogenicity, control measures and treatment** ➢ *Entamoeba histolytica, Fasciola hepatica, Taenia solium, Wuchereria bancrofti*	**5L**	**06hrs**

2.4	**Morphology, life cycle, pathogenicity, control measures and treatment** ➢ Head louse (*Pediculus humanus capitis*), Mite (*Sarcoptes scabei),* Bed bug (*Cimex lectularis)*	**2L**	**06hrs**
2.5	**Parasitological significance** ➢ Zoonosis- Bird flu, Anthrax, Rabies and Toxoplasmosis	**4L**	**03hrs**
	Unit 3 Economic Zoology	**15L**	**24hrs**
	Objective*:* ➢ *To disseminate information on economic aspects of zoology like apiculture, vermiculture, dairy science.* ➢ *To encourage young learners for self employment.*		
	Desired Outcome: ➢ *Learners would gain knowledge on animals useful to mankind and the means to make the most of it.* ➢ *Learners would learn the modern techniques in animal husbandry.* ➢ *Learners would be pursuing entrepreneurship as careers*		
3.1	**APICULTURE**	**5L**	**08hrs**
3.1.1	**Methods of bee keeping and management** ➢ An introduction to different species of honey bees used in apiculture. ➢ Selection of flora and bees for apiculture. ➢ Advantages and disadvantages of traditional and modern methods of apiculture. ➢ Pests and Bee enemies- Wax moth, wasp, black ants, bee eaters , king crow and disease control ➢ Bee keeping industry- Present status and recent efforts to improve and boost the industry		
3.1.2	**Economic importance** ➢ Honey- Production, Chemical composition and economic importance ➢ Bees wax- Economic importance. ➢ Role of honey bees in pollination.		
3.2	**VERMICULTURE**	**4L**	**08hrs**
3.2.1	**Rearing methods, management and economic importance** ➢ An introduction to different species of earthworms used in vermiculture. ➢ Methods of vermiculture. ➢ Maintenance and harvesting ➢ Economic importance: advantages of vermiculture, demands for worms; market for vermicompost and entrepreneurship.		
3.3	**DAIRY SCIENCE**	**6L**	**08hrs**

3.3.1	**Dairy development in India** ➢ Role of dairy development in rural economy, employment opportunities		
3.3.2	**Dairy Processing** ➢ Filtration, cooling, chilling, clarification, pasteurization, freezing		
3.3.3	**Milk and milk products** ➢ Composition of milk ➢ Types of milk: Recombined milk, Soft curd milk, Skimmed and toned milk, Artificial milk. ➢ Milk products		

	SEMESTER III
	Practical USZOP3 (Course V)
1	Extraction and detection of DNA
2	Extraction and detection of RNA.
3	Mounting of Barr bodies.
4	Study of polytene chromosome.
5	Study of mitosis- temporary squash preparation of Onion root tip
6	Detection of blood groups and Rh factor.
7	Problems in genetics a. Monohybrid/ Dihybrid cross b. X- linked inheritance c. Multiple alleles
8	Chromosome morphology: Metaphase spreadsheet (photograph to be provided)
9	Pedigree analysis
10	Problems on molecular biology
	Practical USZOP3 (Course VI)
1	Urine analysis—Normal and abnormal constituents
2	Detection of ammonia in water excreted by fish
3	Detection of uric acid from excreta of Birds
4	Study of striated and non- striated muscle fibre
5	Study of nutritional Apparatus (Amoeba, Hydra, Earthworm, Pigeon, Ruminant stomach)
6	Study of respiratory structures: a. Gills of Bony fish and Cartilaginous fish. b. Lungs of Frog c. Lungs of Mammal. d. Accessory respiratory structure in Anabas (Labyrinthine organ) e. Air sacs of Pigeon.
7	Study of locomotory organs (*Amoeba*, *Unio*, Cockroach, Starfish, Fish, and Birds)

8	Study of hearts (Cockroach, Shark, Frog, *Calotes*, Crocodile, Mammal)
9	Study of permanent slides on topic of Reproduction a. Sponge gemmules b. Hydra budding c. T.S. of mammalian testis d. T.S. of mammalian ovary
	Practical USZOP3 (Course VII)
1	Extraction of Casein from Milk and its qualitative estimation
2	Preparation of paneer from given milk sample
3	Measurement of density of milk using different samples by Lactometer
4	Study of Honey Bee : a) Life Cycle of Honey Bee and Bee Hive b) Mouthparts of Honey Bee c) Legs of Honey Bee d) Sting Apparatus of Honey Bee
5	Study of ethological aspects: a) Warning Colouration b) Instincts c) Imprinting d) Communication in animals: Chemical signals and sound signals e) Displacement activities in animals: Courtship and mating behavior in animals and ritualization
6	Study of Protozoan parasites: a. *Trypanosoma gambiense* *b. Giardia intestinanalis*
7	Study of Helminth parasites: *a) Ancylostoma duodenale* *b) Dracunculus medenensis*
8	Parasitic adaptations: Scolex and mature proglottid of Tapeworm
9	Study of Ectoparasites: a. Leech b. Tick c. Mite
10	Project- Suggested topics on economic zoology (eg Apiculture, sericulture/ lac culture / vermicompost Technique / Construction of artificial beehives /Animal husbandry/ aquaculture etc)

Note -The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.
#There shall be at least one excursion/field trip.

Semester –III

REFERENCE BOOKS AND ADDITIONAL READING

COURSE-V (USZO301)

1. Principles of Genetics. Gardner, E.J., Simmons, M.J and Snustad, D.P. John Wiley and Sons
2. Concepts of Genetics. Klug, W.S., Cummings M.R., Spencer, C.A. Benjamin Cummings.
3. Genetics- A Molecular Approach. Russell, P. J Benjamin Cummings.
4. Genetics: Analysis of Genes and Genomes. Daniel L., Hartl, Elizabeth W. Jones Jones & Bartlett Publishers
5. Introduction to Genetic Analysis. Griffiths, A.J.F., Wessler. S.R., Lewontin, R.C. and Carroll, S.B. W. H. Freeman and Co.
6. Cell Biology Genetics , Molecular Biology Evolution and Ecology Verma P.S. and Agrawal P.K., 9th edition, S. Chand Publication, New Delhi.
7. Principles of Genetics – Eight edition- Eldon john Gardner, Michael J. Simmons, D. Peter Snustad
8. Genetics- Weaver, Hedrick, third edition, Mc Graw Hill Education
9. Genetics A Mendelian approach Peter J.Russel, Pearson Benjamin Cummings
10. Genetics A conceptual approach, Benjamin A. Pierce, Southwestern University, W.H. Freeman and company, New York
11. Genetics, Third Edition, Monroe W. Strickberger
12. Genetics from gene to genome, third edition, Leeland H. Hartwell, Leeroy Hood, Michael 7. L. Goldberg, Ann E. Reynolds, Lee M. Silver, McGraw Hill Education

COURSE-VI (USZO302)

1. Vertebrate Zoology Volume I- Jordan and Verma , S. Chand and Co.
2. Invertebrate Zoology Volume II- Jordan and Verma , S. Chand and Co.
3. Invertebrate Zoology- Majupuria T. C., Nagin S.and Co.
4. Chordate Zoology- Dhami P. S. and Dhami J. K. , R. Chand and Co.
5. Invertebrate Zoology- Dhami P. S. and Dhami J. K., R. Chand and Co.
6. Introduction to Vertebrates- Moore Cambridge University- Low Priced Edition.
7. Zoology- Miller S. A. and Harley J. B., Tata McGraw Hill.
8. Modern Textbook of Zoology, Invertebrates, Kotpal R. L.
9. Biological Science, Taylor D.J., Stout G.W., Green N.P.O, Soper R.,Cambridge University Press.

COURSE-VII (USZO303)

1. Animal Behaviour- David Mc Farland
2. Animal Behaviour- Mohan Arora

3. Animal Behaviour- Reena Mathur
4. An introduction to Animal Behaviour- Dawkins
5. Animal Behaviour-Agarwal
6. Animal Behaviour- Tinbergen
7. Biology of Insects- 1992 Saxena S. C. Oxford and IBH Publishing Co New Delhi. Bombay. Calcutta
8. A Text Book of Entomology- 1974Mathur V. K. and Upadhayay K Goel Printing press, Barani.
9. Bee and Bee Keeping- Roger A. Morse, Conell University Press London
10. Vermiculture Technology - Clive A. Edwards, Norman Q. Arancon and Rhonda Sherman
11. Parasitology- Chatterjee K.D., Chatterjee Medical Publishers.
12. Medical Parasitology- Arora
13. Textbook of Medical Parasitology-. C.K Jayaram Paniker, Jaypee Brothers.
14. A text book of Parasitology- Kochhar S.K. Dominant Pub. & Dis, New Delhi.
15. Essentials of Parasitology- Gerald and Schmidt: Universal Bookstall, New Delhi.
16. Parasitology- Sharma P.N.and Ratnu L.N., Chand S & Co.Pvt.Ltd.
17. Introduction to Parasitology- Chandler and Read John Wiley & Sons
18. Economic Zoology- Biostatistics and Animal behaviour – S.Mathur, Rastogi Publicatons.
19. Economic Zoology- Shukla G.S. & Upadhyay V.B., Rastogi Publications.
20. A handbook on Economic Zoology, S.Chand & Co.

SCHEME OF EXAMINATION (THEORY)

(a) Internal assessment of twenty five (25) marks per course per semester should be conducted according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2015-16.
(b) External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton question paper pattern.
(c) One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON- EXAMINATION PATTERN FOR THE ABOVE SYLLABUS

All Questions are compulsory
Figures to the right indicate full marks

Time: 2.5 hours **Total marks: 75**

Q.1.	UNIT 1 Answer any four out of eight (5 marks each)	20 marks
Q.2.	UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	UNIT 3 Answer any two out of four (10 marks each)	20 marks
Q.4.	a. Unit 1 - (One note of five marks OR objective type questions) b. Unit 2 - (One note of five marks OR objective type questions) c. Unit 3- (One note of five marks OR objective type questions)	15 marks

*For Question 4 it is recommended to have objective questions such as –

(a) Match the column (b) MCQ
(c) Give one word for (d) True and False
(e) Define the term (f) Answer in one sentence etc

MODEL QUESTION BANK SEMESTER III

USZO301(COURSE V)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit :1 (10 Marks)

1. Define genetics and explain its scope and importance.
2. Explain Mendel's laws of inheritance.
3. Describe in detail the monohybrid cross and state the Mendelian principle of inheritance derived from it. Add a note on Co-dominance.
4. Describe in detail dihybrid cross and state the Mendelian principles of inheritance derived from it.
5. Discuss in brief inheritance of Mendelian phenotypic traits in humans.
6. Describe incomplete dominance with a suitable example.
7. Describe Co-dominance with a suitable example.
8. What is epistasis? Give a detailed account of double dominant epistasis.
9. What is epistasis? Give a detailed account of recessive epistasis.
10. What is epistasis? Give a detailed account of dominant epistasis
11. What is epistasis? Give a detailed account of double recessive epistasis.
12. Explain the pattern of inheritance of recessive and dominant lethal alleles.
13. Explain the inheritance of multiple alleles with the help of a suitable example.
14. Describe polygenic inheritance with reference to skin colour and eye colour in man.
15. Compare and contrast pleiotropy and polygenic inheritance.
16. Explain the phenomenon of linkage with respect to Morgan's Experiment. Add a note on the differences between complete and incomplete linkage.
17. Describe the pattern of inheritance of blood group and Rh factor in man.
18. Explain the cytological basis and molecular mechanisms of crossing over.
19. Explain pedigree analysis of X-linked recessive traits.

Unit :1 (5 Marks)

1. Describe the classical concept of gene.
2. Explain the modern concept of gene.
3. Differentiate between (Any two):
   (a) Genotype and phenotype of an organism
   (b) Dominant and recessive traits

(c) Gene and genome
(d) Homozygous and heterozygous
(e) Monohybrid and dihybrid cross
(f) Incomplete Dominance and co-dominance
(g) Multiple alleles and polygenes
(h) Test cross and backcross

4. Explain how probability is used to predict the results of genetic crosses.
5. Write a note on the chromosome theory of inheritance.
6. Describe co-dominance with a suitable example.
7. Give an account of the symbols used in human Pedigree analysis
8. Characteristics of autosomal dominant traits
9. Characteristics of X-linked recessive traits
10. Characteristics of autosomal recessive traits
11. Characteristics of X-linked dominant traits
12. Intermediate lethal alleles
13. Phenylketoneuria
14. Albinism
15. Explain the inheritance of skin colour in humans.
16. Write a note on pleiotropy.

Unit: 2 (10 Marks).

1. Explain the structure of eukaryotic Chromosome.
2. Classify chromosomes on the basis of position of centromere.
3. Explain any two mechanisms of chromosomal basis of sex determination.
4. Explain the inheritance of colour blindness in man.
5. Explain sex determination in man/ Honey bee/ Birds/ Drosophila.

Unit: 2 (05 Marks)

1. Describe the terms euchromatin and heterochromatin.
2. Write a note on polytene chromosomes.
3. Write a note on Lampbrush chromosomes.
4. Write a note on salivary gland chromosome of Drosophila,
5. Write a note on Balbiani rings.
6. Explain endomitosis.
7. Write a note on Gyanandromorphs
8. Explain the role of environment on sex determination.
9. Explain the role of hormones in sex determination.
10. Explain hypertrichosis.
11. Differentiate between sex linked and sex influenced genes.

12. Differentiate between human X and Y chromosome.
13. Differentiate between autosomes and sex chromosomes.
14. Write a note on Lyons hypothesis.
15. What are Barr bodies? Give a scientific reason that Barr bodies are present only in women and not in men.
16. Give a scientific reason that Y chromosome is a sex determining chromosome in man.
17. Explain parthenogenesis.
18. Give scientific reason that the X linked genes affect males more than females in human beings.
19. What is centromere? Explain its role during cell division.

Unit: 3 (10 marks)

1. Describe Griffith transformation experiment.
2. Explain Avery, Macleod, McCarty's experiment
3. Give an account of Hershey Chase experiment of bacteriophage infection.
4. Write a note on types of DNA.
5. Explain RNA as a genetic material.
6. Describe the process of DNA replication
7. Write in detail the process of transcription
8. Discuss the process of translation
9. What is gene expression? Describe the regulation of genes with Lac operon.

Unit 3: (5 Marks)

Write short notes on –

1. Chemical composition of nucleic acid
2. A and B DNA
3. Plasmid
4. Function of mRNA
5. Function of tRNA
6. Genetic code
7. One gene one enzyme hypothesis
8. Concept of operon
9. Z DNA
10. H DNA
11. Chromosomal DNA in prokaryotes
12. Mitochondrial DNA
13. DNA in chloroplast

MODEL QUESTION BANK SEMESTER III

USZO302 (COURSE VI)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (05 Marks)

1. Write a note on nutrition apparatus in amoeba.
2. Describe briefly gastro-vascular cavity in hydra.
3. Explain briefly digestive system of earthworm.
4. Explain briefly digestive system of cockroach.
5. Explain briefly digestive system in bivalve.
6. Write a note on Wheel organ of Amphioxus.
7. Explain briefly digestive system of pigeon.
8. Write a note on ruminant stomach.
9. Explain briefly physiology of digestion in cockroach.
10. Write short note on digestion of proteins with respect to man.
11. Write short note on digestion of carbohydrates with respect to man
12. Write short note on digestion lipids with respect to man
13. Give a brief account of enzymes involved in the process of digestion in cockroach
14. Write short note contractile vacuoles as excretory and osmoregulatory structures in protozoa.
15. Write a note on flame cells.
16. Describe the structure of septal nephridia with the help of a neat labeled diagram.
17. Write a note on nephridia as excretory organs in earthworm.
18. Describe briefly excretory and osmoregulatory structures in arthropods.
19. Write a note on Organ of Bojanus
20. Write a note on structure of kidney in fish.
21. Write a note on structure of amphibian kidney.
22. Write a note on structure of kidney in bird.
23. Write a note on structure of mammalian kidney.
24. Write a note on Ammonotelic organisms.
25. Write a note on Ureotelic organisms.
26. Write a note on Uricotelic organisms.
27. Write a note on ultrafiltration
28. Give a brief account of process of urine formation in man.

Unit 2: (10 Marks)

1. Describe briefly air sacs in pigeon.
2. Describe briefly the process of internal respiration with respect to man
3. Describe briefly the process of external respiration with respect to man
4. Give a brief account of types of circulating fluids present in animals.
5. Describe briefly mechanism of working of heart.
6. Describe briefly two chambered heart in shark.
7. Describe briefly structure of heart of frog.
8. Describe briefly heart of crocodile.
9. Give a brief account of heart of man.

Unit 2: (5 Mark)

1. Write short note on cutaneous respiration.
2. Write a note on Spiracle in cockroach.
3. Write a note on book lungs in spider.
4. Explain the structure of gills of bony fish
5. Explain the structure of gills of cartilaginous fish.
6. Describe briefly lungs as respiratory organs in frog.
7. Describe briefly lungs as respiratory organs in man.
8. Explain briefly accessory respiratory structure in *Anabas*.
9. Write short note on open circulation.
10. Write short note on closed circulation.
11. Write a note on heart of cockroach
12. Write a note on heart of earthworm.

Unit 3:(10 Marks)

1. Describe different types of neurons on the basis of structure and function.
2. Explain conduction of nerve impulse.
3. Briefly describe synaptic transmission.
4. Describe briefly hormones as chemical messenger.
5. Explain briefly feedback mechanism of hormone regulation.
6. Explain sol-gel theory of amoeboid movement.
7. Describe ciliary movement in *Paramecium*.
8. Give an account on types of wings in insects.
9. Explain types of fins in Pisces.
10. Describe sliding filament theory.
11. Describe briefly asexual reproduction in animals.
12. Describe the structure and function of tube feet.
13. Describe spermatogenesis.

14. Describe oogenesis.
15. Describe briefly the structure of mammalian gametes.
16. Give an account on types of fertilization.

Unit 3: (5 Marks)

1. Write a note on irritability in *Paramecium*
2. Write a note on resting potential of nerve membrane.
3. Write a note on action potential of nerve membrane.
4. Describe different types of neurons on the basis of structure.
5. Describe briefly different types of neurons on the basis of functions.
6. Describe the structure of synapse.
7. Write a note on striated muscle fibre.
8. Describe the structure of cilia.
9. Give an account on types of legs in insects.
10. Write a note on ovo-viviparity.
11. Write a note on viviparity.
12. Write a note on oviparity.
13. Describe the structure of mammalian egg.
14. Describe the structure of mammalian sperm.
15. Describe the formation of gemmule in sponges.
16. Write a note on budding as asexual reproduction in mammals

MODEL QUESTION BANK SEMESTER III

USZO303 (COURSE VII)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (5 Marks)

1. How do honey bees communicate for foraging?
2. What is classical conditioning? Explain with an example.
3. What is imprinting? Explain different types of imprinting.
4. What do you mean by learning? Describe any two types of learning.
5. Describe the various ways in which ants communicate.
6. What is the significance of mimicry and warning coloration?
7. What is mimicry? Explain different types of mimicry with examples.
8. What is displacement activity? In what situations do displacement activities occur? Explain with examples.
9. Write notes on:

i. Migration in Fish
ii. Territorial behavior
iii. Schooling behavior in fish
iv. Altruism and kinship

10. Which are the different types of social groups seen in non human primates?
11. Comment on any two aspects of non human primate social behavior.

Unit 2: (10 Marks)

1. Give an account of the life history and pathogencity of the parasite causing amoebic dysentery.
2. Describe in detail part of life cycle of *P.vivax* in mosquito.
3. Give an account of asexual cycle of *P.vivax* in man.
4. Describe the life history of *Taenia solium*.
5. Give an account of parasitic adaptive features of *Taenia solium*.
6. Give an account of the life history of *Fasciola hepatica.*
7. Give an account of the life history of filarial worm and discuss its pathogenic effects.
8. Describe the life history of bedbug and suggest some control measures.
9. Give an account of the life history of *Sarcoptes scabiei.*
10. Give an account of the life history of head louse *Pediculus.*
11. What is bird flu? How is it spread and what are its symptoms?
12. How would you control the transmission of anthrax among humans?
13. How is anthrax transmitted to man?

Unit 2: (5 Marks)

1. Describe the structure of *E. histolytica.*
2. Where is *E. histolytica* found and what disease does it cause?
3. Write a short note on pathogenecity of *E. histolytica*.
4. Briefly describe the life cycle of *E. histolytica*.
5. What are the symptoms of malaria? Write its control measures.
6. Give an account of symptoms and pathogenecity of *Plasmodium vivax.*
7. Illustrate the complete life history of *T. solium* with the help of diagram only.
8. What is the effect of *Fasciola* on the hosts?
9. What are the primary and secondary hosts of *Wuchereria bancrofti*? Which stage of *Wuchereria* is infective for man?
10. What is host specificity?
11. What are the signs and symptoms of bird flu?
12. How is rabies transmitted?
13. What are the preventive measures to be taken to prevent infection of rabies virus?
14. What is toxoplasmosis and what are its causes?
15. Write notes on:
    i. Parasitic adaptations in endoparasites

ii. Cysticercus or bladder worm.
iii. Pathogenecity of *Wuchereria*
iv. Control measures of bedbug.
v. Types of hosts

Unit 3: (10 Marks)

1. What does the modern method of apiculture include? Explain in brief.
2. How is an artificial bee hive constructed?
3. How do you select the flora and bee species for apiculture?
4. What are the benefits of vermiculture?
5. Describe any two methods of vermiculture.
6. How is raw milk processed?
7. What are the common adulterants of milk in India?

Unit 3: (5 Marks)

1. State the economic importance of honey and beeswax.
2. What are the disadvantages of the indigenous method of apiculture?
3. How does the wax moth cause damage to the honey comb?
4. Name any two bee enemies and explain how they harm the bees.
5. Give an account of the commonly found species of honey bee in India.
6. What are the advantages of the modern method of apiculture?
7. Which type of flora is beneficial for apiculture?
8. Which type of bee is suitable for apiculture?
9. What is the chemical composition of honey?
10. What is the suitable material for culturing earthworms?
11. What are the advantages of processing dairy products?
12. What is skimmed milk and toned milk? How are they prepared?
13. How is recombined milk prepared?

PRACTICAL
USZOP3 (Course V)
Skeleton-Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 15 marks

Q1. Extraction and detection of DNA
OR
Q1. Extraction and detection of RNA

Minor Question 07 marks

Q2. Mounting of Barr bodies
OR
Q2. Study of mitosis-Temporary squash preparation of Onion root tip
OR
Q2. Detection of blood groups and Rh factor

Q3. Problems on Genetics and Molecular biology (Transcription /Genetic code) 10 marks
(01 problem each)

Q4. Identification 08 marks
a. Chromosome morphology
b. Pedigree analysis

Q5. Viva and Journal 10 marks

PRACTICAL
USZOP3 (Course VI)
Skeleton-Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 15 marks

Q1. Urine analysis—Normal and abnormal constituents

Minor Question 10 marks

Q2. Detection of ammonia in water excreted by fish
OR
Q2. Detection of uric acid from excreta of Birds

Q3. Identification 15 marks
- c. Nutritional apparatus
- d. Respiratory structures
- e. Locomotory organs
- f. Study of hearts
- g. Permanent slides on reproduction

Q4. Viva 05 marks

Q5. Journal 05 marks

PRACTICAL
USZOP3 (Course VII)
Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 12 marks

Q1. Extraction of Casein from Milk and its qualitative estimation

OR

Q1. Preparation of paneer from the given milk sample.

OR

Q1. Measurement of density of milk using different samples by lactometer

Minor Question 08 marks

Q2. Life Cycle of Honey Bee and Bee Hive

OR

Q2. Mouthparts of Honey Bee

OR

Q2. Legs of Honey Bee

OR

Q2. Sting Apparatus of Honey Bee

Q3. Identifiy and describe as per instructions 15 marks

a. Ethology
b. Protozoan parasites
c. Helminth parasites
d. Ectoparasites
e. Parasitic adaptations

Q4. Project submission and Viva based on project 10 marks

Q5. Journal 05 marks

	SEMESTER IV		
	USZO401 COURSE-8		
	Origin and evolution of Life, Population genetics and evolution, Scientific Attitude methodology , writing and ethics		
	Unit 1 : Origin and evolution of Life	**15L**	**30hrs**
	Objective : ➢ *To impart scientific knowledge to the learner about how life originated and evolved on our planet.*		
	Desired Outcomes : ➢ *Learner will gain insight about origin of life.* ➢ *Learner will know about the different theories of evolution.*		
1.1	**Introduction.** ➢ Origin of universe ➢ Chemical evolution - Miller-Urey experiment, Haldane and Oparin theory ➢ Origin of life ➢ Origin of eukaryotic cell.	**5L**	**10hrs**
1.2	**Evidences in favour of organic evolution** ➢ Evidences from: Geographical distribution, Paleontology Anatomy, Embryology, Physiology and Genetics.	**4L**	**8hrs**
1.3	**Theories of organic evolution** ➢ Theory of Lamarck. ➢ Theory of Darwin and Neo Darwinism ➢ Mutation Theory ➢ Modern Synthetic theory ➢ Weismans germplasm theory ➢ Neutral theory of molecular evolution	**6L**	**12hrs**
	Unit 2: Population genetics and evolution	**15L**	**28hrs**
	Objective: ➢ *To develop learner's knowledge and understanding of genetic variability within a population and how the change in the gene pool leads to evolution of species.*		
	Desired Outcomes: ➢ *Learner would understand the forces that cause evolutionary changes in natural populations.* ➢ *Learner would comprehend the mechanisms of speciation*		

	➢ *Learner will be able to distinguish between microevolution, macroevolution and megaevolution*		
2.1	**Introduction to population genetics**	**1L**	**3hrs**
	➢ Definition		
2.1.1	**Brief explanation of the following terms:** ➢ Population, gene pool, Allele frequency, genotype frequency, phenotype frequency, microevolution		
2.2	**Population genetics**	**6L**	**10hrs**
2.2.1	➢ Hardy-Weinberg Law		
2.2.2	➢ Factors that disrupt Hardy Weinberg equilibrium- ➢ Mutation, ➢ Migration (Gene flow), ➢ Non-random mating (Inbreeding, inbreeding depression, Assortative mating-Positive and Negative, Disassortative mating), ➢ Genetic drift (Sampling error, fixation, Bottleneck effect and Founder effect) ➢ Natural Selection.		
2.2.3	**Patterns of Natural Selection** ➢ Stabilizing selection, ➢ Directional Selection (Examples: Peppered moth, Antibiotic resistance in bacteria, Pesticide resistance) ➢ Disruptive selection		
2.3	**Evolutionary genetics** ➢ **Genetic variation:** Genetic basis of variation-Mutations and Recombination (crossing over during meiosis, independent assortment of chromosomes during meiosis and random union of gametes during fertilization). ➢ Nature of genetic variations- Genetic polymorphism, Balanced polymorphism, Mechanisms that preserve balanced polymorphism-Heterozygote advantage and frequency dependent selection, ➢ Neutral variations. ➢ Geographic variation (Cline).	**8L**	**15hrs**
2.3.1	➢ **Species Concept:** Biological species concept and evolutionary species concept		

2.3.2	**Speciation and Isolating mechanisms**: ➢ Definition and Modes of speciation (Allopatric, Sympatric , Parapatric and Peripatric) ➢ Geographical isolation ➢ Reproductive isolation and its isolating mechanisms (Prezygotic and Postzygotic)		
2.3.3	**Macroevolution and Megaevolution :** ➢ Concept and Patterns of macroevolution (Stasis, Preadaptation /Exaptation, Mass extinctions, Adaptive radiation and Coevolution), ➢ Megaevolution		
	Unit 3: Scientific Attitude methodology , writing and ethics	**15L**	**32hrs**
	***Objective*:** ➢ *To inculcate scientific temperament in the learner.*		
	Desired outcome: ➢ *The learner will develop qualities such as critical thinking and analysis.* ➢ *The learner will develop the skills of scientific communication.* ➢ *Learner will understand the ethical aspects of research*		
3.1	**Process of science: A dynamic approach to investigation**	**4L**	**10hrs**
	The Scientific method ➢ Deductive reasoning and inductive reasoning, Critical thinking, Role of chance in scientific discovery		
	Scientific Research ➢ Definition, difference between method and methodology characteristics, types		
	Steps in the Scientific Method ➢ Identification of research problem, Formulation of research hypothesis, Testing the hypothesis using experiments or surveys, Preparing research/study design including methodology and execution (Appropriate controls, sample size, technically sound, free from bias, repeat experiments for consistency), Documentation of data, Data analysis and interpretation, Results and Conclusions		
	Dissemination of data ➢ Reporting results to scientific community (Publication in peer-reviewed journals, thesis, dissertation, reports, oral presentation, poster presentation)		
	Application of knowledge ➢ Basic research, Applied research, Translational research,		

	Patent		
3.2	**Scientific writing**	**4L**	**10hrs**
	Structure and components of a research paper ➢ (Preparation of manuscript for publication of research paper)- Title, Authors and their affiliations, Abstract, Keywords and Abbreviations, Introduction, Material and Methods, Results, Discussion, Conclusions, Acknowledgement, Bibliography; Figures, Tables and their legends		
3.3	**Writing a review paper**	**3L**	**5hrs**
	Structure and components of research report: ➢ Report writing, Types of report		
	Computer application ➢ Plotting of graphs, Statistical analysis of data. Internet and its application in research-Literature survey, Online submission of manuscript for publication		
3.4	**Ethics**	**3L**	**5hrs**
	Ethics in animal research ➢ The ethical and sensitive care and use of animals in research, teaching and testing, Approval from Institutional animal ethics Committee.		
	Ethics in clinical research ➢ Approval from Clinical Research Ethics Committee ➢ Informed consent		
	Approval from concerned/ appropriate authorities : ➢ National Biodiversity Authority ➢ State Biodiversity Board ➢ Forest Department		
	Conflict of interest		
3.5	**Plagiarism**	**1L**	**2hrs**
	USZO402 COURSE-9		
	Cell Biology, Endo membrane System and Biomolecules		
	Unit 1 : Cell Biology	**15L**	**26hrs**
	***Objective* :** ➢ *To study the structural and functional organization of cell with an emphasis on nucleus, plasma membrane and cytoskeleton.*		
	***Desired outcome* :** ➢ *Learner would acquire insight of transport mechanisms*		

	for maintenance and composition of cell		
1.1	**Introduction to cell biology** ➢ Definition and scope ➢ Cell theory ➢ Generalized prokaryotic , eukaryotic cell: size, shape and structure	**2L**	**4hrs**
1.2	**Nucleus** ➢ Size, shape, number and position ➢ Structure and functions of interphase nucleus ➢ Ultrastructure of nuclear membrane and pore complex ➢ Nucleolus: general organization, chemical composition and functions ➢ Nuclear sap/ nuclear matrix ➢ Nucleocytoplasmic interactions	**5L**	**6hrs**
1.3	**Plasma membrane** a. Fluid Mosaic Model b. Junctional complexes c. Membrane receptors d. Modifications: Microvilli, Desmosomes and Plasmodesmata.	**4L**	**8hrs**
1.4	**Transport across membrane** **a.** Diffusion and Osmosis **b.** Transport: Passive and Active **c.** Endocytosis and Exocytosis	**2L**	**4hrs**
1.5	**Cytoskeletal structures** ➢ Microtubules: Composition and functions ➢ Microfilaments: Composition and functions	**2L**	**4hrs**
	Unit 2 Endomembrane System	**15L**	**25hrs**
	Objective **:** ➢ *To acquaint the learner with Ultrastructure of cell organelles and their functions.*		
	Desired outcome: ➢ *Learner would appreciate the intricacy of endomembrane system.* ➢ *Learner would understand the interlinking of endomembrane system for functioning of cell.*		
2.1	**Endoplasmic reticulum** ➢ Discovery, occurrence and Types ➢ Ultrastructure and Functions	**3L**	**5hrs**

2.2	**Golgi complex** ➢ Origin, occurrence and morphology ➢ Ultra structure and functions	**3L**	**4hrs**
2.3	**Lysosomes** ➢ Origin, occurrence and polymorphism ➢ Ultrastructure and Functions	**3L**	**4hr**
2.4	**Mitochondria** ➢ Origin, occurrence and morphology ➢ Ultrastructure and functions ➢ Marker enzymes, Mitochondrial biogenesis, Semiautonomous nature of mitochondria	**6L**	**12hrs**
	Unit 3: Biomolecules	**15L**	**30hrs**
	***Objective* :** ➢ *To give learner insight into the structure of biomolecules, and their role in sustenance of life.*		
	Desired outcome: ➢ *The learner will realize the importance of biomolecules and their clinical significance.*		
3.1	**Biomolecules** ➢ Concept of Micromolecules and Macromolecules**.**	2L	5hrs
3.2	**Carbohydrates** ➢ Definition Classification, Properties and Isomerism, Glycosidic bond ➢ Structure of a. Monosaccharides- Glucose and Fructose b. Disaccharides - Lactose and Sucrose c. Polysaccharides - Cellulose, Starch, Glycogen and Chitin ➢ Biological role and their Clinical significance	4L	8hrs
3.3	**Amino Acids and Proteins** ➢ Basic structure of amino acid, classification of amino acids , Essential and Non-essential amino acids, Peptide bond ➢ Protein conformation : Primary, Secondary, Tertiary, Quaternary ➢ Types of proteins – Structural (Keratin, Collagen) and functional proteins (Hemoglobin) ➢ Biological role and their Clinical significance	5L	8hrs

3.4	**Lipids** ➢ Definition, classification of lipids with examples, Ester linkage ➢ Physical and Chemical properties of lipids ➢ Saturated and Unsaturated fatty acids , Essential fatty acids ➢ Triacylglycerols, Phospholipids (Lecithin and Cephalin) and Steroids (Cholesterol). ➢ Biological role and their Clinical significance	4L	5hrs
3.5	**Vitamins** ➢ Water soluble vitamins(e.g. Vit C, Vit B12) ➢ Lipid soluble vitamins (e.g. Vit A, Vit D) ➢ Biological role and their Clinical significance	2L	4hrs
	USZO403 COURSE-10		
	Comparative Embryology, Aspects of Human Reproduction, Pollution and its effect on organisms		
	UNIT 1: Comparative Embryology	**15L**	**25hrs**
	Objective: ➢ *To acquaint the learner with key concepts of embryology.*		
	Desired Outcomes: ➢ *Learner will be able to understand and compare the different pre- embryonic stages* ➢ *Learner will be able to appreciate the functional aspects of extra embryonic membranes and classify the different types of placentae.*		
1.1	➢ Types of Eggs- Based on amount and distribution of yolk	2L	4hrs
1.2	➢ Structure and Types of Sperms	1L	1hr
1.3	➢ Types of Cleavages.- Holoblastic and Meroblastic	1L	3hrs
1.4	➢ Types of Blastulae	1L	3hrs
1.5	➢ Gastrulation	2L	4hrs
1.6	➢ Coelom -Formation and types	2L	3hrs
1.7	➢ Extra embryonic membranes ➢ Types of Placentae -Based on histology, morphology and implantation	6L	10hrs
	UNIT 2: Aspects of Human Reproduction	**15L**	**30 hrs**
	Objectives: ➢ *To acquaint the learners with different aspects of human reproduction.* ➢ *To make them aware of the causes of infertility, techniques to overcome infertility and the concept of birth control*		
	Desired Outcome:		

	➢ *Learners will able to understand human reproductive physiology* ➢ *Learners will become familiar with advances in ART and related ethical issues.*		
2.1	**Human Reproductive system and Hormonal regulation** ➢ Anatomy of human male and female reproductive system ➢ Hormonal regulation of Reproduction and Impact of age on reproduction-Menopause and Andropause	2L	4hrs
2.2	**Contraception & birth control** ➢ Difference between contraception and birth control ➢ Natural Methods: Abstinence , Rhythm method, Temperature method, cervical mucus or Billings method, Coitus interruptus, Lactation amenorrhea ➢ Artificial methods **:** Barrier methods, Hormonal methods, Intrauterine contraceptives, Sterilization, Termination , Abortion	2L	4hrs
2.3	**Infertility** **Female infertility** ➢ **Causes -** Failure to ovulate; production of infertile eggs ; damage to oviducts (oviduct scarring and PID or Pelvic inflammatory disease, TB of oviduct), Uterus (T. B. of uterus and cervix) ➢ **Infertility associated disorders (**Endometriosis, Polycystic Ovarian syndrome (PCOS), POF (Primary ovarian failure) STDs (Gonorrhea, Chlamydia, Syphilis and Genital Herpes); Antibodies to sperm; Genetic causes-Recurrent abortions; Role of endocrine disruptors	4L	8hrs
	Male infertility **Causes :** Testicular failure, infections of epididymis, seminal vesicles or prostate, hypogonadism, cryptorchidism , congenital abnormalities ,Varicocele , Blockage, Azoospermia, Oligospermia, abnormal sperms, autoimmunity, ejaculatory disorders and Idiopathic infertility.		
2.5	**Treatment of Infertility** ➢ Removal /reduction of causative environmental factors ➢ Surgical treatment ➢ Hormonal treatment- Fertility drugs ➢ Assisted Reproductive Technology ➢ Sperm banks, cryopreservation of gametes and embryos ➢ Surrogacy	4L	8hrs

2.6	**Techniques and Ethical considerations of ART** ➢ In vitro fertilization, Embryo transfer (ET), Intra-fallopian transfer (IFT), Intrauterine transfer (IUT), Gamete intra-fallopian transfer (GIFT), intra-zygote transfer (ZIFT), Intracytoplasmic sperm injection (ICSI) with ejaculated sperm and sperm retrieved from testicular biopsies – Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST).	3L	6hrs
	UNIT3: Pollution and its effect on organisms	**15L**	**27hrs**
	***Objective*:** ➢ *To provide a panoramic view of impact of human activities leading to pollution and its implications.*		
	Desired Outcome : ➢ *The learners will be sensitized about the adverse effects of pollution and measures to control it.*		
3.1	**Air Pollution** ➢ Types and sources of air pollutants ➢ Effects and control measures	3L	6hrs
3.2	**Water Pollution** ➢ Types and sources of water pollutants ➢ Effects and control measures	3L	6hrs
3.3	**Soil Pollution** ➢ Types and sources of soil pollutants ➢ Effects and control measures	3L	4hrs
3.4	**Noise pollution** ➢ Different means of noise pollution ➢ Effects and control measures	1L	3hrs
3.5	**Radioactive pollution**	1L	2hrs
3.6	**Solid waste Pollution** ➢ Types and sources, ➢ Effects and control	2L	4hrs
3.7	**Pollution – Climate change and Global warming**	2L	2hrs

	SEMESTER IV
	Practical USZOP4 (Course VIII)
1	Study of population density by Line transect method & Quadrant method and calculate different diversity indices. a. Index of Dominance. b. Index of frequency. c. Rarity Index. d. Shannon Index. e. Index of species diversity
2	Study of Prokaryotic cells (bacteria) by Crystal violet staining technique.
3	Study of Eukaryotic cells (WBCs) from blood smear by Leishman's stain.
4	Identification and study of fossils a. Arthropods : Trilobite b. Mollusca: Ammonite c. Aves : Archaeopteryx
5	Identification of a) Allopatric speciation (Cyprinodon species) b) Sympatric speciation.(hawthorn fly and apple maggot fly) c) Parapatric speciation. (Snail)
6	Bibliography/ Abstract writing.
7	Preparation of Power point presentation
	Practical USZOP4 (Course IX)
1	Study of permeability of cell through plasma membrane (Osmosis in blood cells).
2	Measurement of cell diameter by occulometer (by using permanent slide)
3	Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test)
4	Qualitative tests for protein (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)
5	Qualitative test for lipids (solubility test, Sudan III test)
6	Study of rancidity of lipid by titrimetric method.
7	Ultra structure of cell organelles – (Electron micrographs) a. Nucleus

	b. Endoplasmic reticulum (Smooth and rough) c. Mitochondria. d. Golgi apparatus e. Lysosomes
8	Study of clinical disorders due to carbohydrates, proteins and lipids imbalance.(photograph to be provided / significance to given and disorder to be identified) a. Hyperglycemia , Hypoglycemia. b. Thalessemia, Kwashiorkar c. Obesity, Atherosclerosis
	Practical USZOP4 (Course X)
1	Estimation of Dissolved oxygen from the given water sample .
2	Estimation of Salinity by refractometer from the given water sample.
3	Estimation of conductivity by conductometer from the given water sample .
4	Determination of blood pressure by spyghmomanometer.
5	Detection of Creatinine in urine.
6	Determination of blood sugar by GOD and POD method
7	Study of bleeding time and clotting time.
8	Study of the following permanent slides, museum specimens and materials. a. Mammalian sperm and ovum. b. Egg types –Fish eggs, Frog eggs , Hen's egg. c. Cleavage , blastula and gastrula (Amphioxus, Frog and Bird).
9	Study of commercially important fishery (Catla, Rohu, Catfish, Mackerel, Pomfret, Bombay duck, Prawn/ Shrimp, Crab, Lobster, Edible oyster)
10	Review writing based on programmes telecast by Doordarshan, Discovery channel, Gyandarshan, UGC programmes, Animal planet
11	Study of natural ecosystem and field report of the visit

Note -The practicals may be conducted by using specimens authorised by the wildlife and such other regulating authorities though it is strongly recommended that the same should be taught by using photographs/audio-visual aids/ simulations / models, etc. as recommended by the UGC and as envisaged in the regulations of the relevant monitoring bodies. No new specimens, however, shall be procured for the purpose of conducting practicals mentioned here-in-above.
#There shall be at least one excursion/field trip

Semester IV

REFERENCE AND ADDITIONAL READING

COURSE-VIII (USZO401)

1. Theory of Evolution- Smith, Cambridge Press, and Low price Ed.
2. Evolution - Strickberger, CBS publication
3. Evolution- P.S.Verma and Agarwal
4. Introduction to Evolution by Moody
5. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
6. Biology -The Unity and Diversity of Life**.** C. Starr, R. Taggart, C. Evers, L. Starr, Brooks/Cole Cengage learning International Edition
7. Research Methodology, Methods and Techniques- by C.R. Kothari, Wiley Eastern Ltd. Mumbai
8. Practical research planning and design 2nd edition- Paul D Leedy, Macmilan Publication

COURSE-IX (USZO402)

1. Cell Biology by Singh and Tomoar Rastogi Publication..
2. Cell and molecular Biology E.D.P De Robertis and E.M.R Robertis ,CBS Publishers and Distributors
3. The cell A molecular Approach Goeffrey M.Coper ASM Press Washington D.C.
4. A textbook of cytology Suruchi Tyagi Dominant Publishers and Distributors New Delhi.
5. Cell and molecular biology Gupta P.K , Rastogi Publication, India.
6. Cell Biology Pawar C.B. Himalaya publication
7. Molecular Biology of the cell (6th ed) by the Insertus
8. Campbell Biology (9th Ed.)
9. Principles of Biochemistry, 2005, 2nd and 3rd edn. Lehninger A.L. Nelson D.L. and Cox M.M ,
10. Biochemistry, Dushyant Kumar Shrma, 2010, Narosa Publishing house PVT.Ltd.
11. Fundamentals of Biochemistry, Dr AC Deb, 1983, New Central Book Agency Ltd.
12. A Textbook of Biochemistry, 9th edition , Dr. Rama Rao A.V.S.S and Dr A Suryalakshmi.
13. Biochemistry-G Zubay , Addison Wesley, 1983
14. Biochemistry, L Stryer, 3rd/4th/5th ed, 1989 , Freeman and Co. NY
15. Harper's Biochemistry,1996, 26th edition, Murray R.K. Granner D.K. Mayes P.A. Rodwell V.M. Hall international USA
16. Outline of Biochemistry, 1976, E.E. Conn and P.K. Stumpf. John Wiley and Sons USA

COURSE-X (USZO403)

1. Developmental Biology- 5th Edition, Scot F. Gilbert, Sinauer Associates Inc.
2. Developmental Biology- Subramoniam T., Narosa Publishers.
3. Developmental Biology- Berril N.J., Tata Mc Graw –Hill Publication.
4. Essential Reproduction-Martin H. Johnson, Wiley-Blackwell Publication.
5. Chick Embryology- Bradley M. Pattern.
6. Embryology- Mohan P. Arora.
7. Chordate Embryology- Dalela,Verma and Tyagi
8. Human Anatomy and Physiology. E. L. Marieb, Pearson Education Low Price Edition
9. Biological Science. Taylor, Green and Stout. Cambridge Publication
10. Biology. E. P. Solomon, L. R. Berg, D. W. Martin, Thompson Brooks/Cole
11. Human Biology-Daniel D Chiras Jones and Bartlett
12. The Physiology of Reproduction Vol I & II - E.K .Nobil and JU. D.Neil, Raven Press, New York.
12. Air Pollution, Kudesia V.P. Pragati Prakasan, Meerut
13. Fundamentals of Air Pollution Daniel A. Vallero,Academic press 5th Edition
14. Principles and Practices of Air Pollution Control and Analysis J.R. Mudakani I K International Pub. House Pvt. Ltd.
15. Text Book of Air Pollution and its Control, S.C.Bhatia Atlantic
16. Water Pollution, Kudesia V.P., Pragati Prakasan, Meerut
17. A text book of Environmental Chemistry and Pollution Control, S.S.Dogra, Swastic Pub, New Delhi
18. Practical Methods for water and Air Pollution Monitoring,S.K.Bhargava,New Age International
19. Hand Book of Water and waste water Analysis, Kanwaljit Kaur, Atlantic
20. Aquatic Pollution by Edward A. Laws
21. Environmental Science and Technology, Stanely E.Manahan
22. Environmental Chemistry, A.K. De, New Age International
23. A Text Book of Environmental Studies, Gurdeep R.Chatwal, Harish Sharma, Madhu Arora, Himalaya

SCHEME OF EXAMINATION (THEORY)

(a) Internal assessment of twenty five (25) marks per course per semester should be conducted according to the guidelines given by University of Mumbai vide circular number UG/04 of 2014 Dated 5th June 2014 to be implemented from academic year 2015-16.
(b) External assessment of seventy five (75) marks per course per semester should be conducted as per the following skeleton question paper pattern.
(c) One practical examination of fifty (50) marks per course each should be conducted at the end of every semester.

SKELETON- EXAMINATION PATTERN FOR THE ABOVE SYLLABUS

All Questions are compulsory
Figures to the right indicate full marks

Time: 2.5 hours **Total marks: 75**

Q.1.	UNIT 1 Answer any four out of eight (5 marks each)	20 marks
Q.2.	UNIT 2 a. Answer any one of the two (10 marks) b. Answer any two out of the four (5 marks each)	20 marks
Q.3.	UNIT 3 Answer any two out of four (10 marks each)	20 marks
Q.4.	a. Unit 1 - (One note of five marks OR objective type questions) b. Unit 2 - (One note of five marks OR objective type questions) c. Unit 3- (One note of five marks OR objective type questions)	15 marks

*For Question 4 it is recommended to have objective questions such as –

(a) Match the column (b) MCQ
(c) Give one word for (d) True and False
(e) Define the term (f) Answer in one sentence etc

MODEL QUESTION BANK SEMESTER IV

USZO401(COURSE VIII)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 Marks)

1. Write explanatory notes on;
    1. Lamarckism. 2. Darwinism and Neo Darwinism.
    3. Mutation Theory 4. Modern Synthetic theory.5.Weismans germplasm theory
2. Neutral theory of molecular evolution. (Some of them can be asked as short notes as well)
3. Discuss evidences in favor of organic evolution by giving examples of geographical distribution.
4. Discuss evidences in favor of organic evolution by giving examples of genetics, and molecular biology.
5. Discuss evidences in favor of organic evolution by giving examples of physiology and biochemistry.
6. Discuss brief account of Origin of eukaryotic cell.

Unit 1: (5 Marks)

1. Describe chemical evolution with Miller-Urey experiment.
2. Describe chemical evolution with Haldane and Oparin theory.
3. Write short notes on: 1. Mutation Theory 2. Modern Synthetic theory

Unit 2: (10 Marks)

2. Define the term 'population genetics'. Describe in brief the various evolutionary forces that tend to disturb genetic equilibrium and introduce changes in the gene pool of a population.
3. State Hardy Weinberg's law of equilibrium and discuss its salient features.
4. Give an account of the different factors involved in speciation.
5. Describe the different types of speciation.
6. Explain the role of geographic isolation in the development of new species.
7. Explain the role of reproductive isolation in the development of new species.
8. Discuss the pre-zygotic barriers responsible for reproductive isolation.
9. Discuss the post-zygotic barriers which lead to reproductive isolation.
10. Describe the sources of genetic variation in natural populations.
11. Explain the nature and extent of genetic variation within populations.
12. Describe the mechanisms that preserve balanced polymorphisms.

13. Describe the salient features of microevoluion.
14. Compare and contrast microevolution and macroevolution.
15. Explain the salient features of macroevolution.
16. Give an account of the different patterns of macroevolution.
17. Elaborate on the role of adaptive radiation and extinction in macroevolution.
18. What do you understand by the term natural selection? Describe the different types of natural selection with suitable examples.
19. What is megaevolution? Explain the mechanism of megaevolution using a suitable example.

Unit 2: (5 Marks)

1. Explain the term 'gene pool'. How does evolution operate via the gene pools of populations?
2. Differentiate between:
    i. Allopatric and Sympatric speciation
    ii. Biological and evolutionary species
    iii. Microevolution and macroevolution
    iv. Stabilizing selection and disruptive selection
    v. Convergent and divergent evolution
3. Explain stabilizing selection with the help of a suitable example.
4. How does the example of sickle cell allele illustrate heterozygote advantage?
5. How does frequency-dependent selection affect genetic variation within a population over time?
6. Write short notes on:
    i. Role of mutations in evolution
    ii. Role of migration in evolution
    iii. Non-random mating
    iv. Role of natural selection in evolution
    v. Genetic drift
    vi. Bottleneck effect
    vii. Founder effect
    viii. Directional evolution in peppered moth
    ix. Evolution of Antibiotic resistance in bacteria
    x. Geographic variation
    xi. Genetic polymorphism
    xii. Parapatric speciation
    xiii. Adaptive radiation
7. What is the biological species concept? What are its limitations? How does it differ from the evolutionary species concept?
8. Explain the concept of co evolution using suitable examples

Unit 3: (10 Marks)

1. Describe briefly, the steps towards preparing a research design.
2. Describe literature survey, collection of data and its analysis.
3. What is a patent and how is it obtained?
4. Write an account on application of statistics in research.

Unit 3: (5 Marks)

1. Define research. State the difference between research method and research methodology.
2. Write a note on computer application in research.
3. Describe briefly identification of research problem and formulation of research hypothesis.
4. What is abstract writing?
5. What is plagiarism?
6. What is bibliography?
7. Write a short note on ethics in animal research.
8. Write a short note on ethics in clinical research.

MODEL QUESTION BANK SEMESTER IV

USZO402(COURSE IX)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit 1: (10 marks)

1. Explain prokaryotic cell
2. Explain Eukaryotic cell
3. Give an account of cell theory
4. Describe ultrastructure of nuclear membrane
5. State chemical composition and functions of nucleolus
6. Describe nucleocytoplasmic reactions
7. Explain r RNA processing
8. Describe fluid mosaic model of plasma membrane
9. Give an account of active and passive transport
10. Describe various modifications of plasma membrane
11. Explain pinacocytosis, phagocytosis and secretion
12. Give an account of cell permeability
13. Differentiate prokaryotic and eukaryotic cell

Unit 1: (5 Marks)

1. Virus
2. Nuclear matrix
3. Number ad position of nucleus
4. Molecular organization of chromatin
5. Unit membrane concept
6. Nucleolus
7. Membrane receptors
8. Sandwich model
9. Cell coat
10. Cell recognition

Unit 2: (10 Marks)

1. Describe Ultrastructure of Endoplasmic Reticulum
2. Describe types of Endoplasmic Reticulum and add a note on their functions
3. Give an account of Ultrastructure and functions of Golgi complex
4. Explain Ultrastructure and morphology of lysosomes
5. Comment on Semiautonomous nature of mitochondria
6. Describe ultrastructure and function of mitochondria
7. Explain protein import in mitochondria
8. Explain ultrastructure of microtubules
9. Describe chemical composition and functions of microfilaments
10. Give an account of biochemical composition and functions of microtubules.

Unit 2: (5 Marks)

1. Occurrence of Endoplasmic Reticulum
2. Significance of Endoplasmic Reticulum
3. Occurrence and morphology of golgi complex
4. Polymorphism in lysosomes
5. Significance of lysosomes
6. Occurrence and morphology of lysosomes
7. Marker enzymes in mitochondria
8. Significance of mitochondria
9. Location and significance of microfilaments
10. Significance of microtubules.

Unit 3 : (10 Marks)

1. Discuss the chemical behavior of carbon and a note on variety of functional groups of biomolecules.
2. Explain the concept of micromolecules and macromolecules.

3. Describe the structure of water. Add a note on physic-chemical properties of water.
4. Define carbohydrate. Add a note on its classification.
5. What are carbohydrates? Explain the classification of carbohydrate with suitable examples.
6. Define and explain the classification of carbohydrates.
7. Explain with suitable example monosaccharide and disssacharide.
8. Discuss the properties of carbohydrates.
9. What are disaccharides? Draw the structures of maltose and sucrose.
10. What are polysaccharides? How are they classified. Write the structures of glycogen and heparin/ chitin and heparin.
11. Discuss about chemical structure of the monosaccharides/ disaccharides
12. What are amino acids? Discuss classification of amino acids based on R group.
13. Give an account of primary and secondary structure of proteins.
14. Write an account on tertiary and quarternary structure of proteins.
15. Describe the structure of saturated and unsaturated fatty acids.
16. Define essential fatty acids. Add a note on it.
17. Define lipids. Write a note on mono, di and triglcrides/ phospholipids
18. What are fatty acids? Add a note on types of fatty acids.
19. Structure and functions of water soluble vitamins
20. Structure and functions of lipid soluble vitamins

Unit 3: (5mks)

1. Write a short note on - monomers and polymers.
2. Write note on properties of carbohydrates.
3. Give an account of polysaccharides.
4. With suitable example explain glycosidic bond.
5. Explain the linkage in lactose and sucrose.
6. Give the biological importance of carbohydrates.
7. What are essential and nonessential amino acids?
8. Give an account of properties of amino acids.
9. Define and explain peptide bond with suitable example.
10. Types of proteins with suitable examples
11. Biological roles of proteins.
12. Peptide bond
13. Types of fatty acids.
14. Biological role of lipids
15. Properties of fatty acid
16. Sterol and waxes
17. Describe properties of fatty acid/lipids

18. Discuss the clinical significance of protein / carbohydrate /lipids/
19. write short note on clinical significance of lipids
20. Write a note on - isomerism in carbohydrates and amino acids?
21. Structure and functions of vitamin A/ vitamin B/ vitamin C/ vitamin D

MODEL QUESTION BANK SEMESTER IV

USZO403(COURSE X)

Question bank is suggestive. The paper setters are free to modify the questions or include new questions to the best of their perception

Unit-1: (10 Marks)

1) Classify the different types of eggs..
2) Briefly explain types and structure of sperms (any two animals).
3) Define cleavage Explain types of cleavages.
4) Give brief account on various types of blastulae.
5) What is gastrulation ? Explain gastrulation in frog.
6) Give an account of process of coelom formation and its types.
7) Explain various types of placentae in mammals.
8) Give an account of extra embryonic membranes.
9) Describe briefly the types of eggs on the basis of amount and distribution of yolk.
10) Describe the early development of mammalian egg upto gastrulation.
11) Give a brief note on different types of sperms.
12) Write a note on blastula and explain its types.
13) Explain the comparative process of embryo formation**.**

Unit-1: (5-Marks)

1) Draw neat labeled diagram and explain any one of the following:
   (Microlecithal, ,Alecithal, Homolecithal, Heterolecithal, Isolecithal, Telolecithal, Centrolecithal, Discoidal).
2) Explain structure of sperms of frog/ reptiles/ birds/ mammals.
3) Short note on Holoblastic cleavage. Or Meroblastic cleavage.
4) Short note on equal or unequal cleavage.
5) Short note on Discoblastula or Coeloblastula.
6) Short note on centroblastula or amphiblastula or stereoblaastula,
7) Explain the process of coelom formation in process of gastrulation.
8) Short notes on : Amnion /Chorion/Allantois/Yolk sac.
9) Explain the function of Amnion /Chorion/Allantois/Yolk sac/.

10) Short note on Yolk sac placenta or Synsesmochorial placenta/Discoidal placenta/Cotyledonary placenta/Hemo-chorial placenta/Zonary placenta/Diffuse placenta
11) Short note on Deciduous or non-deciduous placenta
12) Write the functions of placenta.
13) What are the roles of Embryonic membranes and extra embryonic membranes

Unit 2: (10 Marks)

1. Describe male reproductive system and its hormonal regulation.
2. Describe female reproductive system and its hormonal regulation.
3. Define reproduction. Explain the hormonal regulation of reproduction.
4. What is contraception? Explain different methods of contraception.
5. How is contraception different from birth control?
6. Define infertility and explain the causes of female infertility.
7. What are the causes of male infertility?
8. Explain the hormonal treatment for infertility using drugs.
9. Describe the methods of treatment of infertility.
10. Give a brief account of infertility related disorders.
11. What are sperm banks? Add a note on cryopreservation of sperms.
12. What is testicular biopsy? Explain Testicular sperm extraction (TESE), Pronuclear stage transfer (PROST).
13. What are the steps involved in Embryo transfer (ET) and / Intra-fallopian transfer (IFT)?
14. What is ART technique? Add a note on IVF (steps, success and ethical considerations).

Unit 2: (5 Marks)

1. Write a note on impact of age on reproductive stage –
    a. Menopause
    b. Andropause
2. What is amenorrhea?
3. What are IUD's? How do they work as barriers for fertilization?
4. How does sterilization act as a method of contraception?
5. Write a note on birth control.
6. What is the difference between natural and artificial methods of contraception?
7. How is T.B. a cause of female infertility?
8. What are the genetic causes of infertility?
9. Write a note on STD's as infertility related disorders?
10. Explain briefly:
    a. Impotency
    b. Surrogacy

c. Endometriosis
d. Idiopathic infertility

11. What are the roles of endocrine disruptions in infertility?
12. Explain the role of the following in infertility:
    a. Gonorrhea
    b. Syphilis
    c. Genital Herpes
    d. Chlamydia
13. Write a note on treatment of infertility by removal of causative environmental factors.
14. Write a note on Ethical considerations of ART.

Unit 3: (10 Marks)

1. What are the causes, effects and control measures for air pollution?
2. What are the causes, effects and control measures for water pollution?
3. What are the causes, effects and control measures for soil pollution?
4. What are the causes, effects and control measures for noise pollution?
5. Define air pollution and give an account of hazardous air pollutants.
6. Explain the causes of nutrient pollution and its control measures.
7. What is ocean littering? Explain in details the causes and control measures for ocean littering?
8. Describe the alteration of metabolism of micro-organisms due to soil pollution.
9. Explain noise pollution along with its measurement and permissible limits.
10. Give a brief account of methods to control gaseous / particulate matters.
11. What is pollution? Add notes on:
    a. Effect of air pollution on vegetation.
    b. Effect of noise pollution on animals.
12. How can the people be made aware of pollution and its effects?

Unit 3: (5 Marks)

1. Explain the effects of air pollution on human beings.
2. What are different types of pollutants that cause air pollution?
3. Write short notes on:
    a. Ozone depletion
    b. Green house gases
    c. Global warming
    d. Acid rain
    e. Sonic boom
    f. Acoustic zoning
4. Explain the effect of thermal pollution on biodiversity.

5. Write a note on solar radiation.
6. Write a note on ionizing radiation
7. How are heavy metals responsible for nutrient pollution? Cite some examples of effects of heavy metal pollution on human health.
8. How is oil spills a cause of water pollution / ocean littering?
9. How do pesticides and fertilizers contaminate water?
10. How can oil be retracted back from sea / ocean?
11. What are the effects of soil pollution on food chain?
12. How are POP's and ordinary salts responsible for nutrient pollution?
13. What are the auditory / non – auditory effects of noise pollution.
14. Why is the necessity to save drinking water?

PRACTICAL
USZOP4 (Course VIII)
Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 12 marks

Q1. Study Population density by Line transect or Quadrant method and calculate biodiversity indices (any 2)

Minor Question 08 marks

Q2. Prepare a smear to show prokaryotic cell.

OR

Q2. Prepare a smear to show eukaryotic cell.

Q3. Identify and describe as per instructions 08 marks

a. Fossils
b. Speciation

Q4. From the given article prepare the bibliography/ abstract 06 marks

Q5. Power point presentation 06 marks

Q6. Viva and Journal 10 marks

PRACTICAL
USZOP4 (Course IX)
Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 15 marks

Q1. Study of permeability of cell through plasma membrane (Osmosis in blood cells).

OR

Q1. Measurement of cell diameter by occulometer (by using permanent slide)

Minor Question 10 marks

Q2. Qualitative tests for carbohydrates (Molisch's test, Benedicts test, Barfoed's test, Anthrone test)

OR

Q2. Qualitative tests for proteins (Ninhydrin test, Biuret test, Millon's test, Xanthoproteic test)

OR

Q2. Qualitative test for lipids (Solubility test, Sudan III test)

OR

Q2. Study of rancidity of lipids by titrimetric method

Q3. Identify and describe as per instructions 15 marks

1. Ultra structure of cell organelles (a, b & c)
2. Clinical disorders (d & e)

Q4. Viva 05 marks

Q5. Journal 05 marks

PRACTICAL

USZOP4 (Course X)

Skeleton -Practical Examination Question Paper Pattern

Time: 2 hrs **Marks: 50**

Major Question 12 marks

Q1. Estimation of Dissolved oxygen from the given water sample

OR

Q1. Detection of Creatinine in urine

OR

Q1. Determination of blood sugar by GOD and POD method

Minor Question 08 marks

Q2. Estimation of Salinity by refractometer from the given water sample

OR

Q2. Estimation of conductivity by conductometer from the given water sample

OR

Q2. Determination of blood pressure by using spyghmomanometer

OR

Q2. Study of bleeding time and clotting time

Q3. Identifiy and describe as per instructions 15 marks

1. Permanent slides (a &b)
2. Fishery (c ,d & e)

Q4. Field Report and viva based on it. 10 marks

Q5. Journal 05 marks

Academic Council 14/06/2018
Item No: 4.49

UNIVERSITY OF MUMBAI

Syllabus for T.Y.B.Sc.

Programme: B.Sc.

Subject: Information Technology

with effect from the academic year

2018 – 2019

Semester – 5			
Course Code	**Course Type**	**Course Title**	**Credits**
USIT501	Skill Enhancement Course	Software Project Management	2
USIT502	Skill Enhancement Course	Internet of Things	2
USIT503	Skill Enhancement Course	Advanced Web Programming	2
USIT504	Discipline Specific Elective (Any One)	Artificial Intelligence	2
USIT505		Linux System Administration	
USIT506	Discipline Specific Elective (Any One)	Enterprise Java	2
USIT507		Next Generation Technologies	
USIT5P1	Skill Enhancement Course Practical	Project Dissertation	2
USIT5P2	Skill Enhancement Course Practical	Internet of Things Practical	2
USIT5P3	Skill Enhancement Course Practical	Advanced Web Programming Practical	2
USIT5P4	Discipline Specific Elective Practical (Any One)*	Artificial Intelligence Practical	2
USIT5P5		Linux Administration Practical	
USIT5P6	Discipline Specific Elective Practical (Any One)*	Enterprise Java Practical	2
USIT5P7		Next Generation Technologies Practical	
		Total Credits	**20**

(All the practical mentioned in the syllabi are compulsory as per the courses chosen)

Semester – 6			
Course Code	**Course Type**	**Course Title**	**Credits**
USIT601	Skill Enhancement Course	Software Quality Assurance	2
USIT602	Skill Enhancement Course	Security in Computing	2
USIT603	Skill Enhancement Course	Business Intelligence	2
USIT604	Discipline Specific Elective (Any One)	Principles of Geographic Information Systems	2
USIT605		Enterprise Networking	
USIT606	Discipline Specific Elective (Any One)	IT Service Management	2
USIT607		Cyber Laws	
USIT6P1	Skill Enhancement Course Practical	Project Implementation	2
USIT6P2	Skill Enhancement Course Practical	Security in Computing Practical	2
USIT6P3	Skill Enhancement Course Practical	Business Intelligence Practical	2
USIT6P4	Discipline Specific Elective Practical (Any One)*	Principles of Geographic Information Systems Practical	2
USIT6P5		Enterprise Networking Practical	
USIT6P6	Skill Enhancement Course Practical	Advanced Mobile Programming	2
		Total Credits	**20**

***The choice of Practical course is based on the theory Course. For Semester V, USIT504, USIT505, USIT506 and USIT507, the practical courses are USIT5P4, USIT5P5 USIT5P6, USIT5P7. For Semester VI, USIT604, USIT605 the practical courses are USIT6P4, USIT6P5 respectively. Practical Course USIT6P6 is compulsory.**

SEMESTER V

B. Sc. (Information Technology)		Semester – V	
Course Name: Software Project Management		**Course Code: USIT501**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Introduction to Software Project Management**: Introduction, Why is Software Project Management Important? What is a Project? Software Projects versus Other Types of Project, Contract Management and Technical Project Management, Activities Covered by Software Project Management, Plans, Methods and Methodologies, Some Ways of Categorizing Software Projects, Project Charter, Stakeholders, Setting Objectives, The Business Case, Project Success and Failure, What is Management? Management Control, Project Management Life Cycle, Traditional versus Modern Project Management Practices. **Project Evaluation and Programme Management**: Introduction, Business Case, Project Portfolio Management, Evaluation of Individual Projects, Cost–benefit Evaluation Techniques, Risk Evaluation, Programme Management, Managing the Allocation of Resources within Programmes, Strategic Programme Management, Creating a Programme, Aids to Programme Management, Some Reservations about Programme Management, Benefits Management. **An Overview of Project Planning** : Introduction to Step Wise Project Planning, Step 0: Select Project, Step 1: Identify Project Scope and Objectives, Step 2: Identify Project Infrastructure, Step 3: Analyse Project Characteristics, Step 4: Identify Project Products and Activities, Step 5: Estimate Effort for Each Activity, Step 6: Identify Activity Risks, Step 7: Allocate Resources, Step 8: Review/Publicize Plan, Steps 9 and 10: Execute Plan/Lower Levels of Planning	**12**
II	**Selection of an Appropriate Project Approach:** Introduction, Build or Buy? Choosing Methodologies and Technologies, Software Processes and Process Models, Choice of Process Models, Structure versus Speed of Delivery, The Waterfall Model, The Spiral Model, Software Prototyping, Other Ways of Categorizing Prototypes, Incremental Delivery, Atern/Dynamic Systems Development Method, Rapid Application Development, Agile Methods, Extreme Programming (XP), Scrum, Lean Software Development, Managing Iterative Processes, Selecting the Most Appropriate Process Model. **Software Effort Estimation:** Introduction, Where are the Estimates Done? Problems with Over- and Under-Estimates, The Basis for Software Estimating, Software Effort Estimation Techniques, Bottom-up Estimating, The Top-down Approach and Parametric Models, Expert Judgement, Estimating by Analogy, Albrecht Function Point	**12**

	Analysis, Function Points Mark II, COSMIC Full Function Points, COCOMO II: A Parametric Productivity Model, Cost Estimation, Staffing Pattern, Effect of Schedule Compression, Capers Jones Estimating Rules of Thumb.	
III	**Activity Planning:** Introduction, Objectives of Activity Planning, When to Plan, Project Schedules, Projects and Activities, Sequencing and Scheduling Activities, Network Planning Models, Formulating a Network Model, Adding the Time Dimension, The Forward Pass, Backward Pass, Identifying the Critical Path, Activity Float, Shortening the Project Duration, Identifying Critical Activities, Activity-on-Arrow Networks. **Risk Management**: Introduction, Risk, Categories of Risk, Risk Management Approaches, A Framework for Dealing with Risk, Risk Identification, Risk Assessment, Risk Planning, Risk Management, Evaluating Risks to the Schedule, Boehm's Top 10 Risks and Counter Measures, Applying the PERT Technique, Monte Carlo Simulation, Critical Chain Concepts. **Resource Allocation**: Introduction, Nature of Resources, Identifying Resource Requirements, Scheduling Resources, Creating Critical Paths, Counting the Cost, Being Specific, Publishing the Resource Schedule, Cost Schedules, Scheduling Sequence.	**12**
IV	**Monitoring and Control**: Introduction, Creating the Framework, Collecting the Data, Review, Visualizing Progress, Cost Monitoring, Earned Value Analysis, Prioritizing Monitoring, Getting the Project Back to Target, Change Control, Software Configuration Management (SCM). **Managing Contracts**: Introduction, Types of Contract, Stages in Contract Placement, Typical Terms of a Contract, Contract Management, Acceptance. **Managing People in Software Environments**: Introduction, Understanding Behaviour, Organizational Behaviour: A Background, Selecting the Right Person for the Job, Instruction in the Best Methods, Motivation, The Oldham–Hackman Job Characteristics Model, Stress, Stress Management, Health and Safety, Some Ethical and Professional Concerns.	**12**
V	**Working in Teams:** Introduction, Becoming a Team, Decision Making, Organization and Team Structures, Coordination Dependencies, Dispersed and Virtual Teams, Communication Genres, Communication Plans, Leadership. **Software Quality :** Introduction, The Place of Software Quality in Project Planning, Importance of Software Quality, Defining Software Quality, Software Quality Models, ISO 9126, Product and Process Metrics, Product versus Process Quality Management, Quality Management Systems, Process Capability Models, Techniques to Help Enhance Software Quality, Testing, Software Reliability, Quality Plans.	**12**

	Project Closeout: Introduction, Reasons for Project Closure, Project Closure Process, Performing a Financial Closure, Project Closeout Report.	

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Software Project Management	Bob Hughes, Mike Cotterell, Rajib Mall	TMH	6th	2018
2.	Project Management and Tools & Technologies – An overview	Shailesh Mehta	SPD	1st	2017
3.	Software Project Management	Walker Royce	Pearson		2005

B. Sc. (Information Technology)		Semester – V	
Course Name: Internet of Things		**Course Code: USIT502**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**The Internet of Things: An Overview** : The Flavour of the Internet of Things, The "Internet" of "Things", The Technology of the Internet of Things, Enchanted Objects, Who is Making the Internet of Things? **Design Principles for Connected Devices:** Calm and Ambient Technology, Magic as Metaphor, Privacy, Keeping Secrets, Whose Data Is It Anyway? Web Thinking for Connected Devices, Small Pieces, Loosely Joined, First-Class Citizens On The Internet, Graceful Degradation, Affordances. **Internet Principles:** Internet Communications: An Overview, IP, TCP, The IP Protocol Suite (TCP/IP), UDP, IP Addresses, DNS, Static IP Address Assignment, Dynamic IP Address Assignment, IPv6, MAC Addresses, TCP and UDP Ports, An Example: HTTP Ports, Other Common Ports, Application Layer Protocols, HTTP, HTTPS: Encrypted HTTP, Other Application Layer Protocols.	**12**
II	**Thinking About Prototyping:** Sketching, Familiarity, Costs versus Ease of Prototyping, Prototypes and Production, Changing Embedded Platform, Physical Prototypes and Mass Personalisation, Climbing into the Cloud, Open Source versus Closed Source, Why Closed? Why Open? Mixing Open and Closed Source, Closed Source for Mass Market Projects, Tapping into the Community. **Prototyping Embedded Devices:** Electronics, Sensors, Actuators, Scaling Up the Electronics, Embedded Computing Basics, Microcontrollers, System-on-Chips, Choosing Your Platform, Arduino, Developing on the Arduino, Some Notes on the Hardware, Openness, Raspberry Pi, Cases and Extension Boards, Developing on the Raspberry Pi, Some Notes on the Hardware, Openness.	**12**
III	**Prototyping the Physical Design:** Preparation, Sketch, Iterate, and Explore, Nondigital Methods, Laser Cutting, Choosing a Laser Cutter, Software, Hinges and Joints, 3D Printing, Types of 3D Printing, Software, CNC Milling, Repurposing/Recycling. **Prototyping Online Components:** Getting Started with an API, Mashing Up APIs, Scraping, Legalities, Writing a New API, Clockodillo, Security, Implementing the API, Using Curl to Test, Going Further, Real-Time Reactions, Polling, Comet, Other Protocols, MQ Telemetry Transport,	**12**

	Extensible Messaging and Presence Protocol, Constrained Application Protocol.	
IV	**Techniques for Writing Embedded Code:** Memory Management, Types of Memory, Making the Most of Your RAM, Performance and Battery Life, Libraries, Debugging, **Business Models:** A Short History of Business Models, Space and Time, From Craft to Mass Production, The Long Tail of the Internet, Learning from History, The Business Model Canvas, Who Is the Business Model For? Models, Make Thing, Sell Thing, Subscriptions, Customisation, Be a Key Resource, Provide Infrastructure: Sensor Networks, Take a Percentage, Funding an Internet of Things Startup, Hobby Projects and Open Source, Venture Capital, Government Funding, Crowdfunding, Lean Startups.	**12**
V	**Moving to Manufacture:** What Are You Producing? Designing Kits, Designing Printed circuit boards, Software Choices, The Design Process, Manufacturing Printed Circuit Boards, Etching Boards, Milling Boards. Assembly, Testing, Mass-Producing the Case and Other Fixtures, Certification, Costs, Scaling Up Software, Deployment, Correctness and Maintainability, Security, Performance, User Community. **Ethics:** Characterizing the Internet of Things, Privacy, Control, Disrupting Control, Crowdsourcing, Environment, Physical Thing, Electronics, Internet Service, Solutions, The Internet of Things as Part of the Solution, Cautious Optimism, The Open Internet of Things Definition.	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Designing the Internet of Things	Adrian McEwen, Hakim Cassimally	WILEY	First	2014
2.	Internet of Things – Architecture and Design	Raj Kamal	McGraw Hill	First	2017
3.	Getting Started with the Internet of Things	Cuno Pfister	O'Reilly	Sixth	2018
4.	Getting Started with Raspberry Pi	Matt Richardson and Shawn Wallace	SPD	Third	2016

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Web Programming		**Course Code: USIT503**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Introducing .NET**: The .NET Framework, C#, VB, and the .NET Languages, The Common Language Runtime, The .NET Class Library. **The C# Language**: C# Language Basics, Variables and Data Types, Variable Operations, Object-Based Manipulation, Conditional Logic, Loops, Methods. **Types, Objects, and Namespaces**: The Basics About Classes, Building a Basic Class, Value Types and Reference Types, Understanding Namespaces and Assemblies, Advanced Class Programming.	**12**
II	**Web Form Fundamentals**: Writing Code, Using the Code-Behind Class, Adding Event Handlers, Understanding the Anatomy of an ASP.NET Application, Introducing Server Controls, Using the Page Class, Using Application Events, Configuring an ASP.NET Application. **Form Controls**: Stepping Up to Web Controls, Web Control Classes, List Controls, Table Controls, Web Control Events and AutoPostBack, Validation, Understanding Validation, Using the Validation Controls, Rich Controls, The Calendar, The AdRotator, Pages with Multiple Views, User Controls and Graphics, User Controls, Dynamic Graphics, The Chart Control, Website Navigation: Site Maps, URL Mapping and Routing, The SiteMapPath Control, The TreeView Control, The Menu Control.	**12**
III	**Error Handling, Logging, and Tracing** : Avoiding Common Errors, Understanding Exception Handling, Handling Exceptions, Throwing Your Own Exceptions, Using Page Tracing **State Management** : Understanding the Problem of State, Using View State, Transferring Information Between Pages, Using Cookies, Managing Session State, Configuring Session State, Using Application State, Comparing State Management Options **Styles, Themes, and Master Pages** : Styles, Themes, Master Page Basics, Advanced Master Pages,	**12**
IV	**ADO.NET Fundamentals**: Understanding Databases, Configuring Your Database, Understanding SQL Basics, Understanding the Data Provider Model, Using Direct Data Access, Using Disconnected Data Access. **Data Binding**: Introducing Data Binding, Using Single-Value Data Binding, Using Repeated-Value Data Binding, Working with Data Source Controls,	**12**

	The Data Controls: The GridView, Formatting the GridView, Selecting a GridView Row, Editing with the GridView, Sorting and Paging the GridView, Using GridView Templates, The DetailsView and FormView	
V	**XML**: XML Explained, The XML Classes, XML Validation, XML Display and Transforms. **Security Fundamentals**: Understanding Security Requirements, Authentication and Authorization, Forms Authentication, Windows Authentication. **ASP.NET AJAX**: Understanding Ajax, Using Partial Refreshes, Using Progress Notification, Implementing Timed Refreshes, Working with the ASP.NET AJAX Control Toolkit.	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Beginning ASP.NET 4.5 in C#	Matthew MacDonald	Apress		2012
2.	C# 2015	Anne Bohem and Joel Murach	Murach	Third	2016
3.	Murach's ASP.NET 4.6 Web Programming in C#2015	Mary Delamater and Anne Bohem	SPD	Sixth	2016
4.	ASP.NET 4.0 programming	J. Kanjilal	Tata McGraw-Hill		2011
5.	Programming ASP.NET	D.Esposito	Microsoft Press (Dreamtech)		2011
6.	Beginning Visual C# 2010	K. Watson, C. Nagel, J.H Padderson, J.D. Reid, M.Skinner	Wrox (Wiley)		2010

B. Sc. (Information Technology)		Semester – V	
Course Name: Artificial Intelligence		**Course Code: USIT504 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Introduction:** What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. **Intelligent Agents:** agents and environment, good behavior, nature of environment, the structure of agents.	**12**
II	**Solving Problems by Searching:** Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions. **Beyond Classical Search:** local search algorithms, searching with non-deterministic action, searching with partial observations, online search agents and unknown environments.	**12**
III	**Adversarial Search:** Games, optimal decisions in games, alpha-beta pruning, stochastic games, partially observable games, state-of-the-are game programs. **Logical Agents:** Knowledge base agents, The Wumpus world, logic, propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.	**12**
IV	**First Order Logic:** Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. **Inference in First Order Logic:** propositional vs. First Order, unification and lifting, forward and backward chaining, resolution.	**12**
V	**Planning:** Definition of Classical Planning, Algorithms for planning as state space search, planning graphs, other classical planning approaches, analysis of planning approaches, Time, Schedules and resources, hierarchical planning, Planning and Acting in Nondeterministic Domains, multiagent planning, **Knowledge Representation:** Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Artificial Intelligence: A Modern Approach	Stuart Russel and Peter Norvig	Pearson	3rd	2015

2.	A First Course in Artificial Intelligence	Deepak Khemani	TMH	First	2017
3.	Artificial Intelligence: A Rational Approach	Rahul Deva	Shroff publishers	1st	2018
4.	Artificial Intelligence	Elaine Rich, Kevin Knight and Shivashankar Nair	TMH	3rd	2009
5.	Artificial Intelligence & Soft Computing for Beginners	Anandita Das Bhattacharjee	SPD	1st	2013

B. Sc. (Information Technology)		Semester – V	
Course Name: Linux System Administration		**Course Code: USIT505 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Introduction to Red Hat Enterprise Linux:** Linux, Open Source and Red Hat, Origins of Linux, Distributions, Duties of Linux System Administrator. **Command Line:** Working with the Bash Shell, Getting the Best of Bash, Useful Bash Key Sequences, Working with Bash History, Performing Basic File System Management Tasks, Working with Directories, Piping and Redirection, Finding Files **System Administration Tasks:** Performing Job Management Tasks, System and Process Monitoring and Management, Managing Processes with ps, Sending Signals to Processes with the kill Command, Using top to Show Current System Activity, Managing Process Niceness, Scheduling Jobs, Mounting Devices, Working with Links, Creating Backups, Managing Printers, Setting Up System Logging, Setting Up Rsyslog, Common Log Files, Setting Up Logrotate **Managing Software:** Understanding RPM, Understanding Meta Package Handlers, Creating Your Own Repositories, Managing Repositories, Installing Software with Yum, Querying Software, Extracting Files from RPM Packages	**12**
II	**Configuring and Managing Storage:** Understanding Partitions and Logical Volumes, Creating Partitions, Creating File Systems, File Systems Overview, Creating File Systems, Changing File System Properties, Checking the File System Integrity, Mounting File Systems Automatically Through fstab, Working with Logical Volumes, Creating Logical Volumes, Resizing Logical Volumes, Working with Snapshots, Replacing Failing Storage Devices, Creating Swap Space, Working with Encrypted Volumes **Connecting to the Network:** Understanding NetworkManager, Working with Services and Runlevels, Configuring the Network with NetworkManager, Working with system-config-network, NetworkManager Configuration Files, Network Service Scripts, Networking from the Command Line, Troubleshooting Networking, Setting Up IPv6, Configuring SSH, Enabling the SSH Server, Using the SSH Client, Using PuTTY on Windows Machines, Configuring Key-Based SSH Authentication, Using Graphical Applications with SSH, Using SSH Port Forwarding, Configuring VNC Server Access	**12**

	Working with Users, Groups, and Permissions: Managing Users and Groups, Commands for User Management, Managing Passwords, Modifying and Deleting User Accounts, Configuration Files, Creating Groups, Using Graphical Tools for User, and Group Management, Using External Authentication Sources, the Authentication Process, sssd, nsswitch, Pluggable Authentication Modules, Managing Permissions, the Role of Ownership, Basic Permissions: Read, Write, and Execute, Advanced Permissions, Working with Access Control Lists, Setting Default Permissions with umask, Working with Attributes	
III	**Securing Server with iptables:** Understanding Firewalls, Setting Up a Firewall with system-config-firewall, Allowing Services, Trusted Interfaces, Masquerading, Configuration Files, Setting Up a Firewall with iptables, Tables, Chains, and Rules, Composition of Rule, Configuration Example, Advanced iptables Configuration, Configuring Logging, The Limit Module, Configuring NAT **Setting Up Cryptographic Services:** Introducing SSL, Proof of Authenticity: the Certificate Authority, Managing Certificates with openssl, Creating a Signing Request, Working with GNU Privacy Guard, Creating GPG Keys, Key Transfer, Managing GPG Keys, Encrypting Files with GPG, GPG Signing, Signing RPM Files **Configuring Server for File Sharing:** What is NFS? Advantages and Disadvantages of NFS, Configuring NFS4, Setting Up NFSv4, Mounting an NFS Share, Making NFS Mounts Persistent, Configuring Automount, Configuring Samba, Setting Up a Samba File Server, Samba Advanced Authentication Options, Accessing Samba Shares, Offering FTP Services.	**12**
IV	**Configuring DNS and DHCP:** Introduction to DNS, The DNS Hierarchy, DNS Server Types, The DNS Lookup Process, DNS Zone Types, Setting Up a DNS Server, Setting Up a Cache-Only Name Server, Setting Up a Primary Name Server, Setting Up a Secondary Name Server, Understanding DHCP, Setting Up a DHCP Server **Setting Up a Mail Server:** Using the Message Transfer Agent, the Mail Delivery Agent, the Mail User Agent, Setting Up Postfix as an SMTP Server, Working with Mutt, Basic Configuration, Internet Configuration, Configuring Dovecot for POP and IMAP **Configuring Apache on Red Hat Enterprise Linux:** Configuring the Apache Web Server, Creating a Basic Website, Understanding the Apache Configuration Files, Apache Log Files, Working with Virtual Hosts, Securing the Web Server with TLS Certificates, Configuring Authentication, Setting Up Authentication with .htpasswd, Configuring LDAP Authentication, Setting Up MySQL	**12**

V	**Introducing Bash Shell Scripting:** Introduction, Elements of a Good Shell Script, Executing the Script, Working with Variables and Input, Understanding Variables, Variables, Subshells, and Sourcing, Working with Script Arguments, Asking for Input, Using Command Substitution, Substitution Operators, Changing Variable Content with Pattern Matching, Performing Calculations, Using Control Structures, Using if...then...else, Using case, Using while, Using until, Using for, Configuring booting with GRUB. **High-Availability Clustering:** High-Availability Clustering, The Workings of High Availability, High-Availability Requirements, Red Hat High-Availability Add-on Software, Components, Configuring Cluster-Based Services, Setting Up Bonding, Setting Up Shared Storage, Installing the Red Hat High Availability Add-On, Building the Initial State of the Cluster, Configuring Additional Cluster Properties, Configuring a Quorum Disk, Setting Up Fencing, Creating Resources and Services, Troubleshooting a Nonoperational Cluster, Configuring GFS2 File Systems **Setting Up an Installation Server:** Configuring a Network Server as an Installation Server, Setting Up a TFTP and DHCP Server for PXE Boot, Installing the TFTP Server, Configuring DHCP for PXE Boot, Creating the TFTP PXE Server Content, Creating a Kickstart File, Using a Kickstart File to Perform an Automated, Installation, Modifying the Kickstart File with, system-config-kickstart, Making Manual Modifications to the Kickstart File	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Red Hat Enterprise Linux 6 Administration	Sander van Vugt	John Wiley and Sons		2013
2.	Red hat Linux Networking and System Administration	Terry Collings and Kurt Wall	Wiley	3rd	
3.	Linux Administration: A Beginner's Guide	Wale Soyinka	TMH	Fifth Edition	

B. Sc. (Information Technology)		Semester – V	
Course Name: Enterprise Java		**Course Code: USIT506 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Understanding Java EE:** What is an Enterprise Application? What is java enterprise edition? Java EE Technologies, Java EE evolution, Glassfish server **Java EE Architecture, Server and Containers:** Types of System Architecture, Java EE Server, Java EE Containers. **Introduction to Java Servlets:** The Need for Dynamic Content, Java Servlet Technology, Why Servlets? What can Servlets do? **Servlet API and Lifecycle:** Java Servlet API, The Servlet Skeleton, The Servlet Life Cycle, A Simple Welcome Servlet **Working With Servlets:** Getting Started, Using Annotations Instead of Deployment Descriptor. **Working with Databases:** What Is JDBC? JDBC Architecture, Accessing Database, The Servlet GUI and Database Example.	**12**
II	**Request Dispatcher:** Resquestdispatcher Interface, Methods of Requestdispatcher, Requestdispatcher Application. **COOKIES:** Kinds Of Cookies, Where Cookies Are Used? Creating Cookies Using Servlet, Dynamically Changing The Colors Of A Page **SESSION:** What Are Sessions? Lifecycle Of Http Session, Session Tracking With Servlet API, A Servlet Session Example **Working With Files:** Uploading Files, Creating an Upload File Application, Downloading Files, Creating a Download File Application. **Working With Non-Blocking I/O:** Creating a Non-Blocking Read Application, Creating The Web Application, Creating Java Class, Creating Servlets, Retrieving The File, Creating index.jsp	**12**
III	**Introduction To Java Server Pages:** Why use Java Server Pages? Disadvantages Of JSP, JSP v\s Servlets, Life Cycle of a JSP Page, How does a JSP function? How does JSP execute? About Java Server Pages **Getting Started With Java Server Pages:** Comments, JSP Document, JSP Elements, JSP GUI Example. **Action Elements:** Including other Files, Forwarding JSP Page to Another Page, Passing Parameters for other Actions, Loading a Javabean. **Implicit Objects, Scope And El Expressions:** Implicit Objects, Character Quoting Conventions, Unified Expression Language [Unified El], Expression Language.	**12**

	Java Server Pages Standard Tag Libraries: What is wrong in using JSP Scriptlet Tags? How JSTL Fixes JSP Scriptlet's Shortcomings? Disadvantages Of JSTL, Tag Libraries.	
IV	**Introduction To Enterprise Javabeans:** Enterprise Bean Architecture, Benefits of Enterprise Bean, Types of Enterprise Bean, Accessing Enterprise Beans, Enterprise Bean Application, Packaging Enterprise Beans **Working With Session Beans:** When to use Session Beans? Types of Session Beans, Remote and Local Interfaces, Accessing Interfaces, Lifecycle of Enterprise Beans, Packaging Enterprise Beans, Example of Stateful Session Bean, Example of Stateless Session Bean, Example of Singleton Session Beans. **Working with Message Driven Beans:** Lifecycle of a Message Driven Bean, Uses of Message Driven Beans, The Message Driven Beans Example. **Interceptors:** Request And Interceptor, Defining An Interceptor, AroundInvoke Method, Applying Interceptor, Adding An Interceptor To An Enterprise Bean, Build and Run the Web Application. **Java Naming and Directory Interface**: What is Naming Service? What is Directory Service? What is Java Naming and Directory interface? Basic Lookup, JNDI Namespace in Java EE, Resources and JNDI, Datasource Resource Definition in Java EE.	**12**
V	**Persistence, Object/Relational Mapping And JPA:** What is Persistence? Persistence in Java, Current Persistence Standards in Java, Why another Persistence Standards? Object/Relational Mapping, **Introduction to Java Persistence API:** The Java Persistence API, JPA, ORM, Database and the Application, Architecture of JPA, How JPA Works? JPA Specifications. **Writing JPA Application:** Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database And Tables in Mysql, Creating a Web Application, Adding the Required Library Files, Creating a Javabean Class, Creating Persistence Unit [Persistence.Xml], Creating JSPS, The JPA Application Structure, Running The JPA Application. **Introduction to Hibernate:** What is Hibernate? Why Hibernate? Hibernate, Database and The Application, Components of Hibernate, Architecture of Hibernate, How Hibernate Works? **Writing Hibernate Application:** Application Requirement Specifications, Software Requirements, The Application Development Approach, Creating Database and Tables in Mysql, Creating a Web Application, Adding The Required Library Files, Creating a Javabean Class, Creating Hibernate Configuration File, Adding a Mapping Class, Creating JSPS, Running The Hibernate Application.	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Java EE 7 For Beginners	Sharanam Shah, Vaishali Shah	SPD	First	2017
2.	Java EE 8 Cookbook: Build reliable applications with the most robust and mature technology for enterprise development	Elder Moraes	Packt	First	2018
3.	Advanced Java Programming	Uttam Kumar Roy	Oxford Press		2015

B. Sc. (Information Technology)		Semester – V	
Course Name: Next Generation Technologies		Course Code: USIT507 (Elective II)	
Periods per week (1 Period is 50 minutes),		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Unit	Details	Lectures
I	**Big Data:** Getting Started, Big Data, Facts About Big Data, Big Data Sources, Three Vs of Big Data, Volume, Variety, Velocity, Usage of Big Data, Visibility, Discover and Analyze Information, Segmentation and Customizations, Aiding Decision Making, Innovation, Big Data Challenges, Policies and Procedures, Access to Data, Technology and Techniques, Legacy Systems and Big Data, Structure of Big Data, Data Storage, Data Processing, Big Data Technologies **NoSQL:** SQL, NoSQL, Definition, A Brief History of NoSQL, ACID vs. BASE, CAP Theorem (Brewer's Theorem), The BASE, NoSQL Advantages and Disadvantages, Advantages of NoSQL, Disadvantages of NoSQL, SQL vs. NoSQL Databases, Categories of NoSQL Databases **Introducing MongoDB:** History, MongoDB Design Philosophy, Speed, Scalability, and Agility, Non-Relational Approach, JSON-Based Document Store, Performance vs. Features, Running the Database Anywhere, SQL Comparison	**12**
II	**The MongoDB Data Model:** The Data Model, JSON and BSON, The Identifier (_id), Capped Collection, Polymorphic Schemas, Object-Oriented Programming, Schema Evolution **Using MongoDB Shell:** Basic Querying, Create and Insert, Explicitly Creating Collections, Inserting Documents Using Loop, Inserting by Explicitly Specifying _id, Update, Delete, Read, Using Indexes, Stepping Beyond the Basics, Using Conditional Operators, Regular Expressions, MapReduce, aggregate(), Designing an Application's Data Model, Relational Data Modeling and Normalization, MongoDB Document Data Model Approach **MongoDB Architecture:** Core Processes, mongod, mongo, mongos, MongoDB Tools, Standalone Deployment, Replication, Master/Slave Replication, Replica Set, Implementing Advanced Clustering with Replica Sets, Sharding, Sharding Components, Data Distribution Process, Data Balancing Process, Operations, Implementing Sharding, Controlling Collection Distribution (Tag-Based Sharding), Points to	**12**

	Remember When Importing Data in a ShardedEnvironment, Monitoring for Sharding, Monitoring the Config Servers, Production Cluster Architecture, Scenario 1, Scenario 2, Scenario 3, Scenario 4	
III	**MongoDB Storage Engine:** Data Storage Engine, Data File (Relevant for MMAPv1), Namespace (.ns File), Data File (Relevant for WiredTiger), Reads and Writes, How Data Is Written Using Journaling, GridFS – The MongoDB File System, The Rationale of GridFS, GridFSunder the Hood, Using GridFS, Indexing, Types of Indexes, Behaviors and Limitations **MongoDB Use Cases:** Use Case 1 -Performance Monitoring, Schema Design, Operations, Sharding, Managing the Data, Use Case 2 – Social Networking, Schema Design, Operations, Sharding **MongoDB Limitations:** MongoDB Space Is Too Large (Applicable for MMAPv1), Memory Issues (Applicable for Storage Engine MMAPv1), 32-bit vs. 64-bit, BSON Documents, Namespaces Limits, Indexes Limit, Capped Collections Limit - Maximum Number of Documents in a Capped Collection, Sharding Limitations, Shard Early to Avoid Any Issues, Shard Key Can't Be Updated, Shard Collection Limit, Select the Correct Shard Key, Security Limitations, No Authentication by Default, Traffi c to and from MongoDB Isn't Encrypted, Write and Read Limitations, Case-Sensitive Queries, Type-Sensitive Fields, No JOIN, Transactions, MongoDB Not Applicable Range **MongoDB Best Practices:** Deployment, Hardware Suggestions from the MongoDB Site, Few Points to be Noted, Coding, Application Response Time Optimization, Data Safety, Administration, Replication Lag, Sharding, Monitoring	**12**
IV	**The End of Disk? SSD and In-Memory Databases:** The End of Disk?, Solid State Disk, The Economics of Disk, SSD-Enabled Databases, In-Memory Databases, TimesTen, Redis, SAP HANA, VoltDB, Oracle 12c "in-Memory Database, Berkeley Analytics Data Stack and Spark, Spark Architecture **jQuery:** Introduction, Traversing the DOM, DOM Manipulation with jQuery, Events, Ajax with jQuery, jQuery Plug-ins, jQuery Image Slider	**12**
V	**JSON:** Introduction, JSON Grammar, JSON Values, JSON Tokens, Syntax, JSON vs XML, Data Types, Objects, Arrays, Creating JSON, JSON Object, Parsing JSON, Persisting JSON, Data Interchange, JSON PHP, JSON HTML, JSONP	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Practical MongoDB	Shakuntala Gupta Edward Navin Sabharwal	Apress		
2.	Beginning jQuery	Jack Franklin Russ Ferguson	Apress	Second	
3.	Next Generation Databases	Guy Harrison	Apress		
4.	Beginning JSON	Ben Smith	Apress		

B. Sc. (Information Technology)		Semester – V	
Course Name: Project Dissertation		**Course Code: USIT5P1**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

The details are given in Appendix – I

B. Sc. (Information Technology)		Semester – V	
Course Name: Internet of Things Practical		**Course Code: USIT5P2**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

Practical No	Details
0	Starting Raspbian OS, Familiarising with Raspberry Pi Components and interface, Connecting to ethernet, Monitor, USB.
1	Displaying different LED patterns with Raspberry Pi.
2	Displaying Time over 4-Digit 7-Segment Display using Raspberry Pi
3	Raspberry Pi Based Oscilloscope
4	Controlling Raspberry Pi with WhatsApp.
5	Setting up Wireless Access Point using Raspberry Pi
6	Fingerprint Sensor interfacing with Raspberry Pi
7	Raspberry Pi GPS Module Interfacing
8	IoT based Web Controlled Home Automation using Raspberry Pi
9	Visitor Monitoring with Raspberry Pi and Pi Camera
10	Interfacing Raspberry Pi with RFID.
11	Building Google Assistant with Raspberry Pi.
12	Installing Windows 10 IoT Core on Raspberry Pi

Raspberry Pi Kits and components should be made available in the ratio of 1 kit : 3 students minimum.

B. Sc. (Information Technology)		Semester – V	
Course Name: Advanced Web Programming Practical		**Course Code: USIT5P3**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

List of Practical	
1.	**Working with basic C# and ASP .NET**
a.	Create an application that obtains four int values from the user and displays the product.
b.	Create an application to demonstrate string operations.
c.	Create an application that receives the (Student Id, Student Name, Course Name, Date of Birth) information from a set of students. The application should also display the information of all the students once the data entered.
	Create an application to demonstrate following operations i. Generate Fibonacci series. ii. Test for prime numbers. iii. Test for vowels. iv. Use of foreach loop with arrays v. Reverse a number and find sum of digits of a number.
2.	**Working with Object Oriented C# and ASP .NET**
a.	Create simple application to perform following operations i. Finding factorial Value ii. Money Conversion iii. Quadratic Equation iv. Temperature Conversion
b.	Create simple application to demonstrate use of following concepts i. Function Overloading ii. Inheritance (all types) iii. Constructor overloading iv. Interfaces
c.	Create simple application to demonstrate use of following concepts i. Using Delegates and events ii. Exception handling
3.	**Working with Web Forms and Controls**
a.	Create a simple web page with various sever controls to demonstrate setting and use of their properties. (Example : AutoPostBack)
b.	Demonstrate the use of Calendar control to perform following operations. a) Display messages in a calendar control b) Display vacation in a calendar control c) Selected day in a calendar control using style d) Difference between two calendar dates
c.	Demonstrate the use of Treeview control perform following operations. a) Treeview control and datalist b) Treeview operations
4.	**Working with Form Controls**
a.	Create a Registration form to demonstrate use of various Validation controls.
b.	Create Web Form to demonstrate use of Adrotator Control.
c.	Create Web Form to demonstrate use User Controls.

5.	**Working with Navigation, Beautification and Master page.**
a.	Create Web Form to demonstrate use of Website Navigation controls and Site Map.
b.	Create a web application to demonstrate use of Master Page with applying Styles and Themes for page beautification.
c.	Create a web application to demonstrate various states of ASP.NET Pages.
6.	**Working with Database**
a.	Create a web application bind data in a multiline textbox by querying in another textbox.
b.	Create a web application to display records by using database.
c.	Demonstrate the use of Datalist link control.
7.	**Working with Database**
a.	Create a web application to display Databinding using dropdownlist control.
b.	Create a web application for to display the phone no of an author using database.
c.	Create a web application for inserting and deleting record from a database. (Using Execute-Non Query).
8.	**Working with data controls**
a.	Create a web application to demonstrate various uses and properties of SqlDataSource.
b.	Create a web application to demonstrate data binding using DetailsView and FormView Control.
c.	Create a web application to display Using Disconnected Data Access and Databinding using GridView.
9.	**Working with GridView control**
a.	Create a web application to demonstrate use of GridView control template and GridView hyperlink.
b.	Create a web application to demonstrate use of GridView button column and GridView events.
c.	Create a web application to demonstrate GridView paging and Creating own table format using GridView.
10.	**Working with AJAX and XML**
a.	Create a web application to demonstrate reading and writing operation with XML.
b.	Create a web application to demonstrate Form Security and Windows Security with proper Authentication and Authorization properties.
c.	Create a web application to demonstrate use of various Ajax controls.
11.	**Programs to create and use DLL**

B. Sc. (Information Technology)		Semester – V	
Course Name: Artificial Intelligence Practical		**Course Code: USIT5P4 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

Practical No		Details
1	a	Write a program to implement depth first search algorithm.
	b	Write a program to implement breadth first search algorithm.
2	a	Write a program to simulate 4-Queen / N-Queen problem.
	b	Write a program to solve tower of Hanoi problem.
3	a	Write a program to implement alpha beta search.
	b	Write a program for Hill climbing problem.
4	a	Write a program to implement A* algorithm.
	b	Write a program to implement AO* algorithm.
5	a	Write a program to solve water jug problem.
	b	Design the simulation of tic – tac – toe game using min-max algorithm.
6	a	Write a program to solve Missionaries and Cannibals problem.
	b	Design an application to simulate number puzzle problem.
7	a	Write a program to shuffle Deck of cards.
	b	Solve traveling salesman problem using artificial intelligence technique.
8	a	Solve the block of World problem.
	b	Solve constraint satisfaction problem
9	a	Derive the expressions based on Associative law
	b	Derive the expressions based on Distributive law
10	a	Write a program to derive the predicate. (for e.g.: Sachin is batsman , batsman is cricketer) - > Sachin is Cricketer.
	b	Write a program which contains three predicates: male, female, parent. Make rules for following family relations: father, mother, grandfather,grandmother, brother, sister, uncle, aunt, nephew and niece, cousin. Question: i. Draw Family Tree. ii. Define: Clauses, Facts, Predicates and Rules with conjunction and disjunction

The practicals can be implemented in C / C++ / Java/ Python / R /Prolog / LISP or any other language.

B. Sc. (Information Technology)		Semester – V	
Course Name: Linux System Administration		**Course Code: USIT5P5 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

Practical No	Details
0	**Installation of RHEL 6.X**
1	**Graphical User Interface and Command Line Interface and Processes**
a	Exploring the Graphical Desktop
b	The Command Line Interface
c	Managing Processes
2	**Storage Devices and Links, Backup and Repository**
b	Working with Storage Devices and Links
a	Making a Backup
b	Creating a Repository
3	**Working with RPMsm Storage and Networking**
a	Using Query Options
b	Extracting Files From RPMs
c	Configuring and Managing Storage
d	Connecting to the Network
4	**Working with Users, Groups, and Permissions**
5	**Firewall and Cryptographic services**
a	Securing Server with iptables
b	Setting Up Cryptographic Services
6	**Configuring Server for File Sharing**
a	Configuring NFS Server and Client
b	Configuring Samba
c	Configuring FTP
7	**DNS, DHCP and Mail Server**
a	Configuring DNS
b	Configuring DHCP
c	Setting Up a Mail Server

8	**Web Server**
a	Configuring Apache on Red Hat Enterprise Linux
b	Writing a Script to Monitor Activity on the Apache Web Server
c	Using the select Command
9	**Shell Scripts and High-Availability Clustering**
a	Writing Shell Scripts
b	Configuring Booting with GRUB
c	Configuring High Availability Clustering
10	**Setting Up an Installation Server**
a	Configuring Network Server as an Installation Server
b	Setting Up a TFTP and DHCP Server for PXE Boot

B. Sc. (Information Technology)		Semester – V	
Course Name: Enterprise Java		**Course Code: USIT5P6 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

List of Practical	
1.	**Implement the following Simple Servlet applications.**
a.	Create a simple calculator application using servlet.
b.	Create a servlet for a login page. If the username and password are correct then it says message "Hello <username>" else a message "login failed"
c.	Create a registration servlet in Java using JDBC. Accept the details such as Username, Password, Email, and Country from the user using HTML Form and store the registration details in the database.
2.	**Implement the following Servlet applications with Cookies and Sessions.**
a.	Using Request Dispatcher Interface create a Servlet which will validate the password entered by the user, if the user has entered "Servlet" as password, then he will be forwarded to Welcome Servlet else the user will stay on the index.html page and an error message will be displayed.
b.	Create a servlet that uses Cookies to store the number of times a user has visited servlet.
c.	Create a servlet demonstrating the use of session creation and destruction. Also check whether the user has visited this page first time or has visited earlier also using sessions.
3.	**Implement the Servlet IO and File applications.**
a.	Create a Servlet application to upload and download a file.
b.	Develop Simple Servlet Question Answer Application using Database.
c.	Create simple Servlet application to demonstrate Non-Blocking Read Operation.
4.	**Implement the following JSP applications.**
a.	Develop a simple JSP application to display values obtained from the use of intrinsic objects of various types.
b.	Develop a simple JSP application to pass values from one page to another with validations. (Name-txt, age-txt, hobbies-checkbox, email-txt, gender-radio button).
c.	Create a registration and login JSP application to register and authenticate the user based on username and password using JDBC.
5.	**Implement the following JSP JSTL and EL Applications.**
a.	Create an html page with fields, eno, name, age, desg, salary. Now on submit this data to a JSP page which will update the employee table of database with matching eno.
b.	Create a JSP page to demonstrate the use of Expression language.
c.	Create a JSP application to demonstrate the use of JSTL.

6.	**Implement the following EJB Applications.**
a.	Create a Currency Converter application using EJB.
b.	Develop a Simple Room Reservation System Application Using EJB.
c.	Develop simple shopping cart application using EJB [Stateful Session Bean].
7.	**Implement the following EJB applications with different types of Beans.**
a.	Develop simple EJB application to demonstrate Servlet Hit count using Singleton Session Beans.
b.	Develop simple visitor Statistics application using Message Driven Bean [Stateless Session Bean].
c.	Develop simple Marks Entry Application to demonstrate accessing Database using EJB.
8.	**Implement the following JPA applications.**
a.	Develop a simple Inventory Application Using JPA.
b.	Develop a Guestbook Application Using JPA.
c.	Create simple JPA application to store and retrieve Book details.
9.	**Implement the following JPA applications with ORM and Hibernate.**
a.	Develop a JPA Application to demonstrate use of ORM associations.
b.	Develop a Hibernate application to store Feedback of Website Visitor in MySQL Database.
c.	Develop a Hibernate application to store and retrieve employee details in MySQL Database.
10.	**Implement the following Hibernate applications.**
a.	Develop an application to demonstrate Hibernate One- To -One Mapping Using Annotation.
b.	Develop Hibernate application to enter and retrieve course details with ORM Mapping.
c.	Develop a five page web application site using any two or three Java EE Technologies.

B. Sc. (Information Technology)		Semester – V	
Course Name: Next Generation Technologies Practical		**Course Code: USIT5P7 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**--**

Practical No	Details
1	**MongoDB Basics**
a	Write a MongoDB query to create and drop database.
b	Write a MongoDB query to create, display and drop collection
c	Write a MongoDB query to insert, query, update and delete a document.
2	**Simple Queries with MongoDB**
3	**Implementing Aggregation**
a	Write a MongoDB query to use sum, avg, min and max expression.
b	Write a MongoDB query to use push and addToSet expression.
c	Write a MongoDB query to use first and last expression.
4	**Replication, Backup and Restore**
a	Write a MongoDB query to create Replica of existing database.
b	Write a MongoDB query to create a backup of existing database.
c	Write a MongoDB query to restore database from the backup.
5	**Java and MongoDB**
a	Connecting Java with MongoDB and inserting, retrieving, updating and deleting.
6	**PHP and MongoDB**
a	Connecting PHP with MongoDB and inserting, retrieving, updating and deleting.
7	**Python and MongoDB**
a	Connecting Python with MongoDB and inserting, retrieving, updating and deleting.
8	**Programs on Basic jQuery**
a	jQuery Basic, jQuery Events
b	jQuery Selectors, jQuery Hide and Show effects
c	jQuery fading effects, jQuery Sliding effects

9	**jQuery Advanced**
a	jQuery Animation effects, jQuery Chaining
b	jQuery Callback, jQuery Get and Set Contents
c	jQuery Insert Content, jQuery Remove Elements and Attribute
10	**JSON**
a	Creating JSON
b	Parsing JSON
c	Persisting JSON
11	**Create a JSON file and import it to MongoDB**
a	Export MongoDB to JSON.
b	Write a MongoDB query to delete JSON object from MongoDB

SEMESTER VI

B. Sc. (Information Technology)		Semester – VI	
Course Name: Software Quality Assurance		**Course Code: USIT601**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Introduction to Quality:** Historical Perspective of Quality, What is Quality? (Is it a fact or perception?), Definitions of Quality, Core Components of Quality, Quality View, Financial Aspect of Quality, Customers, Suppliers and Processes, Total Quality Management (TQM), Quality Principles of Total Quality Management, Quality Management Through Statistical Process Control, Quality Management Through Cultural Changes, Continual (Continuous) Improvement Cycle, Quality in Different Areas, Benchmarking and Metrics, Problem Solving Techniques, Problem Solving Software Tools. **Software Quality:** Introduction, Constraints of Software Product Quality Assessment, Customer is a King, Quality and Productivity Relationship, Requirements of a Product, Organisation Culture, Characteristics of Software, Software Development Process, Types of Products, Schemes of Criticality Definitions, Problematic Areas of Software Development Life Cycle, Software Quality Management, Why Software Has Defects? Processes Related to Software Quality, Quality Management System Structure, Pillars of Quality Management System, Important Aspects of Quality Management.	**12**
II	**Fundamentals of testing:** Introduction, Necessity of testing, What is testing? Fundamental test process, The psychology of testing, Historical Perspective of Testing, Definitions of Testing, Approaches to Testing, Testing During Development Life Cycle, Requirement Traceability Matrix, Essentials of Software Testing, Workbench, Important Features of Testing Process, Misconceptions About Testing, Principles of Software Testing, Salient Features of Good Testing, Test Policy, Test Strategy or Test Approach, Test Planning, Testing Process and Number of Defects Found in Testing, Test Team Efficiency, Mutation Testing, Challenges in Testing, Test Team Approach, Process Problems Faced by Testing, Cost Aspect of Testing, Establishing Testing Policy, Methods, Structured Approach to Testing, Categories of Defect, Defect, Error, or Mistake in Software, Developing Test Strategy, Developing Testing Methodologies (Test Plan), Testing Process, Attitude Towards Testing (Common People Issues), Test Methodologies/Approaches, People Challenges in Software Testing, Raising Management Awareness for Testing, Skills Required by Tester,	**12**

	Testing throughout the software life cycle, Software development models, Test levels, Test types, the targets of testing, Maintenance testing	
III	**Unit Testing: Boundary Value Testing:** Normal Boundary Value Testing, Robust Boundary Value Testing, Worst-Case Boundary Value Testing, Special Value Testing, Examples, Random Testing, Guidelines for Boundary Value Testing, **Equivalence Class Testing:** Equivalence Classes, Traditional Equivalence Class Testing, Improved Equivalence Class Testing, Edge Testing, Guidelines and Observations. **Decision Table–Based Testing:** Decision Tables, Decision Table Techniques, Cause-and-Effect Graphing, Guidelines and Observations, **Path Testing:** Program Graphs, DD-Paths, Test Coverage Metrics, Basis Path Testing, Guidelines and Observations, **Data Flow Testing:** Define/Use Testing, Slice-Based Testing, Program Slicing Tools.	**12**
IV	**Software Verification and Validation:** Introduction, Verification, Verification Workbench, Methods of Verification, Types of reviews on the basis od Stage Phase, Entities involved in verification, Reviews in testing lifecycle, Coverage in Verification, Concerns of Verification, Validation, Validation Workbench, Levels of Validation, Coverage in Validation, Acceptance Testing, Management of Verification and Validation, Software development verification and validation activities. **V-test Model:** Introduction, V-model for software, Testing during Proposal stage, Testing during requirement stage, Testing during test planning phase, Testing during design phase, Testing during coding, VV Model, Critical Roles and Responsibilities.	**12**
V	**Levels of Testing:** Introduction, Proposal Testing, Requirement Testing, Design Testing, Code Review, Unit Testing, Module Testing, Integration Testing, Big-Bang Testing, Sandwich Testing, Critical Path First, Sub System Testing, System Testing, Testing Stages. **Special Tests:** Introduction, GUI testing, Compatibility Testing, Security Testing, Performance Testing, Volume Testing, Stress Testing, Recovery Testing, Installation Testing, Requirement Testing, Regression Testing, Error Handling Testing, Manual Support Testing, Intersystem Testing, Control Testing, Smoke Testing, Adhoc Testing, Parallel Testing, Execution Testing, Operations Testing, Compliance Testing, Usability Testing, Decision Table Testing, Documentation Testing, Training testing, Rapid Testing, Control flow graph, Generating tests on the basis of Combinatorial Designs, State Graph, Risk Associated with New Technologies, Process maturity level of Technology, Testing Adequacy of Control in New technology usage, Object Oriented Application Testing, Testing of Internal Controls, COTS Testing, Client Server Testing, Web Application Testing, Mobile Application Testing, eBusiness eCommerce Testing, Agile Development Testing, Data Warehousing Testing.	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Software Testing and Continuous Quality Improvement	William E. Lewis	CRC Press	Third	2016
2	Software Testing: Principles, Techniques and Tools	M. G. Limaye	TMH		2017
3.	Foundations of Software Testing	Dorothy Graham, Erik van Veenendaal, Isabel Evans, Rex Black	Cengage Learning	3rd	
4.	Software Testing: A Craftsman's Approach	Paul C. Jorgenson	CRC Press	4th	2017

B. Sc. (Information Technology)		Semester – VI	
Course Name: Security in Computing		**Course Code: USIT602**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Information Security Overview** : The Importance of Information Protection, The Evolution of Information Security, Justifying Security Investment, Security Methodology, How to Build a Security Program, The Impossible Job, The Weakest Link, Strategy and Tactics, Business Processes vs. Technical Controls. **Risk Analysis**: Threat Definition, Types of Attacks, Risk Analysis. **Secure Design Principles**: The CIA Triad and Other Models, Defense Models, Zones of Trust, Best Practices for Network Defense.	**12**
II	**Authentication and Authorization**: Authentication, Authorization **Encryption**: A Brief History of Encryption, Symmetric-Key Cryptography, Public Key Cryptography, Public Key Infrastructure. **Storage Security**: Storage Security Evolution, Modern Storage Security, Risk Remediation, Best Practices. **Database Security**: General Database Security Concepts, Understanding Database Security Layers, Understanding Database-Level Security, Using Application Security, Database Backup and Recovery, Keeping Your Servers Up to Date, Database Auditing and Monitoring.	**12**
III	**Secure Network Design**: Introduction to Secure Network Design, Performance, Availability, Security. **Network Device Security**: Switch and Router Basics, Network Hardening. **Firewalls**: Overview, The Evolution of Firewalls, Core Firewall Functions, Additional Firewall Capabilities, Firewall Design. **Wireless Network Security**: Radio Frequency Security Basics, Data-Link Layer Wireless Security Features, Flaws, and Threats, Wireless Vulnerabilities and Mitigations, Wireless Network Hardening Practices and Recommendations, Wireless Intrusion Detection and Prevention, Wireless Network Positioning and Secure Gateways.	**12**
IV	**Intrusion Detection and Prevention Systems**: IDS Concepts, IDS Types and Detection Models, IDS Features, IDS Deployment Considerations, Security Information and Event Management (SIEM). **Voice over IP (VoIP) and PBX Security**: Background, VoIP Components, VoIP Vulnerabilities and Countermeasures, PBX, TEM: Telecom Expense Management. **Operating System Security Models**: Operating System Models, Classic Security Models, Reference Monitor, Trustworthy Computing, International Standards for Operating System Security.	**12**

V	**Virtual Machines and Cloud Computing**: Virtual Machines, Cloud Computing. **Secure Application Design**: Secure Development Lifecycle, Application Security Practices, Web Application Security, Client Application Security, Remote Administration Security. **Physical Security**: Classification of Assets, Physical Vulnerability Assessment, Choosing Site Location for Security, Securing Assets: Locks and Entry Controls, Physical Intrusion Detection.	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	The Complete Reference: Information Security	Mark Rhodes-Ousley	McGraw-Hill	2nd	2013
2.	Essential Cybersecurity Science	Josiah Dykstra	O'Reilly	Fifth	2017
3.	Principles of Computer Security: CompTIA Security+ and Beyond	Wm.Arthur Conklin, Greg White	McGraw Hill	Second	2010

B. Sc. (Information Technology)		Semester – VI	
Course Name: Business Intelligence		**Course Code: USIT603**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Business intelligence:** Effective and timely decisions, Data, information and knowledge, The role of mathematical models, Business intelligence architectures, Ethics and business intelligence **Decision support systems:** Definition of system, Representation of the decision-making process, Evolution of information systems, Definition of decision support system, Development of a decision support system	**12**
II	**Mathematical models for decision making:** Structure of mathematical models, Development of a model, Classes of models **Data mining:** Definition of data mining, Representation of input data , Data mining process, Analysis methodologies **Data preparation**: Data validation, Data transformation, Data reduction	**12**
III	**Classification**: Classification problems, Evaluation of classification models, Bayesian methods, Logistic regression, Neural networks, Support vector machines **Clustering:** Clustering methods, Partition methods, Hierarchical methods, Evaluation of clustering models	**12**
IV	**Business intelligence applications:** **Marketing models**: Relational marketing, Sales force management, **Logistic and production models**: Supply chain optimization, Optimization models for logistics planning, Revenue management systems. **Data envelopment analysis**: Efficiency measures, Efficient frontier, The CCR model, Identification of good operating practices	**12**
V	**Knowledge Management:** Introduction to Knowledge Management, Organizational Learning and Transformation, Knowledge Management Activities, Approaches to Knowledge Management, Information Technology (IT) In Knowledge Management, Knowledge Management Systems Implementation, Roles of People in Knowledge Management **Artificial Intelligence and Expert Systems:** Concepts and Definitions of Artificial Intelligence, Artificial Intelligence Versus Natural Intelligence, Basic Concepts of Expert Systems, Applications of Expert Systems, Structure of Expert Systems, Knowledge Engineering, Development of Expert Systems	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Business Intelligence: Data Mining and Optimization for Decision Making	Carlo Vercellis	Wiley	First	2009
2.	Decision support and Business Intelligence Systems	Efraim Turban, Ramesh Sharda, Dursun Delen	Pearson	Ninth	2011
3.	Fundamental of Business Intelligence	Grossmann W, Rinderle-Ma	Springer	First	2015

B. Sc. (Information Technology)		Semester – VI	
Course Name: Principles of Geographic Information Systems		**Course Code: USIT604 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**A Gentle Introduction to GIS** **The nature of GIS:** Some fundamental observations, Defining GIS, GISystems, GIScience and GIApplications, Spatial data and Geoinformation. **The real world and representations of it:** Models and modelling, Maps, Databases, Spatial databases and spatial analysis **Geographic Information and Spatial Database** **Models and Representations of the real world** **Geographic Phenomena:** Defining geographic phenomena, types of geographic phenomena, Geographic fields, Geographic objects, Boundaries **Computer Representations of Geographic Information:** Regular tessellations, irregular tessellations, Vector representations, Topology and Spatial relationships, Scale and Resolution, Representation of Geographic fields, Representation of Geographic objects **Organizing and Managing Spatial Data** **The Temporal Dimension**	**12**
II	**Data Management and Processing Systems** **Hardware and Software Trends** **Geographic Information Systems:** GIS Software, GIS Architecture and functionality, Spatial Data Infrastructure (SDI) **Stages of Spatial Data handling:** Spatial data handling and preparation, Spatial Data Storage and maintenance, Spatial Query and Analysis, Spatial Data Presentation. **Database management Systems:** Reasons for using a DBMS, Alternatives for data management, The relational data model, Querying the relational database. **GIS and Spatial Databases:** Linking GIS and DBMS, Spatial database functionality.	**12**
III	**Spatial Referencing and Positioning** **Spatial Referencing:** Reference surfaces for mapping, Coordinate Systems, Map Projections, Coordinate Transformations	**12**

	Satellite-based Positioning: Absolute positioning, Errors in absolute positioning, Relative positioning, Network positioning, code versus phase measurements, Positioning technology **Data Entry and Preparation** **Spatial Data Input:** Direct spatial data capture, Indirect spatial data captiure, Obtaining spatial data elsewhere **Data Quality:** Accuracy and Positioning, Positional accuracy, Attribute accuracy, Temporal accuracy, Lineage, Completeness, Logical consistency **Data Preparation:** Data checks and repairs, Combining data from multiple sources **Point Data Transformation:** Interpolating discrete data, Interpolating continuous data	
IV	**Spatial Data Analysis** **Classification of analytical GIS Capabilities** **Retrieval, classification and measurement:** Measurement, Spatial selection queries, Classification **Overlay functions:** Vector overlay operators,Raster overlay operators **Neighbourhood functions:** Proximity computations, Computation of diffusion, Flow computation, Raster based surface analysis **Analysis:** Network analysis, interpolation, terrain modeling **GIS and Application models:** GPS, Open GIS Standards, GIS Applications and Advances **Error Propagation in spatial data processing:** How Errors propagate, Quantifying error propagation	**12**
V	**Data Visualization** **GIS and Maps, The Visualization Process** **Visualization Strategies: Present or explore?** **The cartographic toolbox:** What kind of data do I have?, How can I map my data? **How to map?:** How to map qualitative data, How to map quantitative data, How to map the terrain elevation, How to map time series **Map Cosmetics, Map Dissemination**	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	Principles of Geographic Information Systems-An Introductory Text Book	Editors: Otto Huisman and Rolf A.	The International Institute of Geoinformation Science and Earth Observation	Fourth	2009

2.	Principles of Geographic Information Systems	P.A Burrough and R.A.McDonnell	Oxford University Press	Third	1999
3.	Fundamentals of Spatial Information Systems,	R.Laurini and D. Thompson,	Academic Press		1994
4.	Fundamentals of Geographic Information Systems	Michael N.Demers	Wiley Publications	Fourth	2009
5.	Introduction to Geographic Information Systems	Chang Kang-tsung (Karl),	McGrawHill	Any above 3rd Edition	2013 7th Edition
6.	GIS Fundamentals: A First Text on Geographic Information Systems	Paul Bolsatd	XanEdu Publishing Inc	5th Edition	

B. Sc. (Information Technology)		Semester – VI	
Course Name: Enterprise Networking		**Course Code: USIT605 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**General Network Design:** Network Design Methodology, Architectures for the Enterprise, Borderless Networks Architecture, Collaboration and Video Architecture, Data Center and Virtualization Architecture, Design Lifecycle: Plan, Build, Manage Plan Phase Build Phase Manage Phase Prepare, Plan, Design, Implement, Operate, and Optimize Phases Prepare Phase Plan Phase Design Phase Implement Phase Operate Phase Optimize Phase Summary of PPDIOO Phases Project Deliverables Design Methodology Identifying Customer Design Requirements Characterizing the Existing Network Steps in Gathering Information Network Audit Tools Network Checklist Designing the Network Topology and Solutions Top-Down Approach Pilot and Prototype Tests Design Document **Network Design Models:** Hierarchical Network Models Benefits of the Hierarchical Model, Hierarchical Network Design, Core Layer, Distribution Layer, Access Layer, Hierarchical Model Examples, Hub-and-Spoke, Design Collapsed Core, Design Enterprise Architecture Model, Enterprise Campus Module, Enterprise Edge Area, E-Commerce Module, Internet Connectivity Module, VPN/Remote Access, Enterprise WAN, Service Provider Edge Module, Remote Modules, Enterprise Branch Module, Enterprise Data Center Module, Enterprise Teleworker Module, High Availability Network Services, Workstation-to-Router Redundancy and LAN, High Availability Protocols, ARP Explicit Configuration, RDP, RIP, HSRP, VRRP, GLBP, Server Redundancy, Route Redundancy, Load Balancing, Increasing Availability, Link Media Redundancy	**12**
II	**Enterprise LAN Design:** LAN Media, Ethernet Design Rules, 100Mbps Fast Ethernet Design Rules, Gigabit Ethernet Design Rules, 1000BASE-LX Long-Wavelength Gigabit Ethernet, 1000BASE-SX Short-Wavelength Gigabit Ethernet, 1000BASE-CX Gigabit Ethernet over Coaxial Cable, 1000BASE-T Gigabit Ethernet over UTP 86, 10 Gigabit Ethernet Design Rules, 10GE Media Types, EtherChannel, Comparison of Campus Media LAN Hardware, Repeaters, Hubs, Bridges, Switches, Routers, Layer 3 Switches, Campus LAN Design and Best Practices Best Practices for Hierarchical Layers, Access Layer Best Practices, Distribution Layer Best Practices, Core Layer Best Practices, STP Design Considerations, STP Toolkit, PortFast,	**12**

	UplinkFast, BackboneFast, Loop Guard, Root Guard, BPDU Guard, BPDU Filter, VLAN and Trunk Considerations, Unidirectional Link Detection (UDLD) Protocol, Large-Building LANs, Enterprise Campus LANs, Edge Distribution, Medium-Size LANs, Small and Remote Site LANs, Server Farm Module, Server Connectivity Options, Enterprise Data Center Infrastructure, Campus LAN QoS Considerations, Multicast Traffic Considerations, CGMP, IGMP Snooping. **Data Center Design:** Enterprise DC Architecture, Data Center Foundation Components, Data Center Topology Components, Data Center Network Programmability, SDN, Controllers, APIs, ACI, Challenges in the DC, Data Center Facility Aspects, Data Center Space, Data Center Power, Data Center Cooling, Data Center Heat, Data Center Cabling, Enterprise DC Infrastructure, Data Center Storage, Data Center Reference Architecture, Defining the DC Access Layer, Defining the DC Aggregation Layer, Defining the DC Core Layer, Security in the DC, Fabric Extenders, Virtualization Overview, Challenges, Defining Virtualization and Benefits, Virtualization Risks, Types of Virtualization, Virtualization Technologies, VSS, VRF, vPC, Device Contexts, Server Virtualization, Server Scaling, Virtual Switching, Network Virtualization Design Considerations, Access Control, Path Isolation, Services Edge, Data Center Interconnect, DCI Use Cases, DCI Transport Options, DCI L2 Considerations, Load Balancing in the DC, Application Load Balancing, Network Load Balancing.	
III	**Wireless LAN Design:** Wireless LAN Technologies, WLAN Standards, ISM and UNII Frequencies, Summary of WLAN Standards, Service Set Identifier, WLAN Layer 2 Access Method, WLAN Security, Unauthorized Access, WLAN Security Design Approach, IEEE 802.1X-2001 Port-Based Authentication, Dynamic WEP Keys and LEAP, Controlling WLAN Access to Servers, WLAN Authentication, Authentication Options, WLAN Controller Components, WLC Interface Types, AP Controller Equipment Scaling, Roaming and Mobility Groups, Intracontroller Roaming, Layer 2 Intercontroller Roaming, Layer 3 Intercontroller Roaming, Mobility Groups, WLAN Design, Controller Redundancy Design: Deterministic vs. Dynamic, N+1 WLC Redundancy, N+N WLC Redundancy, N+N+1 WLC Redundancy, Radio Management and Radio Groups, RF Groups, RF Site Survey, Using EoIP Tunnels for Guest Services, Wireless Mesh for Outdoor Wireless, Mesh Design Recommendations, Campus Design Considerations, Power over Ethernet (PoE), Wireless and Quality of Service (QoS), Branch Design Considerations, Local MAC, REAP, Hybrid REAP, Branch Office Controller Options. **WAN Technologies and the Enterprise Edge:** WAN and Enterprise Edge Overview, Definition of WAN, WAN Edge Module, Enterprise	**12**

	Edge Modules, WAN Transport Technologies, ISDN, ISDN BRI Service, ISDN PRI Service, Digital Subscriber Line, Cable, Wireless, Frame Relay, Time-Division Multiplexing, Metro Ethernet, SONET/SDH, Multiprotocol Label Switching (MPLS), Dark Fiber, Dense Wavelength-Division Multiplexing, Ordering WAN Technology and Contracts, WAN and Edge Design Methodologies, Response Time, Throughput, Reliability, Bandwidth Considerations, WAN Link Categories, Optimizing Bandwidth Using QoS, Queuing, Traffic Shaping and Policing, Classification, Congestion Management, Priority Queuing, Custom Queuing, Weighted Fair Queuing, Class-Based Weighted Fair Queuing, Low-Latency Queuing, Traffic Shaping and Policing, Link Efficiency, Window Size, DMZ Connectivity, Segmenting DMZs, DMZ Services, Internet Connectivity, Centralized Internet (Branch) vs. Direct Internet (Branch), High Availability for the Internet Edge, VPN Network Design. **WAN Design** Traditional WAN Technologies Hub-and-Spoke Topology Full-Mesh Topology Partial-Mesh Topology Point-to-Point Topology Remote Site Connectivity Enterprise VPN vs. Service Provider VPN Enterprise Managed VPN: IPsec IPsec Direct Encapsulation Generic Routing Encapsulation IPsec DMVPN IPsec Virtual Tunnel Interface Design GETVPN Service Provider–Managed Offerings ,Metro Ethernet Service Provider VPNs: L2 vs. L3 ,Virtual Private Wire Services VPWS L2 VPN Considerations ,Virtual Private LAN Services VPLS L2 VPN Considerations ,MPLS, MPLS Layer 3 Design Overview MPLS L3 VPN Considerations ,VPN Benefits WAN Backup Design WAN Backup over the Internet Enterprise WAN Architecture Cisco Enterprise MAN/WAN Enterprise WAN/MAN Architecture Comparison ,Enterprise WAN Components Comparing Hardware and Software Enterprise Branch Architecture Branch Design Branch Connectivity Redundancy for Branches Single WAN Carrier vs. Dual WAN Carriers Single MPLS Carrier Site ,Dual MPLS Carriers Hybrid WAN: L3 VPN with IPsec VPN ,Internet for Branches Flat Layer 2 vs. Collapsed Core ,Enterprise Branch Profiles Small Branch Design Medium Branch Design Large Branch Design Enterprise Teleworker Design ,ISRs for Teleworkers	
IV	Internet Protocol Version 4 Design,IPv4 Header ToS IPv4 Fragmentation IPv4 Addressing ,IPv4 Address Classes Class A Addresses Class B Addresses ,Class C Addresses Class D Addresses Class E Addresses ,IPv4 Address Types IPv4 Private Addresses NAT ,IPv4 Address Subnets Mask Nomenclature IP Address Subnet Design Example Determining the Network Portion of an IP Address Variable-Length Subnet Masks, Loopback Addresses IP Telephony Networks ,IPv4 Addressing Design Goal of IPv4 Address Design , Plan for Future Use of IPv4 Addresses , Performing Route Summarization , Plan for a	**12**

	Hierarchical IP Address Network , Private and Public IP Address and NAT Guidelines , Steps for Creating an IPv4 Address Plan Case Study: IP Address Subnet Allocation , Address Assignment and Name Resolution , Recommended Practices of IP Address Assignment , BOOTP DHCP DNS , Internet Protocol Version 6 Design, IPv6 Header IPv6 Address Representation IPv4-Compatible IPv6 Addresses IPv6 Prefix Representation IPv6 Address Scope Types and Address Allocations IPv6 Address Allocations IPv6 Unicast Address Global Unicast Addresses Link-Local Addresses , Unique Local IPv6 Address Global Aggregatable IPv6 Address , IPv4-Compatible IPv6 Address IPv6 Anycast Addresses , IPv6 Multicast Addresses IPv6 Mechanisms ICMPv6 , IPv6 Neighbor Discovery Protocol IPv6 Name Resolution , Path MTU Discovery IPv6 Address-Assignment Strategies , Manual Configuration SLAAC of Link-Local Address , SLAAC of Globally Unique IPv6 Address DHCPv6 , DHCPv6 Lite IPv6 Security IPv6 Routing Protocols RIPng OSPFv3 , BGP4 Multiprotocol Extensions (MP-BGP) for IPv6 , IPv6 Addressing Design , Planning for Addressing with IPv6 , Route Summarization with IPv6 IPv6 Private Addressing IPv6 for the Enterprise IPv6 Address Allocation , Partly Linked IPv4 Address into IPv6, Whole IPv4 Address Linked into IPv6 IPv6 Addresses Allocated Per Location and/or Type , IPv4-to-IPv6 Transition Mechanisms and Deployment Models , Dual-Stack Mechanism IPv6 over IPv4 Tunnels , Protocol Translation Mechanisms IPv6 Deployment Models , Dual-Stack Model Hybrid Model Service Block Model ,IPv6 Deployment Model Comparison IPv6 Comparison with IPv4 ,OSPF, BGP, Route Manipulation, and IP Multicast,OSPFv2 OSPFv2 Metric OSPFv2 Adjacencies and Hello Timers , OSPFv2 Areas OSPF Area Design Considerations OSPF Router Types OSPF DRs LSA Types Autonomous System External Path Types OSPF Stub Area Types Stub Areas Totally Stubby Areas , NSSAs Virtual Links OSPFv2 Router Authentication , OSPFv2 Summary OSPFv3 OSPFv3 Changes from OSPFv2, OSPFv3 Areas and Router Types OSPFv3 LSAs OSPFv3 Summary BGP BGP Neighbors eBGP iBGP Route Reflectors Confederations BGP Administrative Distance , BGP Attributes, Weight, and the BGP Decision Process BGP Path Attributes Next-Hop Attribute Local Preference Attribute Origin Attribute Autonomous System Path Attribute MED Attribute Community Attribute Atomic Aggregate and Aggregator Attributes Weight BGP Decision Process , BGP Summary , Route Manipulation PBR Route Summarization Route Redistribution Default Metric OSPF Redistribution Route Filtering Transit Traffic Routing Protocols on the Hierarchical Network Infrastructure IP Multicast Review , Multicast Addresses Layer 3 to Layer 2 Mapping IGMP , IGMPv1 IGMPv2 IGMPv3 CGMP IGMP Snooping , Sparse Versus Dense Multicast Multicast Source and Shared	

	Trees PIM PIM-SM PIM DR Auto-RP PIMv2 Bootstrap Router , DVMRP IPv6 Multicast Addresses	
V	Managing Security Network Security Overview Security Legislation Security Threats Reconnaissance and Port Scanning Vulnerability Scanners Unauthorized Access Security Risks Targets Loss of Availability Integrity Violations and Confidentiality Breaches , Security Policy and Process Security Policy Defined , Basic Approach of a Security Policy Purpose of Security Policies, Security Policy Components Risk Assessment , Risk Index Continuous Security Integrating Security Mechanisms into Network Design Trust and Identity Management , Trust Domains of Trust Identity Passwords Tokens Certificates , Network Access Control Secure Services Encryption Fundamentals Encryption Keys VPN Protocols , Transmission Confidentiality Data Integrity Threat Defense , Physical Security Infrastructure Protection Security Management Solutions Security Solution Network Security Platforms , Trust and Identity Technologies Firewall Fundamentals , Types of Firewalls Next-Gen Firewalls NAT Placement , Firewall Guidelines Firewall ACLs , Identity and Access Control Deployments Detecting and Mitigating Threats IPS/IDS Fundamentals IPS/IDS Guidelines , Threat Detection and Mitigation Technologies , Threat-Detection and Threat-Mitigation Solutions , FirePOWER IPS Security Management Applications , Security Platform Solutions Security Management Network Integrating Security into Network Devices IOS Security , ISR G2 Security Hardware Options Securing the Enterprise , Implementing Security in the Campus Implementing Security in the Data Center Implementing Security in the Enterprise Edge Network Management Protocols, Simple Network Management Protocol SNMP Components , MIB SNMP Message Versions SNMPv1 SNMPv2 SNMPv3 , Other Network Management Technologies RMON , RMON2 NetFlow Compared to RMON and SNMP , CDP LLDP Syslog	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	CCDA200-310Official Cert Guide	ANTHONY BRUNO, CCIE No. 2738 STEVE JORDAN, CCIE No. 11293	**Cisco Press**		
2.	Network Warrior	Gary A Donabue	**O Reilly**	2nd	2011

B. Sc. (Information Technology)		Semester – VI	
Course Name: IT Services Management		Course Code: USIT606 (Elective I)	
Periods per week (1 Period is 50 minutes),		5	
Credits		2	
		Hours	Marks
Evaluation System	Theory Examination	2½	75
	Internal	--	25

Unit	Details	Lectures
I	**IT Service Management:** Introduction, What is service management? What are services? Business Process, Principles of Service management: Specialisation and Coordination, The agency principle, Encapsulation, Principles of systems, The service Life Cycle, Functions and processes across the life cycle. **Service Strategy Principles:** Value creation, Service Assets, Service Provider Service Structures, Service Strategy Principles. **Service Strategy:** Define the market, Develop the offerings, Develop Strategic Assets, Prepare for execution. **Challenges, Critical Success factors and risks:** Complexity, Coordination and Control, Preserving value, Effectiveness in measurement, Risks.	12
II	**Service Design:** Fundamentals, **Service Design Principles:** Goals, Balanced Design, Identifying Service requirements, identifying and documenting business requirements and drivers, Design activities, Design aspects, Subsequent design activities, Design constraints, Service oriented architecture, Business Service Management, Service Design Models **Service Design Processes:** Service Catalogue Management, Service Level Management, Capacity Management, Availability Management, IT Service Continuity Management, Information Security Management, Supplier Management **Challenges, Critical Success factors and risks:** Challenges, Risks	12
III	**Service Transition:** Fundamentals, **Service Transition Principles:** Principles Supporting Service Transition, Policies for Service Transition **Service Transition Processes:** Transition planning and support, Change Management, Service Asses Configuration Management, Service and Deployment Management, Service Validation and Testing, Evaluation, Knowledge Management. **Challenges, Critical Success factors and risks:** Challenges, Critical Success factors, Risks, Service Transition under difficult Conditions.	12
IV	**Service Operation:** Fundamentals, **Service Operation Principles:** Functions, groups, teams, departments and divisions, Achieving balance in service operations, Providing service, Operation staff involvement in service design and service transition, Operational Health, Communication, Documentation	12

	Service Operation Processes: Event Management, Incident Management, Request fulfilment, Problem Management, Access Management, Operational activities of processes covered in other lifecycle phases. **Challenges, Critical Success factors and risks:** Challenges, Critical Success factors, Risks	
V	**Continual Service Improvement(CSI) Principles:** CSI Approach, CSI and organizational change, Ownership, CSI register, External and Internal drivers, Service level management, Knowledge management, The Deming cycle, Service Measurement, IT governance, Frameworks, models, standards and quality Systems, CSI inputs and outputs. **CSI Process:** The seven step improvement process. **CSI Methods nad Techniques:** Methods and techniques, Assessments, benchmarking, Service Measurement, Metrics, Return on Investment, Service reporting, CSI and other service management processes, **Organising for CSI:** Organisational development, Functions, roles, Customer Engagement, Responsibility model - RACI, Competence and training. **Technology considerations:** Tools to support CSI activities. **Implementing CSI:** Critical Considerations for implementing CSI, The start, Governance, CSI and organisational change, Communication Strategy and Plan	**12**

Books and References:					
Sr. No.	**Title**	**Author/s**	**Publisher**	**Edition**	**Year**
1.	ITIL v3 Foundation Complete Certification Kit				2009
2.	ITIL v3 Service Strategy		OGC/TSO		
3.	ITIL v3 Service Transition		OGC/TSO		
4.	ITIL v3 Service Operation		OGC/TSO		
5.	ITIL Continual Service Improvement		TSO	2011	2011

B. Sc. (Information Technology)		Semester – VI	
Course Name: Cyber Laws		**Course Code: USIT607 (Elective I)**	
Periods per week (1 Period is 50 minutes)		**5**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Theory Examination**	**2½**	**75**
	Internal	**--**	**25**

Unit	Details	Lectures
I	**Power of Arrest Without Warrant Under the IT Act, 2000:** A Critique, Crimes of this Millennium, Section 80 of the IT Act, 2000 – A Weapon or a Farce? Forgetting the Line Between Cognizable and Non-Cognizable Offences, Necessity of Arrest without Warrant from Any Place, Public or Otherwise, Check and Balances Against Arbitrary Arrests, Arrest for "About to Commit" an Offence Under the IT Act: A Tribute to Draco, Arrest, But NO Punishment! **Cyber Crime and Criminal Justice: Penalties, Adjudication and Appeals Under the IT Act, 2000:** Concept of "Cyber Crime " and the IT Act , 2000, Hacking, Teenage Web Vandals, Cyber Fraud and Cyber Cheating, Virus on the Internet, Defamation, Harassment and E-mail Abuse, Cyber Pornography, Other IT Act Offences, Monetary Penalties, Adjudication and Appeals Under IT Act , 2000, Network Service Providers, Jurisdiction and Cyber Crime, Nature of Cyber Criminality, Strategies to Tackle Cyber Crime and Trends, Criminal Justice in India and Implications on Cyber Crime.	**12**
II	**Contracts in the Infotech World:** Contracts in the Infotech World, Click-Wrap and Shrink-Wrap Contract: Status under the Indian Contract Act, 1872, Contract Formation Under the Indian Contract Act, 1872, Contract Formation on the Internet, Terms and Conditions of Contracts. **Jurisdiction in the Cyber World:** Questioning the Jurisdiction and Validity of the Present Law of Jurisdiction, Civil Law of Jurisdiction in India, Cause of Action, Jurisdiction and the Information Technology Act,2000, Foreign Judgements in India, Place of Cause of Action in Contractual and IPR Disputes, Exclusion Clauses in Contracts, Abuse of Exclusion Clauses, Objection of Lack of Jurisdiction, Misuse of the Law of Jurisdiction, Legal Principles on Jurisdiction in the United State of America, Jurisdiction Disputes w.r.t. the Internet in the United State of America.	**12**
III	**Battling Cyber Squatters and Copyright Protection in the Cyber World:** Concept of Domain Name and Reply to Cyber Squatters, Meta-Tagging, Legislative and Other Innovative Moves Against Cyber Squatting, The Battle Between Freedom and Control on the Internet, Works in Which Copyright Subsists and meaning of Copyright, Copyright Ownership and Assignment, License of Copyright, Copyright Terms and Respect for Foreign Works, Copyright	**12**

	Infringement, Remedies and Offences, Copyright Protection of Content on the Internet; Copyright Notice, Disclaimer and Acknowledgement, Downloading for Viewing Content on the Internet, Hyper-Linking and Framing, Liability of ISPs for Copyright Violation in the Cyber World: Legal Developments in the US, Napster and its Cousins: A Revolution on the Internet but a Crisis for Copyright Owners, Computer Software Piracy.	
IV	**E-Commerce Taxation: Real Problems in the Virtual World:** A Tug of War on the Concept of 'Permanent Establishment', Finding the PE in Cross Border E-Commerce, The United Nations Model Tax Treaty, The Law of Double Taxation Avoidance Agreements and Taxable Jurisdiction Over Non-Residents, Under the Income Tax Act, 1961, Tax Agents of Non-Residents under the Income Tax Act,1961 and the Relevance to E-Commerce, Source versus Residence and Classification between Business Income and Royalty, The Impact of the Internet on Customer Duties, Taxation Policies in India: At a Glance. **Digital Signature, Certifying Authorities and E-Governance:** Digital Signatures, Digital Signature Certificate, Certifying Authorities and Liability in the Event of Digital Signature Compromise, E-Governance in India: A Warning to Babudom!	**12**
V	**The Indian Evidence Act of 1872 v. Information Technology Act, 2000:** Status of Electronic Records as Evidence, Proof and Management of Electronic Records; Relevancy, Admissibility and Probative Value of E-Evidence, Proving Digital Signatures, Proof of Electronic Agreements, Proving Electronic Messages, Other Amendments in the Indian Evidence Act by the IT Act, Amendments to the Bankers Books Evidence Act, 1891 and Reserve Bank of India Act, 1934. **Protection of Cyber Consumers in India:** Are Cyber Consumers Covered Under the Consumer Protection Act? Goods and Services, Consumer Complaint, Defect in Goods and Deficiency in Services, Restrictive and Unfair Trade Practices, Instances of Unfair Trade Practices, Reliefs Under CPA, Beware Consumers, Consumer Foras, Jurisdiction and Implications on cyber Consumers in India, Applicability of CPA to Manufacturers, Distributors, Retailers and Service Providers Based in Foreign Lands Whose Goods are Sold or Services Provided to a Consumer in India. Amendments in Indian IT Act 2000	**12**

Books and References:

Sr. No.	Title	Author/s	Publisher	Edition	Year
1.	Cyber Law Simplified	Vivek Sood	TMH Education		2001
2.	Cybersecurity Law	Jeff Kosseff	Wiley		2017

B. Sc. (Information Technology)		Semester – VI	
Course Name: Project Implementation		Course Code: USIT6P1	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	-

The details are given in Appendix – I

B. Sc. (Information Technology)		Semester – VI	
Course Name: Security in Computing Practical		Course Code: USIT6P2	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	-

Practical No	Details
1	**Configure Routers**
a	OSPF MD5 authentication.
b	NTP.
c	to log messages to the syslog server.
d	to support SSH connections.
2	**Configure AAA Authentication**
a	Configure a local user account on Router and configure authenticate on the console and vty lines using local AAA
b	Verify local AAA authentication from the Router console and the PC-A client
3	**Configuring Extended ACLs**
a	**Configure, Apply and Verify an Extended Numbered ACL**
4	**Configure IP ACLs to Mitigate Attacks and IPV6 ACLs**
a	Verify connectivity among devices before firewall configuration.
b	Use ACLs to ensure remote access to the routers is available only from management station PC-C.
c	Configure ACLs on to mitigate attacks.
d	Configuring IPv6 ACLs
5	**Configuring a Zone-Based Policy Firewall**
6	Configure IOS Intrusion Prevention System (IPS) Using the CLI
a	Enable IOS IPS.
b	Modify an IPS signature.
7	**Layer 2 Security**
a	Assign the Central switch as the root bridge.
b	Secure spanning-tree parameters to prevent STP manipulation attacks.
c	Enable port security to prevent CAM table overflow attacks.
8	**Layer 2 VLAN Security**
9	**Configure and Verify a Site-to-Site IPsec VPN Using CLI**

10	**Configuring ASA Basic Settings and Firewall Using CLI**
a	Configure basic ASA settings and interface security levels using CLI
b	Configure routing, address translation, and inspection policy using CLI
c	Configure DHCP, AAA, and SSH
d	Configure a DMZ, Static NAT, and ACLs

B. Sc. (Information Technology)		Semester – VI	
Course Name: Business Intelligence Practical		Course Code: USIT6P3	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	-

Practical No	Details
1	Import the legacy data from different sources such as (Excel , SqlServer, Oracle etc.) and load in the target system. (You can download sample database such as Adventureworks, Northwind, foodmart etc.)
2	Perform the Extraction Transformation and Loading (ETL) process to construct the database in the Sqlserver.
3	a. Create the Data staging area for the selected database. b. Create the cube with suitable dimension and fact tables based on ROLAP, MOLAP and HOLAP model.
4	a.Create the ETL map and setup the schedule for execution. b. Execute the MDX queries to extract the data from the datawarehouse.
5	a. Import the datawarehouse data in Microsoft Excel and create the Pivot table and Pivot Chart. b. Import the cube in Microsoft Excel and create the Pivot table and Pivot Chart to perform data analysis.
6	Apply the what – if Analysis for data visualization. Design and generate necessary reports based on the data warehouse data.
7	Perform the data classification using classification algorithm.
8	Perform the data clustering using clustering algorithm.
9	Perform the Linear regression on the given data warehouse data.
10	Perform the logistic regression on the given data warehouse data.

The BI tools such as Tableau / Power BI / BIRT / R / Excel or any other can be used.

B. Sc. (Information Technology)		Semester – VI	
Course Name: Principles of Geographical Information System Practical		**Course Code: USIT6P4 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**-**

Practical No	Details
0	Familiarizing Quantum GIS: Installation of QGIS, datasets for both Vector and Raster data, Maps.
1	Creating and Managing Vector Data: Adding vector layers, setting properties, formatting, calculating line lengths and statistics
2	Exploring and Managing Raster data: Adding raster layers, raster styling and analysis, raster mosaicking and clipping
3	Making a Map, Working with Attributes, Importing Spreadsheets or CSV files Using Plugins, Searching and Downloading OpenStreetMap Data
4	Working with attributes, terrain Data
5	Working with Projections and WMS Data
6	Georeferencing Topo Sheets and Scanned Maps Georeferencing Aerial Imagery Digitizing Map Data
7	Managing Data Tables and Saptial data Sets: Table joins, spatial joins, points in polygon analysis, performing spatial queries
8	Advanced GIS Operations 1: Nearest Neighbor Analysis, Sampling Raster Data using Points or Polygons, Interpolating Point Data
9	Advance GIS Operations 2: Batch Processing using Processing Framework Automating Complex Workflows using Processing Modeler Automating Map Creation with Print Composer Atlas
10	Validating Map data

B. Sc. (Information Technology)		Semester – VI	
Course Name: Advanced Networking Practical		**Course Code: USIT6P5 (Elective II)**	
Periods per week (1 Period is 50 minutes)		**3**	
Credits		**2**	
		Hours	**Marks**
Evaluation System	**Practical Examination**	**2½**	**50**
	Internal	**--**	**-**

Practical No	Details
1	**Configuring OSPF – I**
a	Single-Area OSPF Link Costs and Interface Priorities
b	Multi-Area OSPF with Stub Areas and Authentication
2	**Configuring OSPF – II**
a	OSPF Virtual Links and Area Summarization
b	OSPF over Frame Relay
3	**Redistribution and Administrative Distances**
a	Redistribution Between RIP and OSPF
b	Manipulating Administrative Distances
4	**BGP**
a	Configuring BGP with Default Routing
b	Using the AS_PATH Attribute
c	BGP Route Reflectors and Route Filters
5	**IPv6**
a	Configuring OSPF for IPv6
b	Configuring 6to4 Tunnels
6	**VLANs and EtherChannel**
a	Static VLANS, VLAN Trunking, and VTP Domains and Modes
b	Configuring EtherChannel
7	**Spanning Tree Protocol**
a	Spanning Tree Protocol (STP) Default Behavior
b	Modifying Default Spanning Tree Behavior
8	**VLAN and Spanning Tree**
a	Per-VLAN Spanning Tree Behavior
b	Multiple Spanning Tree

9	**Internal VLAN Routing**
a	Inter-VLAN Routing with an External Router
b	Inter-VLAN Routing with an Internal Route Processor
10	**Configure NAT Services**

B. Sc. (Information Technology)		Semester – VI	
Course Name: Advanced Mobile Programming Practical		Course Code: USIT6P6	
Periods per week (1 Period is 50 minutes)		3	
Credits		2	
		Hours	Marks
Evaluation System	Practical Examination	2½	50
	Internal	--	--

Practical No	Details
1	**Introduction to Android, Introduction to Android Studio IDE, Application Fundamentals:** Creating a Project, Android Components, Activities, Services, Content Providers, Broadcast Receivers, Interface overview, Creating Android Virtual device, USB debugging mode, Android Application Overview. Simple "Hello World" program.
2	**Programming Resources** Android Resources: (Color, Theme, String, Drawable, Dimension, Image),
3	**Programming Activities and fragments** Activity Life Cycle, Activity methods, Multiple Activities, Life Cycle of fragments and multiple fragments.
4	**Programs related to different Layouts** Coordinate, Linear, Relative, Table, Absolute, Frame, List View, Grid View.
5	**Programming UI elements** AppBar, Fragments, UI Components
6	**Programming menus, dialog, dialog fragments**
7	**Programs on Intents, Events, Listeners and Adapters** The Android Intent Class, Using Events and Event Listeners
8	**Programs on Services, notification and broadcast receivers**
9	**Database Programming with SQLite**
10	**Programming threads, handles and asynchronized programs**
11	**Programming Media API and Telephone API**
12	**Programming Security and permissions**
13	**Programming Network Communications and Services (JSON)**

APPENDIX – 1

Project Dissertation Semester V and Project Implementation Semester VI

Chapter 1 to 4 should be submitted in Semester V in spiral binding. These chapter have also to be included in Semester VI report. Semester VI report has to be hard bound with golden embossing. Students will be evaluated based on the dissertation in semester V and dissertation and viva voce in Semester VI.

I. OBJECTIVES

- Describe the Systems Development Life Cycle (SDLC).
- Evaluate systems requirements.
- Complete a problem definition.
- Evaluate a problem definition.
- Determine how to collect information to determine requirements.
- Perform and evaluate feasibility studies like cost-benefit analysis, technical feasibility, time feasibility and Operational feasibility for the project.
- Work on data collection methods for fact finding.
- Construct and evaluate data flow diagrams.
- Construct and evaluate data dictionaries.
- Evaluate methods of process description to include structured English, decision tables and decision trees.
- Evaluate alternative tools for the analysis process.
- Create and evaluate such alternative graphical tools as systems flow charts and state transition diagrams.
- Decide the S/W requirement specifications and H/W requirement specifications.
- Plan the systems design phase of the SDLC.
- Distinguish between logical and physical design requirements.
- Design and evaluate system outputs.
- Design and evaluate systems inputs.
- Design and evaluate validity checks for input data.

- Design and evaluate user interfaces for input.
- Design and evaluate file structures to include the use of indexes.
- Estimate storage requirements.
- Explain the various file update processes based on the standard file organizations.
- Decide various data structures.
- Construct and evaluate entity-relationship (ER) diagrams for RDBMS related projects.
- Perform normalization for the unnormalized tables for RDBMS related projects
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.
- Decide the various processing systems to include distributed, client/server, online and others.
- Perform project cost estimates using various techniques.
- Schedule projects using both GANTT and PERT charts.
- Perform coding for the project.
- Documentation requirements and prepare and evaluate systems documentation.
- Perform various systems testing techniques/strategies to include the phases of testing.
- Systems implementation and its key problems.
- Generate various reports.
- Be able to prepare and evaluate a final report.
- Brief the maintenance procedures and the role of configuration management in operations.
- To decide the future scope and further enhancement of the system.
- Plan for several appendices to be placed in support with the project report documentation.

- Work effectively as an individual or as a team member to produce correct, efficient, well-organized and documented programs in a reasonable time.
- Recognize problems that are amenable to computer solutions, and knowledge of the tool necessary for solving such problems.
- Develop of the ability to assess the implications of work performed.
- Get good exposure and command in one or more application areas and on the software
- Develop quality software using the software engineering principles
- Develop of the ability to communicate effectively.

II. Type of the Project

The majority of the students are expected to work on a real-life project preferably in some industry/ Research and Development Laboratories/Educational Institution/Software Company. Students are encouraged to work in the areas listed below. However, it is ***not mandatory*** for a student to work on a real-life project. The student can formulate a project problem with the help of her/his Guide and submit the project proposal of the same. **Approval of the project proposal is mandatory**. If approved, the student can commence working on it, and complete it. Use the latest versions of the software packages for the development of the project.

III. SOFTWARE AND BROAD AREAS OF APPLICATION

FRONT END / GUI Tools	.Net Technologies,Java
DBMS/BACK END	Oracle, SQL Plus, MY SQL, SQL Server,
LANGUAGES	C, C++, Java, VC++, C#, R,Python
SCRIPTING LANGUAGES	PHP,JSP, SHELL Scripts (Unix), TcL/TK,
.NET Platform	F#,C#. Net, Visual C#. Net, ASP.Net
MIDDLE WARE (COMPONENT) TECHNOLOGIES	COM/DCOM, Active-X, EJB
UNIX INTERNALS	Device Drivers, RPC, Threads, Socket programming
NETWORK/WIRELESS TECHNOLOGIES	-

REALTIME OPERATING SYSTEM/ EMBEDDED SKILLS	LINUX, Raspberry Pi, Arduino, 8051
APPLICATION AREAS	Financial / Insurance / Manufacturing / Multimedia / Computer Graphics / Instructional Design/ Database Management System/ Internet / Intranet / Computer Networking-Communication Software development/ E-Commerce/ ERP/ MRP/ TCP-IP programming / Routing protocols programming/ Socket programming.

IV. Introduction

The project report should be documented with scientific approach to the solution of the problem that the students have sought to address. The project report should be prepared in order to solve the problem in a methodical and professional manner, making due references to appropriate techniques, technologies and professional standards. The student should start the documentation process from the first phase of software development so that one can easily identify the issues to be focused upon in the ultimate project report. The student should also include the details from the project diary, in which they will record the progress of their project throughout the course. The project report should contain enough details to enable examiners to evaluate the work. The important points should be highlighted in the body of the report, with details often referred to appendices.

1.1 PROJECT REPORT:

Title Page

Original Copy of the Approved Proforma of the Project Proposal

Certificate of Authenticated work

Role and Responsibility Form

Abstract

Acknowledgement

Table of Contents

Table of Figures

CHAPTER 1: INTRODUCTION

1.1 Background

1.2 Objectives

1.3 Purpose, Scope, and Applicability

1.3.1 Purpose

1.3.2 Scope

1.3.3 Applicability

1.4 Achievements

1.5 Organisation of Report

CHAPTER 2: SURVEY OF TECHNOLOGIES

CHAPTER 3: REQUIREMENTS AND ANALYSIS

3.1 Problem Definition

3.2 Requirements Specification

3.3 Planning and Scheduling

3.4 Software and Hardware Requirements

3.5 Preliminary Product Description

3.6 Conceptual Models

CHAPTER 4: SYSTEM DESIGN

4.1 Basic Modules

4.2 Data Design

4.2.1 Schema Design

4.2.2 Data Integrity and Constraints

4.3 Procedural Design

4.3.1 Logic Diagrams

4.3.2 Data Structures

4.3.3 Algorithms Design

4.4 User interface design

4.5 Security Issues

4.6 Test Cases Design

The documentation should use tools like star UML, Visuo for windows, Rational Rose for design as part of Software Project Management Practical Course. The documentation should be spiral bound for semester V and the entire documentation should be hard bound during semester VI.

CHAPTER 5: IMPLEMENTATION AND TESTING

5.1 Implementation Approaches

5.2 Coding Details and Code Efficiency

5.2.1 Code Efficiency

5.3 Testing Approach

5.3.1 Unit Testing

5.3.2 Integrated Testing

5.3.3 Beta Testing

5.4 Modifications and Improvements

5.5 Test Cases

CHAPTER 6: RESULTS AND DISCUSSION

6.1 Test Reports

6.2 User Documentation

CHAPTER 7: CONCLUSIONS

7.1 Conclusion

7.1.1 Significance of the System

7.2 Limitations of the System

7.3 Future Scope of the Project

REFERENCES

GLOSSARY

APPENDIX A

APPENDIX B

V. EXPLANATION OF CONTENTS

Title Page

Sample format of Title page is given in Appendix 1 of this block. Students should follow the given format.

Original Copy of the Approved Proforma of the Project Proposal

Sample Proforma of Project Proposal is given in Appendix 2 of this block. Students should follow the given format.

Certificate of Authenticated work

Sample format of Certificate of Authenticated work is given in Appendix 3 of this block. Students should follow the given format.

Role and Responsibility Form

Sample format for Role and Responsibility Form is given in Appendix 4 of this block.
Students should follow the given format.

Abstract

This should be one/two short paragraphs (100-150 words total), summarising the project work. It is important that this is not just a re-statement of the original project outline. A suggested flow is background, project aims and main achievements. From the abstract, a reader should be able to ascertain if the project is of interest to them and, it should present results of which they may wish to know more details.

Acknowledgements

This should express student's gratitude to those who have helped in the preparation of project.

Table of Contents: The table of contents gives the readers a view of the detailed structure of the report. The students would need to provide section and subsection headings with associated pages. The formatting details of these sections and subsections are given below.

Table of Figures: List of all Figures, Tables, Graphs, Charts etc. along with their page numbers in a table of figures.

Chapter 1: Introduction

The introduction has several parts as given below:

Background: A description of the background and context of the project and its relation to work already done in the area. Summarise existing work in the area concerned with the project work.

Objectives: Concise statement of the aims and objectives of the project. Define exactly what is going to be done in the project; the objectives should be about 30 /40 words.
Purpose, Scope and Applicability: The description of Purpose, Scope, and Applicability are given below:

• Purpose: Description of the topic of the project that answers questions on why this project is being done. How the project could improve the system its significance and theoretical framework.
• Scope: A brief overview of the methodology, assumptions and limitations. The students should answer the question: What are the main issues being covered in the project? What are the main functions of the project?
• Applicability: The student should explain the direct and indirect applications of their work. Briefly discuss how this project will serve the computer world and people.
Achievements: Explain what knowledge the student achieved after the completion of the work. What contributions has the project made to the chosen area? Goals achieved - describes the degree to which the findings support the original objectives laid out by the project. The goals may be partially or fully achieved, or exceeded.

Organisation of Report: Summarising the remaining chapters of the project report, in effect, giving the reader an overview of what is to come in the project report.

Chapter 2: Survey of Technologies

In this chapter Survey of Technologies should demonstrate the students awareness and understanding of Available Technologies related to the topic of the project. The student should give the detail of all the related technologies that are necessary to complete the project. The should describe the technologies available in the chosen area and present a comparative study of all those Available Technologies. Explain why the student selected the one technology for the completion of the objectives of the project.

Chapter 3: Requirements and Analysis

Problem Definition: Define the problem on which the students are working in the project.

Provide details of the overall problem and then divide the problem in to sub-problems. Define each sub-problem clearly.

Requirements Specification: In this phase the student should define the requirements of the system, independent of how these requirements will be accomplished. The Requirements Specification describes the things in the system and the actions that can be done on these things. Identify the operation and problems of the existing system.

Planning and Scheduling: Planning and scheduling is a complicated part of software development. Planning, for our purposes, can be thought of as determining all the small tasks that must be carried out in order to accomplish the goal. Planning also takes into account, rules, known as constraints, which, control when certain tasks can or cannot happen. Scheduling can be thought of as determining whether adequate resources are available to carry out the plan. The student should show the Gantt chart and Program Evaluation Review Technique (PERT).

Software and Hardware Requirements: Define the details of all the software and hardware needed for the development and implementation of the project.

• Hardware Requirement: In this section, the equipment, graphics card, numeric co-processor, mouse, disk capacity, RAM capacity etc. necessary to run the software must be noted.

• Software Requirements: In this section, the operating system, the compiler, testing tools, linker, and the libraries etc. necessary to compile, link and install the software must be listed.

Preliminary Product Description: Identify the requirements and objectives of the new system. Define the functions and operation of the application/system the students are developing as project.

Conceptual Models: The student should understand the problem domain and produce a model of the system, which describes operations that can be performed on the system, and the allowable sequences of those operations. Conceptual Models could consist of complete Data Flow Diagrams, ER diagrams, Object-oriented diagrams, System Flowcharts etc.

Chapter 4: System Design

Describes desired features and operations in detail, including screen layouts, business rules, process diagrams, pseudocode and other documentation.

Basic Modules: The students should follow the divide and conquer theory, so divide the overall problem into more manageable parts and develop each part or module separately. When all modules are ready, the student should integrate all the modules into one system. In this phase, the student should briefly describe all the modules and the functionality of these modules.

Data Design: Data design will consist of how data is organised, managed and manipulated.

• Schema Design: Define the structure and explanation of schemas used in the project.

• Data Integrity and Constraints: Define and explain all the validity checks and constraints provided to maintain data integrity.

Procedural Design: Procedural design is a systematic way for developing algorithms or procedurals.

• Logic Diagrams: Define the systematical flow of procedure that improves its comprehension and helps the programmer during implementation. e.g., Control Flow Chart, Process Diagrams etc.

• Data Structures: Create and define the data structure used in procedures.

• Algorithms Design: With proper explanations of input data, output data, logic of processes, design and explain the working of algorithms.

User Interface Design: Define user, task, environment analysis and how to map those requirements in order to develop a "User Interface". Describe the external and internal components and the architecture of user interface. Show some rough pictorial views of the user interface and its components.

Security Issues: Discuss Real-time considerations and Security issues related to the project and explain how the student intends avoiding those security problems. What are the security policy plans and architecture?

Test Cases Design: Define test cases, which will provide easy detection of errors and mistakes with in a minimum period of time and with the least effort. Explain the different conditions in which the students wish to ensure the correct working of the project.

Chapter 5: Implementation and Testing

Implementation Approaches: Define the plan of implementation, and the standards the students have used in the implementation.

Coding Details and Code Efficiency: Students not need include full source code, instead, include only the important codes (algorithms, applets code, forms code etc). The program code should contain comments needed for explaining the work a piece of code does. Comments may be needed to explain why it does it, or, why it does a particular way.

The student can explain the function of the code with a shot of the output screen of that program code.

• Code Efficiency: The student should explain how the code is efficient and how the students have handled code optimisation.

Testing Approach: Testing should be according to the scheme presented in the system design chapter and should follow some suitable model – e.g., category partition, state machine-based. Both functional testing and user-acceptance testing are appropriate. Explain the approach of testing.

• Unit Testing: Unit testing deals with testing a unit or module as a whole. This would test the interaction of many functions but, do confine the test within one module.

• Integrated Testing: Brings all the modules together into a special testing environment, then checks for errors, bugs and interoperability. It deals with tests for the entire application. Application limits and features are tested here.

Modifications and Improvements: Once the students finish the testing they are bound to be faced with bugs, errors and they will need to modify your source code to improve the system. Define what modification are implemented in the system and how it improved the system.

Chapter 6: Results and Discussion

Test Reports: Explain the test results and reports based on the test cases, which should show that the project is capable of facing any problematic situation and that it works fine in different conditions. Take the different sample inputs and show the outputs.

User Documentation: Define the working of the software; explain its different functions, components with screen shots. The user document should provide all the details of the product in such a way that any user reading the manual, is able to understand the working and functionality of the document.

Chapter 7: Conclusions

Conclusion: The conclusions can be summarised in a fairly short chapter (2 or 3 pages). This chapter brings together many of the points that would have made in the other chapters.

Limitations of the System: Explain the limitations encountered during the testing of the project that the students were not able to modify. List the criticisms accepted during the demonstrations of the project.

Future Scope of the Project describes two things: firstly, new areas of investigation prompted by developments in this project, and secondly, parts of the current work that was not completed due to time constraints and/or problems encountered.

REFERENCES

It is very important that the students acknowledge the work of others that they have used or adapted in their own work, or that provides the essential background or context to the project. The use of references is the standard way to do this. Please follow the given standard for the references for books, journals, and online material. The citation is mandatory in both the reports.

E.g:

Linhares, A., & Brum, P. (2007). Understanding our understanding of strategic scenarios: What role do chunks play? *Cognitive Science*, *31*(6), 989-1007. https://doi.org/doi:10.1080/03640210701703725

Lipson, Charles (2011). Cite right : A quick guide to citation styles; MLA, APA, Chicago, the sciences, professions, and more (2nd ed.). Chicago [u.a.]: University of Chicago Press. p. 187. ISBN 9780226484648.

Elaine Ritchie, J Knite. (2001). *Artificial Intelligence, Chapter 2 , p.p 23 - 44.* Tata McGrawHill.

GLOSSARY

If you the students any acronyms, abbreviations, symbols, or uncommon terms in the project report then their meaning should be explained where they first occur. If they go on to use any of them extensively then it is helpful to list them in this section and define the meaning.

APPENDICES

These may be provided to include further details of results, mathematical derivations, certain illustrative parts of the program code (e.g., class interfaces), user documentation etc.

In particular, if there are technical details of the work done that might be useful to others who wish to build on this work, but that are not sufficiently important to the project as a whole to justify being discussed in the main body of the project, then they should be included as appendices.

VI. SUMMARY

Project development usually involves an engineering approach to the design and development of a software system that fulfils a practical need. Projects also often form an important focus for discussion at interviews with future employers as they provide a detailed example of what the students are capable of achieving. In this course the students can choose your project topic from the lists given in Unit 4: Category-wise Problem Definition.

VII. FURTHER READINGS

1. Modern Systems Analysis and Design; Jeffrey A. Hoffer, Joey F. George, Joseph,S. Valacich; Pearson Education; Third Edition; 2002.
2. ISO/IEC 12207: Software Life Cycle Process
(http://www.software.org/quagmire/descriptions/iso-iec12207.asp).
3. IEEE 1063: Software User Documentation (http://ieeexplore.ieee.org).
4. ISO/IEC: 18019: Guidelines for the Design and Preparation of User Documentation for Application Software.
5. http://www.sce.carleton.ca/squall.
6. http://en.tldp.org/HOWTO/Software-Release-Practice-HOWTO/documentation.html.
7. http://www.sei.cmu.edu/cmm/

PROFORMA FOR THE APPROVAL PROJECT PROPOSAL

(Note: All entries of the proforma of approval should be filled up with appropriate and complete information. Incomplete proforma of approval in any respect will be summarily rejected.)

PNR **No.: ……** Roll no**: _____**

1. Name of the Student
   _____
2. Title of the Project
   _____
3. Name of the Guide

   _____
4. Teaching experience of the Guide _____
5. Is this your first submission? Yes ☐ No ☐

Signature of the Student Signature of the Guide

Date: …… Date: …….

Signature of the Coordinator

Date: ……

(All the text in the report should be in times new roman)

TITLE OF THE PROJECT (NOT EXCEEDING 2 LINES, 24 BOLD, ALL CAPS)

A Project Report (12 Bold)
Submitted in partial fulfillment of the
Requirements for the award of the Degree of (size-12)

BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)(14 BOLD, CAPS)

By(12 Bold)

Name of The Student (size-15, title case)
Seat Number (size-15)

Under the esteemed guidance of (13 bold)
Mr./Mrs. Name of The Guide (15 bold, title case)
Designation (14 Bold, title case)

COLLEGE LOGO

DEPARTMENT OF INFORMATION TECHNOLOGY(12 BOLD, CAPS)
COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University of Mumbai) (12, Title case, bold, italic)
CITY, PIN CODE(12 bold, CAPS)
MAHARASHTRA (12 bold, CAPS)
YEAR (12 bold)

COLLEGE NAME (14 BOLD, CAPS)
(Affiliated to University of Mumbai) (13, bold, italic)
CITY-MAHARASHTRA-PINCODE(13 bold, CAPS)

DEPARTMENT OF INFORMATION TECHNOLOGY (14 BOLD, CAPS)

College Logo

CERTIFICATE (14 BOLD, CAPS, underlined, centered)

This is to certify that the project entitled, **"Title of The Project "**, is bonafied work of **NAME OF THE STUDENT** bearing Seat.No: (**NUMBER**) submitted in partial fulfillment of the requirements for the award of degree of BACHELOR OF SCIENCE in INFORMATION TECHNOLOGY from University of Mumbai. (12, times new roman, justified)

Internal Guide (12 bold) **Coordinator**

(Don't write names of lecturers or HOD)

External Examiner

Date: **College Seal**

COMPANY CERTIFICATE (if applicable)

(Project Abstract page format)

Abstract (20bold, caps, centered)

Content (12, justified)

Note: Entire document should be with 1.5 line spacing and all paragraphs should start with 1 tab space.

ACKNOWLEDGEMENT

(20, BOLD, ALL CAPS, CENTERED)

The acknowledgement should be in times new roman, 12 font with 1.5 line spacing, justified.

(Declaration page format)

DECLARATION (20 bold, centered, allcaps)

Content (12, justified)

I here by declare that the project entitled, "**Title of the Project**" done at **place where the project is done**, has not been in any case duplicated to submit to any other university for the award of any degree. To the best of my knowledge other than me, no one has submitted to any other university.

The project is done in partial fulfillment of the requirements for the award of degree of **BACHELOR OF SCIENCE (INFORMATION TECHNOLOGY)** to be submitted as final semester project as part of our curriculum.

Name and Signature of the Student

TABLE OF CONTENTS (20bold, caps, centered)

Should be generated automatically using word processing software.

List of Tables (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

List of Figures (20 bold, centered, Title Case)

Should be generated automatically using word processing software.

(Project Introduction page format)

Chapter 1

Introduction (20 Bold, centered)

Content or text (12, justified)

Note: Introduction has to cover brief description of the project with minimum 4 pages.

Chapter 2

System Analysis (20 bold, Centered)

Subheadings are as shown below with following format (16 bold, CAPS)

2.1 Existing System (16 Bold)

2.1.1 ---------- (14 bold, title case)

2.1.1.1 ---------- (12 bold, title case)

2.2 Proposed System

2.3 Requirement Analysis

2.4 Hardware Requirements

2.5 Software Requirements

2.6 Justification of Platform – (how h/w & s/w satisfying the project)

Table 2.1: Caption

Chapter 3

System Design (20 bold, centered)

Subheadings are as shown below with following format (16 bold, CAPS)
Specify figures as Fig 11.1 – caption

3.1 Module Division
3.2 Data Dictionary
3.3 E-R Diagrams
3.4 Data Flow Diagrams / UML

Note: write brief description at the bottom of all diagrams

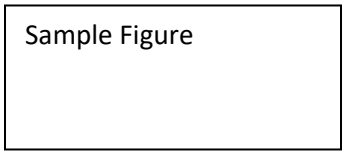

Fig. 3.1: Caption

Chapter 4

Implementation and Testing (20 bold, centered)

4.1 Code (Place Core segments)

Content includes description about coding phase in your project (Font-12)

(* don't include complete code-----just description)

4.2 Testing Approach

Subheadings are as shown below with following format (16 bold, CAPS)

4.2.1 Unit Testing

4.2.2 Integration Testing

Note:

- Explain about above testing methods
- Explain how the above techniques are applied in your project

Provide Test plans, test cases, etc relevant to your project

Chapter 5

Results and Discussions (20 bold, centered)

Note: Place Screen Shots and write the functionality of each screen at the bottom

Chapter 6

Conclusion and Future Work (20 bold, centered)

The conclusions can be summarized in a fairly short chapter around 300 words. Also include limitations of your system and future scope (12, justified)

Chapter 7

References (20 bold, centered)

Content (12, LEFT)

[1] Title of the book, Author

[2] Full URL of online references

[3] ----------

*** NOTE ABOUT PROJECT VIVA VOCE:**

Student may be asked to write code for problem during VIVA to demonstrate his coding capabilities and he/she may be asked to write any segment of coding used in the in the project. The project can be done in group of at most four students. However, the length and depth of the project should be justified for the projects done in group. A big project can be modularised and different modules can be assigned as separate project to different students.

Marks Distribution:

Semester V: 50 Marks

Documentation: 50 marks

Semester VI: 150 Marks

Documentation: 50 Marks:

Implementation and Viva Voce: 100 Marks

The plagiarism should be maintained as per the UGC guidelines.