VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in

BIOTECHNOLOGY

SYLLABUS

Master of Science
(II Semester)

With effect from
2021-22

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Biotechnology

Jnana Sagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme I to IV Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

II – SEMESTER

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC5	21BTH2C5L	Immunology and Immunodiagnostic	30	70	100	4	-	-	4	3
	DSC6	21BTH2C6L	Genomics and Genetic Engineering	30	70	100	4	-	-	4	3
	DSC7	21BTH2C7L	Bioprocess Engineering and Technology	30	70	100	4	-	-	4	3
	DSC8	21BTH2C8L	Stem cell technology and Regenerative medicine	30	70	100	4	-	-	4	3
	SEC2	21BTH2S2L	Biopharmaceutical Techniques	20	30	50	1	-	2	2	1
	DSC54	21BTH2C5P	Immunology and Immunodiagnostic lab	20	30	50	-	-	4	2	4
	DSC65	21BTH2C6P	Genomics and Genetic Engineering lab	20	30	50	-	-	4	2	4
	DSC76	21BTH2C7P	Bioprocess Engineering and Technology lab	20	30	50	-	-	4	2	4
Total Marks for II Semester						**600**				**24**	

Dept Name: Biotechnology
Semester-II
DSC5: Immunology and Immunodiagnostic

Course Title: **Immunology and Immunodiagnostic**	Course code: **21BTH2C5L**
Total Contact Hours: (L-T-P): **4 - 0 - 0**	Course Credits: **04**
Formative Assessment Marks: **30**	Duration of ESA/Exam: **03 Hrs.**
Summative Assessment Marks: **70**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Illustrate various types of immune response
2. Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate
3. Elucidate the genetic basis for immunological diversity and the generation of adaptive immune responses
4. Gather information on research activities in the field of immunology and their applications.
5. Apply their knowledge and design immunological experiments to demonstrate innate, humoral or cytotoxic T lymphocyte responses and figure out kind of immune responses in the setting of infection (viral or bacterial).
6. Understand and explain the basis of immunological tolerance, autoimmunity and transplantation, basis of allergy and allergic diseases

DSC5: Immunology and Immunodiagnostic

Unit	Description	Hours
1	**Basics of immunology:** Immunity - Types of Immunity, Innate and Acquired Immunity. Cells of the Immune System - B & T Lymphocytes; T-cell subsets; Antigen Presenting Cells. Organs of the immune System: Primary lymphoid organs (Bone marrow and Thymus); Secondary lymphoid organs (lymph nodes, spleen and mucosal-associated lymphoid tissue). Antigens - Immunogenecity versus Antigenicity, Factors that influence immunogenecity, Epitopes - Properties of B-cell epitopes and T-cell epitopes, Haptens and the study of Antigenicity.	11
2	**Humoral Immunity**: Immunoglobulins; structure, classes and distribution of antibodies. Theories of antibody formation. Antibody diversity: models, organization of Ig genes, mechanism of gene rearrangement, generation of diversity; expression, synthesis and class switching, antibody engineering. Principles of cell signaling; Kinetics of immune response, memory; B cell maturation, activation and differentiation; T-cell maturation, activation and differentiation and	11

	T-cell receptors. B cell activation, proliferation and differentiation. Generation of humoral immune response- primary and secondary. Complement system – alternate and classical pathways, initiators and MAC.	
3	**Cell mediated immunity:** Major histocompatibility complex and antigen presentation: MHC- organization, inheritance, genes, molecules and peptide binding, expression, disease susceptibility, immune responsiveness, self MHC restriction, cytosolic and endocytic pathway for antigen processing. T-cell receptor, T-cell maturation, activation and differentiation: TCR- genetic organization and rearrangement of genes, TCR-complex, peptide binding, thymic selection, activation and differentiation of T cells. Generation, activation and differentiation of B cells: B cell maturation, activation and proliferation, germinal centers, regulation of the responses. Cell mediated cytotoxicity: Effector T cells, cytotoxic T cells, NK cells, ADCC	**11**
4	**Clinical immunology:** Immunity to Infection: Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity - Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; Treatment of autoimmune diseases; Tumor immunology - Tumor antigens; Immune response to tumors and tumor evasion of the immune system, Cancer immunotherapy; Immunodeficiency - Primary immunodeficiencies, Acquired or secondary immunodeficiencies.	**11**
5	**Immunodiagnostic techniques** Precipitation, agglutination and complement mediated immune reactions; Production of polyclonal and monoclonal antibodies: Principles, Techniques and applications; Advanced immunological techniques - RIA, ELISA, Western blotting, ELISPOT assay, Immunofluorescence, Flow cytometry and Immunoelectron Microscopy; Surface plasmon resonance, Biosensor assays for assessing ligand - receptor interaction, CMI techniques- lymphoproliferation assay, Mixed lymphocyte reaction, Cell Cytotoxicity assays, Apoptosis.	**11**

References:

1. Kuby Immunology (2018) 8th ed., Punt J, Stranford S, Jones P and Owen JA, W.H Freeman and Company, ISBN: 978-1319114701.
2. Janeway's Immunobiology (2017) 9th ed., Murphy KM and Beaver C, WW Norton and Company, ISBN: 978-0815345510.

3. **Roitt's Essential Immunology (2017) 13th ed., Delvis PJ, Martin SJ, Burton DR and Roitt, IM, Wiley-Blackwell, ISBN: 978-1118415771.14**
4. **Lippincott's illustrated Reviews Immunology (2012) 2nd ed., Doan T, Melvold R, Viselli S andWaltenbaugh, C, Wolters Kluwer India Pvt, Ltd, ISBN: 978-8184737639.**
5. **Roitt, I.M, 2006. Essential of Immunology 12th edition, ELBS, Blackwell Scientific Publication**
6. **Abul K. Abbas, Andrew H.L, Shiv Pillai, "Cellular and Molecular Immunology" 7/e Saunders Publications**
7. **The Immune system– peter Parham Garland science, 2/e, 2001**

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II

DSC6: Genomics and Genetic engineering

Course Title: **Genomics and Genetic engineering**	Course code: **21BTH2C6L**
Total Contact Hours: (L-T-P): **4 - 0 - 0**	Course Credits: **04**
Formative Assessment Marks: **30**	Duration of ESA/Exam: **03 Hrs.**
Summative Assessment Marks: **70**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Explain the detailed characteristics of prokaryotes and eukaryotes genome as well as application of forward and reverse genetics.
2. Apply structural and functional genomics approaches on newly sequenced genome for functional characterization of genes.
3. Apply cloning and transformation techniques in prokaryotic and eukaryotic systems
4. Evaluate selectivity and specificity of vectors for cloning genes and their expressions
5. Apply rDNA techniques in development of genetically modified organisms for medical applications.

DSC6: Genomics and Genetic engineering

Unit	Description	Hours
1	**Origin of genomics:** The first DNA genomes, Structure and organization of prokaryotic and eukaryotic genomes – nuclear, mitochondrial and chloroplast genomes, Microbial genomes (including yeast), Plant genomes (Arabidopsis and rice), Animal genomes (fruit fly, mouse, human), Genomes and human evolution, The concept of minimal genome. Genetic maps, Physical maps, EST and transcript maps, Functional maps and Functional genomics, Human genome project-landmarks on chromosomes generated by various mapping method, Comparative genomics and 6ollinearity/synteny in maps, Genetic variation polymorphism, deleterious mutation; FISH to identify chromosome landmarks. Genomics in medical practice, personalized medicine, use of SNP in pharmacogenomics, DNA Microarray technology: Basic principles and design, Global gene expression analysis, Comparative transcriptomics, Differential gene expression.	11
2	**Introduction to Recombinant DNA technology:** Enzymes used in Recombinant DNA technology (Restriction endonucleases, DNA modifying enzymes, other nucleases, Polymerases, Ligase, kinases and phosphatases), Isolation and purification of DNA (genomic and plasmid) and RNA. Various methods of separation,	11

	characterization of nucleic acids including Southern and Northern hybridizations, Molecular cloning of DNA or RNA fragments in bacterial and eukaryotic systems; linkers, adaptors, and homopolymers.	
3	**Vectors in gene cloning:** Expression cassette: Promoters (Constitutive, Inducible, Tissue specific), Terminators, Reporters, Markers (Antibiotic resistant, Herbicide resistant, Antimetabolite); Vectors in gene cloning - Plasmids (pBR322, pUC), Bacteriophages (phage l, M13), Cosmids, Phagemids, Yeast plasmid vector, Viral vectors (Adenovirus, Adeno-associated virus, Baculo virus, Herpes virus, Retrovirus, Cauliflower mosaic virus, Tobacco mosaic virus, Potato virus X), Transposons (Ac-Ds, P) Artificial chromosome (BAC, YAC, HAC), Shuttle vector, Expression vector.	**11**
4	**Gene transfer, Screening & Selection methods**: Transformation - Physical method (electroporation, micro-injection, particle bombardment, liposome mediated transfer); Chemical method (PEG mediated, DEAE Dextran mediated, CaPO4 mediated gene transfer); Biological method (Agrobacterium mediated gene transfer). Insertional inactivation, Blue-White selection, Colony - in situ hybridization, In vitro selection, In vitro translation, Radioactive antibody test, Immunological techniques, DNA labelling, dot blot hybridization, Molecular beacons. Gene Silencing, RNA interference, antisense therapy, Gene Knockout. Blotting techniques - Southern, Northern, Western and South-Western.	**11**
5	**Molecular Techniques :** RFLP, RAPD, AFLP, DNA Finger printing, Polymerase chain reaction (PCR) and types of PCR, DNA Foot printing, Microarray (DNA & Non-DNA). Libraries - Genomic library; C-DNA library & its types; BAC library; YAC library; Methyl filtration libraries; COT fractionation-based libraries. Bioethics & Biosafety in genetic engineering; IPR & Patenting.	**11**

References:

1. Principles of Gene Manipulation and Genomics (2016) 8th ed., Primrose, SB and Twyman, R, Wiley Blackwell, ISBN: 978-1405156660.
2. Gene Cloning and DNA Analysis: An Introduction (2019) 7th ed., Brown, TA, Wiley Blackwell, ISBN: 978-1119072560.
3. Genome 4 (2017) 4th Brown, TA, Garland science, ISBN 13: 978-0815345084.
4. J. Sambrook, E. Frisch and T. Maniatis 2000. Molecular Cloning: Laboratory manual , Cold Spring Harbor Laboratory Press New York.
5. D.M. Glover and BD Hames 2001. DNA Cloning: A Practical Approach, IRL Press, New York.

6. **Introduction to Genomics (2015) 2nd ed., Lesk, AM, Oxford university Press India, ISBN: 978-0198745891.**
7. **Genomics and Personalized Medicine: What Everyone needs to Know (2016) 1st ed., Snyder, M, OUP-USA, ISBN: 978-0190234768.**

Date **Course Coordinator** **Subject Committee Chairperson**

.

Dept Name: Biotechnology
Semester-II

DSC7: Bioprocess engineering and Technology

Course Title: **Bioprocess engineering and Technology**	Course code: **21BTH2C7L**
Total Contact Hours: (L-T-P): **4 - 0 - 0**	Course Credits: **04**
Formative Assessment Marks: **30**	Duration of ESA/Exam: **03 Hrs.**
Summative Assessment Marks: **70**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Appreciate relevance of microorganisms from industrial context and can carry out stoichiometric calculations and specify models of their growth
2. Design and operate various fermenters
3. Calculate yield and production rates in a biological production process, and also interpret data
4. Calculate the need for oxygen and oxygen transfer and can also critically analyse any bioprocess from market point of view
5. Give an account of important microbial/enzymatic industrial processes in food and fuel industry

DSC7: Bioprocess engineering and Technology

Unit	Description	Hours
1	**Bioprocessing Fundamentals:** Biotechnology and Bio-process engineering-Historical development of bioprocess technology-Difference in approaches by biologist and engineer-Introduction to Bioproducts- Bioprocess principles and operations- Outline of a bioprocess and the various unit operations involved in bioprocesses. Steps in bioprocess development- General material balance equation for steady state (for manufacture of penicillin and ethanol)-Generalized bioprocess flow sheets: example of penicillin/Bacitracin/ethanol. Bio-process regulatory constraints.	11
2	**Microbial growth and product formulation** Quantification of cell concentration, Phases of cell growth in bath culture, growth associated and non-growth associated product formation kinetics, environmental factors affecting growth kinetics. Heat generation by microbial growth. Structured and unstructured models for microbial growth- Substrate limited growth-models with growth inhibitors- growth model for filamentous organisms. Microbial interaction in mixed cultures: Major classes of microbial interactions, microbial participation in the natural cycles of matter, Industrial utilization of mixed cultures in biological wastewater treatment.	11

3	**Fermentation Principles** Fermentation Process-General requirements of fermentation Process; An overview of aerobic and anaerobic fermentation process and their application in industry. Media Design: Medium requirements for fermentation process-examples of simple and complex media; Design and usage of commercial media for industrial fermentations, Sterilization: Batch and continuous heat sterilization-sterilization of Liquid media, Filter sterilization of liquids. Thermal death kinetics. Elements in bioreactor design- overview of bioreactor, Construction materials, types of bioreactors, its developments using microbial processes, mammalian cell culture, and plant cell culture, components of bioreactors and importance.	**11**
4	**Bioreactor Design** Different types of bioreactors: Batch, fed-batch and chemostat with recycle, multistage chemostat and perfusion systems, immobilized cell systems. Solid state and submerged state fermentation. Imperfectly mixed bioreactor system. Specialized bioreactors: Tubular bioreactors, Membrane bioreactors, Tower bioreactor, Fluidized bioreactor, Packed bed bioreactors, Photo-bioreactors etc. Operation and control of bioreactor system: pH, Temperature, Aeration and agitation systems, Impeller design, control of other parameters. Non-mechanically agitated bioreactor systems. Data analysis.	**11**
5	**Downstream process** Separation of Biomass from culture fluid. Coagulation and flocculation. Disruption of microbial cells Separation of insoluble solids from fermentation broth: Centrifugation and sedimentation, filtration Cell processing using tangential flow filtration, Adsorption, Precipitation, Cell processing with hollow fiber membranes. Ultra-filtration process in Biotechnology. Liquid-liquid extraction of biopolymers, Aqueous two-phase extraction, Supercritical fluid extraction. Different Chromatographic techniques: Ion exchange recovery of antibiotics, Ion exchange recovery of proteins, Gas Chromatography, Size exclusion chromatography, Hydrophobic chromatography, High performance liquid chromatography. Electrophoresis. Dialysis and electro dialysis. Recovery of Biological products by distillation. Crystallization. Drying.	**11**

References:

1. Pauline M Doran (2013) Bioprocess Engineering Principles, 2nd Edition, Academic Press, USA.
2. Michael L Shuler & Fikret Kargi. (2008) Bioprocess Engineering: Basic Concepts., 2nd Edition, Prentice Hall of India, New Delhi.
3. Elmar Heinzle, Arno P. Biwer, Charles L. Cooney. (2006) Development of Sustainable Bioprocesses Modeling and Assessment, John Wiley & Sons Ltd.

4. Tapobrata Panda. (2011) Bioreactors: Analysis and Design, 1st Edition, Tata McGraw Hill EducationPrivate Limited, New Delhi.
5. Douglas S. Clark, Harvey W. Blanch. (1995) Biochemical Engineering, 2nd Edition, CRC Press.
6. Bioprocess Engineering: Basic Concepts (2017) 3rd ed. Shuler, ML, and Kargi, F. Pearson PrenticeHall, ISBN: 0137062702.
7. Principles of Fermentation Technology (2016) 3rd ed. Stanbury P, Allan Whitaker, Stephen Hall.Imprint (Butterworth-Heinemann), ISBN: 9780080999531.
8. Biochemical Engineering Fundamentals (2013) 5th reprint J. E. Bailey and Ollis, D. F. McGraw-HillEducation (India) Pvt Ltd., ISBN: 0070701237.
9. Bioprocess Engineering Principles (2013) 2nd ed. Doran, P.M, Academic Press, ISBN: 978-0-12-220851-5.
10. Bioreactors Analysis and Design (2011) Panda T, Tata McGraw Hill, ISBN: 978-0-07-

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II
DSC8: Stem cell technology and regenerative medicine

Course Title: **Stem cell technology and regenerative medicine**	Course code: **21BTH2C8L**
Total Contact Hours: (L-T-P): **4 - 0 - 0**	Course Credits: **04**
Formative Assessment Marks: **30**	Duration of ESA/Exam: **03 Hrs.**
Summative Assessment Marks: **70**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Asses the benefit of hemopoietic stem cells in the treatment of cancer and other diseases
2. Apply encapsulation technology and stem cells for therapeutics and Regenerative medicine
3. Utilize the molecular techniques for diagnosis of Biochemical, Immune, Genetic and Neurological disorders

DSC8: Stem cell technology and regenerative medicine

Unit	Description	Hours
1	**Introduction to stem cell:** Stem cell – Definition, characterization, Pluripotent stem cells, Self-renewal and differentiation, hierarchy, Stem cell niche, types of stem cell niches: Embryonic stem cell niches, Hematopoietic stem cell niche, Limbal stem cell niche, Intestinal stem cell niche, Epidermal stem cell niche, Neurogenic niche, Muscle stem cell niche, Germ stem cell niche, Cancer stem cell niche Niche specification -0 Drosophila germ line stem cells. Tissue specific types of stem cells: Peri- and post-natal Mesenchymal stromal cells, Hematopoietic stem cells, Neural stem cells, Cardiac stem cells, Hepatic stem cells	**11**
2	**Cell signals and its pathways:** Characteristics of stem cell – cell cycle, Ras/ Raf pathways, P13K cell signalling, p53 check points, Role of LIF pathways in cell cycle control. Stem cell communications – Types of Junctional complexes- Tight, Gap, Adherens, cell fusions, HOX genes, upstream transcriptional factors, Tran differentiation, Extracellular matrix ECM regulated signalling, Signalling in stem cells niches, Dysregulation of stem cell niches.	**11**
3	**Haemopoeitic Stem Cells and Cloning:** Haematopoietic stem cells differentiation, trans-differentiation and growth factors. Classification and manifestations of Hemopoeitic stem cell disorders, aplastic Hemopoeitic	**11**

	stem cell disorders, clinical applications of colony stems, complications of germ therapy, replacement therapy and bone marrow transplantation, immunological principles**,** preservation and clinical use of blood and blood components. Induced Pluripotent stem cells (iPS), germ line stem cells; Recruiting Donors and Banking hES cells; IPRs and hES Cells. Fate mapping of stem cells in experimental systems. Genetically engineered stem cells and experimental therapies.	
4	**Regenerative medicine:** Stem cell-based therapies: stem cells and repair of heart and nervous system; regeneration strategies. Skin replacement, brain cell transplantation and stem cells in aging. Encapsulation technology and therapeutics- Diabetes, Hypothyroidism, Haemophilia Bioartificial organs, Stem cell therapy - Embryonic and adult Stem Cells, Totipotent, Pluripotent and Mulltipotent Cells. Bone marrow transplantation versus Stem cell transplantation and GVHD.	**11**
5	**Downstream process:** Societal implications: women, low-income, Different religious views, Current Ethical Guidelines in India, Ethical views of other countries and how this affects advancement of science Policy. Current Regulation of Human Embryonic Stem Cell Research. Future of SC research	**11**

References:

1. Jonathan Slack, Stem cells- A Very Short Introduction, Oxford, 2012.
2. Stewart Sell 2003 (Ed) Stem Cells Handbook, Humana Press, NY
3. Verma IM and Gage FH 2002 (Ed) Regenerative Medicine, Natl Acad Sci & Engg, USA
4. The Natl Academies, USA 2007 Understanding Stem Cells
5. The Natl Academies, USA 2002 Stem Cells and the Future of Regenerative Medicine
6. Stem Cells Info 2008, NIH USA Terese
7. Winslow 2006 Regenerative Medicine, Natl Acad Sci & Engg, USA
8. Marshak et al., 2000 Stem Cell Biology, CSHL press, USA.
9. Regenerative Medicine (2006) NIH, Bethesda, USA.
10. Bernhard O. Palsson , Sangeeta N. Bhatia, Tissue Engineering, Prentice Hall; 1 edition, 2003

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II
SEC2: Biopharmaceutical techniques

Course Title: **Biopharmaceutical techniques**	Course code: **21BTH2S2L**
Total Contact Hours: (L-T-P): **1- 0 - 2**	Course Credits: **02**
Formative Assessment Marks: **20**	Duration of ESA/Exam: **1.5 Hrs.**
Summative Assessment Marks: **30**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Comprehend the development, characterization and evaluation of bio therapeutic proteins.
2. Explore the principles and applications of novel bio therapeutics.
3. Formulate protein-based drugs and study their physico-chemical and pharmacological properties.
4. Perform quality control tests to validate quality of product.
5. Apply the knowledge of formulation of biopharmaceuticals for extended release of therapeutics.

SEC2: Biopharmaceutical techniques

Unit	Description	Hours
1	**Drug development process of protein-based therapeutics:** Transforming New Molecular Entities into Drugs, Differences between Development of Biotechnology Products of Macromolecules and Chemical Products, Current Trends in Drug Development, Drug designing: Rational, combinatorial and High Throughput screening.	**07**
2	**Immuno-pharmacology and formulation of peptides:** Overview to immunopharmacology, Antibody-mediated response, Vaccines, Cell mediated immune response, Cancer immunotherapy, Immunosuppressant and immunostimulators. Making Small Protein Particles, Lyophilization, Multiphase Drug Delivery Systems, Protein Compaction, Self- Emulsifying Drug Delivery Systems, skin and parental drug delivery system.	**07**

3	**Practical's** Laboratory 1: Test for sterility: Bacteriological Test for Water for injection (WFI). Laboratory 2: Determination of minimum inhibitory concentration of given antibiotic. Laboratory 3: Standardization of given herbal formulation by TLC. Laboratory 4: Validation of Autoclave by biological indicator method. Laboratory 5: Handling and working of lyophilizer for freeze drying of protein formulation. Laboratory 6: Detection of HIV antibodies Tri- dot test. Laboratory 7: Determination of Partition coefficient of given formulation. Laboratory 8: Determination of antioxidant activity of given formulation by DPPH method Laboratory 9: Extraction and isolation of Caffeine from tea powder. Laboratory 10: Detection of antigen in the given sample by ELISA Laboratory 11: Preparation and evaluation of controlled release formulation. Laboratory 12: Preparation and characterization of blank / loaded liposome.	**28**

References:

1. Christine M. Bladon (2002) Pharmaceutical Chemistry, John Wiley & Sons, Ltd.
2. Manfred E. Wolff (2000) Burger's Medicinal Chemistry and Drug Discovery (5th edition) A Wiley & Sons, Inc.
3. Grietje Molema and Dirk KF. Meije (2002) Drug Targeting Organ-Specific Strategies r. Wiley-VCH.
4. Melgardt M. de Villiers (2007) Nanotechnology in Drug Delivery, Springer.
5. Rodney JY, Milo Gibaldi (2003) Biotechnology and Biopharmaceuticals transforming proteins and genes into drugs, A John Wiley & Sons, Inc., Publication.
6. Gavin Brooks (1998) Biotechnology in Healthcare, An introduction to biopharmaceuticals, Pharmaceutical Press (London).
7. Shayne cox gad (2007) Handbook of pharmaceutical Biotechnology A John Wiley & Sons, Inc., Publication
8. Grietje Molema and Dirk KF (2002) Drug Targeting Organ-Specific Strategies by Meijer. Wiley-VCH.
9. Gary Walsh (2003) Biopharmaceuticals Biochemistry and Biotechnology, Wiley.
10. Heinrich Klefenz. (2002) Industrial Pharmaceutical Biotechnology, Wiley-VCH.
11. Gary Walsh (2011) Biopharmaceuticals: Biochemistry and Biotechnology, Wiley-VCH.

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II
DSC5P4: Immunology and immunodiagnostic lab

Course Title: **Immunology and immunodiagnostic lab**	Course code: **21BTH2C5P**
Total Contact Hours: (L-T-P): **0- 0 - 4**	Course Credits: **02**
Formative Assessment Marks: **20**	Duration of ESA/Exam: **4 Hrs.**
Summative Assessment Marks: **30**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Evaluate usefulness of immunology in different pharmaceutical companies
2. Identify proper research lab working in area of their own interests;
3. Apply their knowledge and design immunological experiments to demonstrate innate, humoral or cytotoxic T lymphocyte responses and figure out kind of immune responses in setting of infection (viral or bacterial) by looking at cytokine profile.

DSC5P4: Immunology and immunodiagnostic lab

Experiment's
1. Determination of A, B, O and Rh blood groups in human beings.
2. Staining of blood smear and identification of different leukocytes.
3. To perform the Technique of Radial immunodiffusion
4. To learn and perform the technique of Ouchterlony Double Diffusion Technique
5. To perform the pregnancy test with the help of Pregnancy Kit
6. To learn the technique of Immuno-electrophoresis
7. To study the technique of Rocket Immuno-electrophoresis for determination of concentration of antigen in unknown sample
8. To perform WIDAL test for detection of typhoid.
9. To study the different immune-informatics tools.
10. To perform the sandwich Dot ELISA Test for antigen detection
11. To perform Affinity chromatography for antibody purification.
12. To identify cells in a blood smear
13. To isolate monocytes from blood
14. To isolate peripheral blood mononuclear cells
15. Identification of t cells by T-cell rossetting using sheep RBC

References:

1. **Wilson, K andWalker, J. Practical Biochemistry, Principles and Techniques. CambridgeUniversity Press**
2. **Harlow, E.D. and Lane, D. Using Antibodies. A Laboratory Manual. CSH LaboratoryPress. NY.**
3. **Hay, F.C., Westwood, O.M.R. Practical Immunology (4th Edition). Blackwell Publishing**
4. **Walker, J.M. (Editor). The protein protocols handbook. Humana press, NJ protocols inImmunology**
5. **Immunology: Theoretical and practical concepts in Laboratory Medicine. Hannah D.Zane, Saunders; 1 edition (2001).**
6. **Clinical Immunology and Serology: A Laboratory Perspective By Christine DorresteynStevens, F.A. Davis Company; 2nd Revised edition edition (2009)**

Note:

1. Minimum of EIGHT experiments must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II

DSC6P5: Genomics and genetic engineering lab

Course Title: **Genomics and genetic engineering lab**	Course code: **21BTH2C6P**
Total Contact Hours: (L-T-P): **0- 0 - 4**	Course Credits: **02**
Formative Assessment Marks: **20**	Duration of ESA/Exam: **4 Hrs.**
Summative Assessment Marks: **30**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Hands on and gain expertise in handling routine laboratory equipment used in Genomics lab
2. To use modern tools for analysis of Nucleic acids and their further analysis. Independently execute a laboratory experiment using the standard methods and techniques in molecular biology, with the appropriate analysis and interpretation of results obtained.
3. Exemplify different types of polymerase chain reactions and their applications.
4. Implement, organize and design different vectors for gene cloning and expression
5. Generating contextual and conditional knowledge of gene function for various applications

DSC5P4: Immunology and immunodiagnostic lab

Experiment's
1. Isolation of genomic DNA from bacteria
2. Preparation of plasmid from given bacterial sample and gel analysis.
3. Gel elution of DNA
4. PCR amplification of gene of interest and analysis by agarose gel electrophoresis
5. Restriction digestion of vector and insertion using Ligase.
6. Competent cell preparation for transformation
7. Transformation in E.*coli DH5α*.
8. Induction of protein with IPTG and analysis on SDS-PAGE
9. Purification of protein and analysis of purification by SDS-PAGE
10. Southern/Northern/Western blotting hybridization
11. Human gene, protein, variant nomenclature and databases

12. Various file formats (including .vcf), databases, process, tools and pipelines (open source) for clinical and personal genome/exome analysis, annotation, and interpretation for personalized diagnosis and therapy.
13. Polygenic risk score and its implementation in disease (cancers, diabetes, obesity, CVDs, diabetes), nutrition, fitness, sports, and other health and wellness traits, adverse drug reaction (PGx) prediction

References:

1. Michael R. Green, Joseph Sambrook, Molecular Cloning: A Laboratory Manual (Fourth Edition), 2014.
2. William Wu, Michael J. welshpeter B. KaufmanHelen H. Zhang, Methods in Gene Biotechnology, CRC Press, New York. 1997.
3. Bruce A. White, Methods in Molecular Biology, Chapman and Hall, London, New York.
4. Durbin, R., Eddy, S., Krog, A., and Mitchison, G. (2003). Biological Sequence Analysis, Probablistics Models. Cambridge Press.
5. Elmasri, R. and Navathe, S.B. Fundamentals of database system. Addison-Wesley.
6. Pevsner, J. (2003). Bioinformatics & Functional Genomics. John Wiley and Sons.
7. Mount, D. W.(2001). Bioinformatics Sequence and Genome Analysis. Cold Spring Harboor Laboratory Press, New York.

Note:

1. Minimum of EIGHT experiments must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

Date **Course Coordinator** **Subject Committee Chairperson**

Dept Name: Biotechnology
Semester-II
DSC7P6: Bioprocess engineering and technology lab

Course Title: **Bioprocess engineering and technology lab**	Course code: **21BTH2C7P**
Total Contact Hours: (L-T-P): **0- 0 - 4**	Course Credits: **02**
Formative Assessment Marks: **20**	Duration of ESA/Exam: **4 Hrs.**
Summative Assessment Marks: **30**	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Understand the growth kinetics, the role of various factors affecting the process of growth. They will also be able to define the media for submerged and solid-state fermentation process and sterilization
2. State the significance of application of process technology on enzyme production, enzyme kinetics, solve the mass balance of production process, learn the process of oxygen transfer rate, agitation systems
3. Collect the proficient knowledge of design of fermenter and operation of fermentation process, methods of translation of laboratory data to pilot scale process

DSC7P6: Bioprocess engineering and technology lab

Experiment's
1. Fermenter Design
2. Determination of doubling time and Z value for Sterilization of fermenter and media
3. Determination of oxygen transfer rate and volumetric oxygen mass transfer coefficient (KLa) under variety of operating conditions in shake flask and bioreactor.
4. Isolation of Different industrially important strains (*Saccharomyces cerevisiae, Lactobacillus, Aspergillus, Bacillus spp*.)
5. Strain improvement by applying mutagenic agents
6. Preparation of fermentation pre-culture
7. Study of antibiotic producing microorganism of local soil: a) Isolation, b) Screening
8. Production of antibiotics by *Penicillium spp*
9. Production of ethanol and organic acids.
10. Production of single cell protein: a) Yeast cells, b). Spirilluna and others
11. Enzyme production: extra and intracellular enzymes (amylase, Cellulase, Sucrase, Pectinase,

Lipases, Protease, Alkaline and Acid Phosphatase, alcohol dehydrogenase) by microorganisms and other sources.

12. Production of vitamins.
13. Purification, a) precipitation, b) dialysis, c) column chromatography, d) extraction
14. Various immobilization techniques of cells/enzymes, use of alginate for cell immobilization

References:

1. Stanbury RF and Whitaker A., Principles of Fermentation Technology,Pergamon press, Oxford, 1997. ISBN: 0080361323
2. Booth, C. (Ed) (1974). Methods in Microbiology. Vol. IV Academic Press.
3. Bull, A.T. and Dalton, H. (Eds.) (1995). Comprehensive Biotechnology. Pergamon Press, Oxford
4. Butterworth-Heinemann (1992). Product Recovery in Bioprocess Technology, Elviser.
5. Casida, L, E,, Jr. (1997). Industrial Microbiology. New AI. New Delhi
6. Doran, P.M. (1995). Bioprocess Engineering Principles. Academic Press.
7. Dordrick, J.S. (1991). Biocatalyst for industry. Plenum Press, New York.
8. El-Mansi, E.M.T. and Bryce, C.F.A. (2002). Fermentation Microbiology and Biotechnology. T & F, London
9. Gerhartz, W. (1990). Enzymes in Industry: Production and applications. VCH Publishers, New York Gupta, P, K. (1999). Elements of biotechnology. Rastogi Publication.
10. Helmut Uhling (1998). Enzyme technology. John Wiley.
11. Lodish, L., Baltimore, D., Berk, A., Zipursky, S.L., Matsudaira, P., Darnell, J. (2000). Molecular cell biology.
12. Malla, R. (2011) Bio-Molecules in Microorganisms and Their Roles to Friendly Environment.
13. Michael L Sular and FikretKargi (2002): Bioprocess Engineering, Basic concepts, Prentice Hall.
14. WHF and Company. McNeil, B., and Harvey, L.M. (1990). Fermentation a practical approach. IRL press. NY.

Note:

1. Minimum of EIGHT experiments must be carried out.
2. Experiments may be added as and when required with the approval of BoS.

Date **Course Coordinator** **Subject Committee Chairperson**

CBCS Question Paper Pattern for PG Semester End Examination

with Effect from the AY 2021-22

Disciplines Specific Core (DSC) and Discipline Specific Elective (DSE)

Paper Code: **Paper Title:**

Time: 3 Hours **Max.**

Marks: 70

Note: Answer any *FIVE* of the following questions with Question No. 1 (Q1) Compulsory, each question carries equal marks.

Q1. 14 Marks

Q2. 14 Marks

Q3. 14 Marks

Q4. 14 Marks

Q5. 14 Marks

Note: Question No.1 to 5, *one question from each unit* i.e. (Unit I, Unit II, ….). The Questions may be a whole or it may consists of sub questions such as a,b, c etc…

Q6. 14 Marks

Note :Question No.6, *shall be from Unit II and III,* the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q7. 14 Marks

Note: Question No.7*, shall be from Unit IV and V*,the Question may be a whole or it may consists of sub questions such as a,b, c etc…

Q8. 14 Marks

Note: Question No-8 shall be from *Unit II, Unit III , Unit IV and Unit V*. The question shall have the following sub questions and weightage. i.e a – 05 marks, b – 05 marks, c – 04 marks.

****

Skill Enhancement Courses (SECs)

Paper Code: **Paper Title:**

Time: 1 Hours **Max. Marks: 30**

There shall be Theory examinations of Multiple Choice Based Questions [MCQs] with Question Paper set of A, B, C and D Series at the end of each semester for SECs for the duration of One hour (First Fifteen Minutes for the Preparation of OMR and remaining Forty-Five Minutes for Answering thirty Questions). The Answer Paper is of OMR (Optical Mark Reader) Sheet.

****

PG IA Question paper pattern

For all DSC and DSE papers

Internals – 2021-22

(Date:)

Semester – I/II/III/IV

Subject:

Section A

Answer any 1 of the following **5x1=5**

Q1.

Q2.

Section B

Q3 Answer any 2 of the following **2.5x2=5**

a.

b.

c.

d.

***Total formative Internal Assessment for Semester-I/II/III/IV = 30 marks**

C1 = 10
C2 =10
Seminar and Presentation = 05 Marks for
Assignment/Fieldwork = 05 Marks
Total 10+10+5+5=30marks

PG IA Question paper pattern

For all SEC papers

Internals – 2021-22

(Date:)

Semester – I/II/I

Subject:
Answer any 1 of the following
5x1=5

Q1.

Q2.

***Total formative Internal Assessment for Semester-**

I/II/III = 20 marksC1 = 05
C2 =05
Seminar and Presentation = 05
Marks forAssignment/Fieldwork=05
Marks
Total 05+05+05+05=20marks

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY
JNANASAGARA CAMPUS, BALLARI-583105

Department of Studies in

Computer Science

SYLLABUS

Master of Science in Computer Science
(II Semester)

With effect from
2021-22

VIJAYANAGARA SRI KRISHNADEVARAYA UNIVERSITY

Department of Studies in Computer Science

Jnana Sagara, Ballari - 583105

Distribution of Courses/Papers in Postgraduate Programme II Semester as per Choice Based Credit System (CBCS) Proposed for PG Programs

With Practical

Semester No.	Category	Subject code	Title of the Paper	Marks			Teaching hours/week			Credit	Duration of exams (Hrs)
				IA	Sem. Exam	Total	L	T	P		
SECOND	DSC5	21CSC2C5L	Database Management Systems	30	70	100	4	-	-	4	3
	DSC6	21CSC2C6L	Python Programming	30	70	100	4	-	-	4	3
	DSC7	21CSC2C7L	Software Engineering	30	70	100	4	-	-	4	3
	DSC8	21CSC2C8L	Operating System	30	70	100	4	-	-	4	3
	SEC2	21CSC2S2	Advanced Web Programming	20	30	50	-	1	2	2	1
	DSC5P4	21CSC2C5P	Database Management Systems Lab	20	30	50	-	-	4	2	4
	DSC6P5	21CSC2C6P	Python Programming Lab	20	30	50	-	-	4	2	4
	DSC7P6	21CSC2C7P	Mini Project based on DBMS & Software Engineering	20	30	50	-		4	2	4
Total Marks for II Semester						**600**				**24**	

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC5: Database Management Systems

Course Title: Database Management Systems	Course code: 21CSC2C5L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Describe the Entity–Relationship (ER) modeling and model the real world database systems usingEntity Relationship Diagrams (ERD) from the requirements specification
2. Apply the Relational Data Model, its Constraints and the Relational Database Schemas Formulate queries in Relational Algebra & SQL (Knowledge)
3. Apply normalization techniques to normalize a database
4. Illustrate how a DBMS enforces recovery from failure and concurrency control

DSC5: Database Management Systems

Unit	Description	Hours
1	Introduction: Data modeling for a database, abstraction and data integration, the three-level architecture, components of DBMS, advantages and disadvantages, data associations, data model classification, Entity Relationship model.	10
2	File organization and storage, secondary storage devices, operations in file, heap files and sorted files, hashing techniques, type of single level ordered index, multi-level indexes indexes on multiple keys, other types of indexes.	10
3	The Relational Model: Relational database, relational algebra, relational calculus SQL- Data definition, relational database manipulation using SQL, views, embedded data manipulation. Relational Database Design: Anomalies in a database, functional dependency, normal forms, lossless join and dependency, BCNF, normalization through synthesis, higher order normal forms.	12
4	Transaction processing, desirable properties of transaction, schedules and recoverability, serializability of schedules concurrency control, locking techniques, time stamp ordering multi version concurrency control, granularity of dataitems.	10
5	Database recovery techniques based on deferred up data and immediate updating, shadow pages, ARIES recovery algorithm, database security and authorization, security issue access control based on granting/revoking of privileges, introduction of statistical database security.	10

References:

1. Elmasri and Navathe, Fundamentals of Database Systems, AddisonWesley, 5th edition, 2018.
2. Bipin C Desai, An Introduction to Database Systems, Galgotia Publications, 2012.

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC6: Python Programming

Course Title: Python Programming	Course code: 21CSC2C6L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Explain basic principles of Python programming language
2. Implement object oriented concepts
3. Implement database and GUI applications.
4. Explain basic principles of Python programming language

DSC6: Python Programming

Unit	Description	Hours
1	INTRODUCTION TO PYTHON PROGRAMMING: Python interpreter and interactive mode; values and types variables, expressions, statements, tuple assignment, Order of operations, comments, debugging; modules and functions: function Calls, adding new functions, Definitions and Uses, flow of execution, parameters and arguments, Fruitful functions. Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, range, break, continue, pass; recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays.	12
2	LISTS, TUPLES, DICTIONARIES: Lists: Traversing a List, list operations, list slices, list methods, Map, Filter and Reduce, list loop, mutability, aliasing, cloning lists, list parameters; Dictionaries: operations and methods; advanced list processing - list comprehension; Tuples: tuple assignment, tuple as return value.	12
3	FILES, MODULES, PACKAGES: Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages: PANDAS, NUMPY, SCIKIT-LEARN	08
4	CLASSES AND OBJECTS: Introduction, Defining Classes, Creating Objects, Data Abstraction and Hiding through Classes, Class method and self argument, Class Constructor (init() Method), Data Members, Calling a Class Method from another Class Method, Class Methods and Static Methods, Inheritance, Types of Inheritance, Abstract Classes and Interfaces, Operator Overloading, Overriding Methods.	10

5	Multithreading, GUI Programming, Graphics, Plotting and Web Programming: Multithreading- Introduction, Threading Module (Creating a Thread, Synchronizing Threads) GUI Programming with tkinter Package, Simple Graphics using Turtle, Plotting Graphs in Python, Web Programming using Python.	10

References:

1. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, 2nd edition, Updated for Python 3, Shroff/O Reilly Publishers, 2016.
2. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
3. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press , 2013.
4. Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter- disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016.

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC7: Software Engineering

Course Title: Software Engineering	Course code: 21CSC2C7L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Analyze the process model chosen for the development of software and its merits and demerits
2. Identify the clear, correct and consistent requirements for the project
3. Design suitable data, architecture and user interface that copes with the requirements
4. Estimate the cyclomatic complexity and design the corresponding test cases.
5. Conduct various integration testing approaches and note down pit falls in requirements, design.

DSC7: Software Engineering

Unit	Description	Hours
1	THE NATURE OF SOFTWARE: The Nature of Software, The Changing Nature of Software SOFTWARE ENGINEERING: Defining the Discipline, The Software Process, Software Engineering Practice, Software Development Myths. THE SOFTWARE PROCESS STRUCTURE: A Generic Process Model, Defining a Framework Activity, Identifying a Task set, Process Patterns	10
2	PROCESS MODELS: Perspective Process Models, Specialized Process Models, The Unified Process, Personal and Team Process Models. AGILE DEVELOPMENT: What is Agility, Agility and the Cost of Change, What is an Agile Process, Extreme Programming, Scrum. UNDERSTANDING REQUIREMENTS: Requirements Engineering, Establishing the Groundwork, Eliciting Requirements, Developing Use Cases, Building the Analysis Model, Negotiating Requirements and Validating Requirements.	12
3	REQUIREMENTS MODELING: SCENARIOS and CLASS BASED METHODs: Requirements Analysis, Scenario-Based Modeling, Identifying Analysis Classes, Specifying Attributes, Defining Operations, Class Responsibility-Collaborator Modeling, Association and Dependencies. DESIGN CONCEPTS: Design within the Context of Software Engineering, The Design Process, Design Concepts, The Design Model.	10
4	ARCHITECTURAL DESIGN: Software Architecture, Architectural Genres, Architectural Styles. COMPONENT-LEVEL DESIGN: What is a	10

	Component, Designing Class-Based Components, Conducting Component-Level Design. USER INTERFACE DESIGN: The Golden Rules, User interface Analysis and Design.	
5	SOFTWARE TESTING STRATEGIES: A Strategic Approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Test Strategies for Object Oriented Software, Validation Testing, System Testing and The Art of Debugging. TESTING CONVENTIONAL APPLICATIONS: Software Testing Fundamentals, Internal and External Views of Testing, White-Box Testing, Basis Path Testing, Control Structure Testing and Black-Box Testing.	10

References:

1. Roger S Pressman Software Engineering - A Practitioner's Approach, 8th Edition, TMH publication, 2014.
2. Ian Sommerville Software Engineering, Pearson Education limited, 8th Edition 2007.
3. Pankaj Jalote, An Integrated Approach to Software Engineering, Narosa Publications, 3rd Edition 2005.
4. Rajib Mall Fundamentals of Software Engineering, PHI India Publications. 5th Edition, 2018.

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC8: Operating System

Course Title: Operating System	Course code: 21CSC2C8L
Total Contact Hours: 52	Course Credits: 04
Formative Assessment Marks: 30	Duration of ESA/Exam: 03 hrs.
Summative Assessment Marks: 70	

Course Outcomes (CO's):

At the end of the course, students will be able to:

1. Explain the core structure and functionality of operating system.
2. Discuss and analyze various inter process communication mechanisms.
3. Evaluate and analyze the different techniques for solving CPU scheduling problems
4. Describe and Apply the knowledge of deadlock concepts to provide wide range of functionality to applications
5. Identify and analyze the problems that occur in the design of OS based on knowledge gained through process synchronization techniques
6. Analyze the performance of different memory management techniques and page replacement algorithms

DSC8: Operating System

Unit	Description	Hours
1	Introduction: What operating systems do - User view, System view, Defining operating systems, Operating System Structure, Operating System Operations – Duel mode and multimode operation, Timer, Process Management; Memory Management; Storage Management; Protection and Security. System structures: Operating System Services; User-Operating System interface –Command interpreters, Graphical user interface, Choice of Interface System calls; Types of system calls; System programs; Operating System Structure –Simple structure, Layered approach, Microkernels, Modules, Hybrid Systems – Mac OS X, iOS, Android.	10
2	Process: Process concept, Process state, Process control block, Process scheduling, Scheduling queues, Schedulers, Context switch, Operations on processes – Process creation and termination, Inter-process communication, Shared memory and message passing systems. Threads: Overview, Benefits, Multicore Programming, Types of parallelism, Multithreading models. Process management: Basic concepts, CPU scheduler, Preemptive and non-preemptive scheduling, Scheduling criteria, Scheduling algorithms – FCFS, SJF, Priority and Round robin scheduling, Multi- level and multilevel feedback queue scheduling, Multiple-Processor Scheduling.	11
3	Process synchronization: Background, The Critical section problem,	10

	Petersons solution, Synchronization hardware, Mutex locks, Semaphores, Classic problems of synchronization, Bounded buffer problem, Readers writer's problem, Dining philosopher's problem. Deadlocks: System model, Deadlock characterization, Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection and recovery from deadlock	
4	Memory management: Background, Basic hardware, Address binding, Dynamic loading and linking, Swapping – Standard swapping, Swapping on Mobile Systems, Contiguous memory allocation Fragmentation, Segmentation. Paging, Structure of page table – Hierarchical paging, Hashed paging, Inverted paging, Oracle SPARC Solaris FILE SYSTEM: File concept, File operations, File types, File structure, Access methods, Sequential access, Direct access, other access methods.	11
5	Virtual memory management: Basic concepts, Demand paging, Copy-on-write, Page replacement – FIFO, LRU, Optimal, LRU-approximation, counting based page replacement algorithms, Page buffering algorithms, Applications, Thrashing – causes of thrashing, Working set model, Page fault frequency. Case study: Linux operating system, Linux history, Process management, Scheduling, Memory management.	10

References:

1. Abraham Silberschatz, Peter Baer Galvin Greg Gagne Operating System Concepts, Wiley-India, 9th edition, 2013.
2. D.M Dhamdhere Operating Systems- A Concept Based Approach, Tata McGraw-Hill, 2nd Edition, 2002.
3. P.C.P. Bhatt Operating Systems, PHI, 4th Edition, 2013.

SEC 2: Advanced Web Programming

Course Title: Advanced Web Programming	Course code: 21CSC2S2
Total Contact Hours: 0 - 1 - 2	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 01 hr.
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Understand client server architecture and able to use the skills for web project development Develop a static, interactive and well-formed webpage using JavaScript, CSS and HTML5
2. Apply PHP to improve accessibility of a web document.
3. Understand client server architecture and able to use the skills for web project development Develop a static, interactive and well-formed webpage using JavaScript, CSS and HTML5

SEC 2: Advanced Web Programming

Unit	Description	Hours
1	Web Programming concepts: Architecture of the Web, HTTP Protocols (GET, POST, HEAD, PUT, DELETE), HTTP session. HTML: Document Object Model (DOM), Elements, Events. HTML5: Elements, Objects, Events, Canvas, Audio & Video Support, Geo-location Support CSS: Styling HTML with CSS, Inline Styling (Inline CSS),External Styling (External CSS),CSS Fonts, The CSS Box Model, The id Attribute, The class Attribute, HTML Style Tags.	08
2	JavaScript: Javascript console, Scope, Events, Strings, String Methods, Numbers, Number Methods, Dates, Date Formats, Date, Methods, Arrays, Array Methods, Booleans, Comparisons. Control Structures: Conditions, Switch, Loop For, Loop While, Break. Functions: Function Definitions, Function Parameters, Function Invocation, Function Closures. Object Oriented Programming: Method, Constructor, Inheritance, Encapsulation, Abstraction, Polymorphism, Javascript Validations, Document Object Model, Document and Events (DOM Manipulation).	09
3	Forms: Forms Validation, Forms API,JS Browser BOM, Window, Screen, Location, History, Navigator, Popup Alert, Timing, Cookies, Javascript Windows, Pushing code quality via JSLint tool, Security in Java Script Introduction to PHP: What is PHP, How to install XAMPP on Windows, PHP Data Types, Variables, Constant, Operators, PHP Comments, PHP Array.	09

References (indicative)

1. Programming the World Wide Web – Robert W. Sebesta, 4th Edition, Pearson Education, 2008.

2. Internet & World Wide Web How to Program – M. Deitel, P.J. Deitel, A. B. Goldberg, 3rd Edition, Pearson Education / PHI, 2004.
3. The Joy of PHP Programming, Fifth Edition, Alan Forbes, Plum Island
4. Web Programming Building Internet Applications – Chris Bates, 3rd Edition, Wiley India, 2006
5. The Web Warrior Guide to Web Programming – Xue Bai et al, Thomson, 2003
6. https://www.tutorialspoint.com/restful/index.htm (REST Web Services topics are referred to this link)

Dept Name: Dept. of Studies in Computer Science
Semester-II
DSC5P4 : Database Management Systems Lab

Course Title: Database Management Systems Lab	Course code: 21CSC2C5P
Teaching Hours/Week (L-T-P): 0 - 0 - 4	Course Credits: 02
Formative Assessment Marks: 20	Duration of ESA/Exam: 04 hrs.
Summative Assessment Marks: 30	

Course Outcomes (COs):

At the end of the course, students will be able to:

1. Design database schema for a given application and apply normalization
2. Acquire skills in using SQL commands for data definition and data manipulation.
3. Develop solutions for database applications using procedures and triggers.

DBMS Laboratory

Consider the following relations for a central store which receives raw materials from its venders and issues them to its different sections.

ITEM (Item-Code, Item-Description, Unit-Price, EOQ, ROL, SOH, Back-Order-Qty)
EOQ: Economic Order Quantity, ROL: Reorder level, SOH: Stock On Hand
ORDERING (Order-No. Item-Code, Quantity-Received)
ORDER (Order-No, Order-Date, Voucher-No, Vender-No, Due-date)
VENDER (Vender-No, Vender-Name, Vender-Address)
VOUCHER (Voucher-No, Voucher-Date, Vender-No, Cheque-No)
INDENT (Indent-No, Quantity-Demanded, Quantity-Issued, Section-Code, Item-Code)
SECTION (Section-Code, Section-Name)
CHEQUE (Cheque-No, Cheque-date, Cheque-Amount)

1. Create the above tables by properly specifying the primary keys and the foreign keys.
2. Enter at least five tuples for each relation.
3. Increase the unit price by 1% for all items
4. Add check constraint to Unit Price in Item table, which should allow only positive values.
5. Delete a voucher details from voucher table given by voucher no and make sure that, this operation automatically inserts null to all related tuples in a system.
6. Demonstrate with suitable example, group by, having, order by clauses.
7. Demonstrate all aggregation operations in SQL ,with suitable examples,
8. Produce the list of orders between Jan 2000 to Jan 2006.
9. Demonstrate with suitable example, Left outer join, Right outer join and Full outer join.
10. Demonstrate Create Index and Drop index on any table.
11. Demonstrate with suitable example, Union, Intersect and Except operations
12. Alter the table SECTION by adding section In-charge-Code.
13. Produce the list of order with the following details: item code, descriptions and Unit-Price, given by Order-No & Vendor –No.

14. Produce the daily items receipt summary with the following details: Order-no, Order date, Vender no, vender date, vender address item code item description EOQ, quantity received. [Note: result should be displayed on date wise]
15. Produce the daily items issue summary with the following details: Indent no, section code, section name, item code, item description, quantity demanded, quantity issued. [Note: result should be displayed on date wise]
16. Produce the list of orders with the following details: order no, order date, due date, vender no and vender name, given by delay duration. [Note: Delay duration=current date- due date]
17. Produce the everyday bill payment voucher with the following details: item code, item description unit price, EOQ, quantity Received and item order value in Rs. (EOQ x quantity-received) given by order no, voucher no & vender no.
18. Produce the monthly bill settlement summery of given vendor no with the following details: voucher no, voucher date, cheque no, cheque date cheque amount.
19. Produce the monthly stores materials consumption summary with the following details: item code, item description, Unit price, quantity consumed and item consumption values in Rs.
20. Write a trigger to notify back order quantity (ROL-SOH) with suitable message whenever SOH crosses ROL.
21. Write a Stored procedure to display the details of ITEM which are ordered on specific Order-Date.
22. Write a Stored procedure which accepts Item-Code and vendor-no as parameter and displays the number of orders on the Item ordered by the vendor.