B.Tech. Biotechnology
Kurukshetra University, Kurukshetra
Scheme of Exams w.e.f. session 2024-2025
SEMESTER-III

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-BTT-201	Biochemistry	3:0:0	3	3	70	30	--	100	3
2	B23- BTT -203	Microbiology	3:0:0	3	3	70	30	--	100	3
3	B23- BTT -205	Molecular Biology	3:0:0	3	3	70	30	--	100	3
4	B23- BTT -207	Green biotechnology and Pollution Abatement	3:0:0	3	3	70	30	--	100	3
5	B23-BTT-209	Genetics and Cell Biology	3:0:0	3	3	70	30	_	100	3
6	B23- BTT -211	Green biotechnology and Pollution Abatement Lab	0:0:3	3	1.5	--	40	60	100	3
7	B23- BTT -213	Molecular Biology Lab	0:0:3	3	1.5	--	40	60	100	3
8	B23- BTT -215	Microbiology Lab	0:0:3	3	1.5	--	40	60	100	3
9	B23- BTT -217	Biochemistry Lab	0:0:3	3	1.5	--	40	60	100	3
10	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	--	100	3
11	B23- BTT -219	Seminar	0:0:1	1	0.5	--	100	--	100	---
TOTAL				**31**	**22.5**	**420**	**440**	**240**	**1100**	

B.Tech. Biotechnology
Kurukshetra University, Kurukshetra
Scheme of Exams w.e.f. session 2024-2025
SEMESTER-IV

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-BTT -202	Bioprocess Engineering	3:0:0	3	3	70	30	--	100	3
2	B23- BTT -204	Structural Biology	3:0:0	3	3	70	30	--	100	3
3	B23- BTT-206	Immunology and Diagnostic Techniques	3:0:0	3	3	70	30	--	100	3
4	B23- BTT-208	Recombinant DNA Technology	3:0:0	3	3	70	30	--	100	3
5	B23- BTT-212	Bioprocess Engineering Lab	0:0:3	3	1.5	--	40	60	100	3
6	B23-BTT-214	Immunology and Diagnostic Techniques Lab	0:0:3	3	1.5	--	40	60	100	3
7	B23- BTT-216	Recombinant DNA Technology Lab	0:0:3	3	1.5		40	60	100	3
8	B23- MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
9	B23- HSM-202	Innovation, Start-up and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
TOTAL				**26**	**20.5**	**350**	**370**	**180**	**900**	

Note: All students have to undertake the industrial training for 6 to 8 weeks after 4th semester which will be evaluated in 5th semester.

B23-BTT-201	Biochemistry (B.Tech Biotechnology) Semester-III						
Lecture	Tutorial	Practical	Credit	End semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3 Hrs.
Purpose	To introduce the students with basics of Biochemistry						

Course Outcomes	
CO1	The students will be able to learn the structure and functions of carbohydrates and proteins
CO2	The students will be able to learn structure and functions of lipid and nucleic acids along with basic concepts of enzymes.
CO3	The students will be able to write major pathways of carbohydrates and lipid metabolism
CO4	The students will be able to write the process of urea cycle and mitochondrial oxidative phosphorylation.

UNIT-I

1. **Amino acids** : Introduction, classification of amino acids, peptide bond important peptides. Industrial applications of amino acids.

2. **Proteins** classification based on their biological roles. Forces stabilizing protein structure and shape. Different levels of structural organization of proteins. Ramachandran plot, alpha helix, beta plated sheets, domain motif and fold. Protein folding.

3. **Carbohydrates-Structure and functions:** Structures and properties of glucose and fructose, distinguishing features of different disaccharides. Ring structure and mutarotation. Structure and brief introduction of starch, glycogen and cellulose.

UNIT-II

4. **Lipids-Structure and functions:** Classification of lipids based on their biological roles and their general functions. Membrane lipids and brief discussion on fatty acids.

5. **Nucleic Acids-Structure and functions:** Structure and properties of purine and pyrimidine bases. A brief introduction of ATP, GTP, CTP and UTP.

6. **Enzymes:** Classification of Enzymes according to enzyme commission report. Activation energy and rate of reaction. Rate constant, reaction order. A brief introduction of mechanism of enzyme catalysis. Enzyme inhibition and concept of allostery. Michaelis- Menten equation.

UNIT-III

7. **Carbohydrate Metabolism:** Glycolysis and TCA cycle. Pentose phosphate pathway and its significance. Gluconeogenesis pathway. Glycogenolysis, glycogenesis and control of glycogen metabolism.

8. **Lipid Metabolism:** Beta -oxidation of saturated fatty acids, Degradation of triacylglycerols by lipases. Biosynthesis of saturated fatty acids. Biosynthesis of triacylglycerols, phospholipids.

UNIT -IV

9 Amino Acid Metabolism: General reactions of amino acids metabolism- transamination, oxidative and non-oxidative deamination and decarboxylation. Urea cycle and its regulations.

10. Nucleic Acid Metabolism: Catabolism, *de novo*-biosynthesis .

11. Mitochondrial oxidative phosphorylation: Mitochondrial electron transport chain. Hypotheses of mitochondrial oxidative phosphorylation.

Text

1. Biochemistry, concepts and connections, 1st edition, by Dean R. Appling, Spencer J. Anthony-Cahill and Christopher K. Matthews (2015). Pearson Education, Inc.

2. Biochemistry, 4th edition, by L. Stryer (1995). W.H. Freeman & Co. NY

3. Lehninger: Principles of Biochemistry, 3rd edition, by David L. Nelson and M.M. Cox (2000) Maxmillan/ Worth publishers

References Books:

1. Biochemistry, 4th edition, by G. Zubay (1998). Wm.C. Brown Publishers.

2. Biochemistry, 2nd edition, by Laurence A. Moran, K.G. Scrimgeour, H. R. Horton, R.S. Ochs and J. David Rawn (1994), Neil Patterson Publishers Prentice Hall.

3. Biochemistry, 2nd edition, by R.H. Garrett and C.M. Grisham (1999) . Saunders college Publishing, NY. Sons, NY.

4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999) , John Wiley & Sons, NY

5. Harper's Biochemistry, 25th edition, by R.K. Murray, P.A. Hayes, D.K. Granner, P.A. Mayes and V.W. Rodwell (2000). Prentice Hall International.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B23- BTT -203	MICROBIOLOGY (B.Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	**The course provides the students both conceptual and experimental background in the broad discipline of microbiology**						
Course outcome							
CO1	**Student to learn the history and classification of microbiology**						
CO2	**The students will be introduced to microbial diversity and various microbiological techniques**						
CO3	**Emphasis has been laid on bacterial growth, nutrition, control, metabolism and Genetics.**						
CO4	**Course also introduces the students to the Microbial ecology and relevance of microbes in the field of medicine, agriculture and industry.**						

UNIT – I

Introduction to Microbiology: History and Various branches of microbiology, Organization of Prokaryotic and Eukaryotic Cell Structure and Function, Viruses.

Classification of Microorganisms: Microbial Taxonomy- Criteria used including molecular approaches. Current classification of bacteria.

UNIT – II

Diversity of Microbial World: Microbial Evolution, Microbial Diversity.

Control of Microbial Growth: Effect of heat, sterilization, disinfectants, therapeutic agents, antimicrobial resistance, purification and preservation of microbes.

Microbial Nutrition and Growth: Types of growth media, growth phases, culture methods,

UNIT – III

Microbial Metabolism: Aerobic & anaerobic respiration, fermentation, Entner Duodruffs pathway, photosynthesis, nitrogen fixation

Microbial Molecular Biology and Genetics: Genome and gene structure, Replication, Expression, Regulation of gene expression (operon system), transformation conjugation and transduction

UNIT - IV

Microbial Ecology: Microbes from marine, freshwater and terrestrial environments, Microbial Interactions (Symbiotic, non-symbiotic), Pathogenic microbes

Application of Microbiology: Role of Microbes in agriculture, public health, medicine and industry

Text Books/References:

1. Prescott's Microbiology by Willey, Sherwood and Woolverton.
2. Brock Biology of Microorganisms by Madigan, Martinko, Stahl and Clark.
3. General Microbiology by Stanier, Ingraham, Wheelis and Painter.
4. Microbiology, M. Pelczar, E. Chan, N. Kreig, 5th ed, MGH.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B23-BTT-205	Molecular Biology (B. Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal Assessment**	**Total**	**Time**
3	0	**0**	**3**	**70**	**30**	**100**	**3 Hrs**
Purpose	**To understand the basics of molecular biology**						
Course Outcomes							
CO 1	**To learn about genetic material and replication process.**						
CO 2	**To learn about the process of transcription and gene expression.**						
CO 3	**To learn about process of splicing.**						
CO 4	**To know about the next step of transfer of genetic information by translation process**						

UNIT- I

1.Genes : DNA/RNA as the genetic material. Double helical structure of DNA.Types of DNA.Super coiling and periodicity of DNA.Linking number of DNA. Euchromatin and heterochromatin.

2.From Genes to Genomes : Exons and introns, repetitive and non –repetitive DNA, C-value paradox.

3.DNA Replication : Origin of DNA replication. Bacterial and eukaryotic replicons. DNA polymerases. Mechanism and regulation of DNA replication in prokaryotes and eukaryotes.

UNIT - II

4.Transcription: Various RNA species and their properties- tRNA as an adapter and turnover of mRNA.

5.Transcription in Prokaryotes: RNA polymerases. Mechanism of transcription- initiation, elongation and termination.Role of sigma factor in transcription.

6.Transcription in Eukaryotes: RNA Polymerases. Downstream and upstream promoters.. Mechanism of transcription. Interaction of upstream factors with basal apparatus. Post-transcriptional modifications of various RNA species (mRNA, rRNA, tRNA).

UNIT III

7. Nuclear Splicing : Lariat formation Sn RNAs group I & II introns cis-splicing and trans-splicing reactions. Catalytic RNA- Ribozymes- Ribonuclease .

8.Control of transcription: Operon concept Positive and negative control lac trp operon repressor-inducer complex, catabolite repression and attenuation.

UNIT - IV

9. Genetic Code: Evidence for triplet code. Properties of genetic code, Wobble hypothesis.

10. Protein Synthesis : Structure of prokaryotic and eukaryotic ribosomes and their role in protein synthesis. Mechanism of initiation, elongation and termination of protein synthesis. Regulation of translation in prokaryotes and eukaryotes. Post translational modifications of proteins.

11. Protein folding: Role of molecular chaperones.

Text/Reference Books :

1. Genes XI Lewin, Benjamin(2013)OUP, Oxford.
2. Genomes,2nded, Brown, T. A.(2002) John Wiley and sons ,Oxford
3. Molecular biology of cell 4thed Alberts, Bruce; Watson,J D(2002) Garland Science Publishing, New York.
4. Molecular cell biology 4th edLodish, Harvey and. Baltimore,D(2000) W.H. Freeman and Co., New York
5. Cell and Molecular Biology 8th ed, Robertis, EDP De &Robertis, EMF De(2002) lippincott Williams & Wilkins international student edition, Philadelphia.
6. Essentials of Molecular Biology 4th ed, Malacinski, G. M. (2003) Jones &Bartlet Publishers, Boston
7. Cell and Molecular Biology: concepts and experiments 3rd ed Karp, Gerald(2002) John Wiley and sons, New York.
8. The Cell-a molecular approach, 3rd ed Cooper, G M&Hausman, R E(2004) ASM Press, Washington D C

B23- BTT -207	Green Biotechnology and Pollution Abatement (B. Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Sem. Exam**	**Internal assessment**	**Total**	**Time**
3	-	**-**	**3**	**70**	**30**	**100**	**3 Hrs**
Purpose	**To familiarize the students with fundamentals of Green Biotechnology and Pollution Abatement.**						
Course Outcomes							
CO 1	**Students will learn principles and different methods for waste water treatment and solid waste management**						
CO 2	**Students will understand novel biotechnological methods for degradation of xenobiotics and recalcitrant compounds**						
CO 3	**Students will know how biotechnology can help in removal of the pollutants from soil and waste water using bioremediation and phytoremediation.**						
CO 4	**Developing an understanding of new trends of developing ecofriendly biproducts such as biopesticides, biofuels, renewable energy sources.**						

Unit I

Classification and Characterization of waste: Physicochemical Characteristics of waste. Waste material suitable for biological treatment : Biological Waste Treatment : Solid waste management: landfills, recycling and processing .

Unit II

Biodegradation of Hydrocarbons, Xenobiotic and Recalcitrant Compounds: Xenobiotic compounds–Definition and examples. Recalcitrant Compounds-Definition and examples. Biodegradation- Introduction, effect of chemical structure on biodegradation, co metabolism . Factors affecting biodegradation, microbial degradation of hydrocarbons.

Unit III

Bioremediation and Introduction and types of bioremediation, In situ and Ex-situ technologies, Bioaugmentation, Biostimulation; Phytoremediation- Introduction and Types of phytoremediation; Advantages and limitations of bioremediation; Biorestoration: reforestation through micropropagation.

Unit IV

Eco-Friendly Bioproducts and Processes: Basic concepts and prospects of biofuel production: bioethanol, biohydrogen and biodiesel; Biogas , biofertilizers and biopesticides. Fundamentals of composting and vermicomposting process. Use of mycorrhizae and microbes for improving soil fertility. Organic Farming. Biotechnology in Environment Protection: Current status of biotechnology in environment protection and its future.

Text Books/Reference Books:

1. **Environmental Processes I-III, J. Winter, 2nd ed., Wiley Publications**
2. **Introduction to Wastewater Treatment- R. S. Ramalho, Academic Press.**
3. **Elements of Water Pollution Control Engineering – O.P. Gupta, Khannabooks.**
4. **Energy Technology- O.P. Gupta, Khannabooks, 2018**
5. **Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd.**
6. **Environmental Biotechnology, B.C. Bhattacharya & Ritu Banerjee, Oxford Press, 2007.**
7. **Environmental Biotech- Pradipta Krimar, I.K. International Pvt. Ltd., 2006.**
8. **Environmental Microbiology & Biotechnology- D.P. Singh, S.K. Dwivedi, New Age International Publishers, 2004.**
9. **Biodegradation and Bioremediation 1999 (2nd edition). Martin Alexander, Elsevier Science & Technology.**
10. **Environmental Biotechnology by Bruce Rittmann and Perry McCarty.**

B23-BTT-209	Genetics and Cell Biology (B. Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal Assessment**	**Total**	**Time**
3	-	**-**	**3**	**70**	**30**	**100**	**3 Hrs**
Purpose	**To familiarize the students with fundamentals of genetics and cell biology.**						
Course Outcomes							
CO 1	**To understand the basis of Mendelian inheritance along-with exceptions to this pattern of inheritance.**						
CO 2	**To learn structural and molecular mechanism of gene aberrations and gene mapping using variable methods.**						
CO 3	**Students will acquire knowledge of organizational and functional aspects of cell.**						
CO 4	**Able to learn interaction of cells with outside environment through exchange of information and transport of molecules.**						

UNIT I

1. **Mendelian inheritance and its exceptions**; History of genetics, Reproduction as basis of heredity, Mendelian principal of genetics, Co-dominance (Blood group system), incomplete and complete dominance. Multiple alleles (skin color in Rabbits).Linkage phenomenon, types and detection.

2. **Polygenic Inheritance:** Nelsson- Ehle experiment, Yule experiment, Skin color in human beings, Numerical problems on Mendelian and polygenic inheritance.

UNIT II

3. **Basic inheritance linked to sex chromosomes:** Sex limited, Sex Influenced and Sex Linked inheritance patterns, Sex Determination, Chromosomal Theory of inheritance, Pedigree analysis, Lethality Concept.

4. **Genome Mapping**: Physical mapping, Genetic mapping, Chromosomal mapping, Two point cross (*Neurospora crassa*) to map genes, Three point test cross mapping, Somatic cell hybrid for mapping, Human Genome project. Mapping in Prokaryotes and Eukaryotes.

UNIT-III

5. **Cell Division**: Mitosis, Meiosis, Phases of cell division. Cell cycle regulation along with checkpoints, Intracellular trafficking and cell death via apoptosis.

6. **Cell Signaling:** -Cell-cell interactions, Cell Receptors, Ligands and Trans-membrane signaling, Signal Transduction Pathways.

UNIT IV

7. **Mutations:** Introduction, types of mutation, application of mutations, Different modes of introducing mutations via mutagens, DNA Repair Mechanism (Photoreactivation, Mismatch repair).

8. Problem Solving: Numericals on Mendelian inheritance, Co dominance, Linkage, Pedigree analysis, Gene mapping via two point and three point test cross, Polygenic inheritance and gene and genotype frequency calculations.

Text Books:

1. Concepts of Genetics: Klug, W.S. and Cumming, M.R., Pearson Education, Inc.
2. Principles of Genetics by Snustad, S. John Willey& sons Inc Hoboken,2003.
3. Molecular Biology of the cell: Bruce A., Alexander J., Julian L., Martin R., Keith R., Peter W.; 6th edition, New York: Garland Science, 2008.
4. Cell and Molecular Biology-Concepts and Experiments, Gerald Karp et al., John Wiley, 8th Edition,2015.

Reference Books:

1. Fundamental of Genetics, Singh, B. D., Kalyani Publishers, New Delhi.
2. Basic Genetics.(2004),Miglani,G.S.,Narosa Publishing House, New Delhi.
3. Cell Biology:Organelle structure and Functions, Sadava, D.E., (2004), Panima Publications, New Delhi.

B23- BTT -211	Green Biotechnology and Pollution Abatement LAB (B.Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the practical aspects of Green biotechnology and Pollution Abatement**						
Course Outcomes							
CO1	**Students will learn to test water samples**						
CO2	**Students will learn to test polluted soil samples**						
CO3	**Students will learn the technique of isolation of bacteria from contaminated soil**						
CO4	**Students will explore the vermicomposting , biogas and organic farming plant**						

Laboratory Experiments:

1. Qualitative analysis of water/waste water/soil:
2. Bacterial analysis of water samples.
3. Determination of hardness, alkalinity, Electrical conductivity.
4. Determination of soluble phosphates. chlorides and pH In water samples.
5. Determination of BOD and DO contents.
6. Decolourization of industrially important dyes from waste water with help of resistant microbes.
7. Isolation of resistant microbes from contaminated soil.
8. Effect of temperature and pH on activity of microbes used for bioremediation.
9. Visit to Vermicomposting and Biogas Plant .

Text Books:

1. Microbiology- A laboratory manual. 4th edition. Cappuccino J. and Sheeman N. (2000) Addison Wesley, California.

2. Environmental Microbiology – A Laboratory Manual Pepper. I.L.; Gerba, C.P. and Brendecke, J.W.(1995) Academic Press, New York.

Reference Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. 4th Edition. Aneja, K.R. (2003) Age International Publishers, New Delhi**.**

2. Manual of Industrial Microbiology and Biotechnology. 2nd Edition. Ed. Arnold L. Demain and Julian E. Davies (1999) ASM Press Washington D.C.

B23-BTT-213	MOLECULAR BIOLOGY LAB (B.Tech Biotechnology Semester III)						
Lecture	Tutorial	Practical	Credit	Internal Assessment	Practical Exam	Total	Time
-	-	3	1.5	40	60	100	3 Hrs
Purpose	To learn the practical aspects of Molecular Biology						
Course Outcomes							
CO1	Students will be able to learn Isolation of DNA from Prokaryotic and Eukaryotic Cells						
CO2	Learning of Gel Electrophoresis for separation of DNA, RNA and Proteins						
CO3	Students will learn the technique of PCR Amplification of Nucleic Acids						
CO4	Students will learn Restriction Mapping of Plasmid DNA						

LABORATORY EXPERIMENTS

1. Isolation of genomic DNA from eukaryotic cells.

2. Isolation of RNA from eukaryotic cells.

3. Isolation of proteins from eukaryotic cells.

4. Isolation of genomic DNA from prokaryotic cells.

5. Gel electrophoretic separation of DNA and molecular wt. determination.

6. Gel electrophoretic separation of RNA.

7. Gel electrophoretic separation of proteins.

8. PCR amplification of DNA: Visualization by gel electrophoresis.

Reference Book:

1. **Molecular Cloning – A laboratory manual: 3rd Edition Vol. 1-3. Sambrook J and Russell D.W. (2001). Cold Spring Harbor laboratory Press, New York.**

B23- BTT -215	MICROBIOLOGY LAB (B.Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	**0**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**At the end of the course students will be aware about the conspicuous presence of microbes in the environment and their influence in our daily lives as part of food, soil, air environment and disease development.**						
Course Outcomes							
CO1	**Students will be able to operate microscopes and staining methods**						
CO2	**Learning of Culture Media Preparation for Microbial Growth**						
CO3	**Students will learn Pure Culture Techniques for maintenance and preservation of microbes.**						
CO4	**Students will learn various aspects of Biochemical Tests used in Microbial Taxonomy**						

LABORATORY EXPERIMENTS

1. Microbial Good Lab Practices and Biosafety
2. Media preparation and sterilization
3. Microscopic examination of different groups of microorganisms
4. Total count and viable count determination
5. Microbial simple and differential staining methods
6. Isolation of pure culture and its preservation
7. Microbial Growth curve determination
8. Effect of physical and chemical environment on growth
9. Biochemical tests for Microbial identification
10. Antibiotic Sensitivity of Microorganisms

Text Book/ References Books:

1. Experiments in Microbiology, Plant Pathology and Biotechnology. 4th Edition.Aneja, K.R. (2003), New Age International Publishers, New Delhi**.**

2. Microbiology- a laboratory manual. 4th edition.Cappuccino J. and Sheeman N. (2000) Addison Wesley, California.

3. Environmental Microbiology – A Laboratory Manual Pepper. I.L.; Gerba, C.P. and Brendecke, J.W. (1995) Academic Press, New York.\

B23-BTT-217	BIOCHEMISTRY LAB (B.Tech. Biotechnology) Semester-III						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the practical aspects of Biochemistry**						
Course Outcomes							
CO1	**Students will be able to learn qualitative and quantitative estimation of biomolecules.**						
CO2	**Students will be able to learn procedure to perform enzyme assay**						
CO3	**Students will learn technique of paper and thin layer chromatography.**						
CO4	**Students will be able to determined molar extinction coefficient of NADH/NAD**						

LABORATORY EXPERIMENTS

1. Qualitative tests for amino acids, proteins, Lipids and carbohydrates.
2. Quantitative estimation of proteins by Lowry method.
3. Determination of reducing sugar by Nelson-Somogyi's method
4. EnzymeAssay of protease/amylase/peroxidase/catalase.
5. Identification of amino acid by paper chromatography.
6. Determination of Km and Vmax of any commonly occurring enzyme.
7. Identification of sugars by thin layer chromatography.
8. To verify the validity of Beer,s law and determined the molar extinction coefficient of NADH.

Text/ Reference Books:

1. Principles and techniques of Practical Biochemistry: K. Wilson and J. Walker (1994), Cambridge University Press, Cambridge.

2. Introductory practical Biochemistry by S.K. Sawhney and Randhir Singh (2000), Narosa Publishing House, New Delhi.

3. An introduction to Practical Biochemistry by David T. Plummer (1988), McGraw- Hill, Book company, UK.

B23-MAC -201	Environmental Studies (B.Tech. Biotechnology Semester III)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End semester Exam**	**Internal Assessment**	**Total**	**Time**
3	-	**-**	**1**	**70**	**30**	**100**	**3 Hrs**
Purpose	**To learn the multidisciplinary nature, scope, and importance of Environmental studies.**						
Course Outcomes (CO)							
CO1	**Students will be able to learn the importance of the environment and natural resources.**						
CO2	**To learn the structure and functions of different types of ecosystems and understand the different conservation methods of biodiversity.**						
CO3	**Will be able to understand the types of pollution, the various social issues, and their impacts on the environment.**						
CO4	**The students will be able to understand the relationship between the human population and the environment.**						

UNIT- I

The Multidisciplinary nature of environmental studies: Definition; Scope and importance, Need for public awareness.

Natural resources and associated problems. Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, and use of alternate energy sources. Land resources: Land as a resource, land degradation, soil erosion, and desertification. Role of an individual in the conservation of natural resources.

UNIT II

Concept of an ecosystem: Structure and function of an ecosystem. Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the following ecosystem: Forest ecosystem, Grassland ecosystem**,** Desert ecosystem**,** Aquatic ecosystems.

Biodiversity and its Conservation: Introduction-Definition: genetic, species and ecosystem diversity. Biogeographical classification of India. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Biodiversity at global, National and local levels. India as a mega-diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental Pollution: Definition- Causes, effects and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards.

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution. Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: From Unsustainable to Sustainable development. Urban problems related to energy. Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation.

Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and Control of Pollution) Act. Wildlife Protection Act. - Forest Conservation Act. Issues involved in enforcement of environmental legislation.

UNIT-IV

Human Population and the Environment: Population growth, variation among nations. Population explosion-Family welfare Programme. Environment and human health. Human Rights. Value Education. HIV/AIDS. Women and Child Welfare. Role of information Technology in Environment and human health. Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical). Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain. Visit to a local polluted site-Urban/Rural/Industrial/Agricultural. Study of common plants, insects, birds. Study of simple ecosystems-pond, river, hill slopes, etc..

Suggested Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.

2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).

3. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.

4. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).

5. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.

6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

7. Down to Earth, Centre for Science and Environment (R).

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B23-BTT - 219	Presentation Skills (3rd sem.)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal assessment**	**End Sem Exam**	**Total**	**Time**
-	**-**	**1**	**0.5**	**100**	**-**	**100**	**1 Hr.**
Purpose	To learn different aspects of Presentation Skills						
Course Outcomes							
CO1	Students will be able to demonstrate a sound technical knowledge of their selected presentation topic.						
CO2	Students will undertake problem identification, formation and solution.						
CO3	Students will communicate with engineers and the community at large.						
CO4	Students will learn about attributes of a professional engineer.						

- In presentation Skills, a student is expected to do an in depth study in a specialized area by doing literature survey, understanding different aspects of the problem and arriving at a status report in that area. The student is expected to learn investigation methodologies, study relevant research papers, correlate work of various authors/researchers critically, study concepts, techniques, prevailing results etc., analyze it and present a report.
- The grading is done on the basis of the depth of the work done, understanding of the problem, report and presentation by the student concerned.
- **Merits of evaluation**:

1.) Quality of work: Based on: Depth of work done and understanding of the problem. Whether the student has learnt investigation methodologies described above.

2) Quality of presentation: Based on: Whether the student has been able to express his/her understanding of the topic. Whether the student has been able to satisfactorily answer questions of the panel members.

B23-BTT-202	BIOPROCESS ENGINEERING (B.Tech. Biotechnology) Semester -IV						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	**To introduce the basics of Bioprocess Engineering to the students for applications in Biotechnology**						
Course Outcomes							
CO1	**Introduce the fundamentals of Bioprocess Engineering**						
CO2	**To make the students aware of the importance of rate kinetics, formulation of culture media and sterilization of process fluid**						
CO3	**To introduce the concept of configuration and different types of bioreactors**						
CO4	**To make aware of the applications of Bioprocess Engineering to non- conventional Biological Systems**						

UNIT-I

1. **Introduction.** History and scope of Bioprocess Engineering. Basic concepts and approaches used in Bioprocess Engineering. Upstream and downstream processing. Bioprocesses and regulatory constraints. Major products of bioprocess engineering.
2. **Basics of Bioprocess Engineering**. Introduction to the fundamentals of heat transfer, mass transfer and diffusion with reference to Bioprocess Engineering. Principles of material and energy balances in a macroscopic view. Concepts of variables, dimensions and units, standard conditions and ideal gases. Concept of unit operations and unit processes.

UNIT-II

3. **Bioreaction Engineering.** Concepts of Rate Law, Zero and first order kinetics. Kinetics of cell growth. Enzyme Kinetics. Substrate utilization and product formation, Structured and unstructured models. Batch, fed-batch and continuous processes. Introduction to various kinds of bioreactors. Basic knowledge of bioreactor instrumentation and process control. Optimization and scale up.

UNIT-III

4. **Media formulation and optimization**. Sterilization of air and media; Methods of purification of fermented products. Basic concepts of filtration, centrifugation and principles of chromatography - ion exchange, gel filtration, hydrophobic interaction, affinity, GC, HPLC and FPLC; Extraction, adsorption and drying.

UNIT-IV

5. **Advances in Bioprocess Engineering**. Immobilized cell systems. Solid State Fermentation and its applications. Scale-up and scale down concepts. Fermentation economics. Bioprocess considerations in using plant and animal cell cultures. Use of genetically engineered microorganisms in bioprocess development.

Text Books

1. Shuler. M. L. and Kargi, F. 2017. Bioprocess Engineering-Basic Concepts. 3/e. Prentice Hall India, New Delhi.
2. Doran, P.M. 2013. Bioprocess Engineering Principles. Elsevier.
3. Mukhopadhyay, S. N. 2012. Process Biotechnology- Theory and Practice. The Energy and Research Institute, New Delhi.

B23-BTT-204	Structural Biology (B.Tech Biotechnology Semester IV)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3		**-**	**3**	**70**	**30**	**100**	**3**
Purpose	To provide a solid foundation of understanding structural biology						
Course Outcomes	**After completion of course students will be able**						
CO 1	To explain the concepts of protein stucture and sequence alignment						
CO 2	To articulate the concepts of protein crystallization .and associated techniques.						
CO 3	To explain the technique of Cryo Electron Microscopy and X- ray crystallography.						
CO 4	To write the basic concepts of nucleic acid structure and M.D. simulation.						

Unit-I

Protein structural biology: Protein sequences, sequence alignment, hierarchy in protein folds: secondary structure, tertiary structure, quaternary structure. Chaperones assisted protein production, Protein structure and analysis.

Unit-II

Phase diagram and separation, crystallization, Use of robotics in crystallization, symmetry, structure determination; NMR sample preparation, Sample preparation for Cryo EM, Structure validation

Unit-III

Protein fold-function relationships, Protein Data Bank (PDB) and EM Data Bank, Methods for atomic-resolution structure determination: X-ray crystallography, solution- and solid-state NMR spectroscopy, Single particle Cryo Electron Microscopy.

Unit-IV

DNA and RNA structures: DNA and RNA secondary structures (duplex, triplex, quadruplexes and aptamers), RNA secondary structure prediction. Structure of Sugars and lipids Structural dynamics: Dynamics of Protein-RNA complexes; Simulations: Protein functional dynamics, Protein dynamics studies by MD simulations.

Text Books/References:

1.Structure and Mechanism in Protein Science by Alan Feverish.

2. Proteins: Structures and Molecular Properties, by Thomas E. Creighton.

3. RNA Sequence, Structure, and Function: Computational and Bioinformatic Methods by Walter L. Ruzzo, Jan Gorodkin, Springer 2014.

4. Crystallography made crystal clear by Gale Rhodes.

5. NMR of Proteins and Nucleic Acids by Kurt Wüthrich.

6. The Art of Molecular Dynamics Simulation by D. C. Rapaport Cambridge University Press; 2nd edition 2004.

B23-BTT-206	Immunology and Diagnostic Techniques (B.Tech. Biotechnology Semester IV)						
Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3 Hrs
Purpose	To learn the role of various components of immune system and their response against various diseases						
Course Outcomes							
CO 1	The students will be able to learn the basic concepts of cells and organs related to immune system.						
CO 2	Able to learn and understand various effector responses of body against an infection.						
CO 3	To learn the concepts of various Immunological techniques						
CO 4	To learn the immunological reasons behind various diseases with advanced molecular diagnostics.						

UNIT I

1. **Introduction to Immune System:** Innate and acquired immunity, cells and organs of immune System- B-Lymphocytes and T-Lymphocytes, primary and secondary lymphoid organs, humoral and cell mediated immune response. Antigens. Immunoglobulins-structure and function

UNIT II

2. **Generation of B and T Cell Responses:** Major histocompatibility complex. Antigen Processing and presentation.
3. **Immune Effector Responses:** Cytokines. Complement system

UNIT III

4. **Immunological Techniques:** Immuno-precipitin reactions, agglutination reactions, ELISA, RIA, Immuno-fluorescence, FACS
5. **DNA Dignostics:** Radioactive and non radioactive nucleic acid hybridisation.

UNIT IV

6. **Immune System in Health and Disease:** Hypersensitive reactions. Auto immunity and immune response to infectious diseases. Immune response to transplants. Vaccines
7. **Molecular Diagnosis for Genetic Disorder:** PCR/OLA Procedures for diagnosis heredity disease caused by mutation without affecting restrictions sites. Genotyping with FISH and related techniques. Detection of Mutation.

Text Books:

1. Moloecular Biotechnology: Principles and Applications of Recombinant DNA. 3rd Edition. Glick Bernard R.and Pasternak Jack J. (1998), ASM Press washington DC.
2. Kuby's immunology, 5th Edition. Goldsby, R A., Kindt, T.Jand Osborne B.A.(2003). W. H. Freeman and company, New york..

Reference Books:

1 Essential Immunology, 10th ed Roitt, Ivon; Delves, Peter (2001) Blackwell Scientific Publications Oxford.
2 Fundamentals of Immunology: Paul W.E. (Eds.) Raven Press, New York.
3. Immunology by Presscot.

B23-BTT-208	Recombinant DNA Technology (B.Tech Biotechnology IV Semester)						
Lecture	Tutorial	Practical	Credit	d Semester Exam	Internal Assessment	Total	Time
3	0	-	3	70	30	100	3 Hrs
Purpose	It is intended to impart basic undergraduate-level knowledge in the area of recombinant DNA technology						

Course Outcomes	
CO1	The students will learn about different enzymes and vectors
CO2	The students will learn how to clone a gene and its selection
CO3	Students will learn about sequencing techniques
CO4	Student will understand application of all RDNA tools and techniques in biotechnology

UNIT I

1. Tools of Recombinant DNA: DNA modifying enzymes: Methylase, Alkaline phosphatase, Terminal deoxy nucleitidyl transferase, T4 polynucleotide kinase, Restriction endonucleases. Linkers adapters, Blunt end ligation, DNA labelling and detection

2.Vectors: Plasmid Bacteriophage Phagemid Cosmid cloning vectors. Vectors for cloning large pieces of DNA. Creating and screening a gene library cDNA library.

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UNIT II

3. Identification and Isolation of cloned genes: Selection and screening of cloned genes. Probes to locate clones and related genes Identification and isolation of tissue specific cDNA. Procedures to analyze proteins encoded by cDNA clones.

4. DNA markers: RFLP RAPD and DNA fingerprinting.

UNIT III

5. Chemical synthesis, sequencing and amplification of DNA: Chemical synthesis of DNA. DNA sequencing techniques. PCR. Analysis of eukaryotic DNA by chromosomal walking. Southern and Northern Blotting. Western Blotting. *In situ* hybridization.

UNIT IV

6. Application of recombinant DNA in biotechnology: In medicine and Industry: Production of small biomolecules: vitamin-C, amino acids and indigo. Production of insulin, Human growth hormone, Hepatitis-B virus vaccine. Tailoring antibodies for specific applications. Biopolymers production. Marshalling recombinant DNA to fight AIDS.

Text Books:

1. Recombinant DNA 2nd Edition. Watson, James D. and Gilman, M. (2001) W.H Freeman and Company, New York.
2. Molecular Biotechnology: Principles Application of Recombinant *DNA* 2nd Edition. Glick, B. R. and Pasternak, J. J. (1998) ASM press Washington DC.
3. Genetic Engineering. Ahluwalia, K. B. (2002) New Age International (P) Ltd.
4. An Introduction to Genetic Engineering 2nd edition Desmond Nicholl S.T. (2002) Cambridge University Press.
5. Genetic Engineering: *An introduction to Gene analysis and exploitation in eukaryotes*. Kingsman and Kingsman (1998) Blackwell Scientific Publication, Oxford.
6. DNA cloning: *A Practical Approach.* Glover and Hames (2001) Oxford University Press.

B23-BTT-212	BIOPROCESS ENGINEERING LAB (B.Tech. Biotechnology) Semester -IV						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs.**
Purpose	**To learn the Practical Aspects of Bioprocess Engineering**						
Course Outcomes							
CO1	**Learning of Fermentor and sterilization techniques used in Bioprocessing Lab**						
CO2	**Learning of Isolation, Identification and Preservation of industrially important microorganisms**						
CO3	**Students will learn methods of screening of microbes for various industrially important metabolites**						
CO4	**Students will learn various optimization processes and statistical tools used in fermentation tecbnology**						

LABORATORY EXPERIMENTS

1. Sterilization Techniques (Media, air and water)
2. Study of various fermentors (bioreactors)
3. Isolation, Identification, Preservation and Screening of industrially important microorganisms for primary and secondary metabolite production.
4. Formulation of fermentation media for production of industrially important metabolites by microorganisms.
5. Effect of pH on fermentation processes using microorganisms.
6. Effect of temperature on fermentation processes using microorganisms.
7. Effect of Carbon and nitrogen sources on fermentation processes using microorganisms.
8. Study of statistical tools used in Bioprocess Engineering.

Reference Books:

1. Fermentations & Biochemical Hand Book: Principles, Process Design and Equipment. Vogel, H.C. and Todaro, C. L. Noyes Publication (1996).
2. Microbiology- A Laboratory Manual. Cappuccino and Welsh (2017), 11/e, Pearson.
3. Manual of Industrial Microbiology and Biotechnology. 2/e. Eds. Arnold L. Demain and Julian E. Davies (1999) ASM Press, Washington D.C.

B23-BTT-214	Immunology and Diagnostic Techniques Lab (B.Tech. Biotechnology) Semester -IV						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the practical aspects of Immunology**						
Course Outcomes							
CO1	**Students will be able to learn basic techniques in handling laboratory animals.**						
CO2	**Learning of techniques for purification and detection of immunoglobulins.**						
CO3	**Students will learn the technique of Immunoprecipitation and Agglutination.**						
CO4	**Students will learn the principles of ELISA.**						

LABORATORY EXPERIMENTS

1. Routine techniques in handling laboratory animals: feeding, cleaning and bleeding procedure for mice and rabbit.
2. ABO blood group typing
3. Estimation of heamoglobin in blood sample
4. Detection of antigen/antibody from test sample
5. Purification of immunoglobulins.
6. Immunoprecipitation techniques
7. Agglutination techniques
8. ELISA

Reference Books:

1. Using Antibodies: A Laboratory Manual. Harlow &Lane (1998) Cold Spring Harbor Lab Press.
2. Immunological Techniques Made Easy. Cochet, et al.(1998)Wiley Publishers,Canada.

B23-BTT -216	Recombinant DNA Technology Lab(B. Tech. Biotechnology Semester IV Sem)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the experiments of Genetic engineering**						
Course Outcomes							
CO1	**The students will be able to digest, ligate and amplify the DNA**						
CO2	**To learn how to design primers**						
CO3	**The students will be able to digest, ligate and amplify the DNA**						
CO4	**Students will learn Techniques of DNA extraction and its analysis**						

Note: A college should offer 70% of the below listed experiments. The remaining 30% experiments may be modified by college according to facilities available

LIST OF EXPERIMENTS

1. Restriction Digestion of DNA
2. Ligation of desired fragments
3. Restriction mapping
4 .Target selection
5. Primer design
6. Isolation of genomic DNA
7. Gene amplification by PCR
8. Elution of DNA from gel
9. DNA fingerprinting by using molecular marker
10.Extraction of DNA from gel

References Book:

1.Molecular Cloning – A laboratory manual 3rd Edition Vol. 1-3. Sambrook J. and Russell D.W. (2001) Cold Spring Harbor laboratory Press, New York
2. Molecular Biology-Principles and Practices. Singh, N. and Siwach, P. Luxmi Publications, Delhi

B23-MAC-202	Essence of Indian Traditional Knowledge (B.Tech. Biotech. Engineering , Semester IV)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Sem, Exam**	**Total**	**Time**
2	**-**	**-**	**1**	**100**	**-**	**100**	**3 Hrs**
Purpose	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system , analyse and apply to their day to day life.						
	Course Outcomes						
CO 1	The students will be able to understand , connect up and explain basics of Indian traditional knowledge in modern scientific perspective						
CO2	The students will be able to understand Holistic Health using Indian Knowledge System						
CO3	The students will be able to Manage thoughts and Emotions , will learn positivity, self regulation and control						
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System						

Unit 1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karamyoga,
Benefits of Rajyoga and Karamyoga.

Unit 2

Holistic Health using Indian Knowledge System:
Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras.
Physical, Mental, Emotional and Spiritual health using traditional knowledge .

Unit 3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience,
Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga.
Achieving Powers for Self Mastery.

Unit 4

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology.
Consciousness; levels, body-mind relationship, self motivation, Self and Identity in modern Psychology and Indian thought.,
Spirituality and well being.

Reference and Text Books:

- Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning.
- Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.
- Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.
- Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.
- Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.
  Prakartik Swasthya Shastra, Publisher Natural Lifestyle.

B23-HSM-202		Innovation, Start ups and Entrepreneurship (Sem.-IV)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**	
3	**-**	**-**	**3**	**70**	**30**	**100**	**3** Hours	
Purpose	**The objective of this Course is to inspire students and help them imbibe entrepreneurial mindset.**							
	Course Outcomes							
CO 1	**Understanding the essence of innovation and features of innovative processes; models and methods of innovative entrepreneurship, the role of innovation as a major factor in creating the value of companies**							
CO 2	**Understanding, the dynamic role of entrepreneurship and small businesses, , types of business structure, organizing and managing a Small Business**							
CO 3	**Understanding concept of start ups, Control Strategic Marketing Planning , concept of incubation and proto type, new Product Development, Business Plan Creation.**							
CO 4	**Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship**							

Unit -I

Introduction to Innovation and Entrepreneurial Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

Unit-II

Introduction to Entrepreneurship and Start – Ups - Definitions, Traits of an entrepreneur, Intrapreneurship, Entrepreneurial Motivation ,Functions of Entrepreneur, Concept, Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of startups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

Unit -III

Start ups - Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit -IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowdfunding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work

Suggested Readings:

- Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.

Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.

- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- The Three-Box Solution: A Strategy for Leading Innovation By Vijay Govindarajan
- Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). Managing Global Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
- Brown K. and Stephen P. Osborne (2005) Managing change and innovation in public service organisation. New York: Routledge
- Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks Knowledge Creation and Innovation in Medium-technology Clusters. UK: Edward Elgar Publishing Limited.
- Eveleens, C. (2010). Innovation management; a literature review of innovation process models and their implications. Working Paper HAN University of Applied Sciences.
- Enterpreneurship Development- S.Chand & Co.,Delhi- S.S.Khanka 1999

- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
- Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2007

*B.Tech.*Computer Science and Engineering(CSE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2024-25

SEMESTER-III

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam(Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CSE-201	Data Structures and Algorithms	4:0:0	4	4	70	30	0	100	3
2	B23-CSE-203	Computer Organization & Architecture	3:0:0	3	3	70	30	0	100	3
3	B23-CSE-205	Object Oriented Programming	4:0:0	4	4	70	30	0	100	3
4	B23-CSE-207	IT Workshop (Python)	3:0:0	3	3	70	30	0	100	3
5	B23-BSC-203	Probability and Statistics	3:0:0	3	3	70	30	0	100	3
6	B23-HSM-201	Organizational Behaviour	3:0:0	3	3	70	30	0	100	3
7	B23-CSE-209	Data Structures and Algorithms Lab	0:0:3	3	1.5	0	40	60	100	3
8	B23-CSE-211	Object Oriented Programming Lab	0:0:3	3	1.5	0	40	60	100	3
9	B23-CSE-213	IT Workshop (Python) Lab	0:0:2	2	1	0	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
TOTAL				**30**	**25**	**420**	**400**	**180**	**1000**	

Note:

- NCC/NSS/Sports/Yoga/Technical/cultural club/society activities may also be joined by students in second year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines.

B.Tech. Computer Science and Engineering(CSE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2024-25

SEMESTER-IV

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam(Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CSE-202	Advanced Programming (Java)	4:0:0	4	4	70	30	0	100	3
2	B23-ESC-212	Digital Electronics	4:0:0	4	4	70	30	0	100	3
3	B23-CSE-204	Design and Analysis Algorithms	4:0:0	4	4	70	30	0	100	3
4	B23-CSE-206	Principles of Programming Languages	4:0:0	4	4	70	30	0	100	3
5	B23-HSM-302	Intellectual Property Rights (IPR) and Regulatory	3:0:0	3	3	70	30	0	100	3
6	B23-CSE-208	Advanced Programming Lab (Java)	0:0:3	3	1.5	0	40	60	100	3
7	B23-ESC-214	Digital Electronics Lab	0:0:2	2	1	0	40	60	100	3
8	B23-CSE-212	Design & Analysis Algorithms Lab	0:0:3	3	1.5	0	40	60	100	3
9	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	0	100	3
TOTAL				**30**	**24**	**420**	**300**	**180**	**900**	

Note:

All students have to undertake the industrial training for 6 to 8 weeks after 4th semester which will be evaluated in 5th semester.

B23-CSE-201	Data Structures and Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
4	**0**	**0**	**4.0**	**70**	**30**	**100**	**3 Hour**
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO 2	To introduce the structured data types like Stacks and Queue and its basic operations's implementation.						
CO 3	To introduce dynamic implementation of linked list.						
CO 4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

UNIT-1

Introduction to Data Structures, Data Types, Built in and User Defined Data Structures, Applications of Data Structure, Algorithm Analysis, Worst, Best and Average Case Analysis, Notations of Space and Time Complexity, Basics of Recursion.

Arrays, One Dimensional Arrays, Two Dimensional Arrays and Multi-Dimensional Arrays, Sparse Matrices, Searching from array using Linear and Binary Searching Algorithm, Sorting of array using Selection, Insertion, Bubble sort.

UNIT-2

Stacks: Definition, Implementation of Stacks and Its Operations, Evaluation of Infix, prefix and Postfix Expression, Inter-conversion of Infix, Prefix and Post-Fix Expression, Implementation of Merge Sort and Quick Sort Algorithm.

Queues: Definition, Sequential Implementation of Linear Queues and Its Operations, Circular Queue and its Implementation, Priority Queues and Its Implementation, Applications of queues.

UNIT-3

Linked Lists: Need of Dynamic Data Structures, Single Link List and Its Dynamic Implementation, Traversing, Insertion, Deletion Operations on Single Link Lists. Comparison between Static and Dynamic, Implementation of Linked List.

Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Link List, Dynamic Implementation of Stacks and Queues.

UNIT-4

Trees: Definition, Basic Terminology, Binary Tree, External and Internal Nodes, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals: Pre-Order, In-Order and Post-Order Traversals, Representation of Infix, Post-Fix and Prefix Expressions using Trees.

Introduction to Binary Search Trees**:** B+ trees, AVL Trees, Threaded Binary trees, Balanced Multi-way search trees, Implementation of Heap Sort Algorithm.

Graphs: Basic Terminology, Definition of Undirected and Directed Graphs, Memory Representation of Graphs, Graph Traversals Algorithms: Breadth First and Depth First.

Suggested Books:

- Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.
- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison- Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach , Jean Paul Tremblay, Richard B. Bunt, 2002, T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

B23-CSE-203	Computer Organization & Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	0	0	3	70	30	100	3Hrs.
Purpose	Student will be able to understand the basic concepts of computer architecture and organization, and understand the key skills of constructing cost-effective computer systems.						
Course Outcomes (CO)							
CO1	Be familiar with the Computer arithematic and data representation						
CO2	Be familiar with the basic computer organization and design						
CO3	Be familiar with instruction set architecture and parallel processing.						
CO4	Be acquainted with the basic knowledge of I/O organization.						

UNIT- 1

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and Architecture, Von Neumann Architecture, evolution and computer generations; fixed point, Floating-point and Decimal arithmetic operations, Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm, Multiprocessors and Multicomputer, MIPS, MFLOPS.
Memory Organization: Memory Hierarchy, Types of Memory, TLB

UNIT-2

Basic Computer organization and Design: General register organization, stack organization and common bus system, computer instructions, timing and control, Input, output and Interrupt: Interrupt cycle, Design drivers: common case, Amdahl's law.

Micro programmed Control organization, Control Memory, address sequencing, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, micro program sequencer, Hardwired v/s Micro-programmed. CISC and RISC: features and comparison.

UNIT-3

Instruction set Architecture: Instruction codes, instruction formats (Zero, One, Two and Three Address Instruction).Instruction cycle, reference instructions; Memory reference instructions.Various addressing modes.
Pipeline and vector Processing, Parallel Processing, Flynn's Taxonomy, Pipelining,
Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-4

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus.
Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer. Input output Processor, CPU-IOP communication, Serial communication.

Suggested Books:

- William Stallings, “Computer Organization and Architecture – Designing for Performance”, Sixth Edition, Pearson Education, 2003.
- Morris Mano, M., “Computer System Architecture,” 3/e, Pearson Education, 2005.
- John P. Hayes, “Computer Architecture and Organization,” 3/e, TMH, 1998.
- David A. Patterson and John L. Hennessy, “Computer Organization and Design: The Hardware/Software interface”, Third Edition, Elsevier, 2005.
- V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson Education, 2004.
- Carl Hamacher, ZvonkoVranesic and SafwatZaky, “Computer Organization”, Fifth Edition, Tata McGraw Hill, 2002.

B23-CSE-205	Object Oriented Programming						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Minor Test**	**Total**	**Time**
4	0	0	4.0	70	30	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

UNIT–1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming. Control flow, variables and assignments statements, conditional execution, looping, function calls including recursion.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Constant, Class Member, Structure and Class.Macro vs Inline Functions.

UNIT-2

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,
Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

UNIT-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

UNIT-4

Text Streams and binary stream, Sequential and Random Access File creation and updation, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an

Exception, Exception specifications.
Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

Suggested Books:

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

B23-CSE-207	IT Workshop (Python)						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	0	0	3.0	70	30	100	3 Hours
Purpose	To familiarize the students with the basics of Python Programming						
Course Outcomes							
CO1	To Study Fundamental concept of Python.						
CO2	To Study and implement expression and Strings methods						
CO3	To Study and implement tuples , list and dictionary operations.						
CO4	To Study and implement exception handling and file operation.						

Unit-1

Familiarization with the basics of Python programming: Introduction to Python, Features of Python, Execution modes: interactive mode and script mode, Python character set, use of indentation, Python tokens(keyword, identifier, literal, operator, punctuator), variables, use of comments, Knowledge of data types: Number(Integer, Floating point, Complex).
Errors: syntax errors, logical errors, and run-time errors

Unit-2

Expressions: Statement, Type conversion, and input/output: Precedence of Operators,Arithmetic operators, relational operators, logical operators, assignment operators, augmented assignment operators, identity operators (is, is not),Expression, evaluation of an expression, type-conversion, Flow of Control,Conditional statements, Iterative Statements
Strings: Introduction, string operations (concatenation, repetition, membership and slicing), traversing a string using loops, built-in functions/methods–len(), capitalize(), title(), lower(), upper(), count(), find(), index(), endswith(), startswith(), isalnum(), isalpha(), isdigit(), islower(), isupper(), isspace(),lstrip(), rstrip(), strip(), replace(), join(), partition(), split()

Unit-3

Array: Access the Elements of an Array, Length of an Array, Adding Array Elements, Removing Array Elements, Adds and remove the element at the specified position. **Lists, Tuples, Dictionary**: introduction, indexing, list operations, traversing a list using loops, built-in functions/methods–len(), list(), append(), extend(), insert(), count(), index(), remove(), pop(), reverse(), sort(), sorted(), min(), max(), sum().
Introduction to Python modules: Importing module using 'import ' and using from statement, importing math module (pi, e, sqrt(), ceil(), floor(), pow(), fabs(), sin(), cos(), tan()); random module (random(), randint(), randrange()), statistics module (mean(), median(), mode()).Functions and its types (Built-in Functions, Functions defined in Module, User Defined Functions), arguments, default parameters, positional parameters, Function Returning Value(s), Recursion, Scope of a Variable.

Unit-4

Files: Introduction to files, types of files (Text file, Binary file, CSV file),Text file: opening a text file, file open modes (r, r+, w, w+, a, a+ etc), closing a text file, opening a file using with clause, writing/appending data to a text file using write() and writelines(), reading from a text file using read(), readline() and readlines

Reference Book:

1.The Complete Reference Python By Martin C Brown Publication by McGraw Hill.
2. Let us Python By Yashwant Kanetkar

B23-BSC-203	PROBABILITY AND STATISTICS						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	**0**	**-**	**3.0**	**70**	**30**	**100**	**3 Hrs.**
Purpose	To familiarize the prospective students with the fundamentals of probability & statistics and how to apply the principles to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.						
Course Outcomes							
CO1	introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.						
CO 2	obability theory provides models of probability distributions (theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications.						
CO 3	make the students familiar about basic statistics to analyze data sets using various measures of central tendency and dispersion						
CO 4	on completion of Unit IV, students will proficiently apply correlation and regression techniques, including calculating coefficients and determining lines of regression, to analyze relationships between variables in datasets.						

UNIT-I (10 Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-II(12hrs)

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-III(10hrs)

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis.

UNIT-IV(08hrs)

Correlation & Regression:

Introduction,Correlation, Coefficient of correlation, methods of calculations, Lines of regression, Rank correlation.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley &

Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8.Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

B23-HSM-201	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	0	-	3.0	70	30	100	3 Hours
Course Outcomes							
Purpose	The objective of this Course is to make students conversant with the basic concepts of organization behaviour for nurturing managerial skills.						
CO1	An overview about organizational behavior as a discipline and understanding the concept of individual behavior.						
CO2	Understand the concept and importance of personality, emotions and its importance in decision making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

UNIT- 1

Introduction to organizational behavior: Concept and importance of organizational behavior, role of Managers in OB, challenges and opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept and types of abilities , concept of values and attitude, types of attitude, attitude and workforce diversity.

UNIT- 2

Introduction to personality and emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence.

Perception and individual decision making: meaning of perception, factors influencing perception, rational decision making process, concept of bounded rationality. Leadership-trait approaches, behavioural approaches, situational approaches, and emerging approaches to leadership.

UNIT-3

Motivation: Concept and theories of motivation, theories of motivation-Maslow, two factor theory, theory X and Y, ERG Theory, McClelland's theory of needs, goal setting theory, application of theories in organizational scenario, linkage between MBO and goal setting theory.

Foundations of group behaviour and conflict management: Defining and classifying of groups, stages of group development, Informal and formal groups- group dynamics, managing conflict and negotiation , causes of group conflicts, managing intergroup conflict through resolution.

UNIT-4

Introduction to Organizational Communication: Meaning and importance of communication process, importance of effective communication, organizational stress: definition and meaning sources and types of stress, impact of stress on organizations, stress management techniques.

Introduction to Organization Culture: Meaning and nature of organization culture, types of culture, managing cultural diversity, managing change and innovation-change at work, resistance to change, a model for managing organizational change.

Text Books:

1. Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGrawHill Education, 2017.

2. Hitt, Michael A., C. Chet Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.

3. Robbins, Stephen P., and Timothy Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017. Stephen P. Robins, Organisational Behavior, PHI Learning / Pearson Education, 11th edition, 2008.

Reference Books:

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.

2. Udai Pareek, Understanding OrganisationalBehaviour, Oxford Higher Education.

3. Mc Shane & Von Glinov, OrganisationalBehaviour, Tata Mc Graw Hill.

4. Aswathappa, K., OrganisationalBehaviour– Text and Problem, Himalaya Publication.

B23-CSE-209	Data Structures and Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Practical Exam**	**Total**	**Time**
0	0	3	1.5	40	60	100	3
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

1. Write a program for Binary search methods.
2. Write a program for insertion sort, selection sort and bubble sort.
3. Write a program to implement Stack and its operation.
4. Write a program for quick sort.
5. Write a program for merge sort.
6. Write a program to implement Queue and its operation.
7. Write a program to implement Circular Queue and its operation.
8. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
9. Write a program to implement doubly linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
10. Write a program to implement circular linked list for the following operations: Create, Display, inserting, counting, searching, traversing and deletion.
11. Write a program to implement insertion, deletion and traversing in B tree

B23-CSE-211	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Practical Exam**	**Total**	**Time**
0	0	3	1.5	40	60	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and inheritance,Constructors.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power

( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

Q2. Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class. b) Write a Program to Invoking Derived Class Member Through Base Class Pointer.

Q3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3 Answer = 3.333333

Do another (Y/ N)? Y

Enter first number, operator, second number 12 + 100 Answer = 112

Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

Q5. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

Q6. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout. Write a main ( ) to test all the functions in the class.

Q7. Consider the following class definition class father {
protected : int age; public;
father (int x) {age = x;} virtual void iam( )
{ cout<< "I AM THE FATHER, my age is : "<< age<< end1:}
};
Derive the two classes son and daughter from the above class and for each, define iam( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam( ) through the pointer to demonstrate polymorphism in action.

Q8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q10. Create a class **Employee** with a name and salary. Create a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Create a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car. Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit( ) as an argument. Write a program to exercise reversit( ). The program should get a string from the user, call reversit( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

Q13. Create a class Student with a name and roll no. as data member. Create a Class Template for student class. The program should also implement template overloading.

Q14. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.
b) Display the balance.
c) Compute and deposit interest.
d) Permit withdrawal and update the balance.
e) Check for the minimum balance, impose penalty, necessary and update the balance.
f) Do not use any constructors. Use member functions to initialize the class members.

B23-CSE-213	IT Workshop (Python) Lab						
L	**T**	**P**	**Credit**	**Internal assessment**	**Practical Exam**	**Total**	**Time**
0	0	2	1	40	60	100	3 Hours
Purpose	The course is designed to provide Basic knowledge of Python.						
Course Outcomes							
CO1	To study fundamentals of python programming and implement basic programs.						
CO2	To implement the searching technique using python.						
CO3	To implement sorting techniques using python.						
CO4	To implement matrix multiplication using python.						

LIST OF PROGRAMS

1. Write a program to compute the GCD of two numbers.
2. Write a program to find the square root of a number
3. Write a program to find the Exponentiation (power of a number)
4. Write a program to find the maximum of a list of numbers
5. Write a program for Linear search and Binary search
6. Write a program for Selection sort
7. Write a program for Insertion sort
8. Write a program to find first n prime numbers
9. Write a program to multiply matrices
10. Write a program that take command line arguments (word count)
11. Write a program to find the most frequent words in a text read from a file

B23-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
2	**-**	**-**	**1.0**	**100**	**-**	**100**	**3**
Purpose	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system, analyse and apply to their day to day life.						
	Course Outcomes						
CO 1	The students will be able to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective						
CO2	The students will be able to understand Holistic Health using Indian Knowledge System						
CO3	The students will be able to manage thoughts and emotions, will learn positivity, self regulation and control						
CO4	The students will be able to achieve Consciousness through Indian Knowledge System						

UNIT-1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karamyoga, Benefits of Rajyogaand Karamyoga.

UNIT-2

Holistic Health using Indian Knowledge System:
Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras.
Physical, Mental, Emotional and Spiritual health using traditional knowledge .

UNIT-3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self Mastery.

UNIT-4

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well being.

Reference and Text Books:

Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning

- Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.
- Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.

Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.

Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.

PrakartikSwasthya Shastra, Publisher Natural Lifestyle

B23-CSE-202	Advanced Programming (Java)						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
4	-	-	4.0	70	30	100	3 hrs
Purpose	To introduce the concepts of advanced java and its implementations.						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	To study and implement String and Collection methods.						
CO3	To study oops concept and implement abstraction, inheritance						
CO4	To study servlet and data base connectivity of java and java servlets.						

UNIT – 1

Introduction: Importance and features of Java, Concepts of Java Virtual machine (JVM), Java Comments, Keywords, Constants, Variables and Data types, java Type Casting, Wrapper classes, Operators and Expressions, Control Statements, Conditional Statements, Loops and Iterations. Creating an Array of one and two dimensional . Java Math methods. Method parameter, Calling Methods.

UNIT – 2

String, String Buffer and string Builder classes. String methods (char At, concat, compare To, equals, get Chars, length, replace, to Lower Case, to Upper Case etc.).

Java Collection: list interface(Array, vector, stack, linked list),Queue interface, Map interface, Tree Set and Tree Map interface, Hash Map and Hash Set interface.

Exception Handling, Manual Exception creation, File Handling

UNIT – 3

Class definition, adding Variables and Methods, creating Objects, Constructors, java Modifier, java encapsulation, java inheritance, method Overloading and Over Riding, Java abstraction, Java interface, Java Packages.

UNIT – 4

JDBC: JDBC Fundamentals, Establishing Connectivity and working with connection interface, working with statements, Creating and Executing SQL statements(creation of table, insertion, deletion, updation).

Servlets: Introduction to Servlets, Life cycle of Servlets, Creating, Compiling and running Servlet, Reading the servlet Parameters, Reading Initialization parameter, Handling HTTP Request and Response (GET / POST Request), Session Tracking.

Suggested Books:

1. Gary Cornell and Horstmann Cay S., Core Java, Vol I and Vol II, Sun Microsystems Press.

2. Herbert Schildt, Java: The Complete Reference, McGraw-Hill.
3. Philip Hanna, JSP: The Complete Reference, McGraw-Hill.
4. Deital and Deital, Java How to Program, Prentice Hall (2007).

B23-ESC-212	Digital Electronics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
4	-	-	4.0	70	30	100	3 Hour
Purpose	To learn the basic methods for the design of digital circuits and provide the fundamental concepts used in the design of digital systems.						
Course Outcomes (CO)							
CO1	To introduce basic postulates of Boolean algebra and shows the correlation between Boolean expressions						
CO2	To introduce the methods for simplifying Boolean expressions						
CO3	To outline the formal procedures for the analysis and design of combinational circuits and sequential circuits						
CO4	To introduce the concept of memories and programmable logic devices.						

UNIT-1
MINIMIZATION TECHNIQUES AND LOGIC GATES

Binary Digits, Logic Levels, and Digital Waveforms, Logic Systems-Positive and negative, Logic Operations, Logical Operators, Logic Gates-AND, OR, NOT, NAND, NOR, Exclusive-OR and Exclusive-NOR, Active high and Active low concepts, Universal Gates and realization of other gates using universal gates, Gate Performance Characteristics and Parameters. Boolean Algebra: Rules and laws of Boolean algebra, Demorgan's Theorems, Boolean Expressions and Truth Tables, Standard SOP and POS forms; Minterm and Maxterms, Canaonical representation of Boolean expressions, Duality Theorem, Simplification of Boolean Expressions, Minimization Techniques for Boolean Expressions using
Karnaugh Map. Introduction of TTL and CMOS Logic and their characteristics,
Tristate gates.

UNIT-2
COMBINATIONAL CIRCUITS

Introduction to combinational Circuits, Adders-Half-Adder and Full-Adder, Subtractors- Half and Full Subtractor;
Parallel adder and Subtractor; Look-Ahead Carry Adders. BCD adder, BCD subtractor, Parity Checker/Generator, Multiplexer, Demultiplexer, Encoder, Priority Encoder; Decoder ,BCD to Seven segment Display Decoder/Driver, and Comparators.

UNIT-3
SEQUENTIAL CIRCUITS

Introduction to Sequential Circuits, Flip-Flops: Types of Flip Flops -RS, T, D, JK; Edge triggering, Level Triggering; Flip Flop conversions; Master-Salve JK.

Introduction to shift registers, Basic Shift Register Operations, types of shift registers, Bidirectional Shift Registers,
Shift Register Counters. Introduction to counters, Types of Counters-Asynchronous and

synchronous counters, Up/Down Synchronous Counters, Modulo-n Counter , State table, excitation table concepts, Design of asynchronous and synchronous counters, Ring Counter, Applications of counters.

UNIT-4
CONVERTER and MEMORY DEVICES

Digital to Analog Converter, Weighed Register: R-2R Ladder Network: Analog to Digital Conversion, Successive Approximation Type, Dual Slope Type.

Classification of memories - ROM: ROM organization, PROM, EPROM, EEPROM, EAPROM, RAM: - RAM organization - Write operation, Read operation, Memory cycle, Timing wave forms, memory expansion, Static RAM Cell, MOSFET RAM cell structure, Dynamic RAM cell structure, Programmable Logic Devices - Programmable Logic Array (PLA), Programmable Array Logic (PAL), Implementation of PLA, PAL using ROM.

Suggested Books:

- Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.M.
- Morris Mano, Digital Design, 3rd Edition, Prentice Hall of India Pvt. Ltd., 2003 / Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2003.
- ALI, Digital Switching Systems, , TMH
- A.K. Maini, Digital Electronics, Wiley India
- John F. Wakerly, Digital Design, Fourth Edition, Pearson/PHI, 2006
- John. M Yarbrough, Digital Logic Applications and Design, Thomson Learning, 2002.
- S. Salivahanan and S. Arivazhagan, Digital Circuits and Design, 3rd Edition., Vikas Publishing House Pvt. Ltd, New Delhi, 2006
- William H. Gothmann, Digital Electronics, 2nd Edition, PHI, 1982.
- Thomas L. Floyd, Digital Fundamentals, 8th Edition, Pearson Education Inc, New Delhi, 2003 □ Donald D. Givone, Digital Principles and Design, TMH, 2003.

B23-CSE-204	Design and Analysis of Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
4	-	-	4.0	70	30	100	3 Hrs.
Purpose	To introduce advanced data structures & algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	Learn the basic concepts of data structures and their analysis.						
CO2	Study the concept of dynamic programming and various advanced data structures.						
CO3	Learn various graph algorithms and concepts of computational complexities.						
CO4	Study various String matching algorithms						

UNIT-1
Introduction

Review :- Elementary Data Structures, Algorithms & its complexity(Time & Space), Analysing Algorithms, Asymptotic Notations, Pseudocode Conventions, Binary search trees.
Recurrence relation:- Methods for solving recurrence(Substitution , Recursion tree, Master theorem).

UNIT-2
Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,
Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Knapsack problem.
Backtracking algorithms:- Graph coloring, N-Queen problem, Hamiltonian path and circuit.

UNIT-3
Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first & Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal's and Prim's Algorithm, Single source shortest paths, Relaxation, Dijkstra's Algorithm, Bellman-Ford algorithm, Single source shortest paths for directed acyclic graphs, Floyd-Warshall algorithm,

UNIT-4
Computational Complexity

Basic Concepts, Polynomial vs Non-Polynomial Complexity, NP- hard & NP-complete classes. The Naïve string-matching algorithm, Rabin-Karp Algorithm, String matching with finite automata.

Text Books:

1. Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
2. Harsh Bhaisn, Algorithms: Design And Analysis Oxford University Press,2015.

Reference Books:

1. Aho, Hopcroft and Ullman : The Design and Analyses of Computer Algorithms. Addison Wesley.
2. R.B.Patel, Expert Data Structures with C, Khanna Publications , Delhi, India, 2ndEdition 2004, ISBN 81-87325-07-0, pp.1-909.
3. R.B.Patel& M.M.S Rauthan, Expert Data Structures with C++, Khana Publications, Delhi , India, 2ndEdition 2004,ISBN : 87522-03-8.
4. Horowitz, Ellis and Sahni, Sartaj : Fundamentals of Computer Algorithms, Galgotia Publications

B23-CSE-206	Principles of Programming Languages						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
4	-	-	4.0	70	30	100	3 Hour
Purpose	To introduce the principles and paradigms of programming languages for design and implement the software intensive systems.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of programming language, the general problems and methods related to syntax and semantics.						
CO 2	To introduce the structured data objects, subprograms and programmer defined data types.						
CO 3	To outline the sequence control and data control.						
CO 4	To introduce the concepts of storage management using programming languages.						

UNIT-1
Introduction, Syntax and Semantics

Introduction: A brief history, Characteristics of a good programming language, Programming language translators- compiler and interpreters, Elementary data types – data objects, variable and constants, data types. Specification and implementation of elementary data types, Declarations, type checking and type conversions, Assignment and initialization, Numeric data types, enumerations, Booleans and characters.

Syntax and Semantics: Introduction, general problem of describing syntax, Formal method of describing Syntax, attribute grammar dynamic semantic.

UNIT-2
Structured data objects, Subprograms and Programmer Defined Data Types

Structured data objects: Structured data objects and data types, specification and implementation of structured data types, Declaration and type checking of data structure, vector and arrays, records Character strings, variable size data structures, Union, pointer and programmer defined data objects, sets, files.

Subprograms and Programmer Defined Data Types: Evolution of data type concept abstraction, encapsulation and information hiding, Subprograms, type definitions, abstract data types, over loaded subprograms, generic subprograms.

UNIT–3
Sequence Control and Data Control

Sequence Control: Implicit and explicit sequence control, sequence control within expressions, sequence control within statement, Subprogram sequence control: simple call return, recursive subprograms, Exception and exception handlers, co routines, sequence control. Concurrency – subprogram level concurrency, synchronization through semaphores, monitors and message passing

Data Control: Names and referencing environment, static and dynamic scope, block structure, Local data and local referencing environment, Shared data: dynamic and static scope, Parameter and parameter transmission schemes.

UNIT-4

Storage Management and Programming Languages

Storage Management: Major run time elements requiring storage, programmer and system controlled storage management and phases, Static storage management, Stack based storage management, Heap storage management, variable and fixed size elements.

Programming Languages: Introduction to procedural, non-procedural, structured, logical, functional and object oriented programming language, Comparison of C and C++ programming languages.

Suggested Books:

- Terrence W. Pratt, Marvin V. Zelkowitz, Programming Languages Design and Implementation, Pearson.
- Allen Tucker and Robert Noonan, Programming Languages–Principles and Paradigms, Tata McGraw-Hill,2009.
- Ellis Horowitz, Fundamentals of Programming Languages, Galgotia Publications, 2010.
- C. Ghezzi, Programming Languages Concepts, Wiley Publications, 2010.

B23-HSM-302	Intellectual Property Rights (IPR) & Regulatory						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	-	-	3.0	70	30	100	3 Hours
Course Outcomes							
Purpose	The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concept and Theories, International Regime Relating to IPR						
CO1	Students will be familiarized with the introduction about patent concept and legal implications						
CO2	Students will be able understand the concept of copyright in detail						
CO3	Students will be able to understand trademark and law associated with it						
CO4	Students will be able to know about geographical Indications, industrial design and IPR in information Technology						

UNIT-1

Indian patent law: The patents act, 1970,amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. procedure of obtaining patents, working of patents. infringement.

UNIT-2

Copyrights: Introduction, works protected under copyright law, infringement. introduction to copyright, international protection of copyright and related rights- an overview Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright

Industrial Designs : Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000,procedure for obtaining design protection, revocation, infringement and remedies.

UNIT-3

Trademarks : Objectives, types, rights, protection of goodwill, infringement, passing off, need for protection of trademark, kinds of trademark , Indian trademarks law, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

UNIT-4

Geographical Indications: Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. Industrial Designs: Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Protection of Semiconductor chips, Domain Name Protection, Implications of intellectual property rights on the commercialization of Biotechnology products.

References:

- N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
- David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012
- Susan K Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge University Press, 2003
- N.S. Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company,2nd Edition , 2014
- Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
- Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008
- Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual Property Rights, Universal Publishing House, 2014
- Paul Torremans, Intellectual Property And Human Rights, Kluwer Law International, 2008
- Steven D Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
- Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005

B23-CSE-208	Advanced Programming Lab (Java)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
--	--	3	1.5	40	60	100	3 Hour
Purpose	To introduce the concepts of Advanced Java Programming						
Course Outcomes (CO)							
CO1	Study fundamental concepts of Java.						
CO2	To study and implement String and Collection methods.						
CO3	To study oops concept and implement abstraction, inheritance						
CO4	To study servlet and data base connectivity of java and java servlets.						

List of Practicals

1. Write a Java program to implement matrix multiplication
2. Write a java program to implement String, String Buffer and String builder.
3. Write a java program to implement Stack and queue.
4. Write a java program to handle File Exception, Arithmetic exception and Array out of bound Exception.
5. Write a java program to throw user defined exception.
6. Write a java program to implement multiple inheritance
7. Write a java program to calculate area of cube and volume using abstraction.
8. Write a java program to insert and display data from database.
9. Write a java servlet program to display data from HTML form.
10. Write a java servlet program to setup session tracking using cookie.
11. Write a java servlet program to set session tracking using hidden form and url rewriting.
12. Write a java servlet program to display data from employee table.

B23-ESC-214	Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
0	0	2	1.0	40	60	100	3 Hrs
Purpose	To learn the basic methods for the design of digital circuits and systems.						
Course Outcomes (CO)							
CO1	To Familiarization with Digital Trainer Kit and associated equipment.						
CO2	To Study and design of TTL gates						
CO3	To learn the formal procedures for the analysis and design of combinational circuits.						
CO4	To learn the formal procedures for the analysis and design of sequential circuits						

LIST OF EXPERIMENTS:

1. Familiarization with Digital Trainer Kit and associated equipment.
2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
3. Design and realize a given function using K-Maps and verify its performance.
4. To verify the operation of Multiplexer and De-multiplexer.
5. To verify the operation of Comparator.
6. To verify the truth table of S-R, J-K, T, D Flip-flops.
7. To verify the operation of Bi-directional shift register.
8. To design and verify the operation of 3-bit asynchronous counter.
9. To design and verify the operation of asynchronous Up/down counter using J-K FFs.
10. To design and verify the operation of asynchronous Decade counter.
11. Study of TTL logic family characteristics.
12. Study of Encoder and Decoder.
13. Study of BCD to 7 segment Decoder.

B23-CSE-212	Design and Analysis of algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
--	--	3	1.5	40	60	100	3 Hour
Purpose	The student will learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and understand how to implement various algorithms						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems						
CO2	The student should be able to Analyse the time and space complexity of algorithms.						
CO3	The student should be able to critically analyse the different algorithm design techniques for a given problem.						
CO4	The student should be able to modify existing algorithms to improve efficiency.						

List of Practicals

1. Program to find the given element in Binary Search Tree.
2. Program to implement Binary Search Tree.
3. Program to implement Prim's algorithm using greedy method.
4. Program to implement Kruskal's algorithm using greedy method.
5. Program to implement graph traversal using Breadth First Search.
6. Program to implement graph traversal using Depth First Search.
7. Program to implement N queen's problem.
8. Program to implement all pairs shortest path.
9. Program to implement Activity Selection Problem.
10. Program to implement Knapsack problem.
11. Program to implement Graph Coloring Problem.
12. Program to implement Naïve String matching algorithm.

B23-MAC-201	Environmental Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Time**
3	--	--	1	30	70	100	3 Hour
Purpose							
Course Outcomes (CO)							
CO1	Students will be able to understand the importance of natural resources.						
CO2	Students will understand the concept of an ecosystem, its structure, and its functions.						
CO3	The students will be able to understand the causes and impacts of various environmental pollution.						
CO4	Students will be able to understand the relationship between human population and the environment.						

UNIT-1

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

UNIT-2

Ecosystems: Concept of an ecosystem, Structure, and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-3

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental

ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

UNIT-4

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Suggested Readings:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
   Down to Earth, Centre for Science and Environment (R).

*B.Tech.*Computer Science and Engineering(Artificial Intelligence and Machine Learning)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2024-25

SEMESTER-III

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam(Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CAM-201	Data Structures	4:0:0	4	4	70	30	0	100	3
2	B23-CAM-203	Modern Computer Architecture	3:0:0	3	3	70	30	0	100	3
3	B23-CSE-205	Object Oriented Programming	4:0:0	4	4	70	30	0	100	3
4	B23-CSE-207	IT Workshop (Python)	3:0:0	3	3	70	30	0	100	3
5	B23-BSC-205	Mathematical Concepts for AI	3:0:0	3	3	70	30	0	100	3
6	B23-CAM-209	Artificial Intelligence	3:0:0	3	3	70	30	0	100	3
7	B23-CAM-211	Data Structures Lab	0:0:3	3	1.5	0	40	60	100	3
8	B23-CSE-211	Object Oriented Programming Lab	0:0:3	3	1.5	0	40	60	100	3
9	B23-CSE-213	IT Workshop (Python) Lab	0:0:2	2	1	0	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	0	100	3
TOTAL				**30**	**25**	**420**	**400**	**180**	**1000**	

Note:

- NCC/NSS/Sports/Yoga/Technical/cultural club/society activities may also be joined by students in second year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines.
- The Syllabus of B23-CSE-205, B23-CSE-207, B23-CSE-211, B23-CSE-213 subjects are same with B.Tech (CSE) scheme.

*B.Tech.*Computer Science and Engineering(Artificial Intelligence and Machine Learning)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

MODIFIED SCHEME OF EXAMS W.E.F THE SESSION 2024-25

SEMESTER-IV

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam(Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-CAM-202	Introduction to Machine Learning	3:1:0	4	4	70	30	0	100	3
2	B23-ESC-220	Internet of Things	3:1:0	4	4	70	30	0	100	3
3	B23-CSE-204	Design and Analysis Algorithms	3:1:0	4	4	70	30	0	100	3
4	B23-CAM-208	Data Base System	3:1:0	4	4	70	30	0	100	3
5	--	Open Elective-I	3:0:0	3	3	70	30	0	100	3
6	B23-CAM-210	Machine Learning Lab	0:0:3	3	1.5	0	40	60	100	3
7	B23-CSE-212	Design & Analysis Algorithms Lab	0:0:3	3	1.5	0	40	60	100	3
8	B23-CAM-214	DBS Lab	0:0:2	2	1	0	40	60	100	3
9	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	0	100	3
TOTAL				**30**	**24**	**420**	**300**	**180**	**900**	

Note:

- All students have to undertake the industrial training for 6 to 8 weeks after 4th semester which will be evaluated in 5th semester.
- The course of Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.

Open Elective –I	
Intellectual Property Rights (IPR) and Regulatory	B23-OCA-202
International and Corporate Law	OE23-OCA-204
Cyber Law and Ethics-	OE23-OCA-206

B23-CAM-201	Data Structures						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
4	0	0	4.0	70	30	100	3 Hour
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the software systems logically and physically.						
Course Outcomes (CO)							
CO 1	To introduce the basic concepts of Data structure , basic data types ,searching and sorting based on array data types.						
CO 2	To introduce the structured data types like Stacks and Queue and its basic operations's implementation.						
CO 3	To introduce dynamic implementation of linked list.						
CO 4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

Unit-1

Introduction to Data Structures, Data Types, Built in and User Defined Data Structures, Data Structure Operations, Applications of Data Structure, Analysis of an Algorithm, Asymptotic Notations, Time-space trade off .

Arrays, Arrays(One Dimensional , Two Dimensional and Multi-Dimensional), Sparse Matrices, Searching from Array using Linear and Binary Searching Algorithm, Sorting of Array using Selection, Insertion,Bubble Sort.

Unit-2

Stacks: ADT Stack and Its Operations, Algorithm and their complexity analysis, Applications of Stack, Conversion and Evaluation, Implementation of Merge Sort and Quick Sort Algorithm.

Queues: ADT Queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue, Operations on each type of Queues, Applications of Queues.

Unit-3

Linked Lists: Need of Dynamic Data Structures, Singly Linked List and Its Dynamic Implementation, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from Linked Lists, Comparison between Static and Dynamic, Implementation of Linked List.

Circular Link Lists and Doubly Link List, Dynamic Implementation of Primitive Operations on Doubly Linked Lists and Circular Linked List, Linked representations of Stacks and Queues.

Unit-4

Trees: Definition, Basic Terminology, Binary Tree, Static and Dynamic Implementation of a Binary Tree, Primitive Operations on Binary Trees, Binary Tree Traversals, Representation of Infix, Post-Fix and Prefix Expressions using Trees.

Different types of Trees: Binary Search Trees**,** B+ Trees, AVL Trees, Threaded Binary Trees, Balanced Multi- way Search Trees, Implementation of Heap Sort Algorithm.

Graphs: Basic Terminologies and Representations, Graph Search and Traversal Algorithms and Complexity Analysis.

Suggested Books:

- Theory and Problems of Data Structures by Jr. Symour Lipschetz, Schaum's outline, TMH.
- Data Structures and Algorithms by PAI, TMH.

- Fundamentals of Data structures by Ellis Horowitz and Sartaj Sahni, Pub, 1983, AW.
- Data Structures and Algorithms by A.V. Aho, J.E. Hopcroft and T.D. Ullman, Original edition, Addison-Wesley, 1999, Low Priced Edition.
- Data Structures and Program Design in C by Robert Kruse, PHI,
- Shukla, Data Structures using C++, Wiley India
- Introduction to Computers Science -An Algorithms Approach , Jean Paul Tremblay, Richard B. Bunt, 2002,T.M.H.
- Data Structure and the Standard Template library – Willam J. Collins, 2003, T.M.H.

B23-CAM-203	Modern Computer Architecture						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	0	0	3.0	70	30	100	3Hrs.
Purpose	This course introduces the principles of computer organization and the basic architecture concepts. The course emphasizes performance and cost analysis, instruction set design, pipelining, memory technology, memory hierarchy, virtual memory management, and I/O systems.						
Course Outcomes (CO)							
CO1	Be familiar with computer arithmetic and digital logic related to computer architecture						
CO2	Be familiar with computer architecture and instruction set architecture.						
CO3	Be familiar with understanding the concept of memory hierarchy and basic computer organization and design						
CO4	Be acquainted with the basic knowledge of I/O devices organization.						

UNIT-I

Digital Logic and Architecture: History of computer architecture, Von Neumann Architecture, Flynn's Classification of Computers, combinational vs sequential logic, physical constraints (gate delay, fan-in, fan-out, energy/power), MIPS, MFLOPS.

Computer Arithmetic: Representation of numeric data, signed and unsigned arithmetic; Range, precision and errors in floating-point arithmetic; Digital arithmetic algorithms for Addition, Subtraction, Multiplication using Booth's algorithm.

UNIT-II

Computer Architecture: Computer architecture for artificial intelligence applications, AI-assisted Design for Architecture (AIDArc). Common Bus System, General register organization, stack organization

Instruction Set Architecture: Basic organization of computing machine: fetch, decode, and execute; Instruction set types, instruction format, addressing modes, subroutine call and return mechanisms.

UNIT-III

Basic Computer Organization and Design: Storage systems, Types of cache memory: address mapping, block size, replacement, and store policies; virtual memory system: page table and TLB. Advanced Optimizations of Cache Performance, Memory Technology and Optimizations,

Case Study: Memory Hierarchies in Intel Core i7 and ARM Cortex-A8.

CISC vs RISC Designs, Design of arithmetic and logic unit (ALU). control unit: hardwired realization vs micro-programmed realization, multi-cycle implementation, Instruction level parallelism, instruction pipelining, pipeline hazards.

UNIT-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt driven I/O, Priority interrupt; Daisy chaining, Parallel Priority interrupt. Direct memory Access, DMA controller and transfer.

Text Book:

- J.L. Hennessy and D.A. Patterson. Computer Architecture: A Quantitative Approach. 5th Edition, Morgan Kauffmann Publishers, 2012.

- J.P. Shen and M.H. Lipasti. Modern Processor Design: Fundamentals of Superscalar Processors. McGraw-Hill Publishers, 2005.
- D.B. Kirk and W.W. Hwu. Programming Massively Parallel Processors. 2nd Edition, Morgan Kauffmann Publishers, 2012.
- David A. Patterson, John L. Hennessy - second edition: "Computer Organization and Design: the hardware/software interface", Morgan Kaufmann.
- Harvey G. Cragon, "Memory Systems and Pipelined Processors", Jones and Bartlett.

B23-CSE-205	Object Oriented Programming						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Minor Test**	**Total**	**Time**
4	0	0	4.0	70	30	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and the behavior of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

UNIT–1

Introduction to C++, C++ Standard Library, Illustrative Simple C++ Programs. Header Files, Namespaces, Application of object oriented programming. Control flow, variables and assignments statements, conditional execution, looping, function calls including recursion.

Object Oriented Concepts, Introduction to Objects and Object Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class Members, Constant, Class Member, Structure and Class.Macro vs Inline Functions.

UNIT-2

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors,

Introduction of inheritance, Types of Inheritance, Overriding Base Class Members in a Derived Class, Public, Protected and Private Inheritance, Effect of Constructors and Deconstructors of Base Class in Derived Classes.

UNIT-3

Polymorphism, Pointer to Derived class, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding, Virtual Deconstructors.

Fundamentals of Operator Overloading, Rules for Operators Overloading, Implementation of Operator Overloading Like <<,>> Unary Operators, Binary Operators.

UNIT-4

Text Streams and binary stream, Sequential and Random Access File creation and updation, Stream Input/ Output Classes, Stream Manipulators.

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.
Templates: Function Templates, Overloading Template Functions, Class Template, Class Templates and Non- Type Template arguments.

Suggested Books:

- The complete reference C ++ by Herbert shieldt Tata McGraw Hill.
- Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
- Shukla, Object Oriented Programming in c++, Wiley India.
- C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
- Programming with C++ By D Ravichandran, 2003, T.M.H.

B23-CSE-207	IT Workshop (Python)						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	0	0	3.0	70	30	100	3 Hours
Purpose	To familiarize the students with the basics of Python Programming						
Course Outcomes							
CO1	To Study Fundamental concept of Python.						
CO2	To Study and implement expression and Strings methods						
CO3	To Study and implement tuples , list and dictionary operations.						
CO4	To Study and implement exception handling and file operation.						

Unit-1

Familiarization with the basics of Python programming: Introduction to Python, Features of Python, Execution modes: interactive mode and script mode, Python character set, use of indentation, Python tokens(keyword, identifier, literal, operator, punctuator), variables, use of comments, Knowledge of data types: Number(Integer, Floating point, Complex).
Errors: syntax errors, logical errors, and run-time errors

Unit-2

Expressions: Statement, Type conversion, and input/output: Precedence of Operators,Arithmetic operators, relational operators, logical operators, assignment operators, augmented assignment operators, identity operators (is, is not),Expression, evaluation of an expression, type-conversion, Flow of Control,Conditional statements, Iterative Statements
Strings: Introduction, string operations (concatenation, repetition, membership and slicing), traversing a string using loops, built-in functions/methods–len(), capitalize(), title(), lower(), upper(), count(), find(), index(), endswith(), startswith(), isalnum(), isalpha(), isdigit(), islower(), isupper(), isspace(),lstrip(), rstrip(), strip(), replace(), join(), partition(), split()

Unit-3

Array: Access the Elements of an Array, Length of an Array, Adding Array Elements, Removing Array Elements, Adds and remove the element at the specified position. **Lists, Tuples, Dictionary**: introduction, indexing, list operations, traversing a list using loops, built-in functions/methods–len(), list(), append(), extend(), insert(), count(), index(), remove(), pop(), reverse(), sort(), sorted(), min(), max(), sum().
Introduction to Python modules: Importing module using 'import ' and using from statement, importing math module (pi, e, sqrt(), ceil(), floor(), pow(), fabs(), sin(), cos(), tan()); random module (random(), randint(), randrange()), statistics module (mean(), median(), mode()).Functions and its types (Built-in Functions, Functions defined in Module, User Defined Functions), arguments, default parameters, positional parameters, Function Returning Value(s), Recursion, Scope of a Variable.

Unit-4

Files: Introduction to files, types of files (Text file, Binary file, CSV file),Text file: opening a text file, file open modes (r, r+, w, w+, a, a+ etc), closing a text file, opening a file using with clause, writing/appending

data to a text file using write() and writelines(), reading from a text file using read(), readline() and readlines

Reference Books:

1.The Complete Reference Python By Martin C Brown Publication by McGraw Hill.
2. Let us Python By Yashwant Kanetkar

B23-BSC-205	Mathematical Concepts for AI						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 h**
Purpose	To familiarize the prospective students with the fundamentals of probability & statistics and how to apply the principles to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.						
Course Outcomes							
CO1	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.						
CO 2	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications..						
CO 3	To make the students familiar about basic statistics to analyze data sets using various measures of central tendency and dispersion						
CO 4	Upon completion of Unit IV, students will proficiently apply correlation and regression techniques, including calculating coefficients and determining lines of regression, to analyze relationships between variables in datasets.						

UNIT-I

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-II

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-III

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean,

Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis.

UNIT-IV

Correlation & Regression: Introduction,Correlation, Coefficient of correlation, methods of calculations, Lines of regression, Rank correlation.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8.Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

B23-CAM-209	Artificial Intelligence						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hour**
Purpose	To obtainthrough understanding of the discipline of Artificial Intelligence and its scope in various emerging areas.						
Course Outcomes (CO)							
CO 1	To determine a fundamental understanding of Artificial Intelligence (AI) and its core principles.						
CO 2	To demonstrate fundamental concepts of problem solving, searching, inference, and perception.						
CO 3	To demonstrate proficiency in applying AI techniques in various domains						
CO 4	To examine role of AI in various application areas.						

UNIT – 1

Scope of AI: Introduction to Artificial Intelligence, History of Artificial Intelligence, Artificial Intelligence Languages, Multi Agent Systems, natural language processing, vision and speech processing, robotics, expert systems.

UNIT – 2

Problem Solving, Searching and Planning: Problem spaces and search, Heuristic and Informed search strategies, Minmax search, Alpha-beta pruning.
Search and optimization (gradient descent), Adversarial search, Planning and scheduling, Case study: Health CareSystem.

UNIT – 3

Knowledge Engineering, Representation, Reasoning and finding Optimal Paths: Knowledge and Knowledge based system, Knowledge and rationality, Logic and inference, Propositional and predicate logic, Ontologies, Bayesian Reasoning, Temporal reasoning, Knowledge Discovery: Data and Web Mining.

UNIT – 4

Applications of AI in Various domains: AI in Marketing, AI in Banking, AI in Finance, AI in Agriculture, AI in Health Care, AI in Gaming, AI in Space Exploration, AI in Autonomous vehicles, AI in Chatbots, AI inCreativity.

Suggested books:

1. E. Rich and K. Knight, “Artificial Intelligence”, TMH, 2nd Ed.,1992.

2. N. J. Nilsson, “Principles of AI”,Narosa Publ. House,1990.
3. M. N. Hoda, “Foundation Course in Artificial Intelligence”, Vikas Pub.,2004.
4. Artificial Intelligence“ RBMishra,PHI

B23-CAM-211	Data Structures Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal assessment**	**Practical Exam**	**Total**	**Time**
0	0	3	1.5	40	60	100	3
Purpose	To introduce the principles and paradigms of Data Structures for design and implement the softwaresystems logically and physically.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based onarray data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce dynamic implementation of linked list.						
CO4	To introduce the concepts of Tree and graph and implementation of traversal algorithms.						

1. Write a program for Binary search methods.
2. Write a program that implements the following sorting: (i) Bubble Sort (ii) Selection Sort (iii) Insertion Sort.
3. Write a program to implement Stack and its operation using (i) Arrays (ii) Linked List.
4. Write a program that implements the following : (i) Quick Sort (ii) Merge Sort (iii) Heap Sort.
5. Write a program to implement Queue and its operation using (i) Arrays (ii) Linked List.
6. Write a program to implement Circular Queue and its operation using Arrays.
7. Write a program to implement singly linked list for the following operations: Create, Display, searching,traversing and deletion.
8. Write a program to implement doubly linked list for the following operations: Create, Display, inserting,counting, searching, traversing and deletion.
9. Write a program to implement circular linked list for the following operations: Create, Display, inserting,counting, searching, traversing and deletion.
10. Write a program to implement the tree traversal methods.
11. Write a program to perform the following operations :
    (i) Insert an element into a AVL tree.
    (ii) Delete an element from a AVL tree.
    (iii) Search for a key element in a AVL tree.

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B23-CSE-211	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Practical Exam**	**Total**	**Time**
0	0	3	1.5	40	60	100	3 Hour
Purpose	To introduce the principles and paradigms of Object Oriented Programming Language for design and implement the Object Oriented System.						
Course Outcomes (CO)							
CO1	To introduce the basic concepts of object oriented programming language and the its representation.						
CO2	To allocate dynamic memory, access private members of class and inheritance,Constructors.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To handle backup system using file, general purpose template and handling of raised exception during programming.						

Q1. Raising a number n to a power p is the same as multiplying n by itself p times. Write a function called power
( ) that takes a double value for n and an int value for p, and returns the result as double value. Use a default argument of 2 for p, so that if this argument is omitted, the number will be squared. Write a main ( ) function that gets values from the user to test this function.

Q2. Write a C++ program that illustrates the order of execution of constructors and destructors when new class is derived from more than one base class. b) Write a Program to Invoking Derived Class Member Through Base Class Pointer.

Q3. Create the equivalent of a four function calculator. The program should request the user to enter a number, an operator, and another number. It should then carry out the specified arithmetical operation: adding, subtracting, multiplying, or dividing the two numbers. (It should use a switch statement to select the operation). Finally it should display the result. When it finishes the calculation, the program should ask if the user wants to do another calculation. The response can be 'Y' or 'N'. Some sample interaction with the program might look like this.

Enter first number, operator, and second number: 10/ 3 Answer = 3.333333
Do another (Y/ N)? Y
Enter first number, operator, second number 12 + 100 Answer = 112
Do another (Y/ N) ? N

Q4. A phone number, such as (212) 767-8900, can be thought of as having three parts: the area code (212), the exchange (767) and the number (8900). Write a program that uses a structure to store these three parts of a phone number separately. Call the structure phone. Create two structure variables of type phone. Initialize one, and have the user input a number for the other one. Then display both numbers. The interchange might look like this:

- Enter your area code, exchange, and number: 415 555 1212
- My number is (212) 767-8900
- Your number is (415) 555-1212

Q5. Create two classes DM and DB which store the value of distances. DM stores distances in metres and centimeters and DB in feet and inches. Write a program that can read values for the class objects and add one object of DM with another object of DB. Use a friend function to carry out the addition operation. The

object that stores the results maybe a DM object or DB objects, depending on the units in which the results are required. The display should be in the format of feet and inches or metres and cenitmetres depending on the object on display.

Q6. Create a class rational which represents a numerical value by two double values- NUMERATOR and DENOMINATOR. Include the following public member Functions:

- constructor with no arguments (default).
- constructor with two arguments.
- void reduce( ) that reduces the rational number by eliminating the highest common factor between the numerator and denominator.
- Overload + operator to add two rational number.
- Overload >> operator to enable input through cin.
- Overload << operator to enable output through cout. Write a main ( ) to test all the functions in the class.

Q7. Consider the following class definition class father {

protected : int age; public;

father (int x) {age = x;} virtual void iam ( )

{ cout < < "I AM THE FATHER, my age is : "<< age<< end1:}

};

Derive the two classes son and daughter from the above class and for each, define iam ( ) to write our similar but appropriate messages. You should also define suitable constructors for these classes. Now, write a main ( ) that creates objects of the three classes and then calls iam ( ) for them. Declare pointer to father. Successively, assign addresses of objects of the two derived classes to this pointer and in each case, call iam ( ) through the pointer to demonstrate polymorphism in action.

Q8. Write a program that creates a binary file by reading the data for the students from the terminal. The data of each student consist of roll no., name (a string of 30 or lesser no. of characters) and marks.

Q9. A hospital wants to create a database regarding its indoor patients. The information to store include

a) Name of the patient
b) Date of admission
c) Disease
d) Date of discharge

Create a structure to store the date (year, month and date as its members). Create a base class to store the above information. The member function should include functions to enter information and display a list of all the patients in the database. Create a derived class to store the age of the patients. List the information about all the to store the age of the patients. List the information about all the pediatric patients (less than twelve years in age).

Q10. Create a class **Employee** with a name and salary. Create a class **Manager** inherit from **Employee**. Add an instance variable, named department, of type string. Supply a method to **to String** that prints the manager's name, department and salary. Create a class **Executive** inherits from **Manager**. Supply a method **to String** that prints the string **"Executive"** followed by the information stored in the **Manager** superclass object. Supply a test program that tests these classes and methods.

Q11. Imagine a tollbooth with a class called toll Booth. The two data items are a type unsigned int to hold the total number of cars, and a type double to hold the total amount of money collected. A constructor initializes both these to 0. A member function called payingCar ( ) increments the car total and adds 0.50 to the cash total. Another function, called nopayCar ( ), increments the car total but adds nothing to the cash total. Finally, a member function called displays the two totals. Include a program to test this class. This program should allow the user to push one key to count a paying car, and another to count a nonpaying car.

Pushing the ESC kay should cause the program to print out the total cars and total cash and then exit.

Q12. Write a function called reversit ( ) that reverses a string (an array of char). Use a for loop that swaps the first and last characters, then the second and next to last characters and so on. The string should be passed to reversit ( ) as an argument. Write a program to exercise reversit ( ). The program should get a string from the user, call reversit ( ), and print out the result. Use an input method that allows embedded blanks. Test the program with Napoleon's famous phrase, "Able was I ere I saw Elba)".

Q13. Create a class Student with a name and roll no. as data member. Create a Class Template for student class. The program should also implement template overloading.

Q14. Assume that a bank maintains two kinds of accounts for customers, one called as savings account and the other as current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.

Create a class account that stores customer name, account number and type of account. From this derive the classes

cur_acct and sav_acct to make them more specific to their requirements. Include necessary member functions in order to achieve the following tasks:

a) Accept deposit from a customer and update the balance.

b) Display the balance.

c) Compute and deposit interest.

d) Permit withdrawal and update the balance.

e) Check for the minimum balance, impose penalty, necessary and update the balance.

f) Do not use any constructors. Use member functions to initialize the class members.

B23-CSE-213	IT Workshop (Python) Lab						
L	**T**	**P**	**Credit**	**Internal assessment**	**Practical Exam**	**Total**	**Time**
0	0	2	1	40	60	100	3 Hours
Purpose	The course is designed to provide Basic knowledge of Python.						
Course Outcomes							
CO1	To study fundamentals of python programming and implement basic programs.						
CO2	To implement the searching technique using python.						
CO3	To implement sorting techniques using python.						
CO4	To implement matrix multiplication using python.						

LIST OF PROGRAMS

1. **Write a program to compute the GCD of two numbers.**
2. **Write a program to find the square root of a number**
3. **Write a program to find the Exponentiation (power of a number)**
4. **Write a program to find the maximum of a list of numbers**
5. **Write a program for Linear search and Binary search**
6. **Write a program for Selection sort**
7. **Write a program for Insertion sort**
8. **Write a program to find first n prime numbers**
9. **Write a program to multiply matrices**
10. **Write a program that take command line arguments (word count)**
11. **Write a program to find the most frequent words in a text read from a file**

B23-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
2	**-**	**-**	**1**	**100**	**-**	**100**	**3**
Purpose	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system , analyse and apply to their day to day life.						
	Course Outcomes						
CO 1	The students will be able to understand , connect up and explain basics of Indian traditional knowledge in modern scientific perspective						
CO2	The students will be able to understand Holistic Health using Indian Knowledge System						
CO3	The students will be able to Manage thoughts and Emotions , will learn positivity, self regulation and control						
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System						

Unit 1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karamyoga,
Benefits of Rajyoga and Karamyoga.

Unit 2

Holistic Health using Indian Knowledge System:
Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras.
Physical, Mental, Emotional and Spiritual health using traditional knowledge .

Unit 3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self Mastery.

Unit 4

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well being.

Reference and Text Books:

Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning

- Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.
- Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.

Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.

Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.

Prakartik Swasthya Shastra, Publisher Natural Lifestyle

B23-CAM-202	Introduction to Machine Learning						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	1	0	4.0	70	30	100	3 Hrs.

Purpose	Machine learning for students looking to implement solutions to real-world machine learning problems.
CO 1	Understanding the Basics of Machine Learning.
CO 2	To learn the various machine learning techniques.
CO3	Knowledge about different types of Neural Networks based machine learning approaches.
CO4	Comparison of various machine learning algorithms.

UNIT- 1

Introduction to the Machine Learning, Design a Learning System- Selection of Training set, Selection of Target Function, Selection of a Function Approximation Algorithm, Perspective and issues in Machine Learning, Applications of Machine Learning.

UNIT- 2

Linear Regression and Logistic Regression, Support Vector Machine, Decision Trees, Issues in Decision Tree Learning.

UNIT- 3

Neural Networks - Perceptron Learning, Backpropagation, Supervised Machine Learning Algorithms, Unsupervised Machine Learning Techniques.

UNIT- 4

Bias and Fairness in Machine Learning, Detecting Bias, Achieving Fairness in Machine Learning Comparing Machine Learning Algorithms.

Suggested Books:

1. Introduction to Machine Learning with Python by Deepti Chopra and Roopal Khurana, Published by Bentham Science Pvt Ltd., 2023
2. Introduction to Machine Learning with Python by Andreas C. Muller and Sarah Guido Published by O'Reilly Media Inc., 2016

B23-ESC-220	Internet of Things						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	1	0	4.0	70	30	100	3Hrs.
Purpose	This course introduces the principles of IoT and the basic architecture concepts. The course emphasizes implementation of various logic related to IoT and understanding the concept of data communication among IoT device, data storage, data analytics and data security.						
Course Outcomes (CO)							
CO1	Be familiar with IoT architecture and Communication services related to computer architecture						
CO2	Be familiar with the design of IoT microcontroller and understanding the concept of applying different logics.						
CO3	Be familiar with understanding the concept of data communication through various IoT devices						
CO4	Be acquainted with the basic knowledge of data storage, data analytics and security in IoT						

UNIT-1

IoT: History of IOT, Requirements, Functionalists, and structure of IOT, IoT enabling technologies, IoT Architecture, IoT communication and networking protocols, Role of wired and wireless communication, IoT services and applications, IoT Standards, Fog Computing, Smart Cities and Smart Homes, Connected Vehicles, Smart Grid, Industrial IoT. Balock chain and IoT, AI and IoT

UNIT-2

IOT Data Acquisition & Platforms: Micro Controllers (Arduino uno/mega2560, Rasberry-Pi, ARM), Real-time systems, and embedded software, Hardware & Software Requirements

UNIT-3

IOT Data Communication: Ipv4/Ipv6, Ethernet/GigE, MIPI, M-PHY, UniPro, SPMI, BIF, Super Speed USB Inter-Chip (SSIC), Mobile PCIe (M-PCIe) and SPI, GSM , 2G ,3G ,4G and 5G, IEEE 802.15.4, IEEE 802.15.4e, 802.11ah, Relay Access Point (AP), Grouping of station, Target Wake Time (TWT)

UNIT-4

IOT Data Storage & Retrieval: Cloud Storage, Databases Connectivity with IOT and uses, Case Study over Cloud Services And Administration, Case Study of Big Data & Hadoop Platforms

IOT Data Analytics & Security: Analysis Of data using the Ipython Module, Data Cleaning in IoT, Attack, Defense, and Network Robustness of Internet of Things, Authentication in IoT, Security Protocols for IoT Access Networks

Books and references:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Research papers

B23-CSE-204	Design and Analysis of Algorithms						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	1	-	4.0	70	30	100	3 Hrs.
Purpose	To introduce advanced data structures & algorithms concepts involving their implementation for solving complex applications.						
Course Outcomes (CO)							
CO1	Learn the basic concepts of data structures and their analysis.						
CO2	Study the concept of dynamic programming and various advanced data structures.						
CO3	Learn various graph algorithms and concepts of computational complexities.						
CO4	Study various string matching algorithms						

UNIT-1
Introduction

Review :- Elementary Data Structures, Algorithms & its complexity(Time & Space), Analysing Algorithms, Asymptotic Notations, Pseudocode Conventions, Binary search trees.

Recurrence relation:- Methods for solving recurrence(Substitution, Recursion tree, Master theorem).

UNIT-2
Advanced Design and analysis Techniques

Dynamic programming:- Elements, Matrix-chain multiplication, longest common subsequence,

Greedy algorithms:- Elements , Activity- Selection problem, Huffman codes, Task scheduling problem, Knapsack problem.

Backtracking algorithms:- Graph coloring, N-Queen problem, Hamiltonian path and circuit.

UNIT-3
Graph Algorithms

Review of graph algorithms:-Traversal Methods(Depth first & Breadth first search),Topological sort, Strongly connected components, Minimum spanning trees- Kruskal's and Prim's Algorithm, Single source shortest paths, Relaxation, Dijkstra's Algorithm, Bellman- Ford algorithm, Single source shortest paths for directed acyclic graphs, Floyd-Warshall algorithm,

UNIT-4
Computational Complexity

Basic Concepts, Polynomial vs Non-Polynomial Complexity, NP- hard & NP-complete classes. The Naïve string-matching algorithm, Rabin-Karp Algorithm, String matching with finite automata.

Text Books :

1. Corman, Leiserson and Rivest : Introduction to Algorithms, 2/e, PHI
2. Harsh Bhaisn, Algorithms: Design And Analysis Oxford University Press,2015.

Reference Books:

1. Aho, Hopcroft and Ullman : The Design and Analyses of Computer Algorithms. Addison Wesley.
2. R.B.Patel, Expert Data Structures with C, Khanna Publications , Delhi, India, 2ndEdition 2004, ISBN 81-87325-07-0, pp.1-909.

3. R.B.Patel& M.M.S Rauthan, Expert Data Structures with C++, Khana Publications, Delhi , India, 2ndEdition 2004,ISBN : 87522-03-8.
4. Horowitz, Ellis and Sahni, Sartaj : Fundamentals of Computer Algorithms, Galgotia Publications

B23-CAM-208	Data Base System						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3 Hour**
Purpose	To familiarize the students with Data Base Management system						
Course Outcomes							
CO 1	To provide introduction to relational model and ER diagrams.						
CO 2	To realize about query processing & constraints .						
CO 3	To comprehend about the concept of functional dependencies& normalization .						
CO 4	To learn the concept of failure recovery and concurrency control.						

UNIT-1

Introduction: DBMS an overview, Types of Database¸ Data Models-, Network, Hierarchical, Object Oriented and Relational Model, Levels of abstraction. Database Administrator role, Database Users, Three Schema architecture of DBMS, Advantages of DBMS.

Entity-Relationship Model: : Entities, Attributes and Entity Sets, Relation and Relationships sets, Mapping and participation Constraints, Keys, Entity-Relationship Diagram- Conversion of E-R Diagram to Relational Database. Weak Entity Sets, Extended E-R features.

UNIT-2

Relational Model: Structure of relational Databases, Relational Algebra and Relational Calculus, Operations on Relational Algebra, Operations on Relational Calculus, Tuple Relational Calculus, Domain Relational Calculus.

SQL and Integrity Constraints: Concept of DDL, DML, DCL & TCL. Basic Structure, Set operations, Aggregate Functions, Introduction to views, Nested Sub queries, Stored procedures and triggers, Null Values, Domain Constraints, Referential Integrity Constraints.

UNIT-3

Relational Database Design:

Functional Dependencies, Armstrong's axioms for functional dependency, Closure of a set of functional dependency,minimal cover, Different anomalies in designing a Database, Normalization using functional dependencies.

Normal Forms-1st normal form, 2nd normal form, 3rd normal form, Boyce-Codd normal form, 4th normal form, 5th normal form, concept of Denormalization.

Transaction Management & Concurrency Control: ACID Properties, Transaction states, Serializability of Transaction, Testing for Serializability and concurrency control, Lock based concurrency control (2PL, Deadlock), Time stamping methods , Validation.

Recovery System: Types of Failures, Recovery Techniques, ARIES.

Suggested Books:

- Ramez Elmasri, Shamkant B. Navathe," Fundamentals of Database systems", Pearson

- Korth, Silberschatz, Sudarshan: database concepts, MGH,
- R. Ramakrishnan and J. Gehrks database management system; MGH, International edition,
- C. J. Date, data base systems: 7th edition, Addison Wesley, Pearson Education, Chakrabarti, Advance database management systems, Wiley Dreamtech

B23-OCA-202	Intellectual Property Rights (IPR) and Regulatory						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose	The subject introduces various categories of intellectual property like patents, copyrights, trademarks, industrial designs, geographical indications, trade secrets etc.						
CO 1	Introduction to Intellectual Property.						
CO 2	To understand about Patents in detail.						
CO3	To learn about Copyrights and Trademarks.						
CO4	Knowledge about Industrial Designs and Geographical Indications.						

UNIT-1

Introduction to Intellectual Property - Origin of IP, History of IP in India, Patents, Copyrights and Related Rights, Trademarks, Geographical Indications, Trade Secrets, Industrial Designs, Major Amendments in IP Laws and Acts in India, IP Organizations in India, Indian Web Portals for Patents and Technologies.

UNIT-2

Categories of Intellectual Property, Conditions for obtaining Patent Protection, Rights associated with Patents, Enforcement of Patent Rights, Inventions eligible for Patenting, Non-Patentable Matters, Patent Infringements, Process of Patenting, World Intellectual Property Organization.

UNIT-3

Classes of Copyrights, Criteria for Copyright, Ownership of Copyright, Copyrights of the Author, Copyright Infringements, Non-copyright Work, Validity of Copyright, Transfer of Copyrights to a Publisher; Trademarks Eligibility Criteria, Classification of Trademarks, Validity of Trademark, Types of Trademark Registered in India, Process of Trademarks Registration.

UNIT-4

Industrial Designs Eligibility Criteria, Acts and Laws to Govern Industrial Designs, Design Rights, Procedure for Registration of Industrial Designs, Importance of Design Registration, Classification of Industrial Designs, Acts, Laws and Rules pertaining to Geographical Indications (GI), Ownership of GI, Identification of Registered GI, Classes of GI, Non-Registerable GI, Protection of GI, Procedure for GI Registration, Criteria for Trade Secrets, Rights Associated with Trade Secrets, Enforcement of Trade Secrets, Disparity between Trade Secrets and Patents.

Suggested Books:

1. Intellectual Property: A Primer for Academia by Prof. Rupinder Tewan, Ms. Manita Bhardwaj, Publication Panjab University Chandigarh, 2021
2. Intellectual Property Rights - Law and Practice, Publication by Institute of Company Secretaries of India, New Delhi, 2014.

O23-OCA-204	International & Corporate Law						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Purpose	The Purpose is to impart knowledge about various international and national laws.
CO 1	To acquire basic knowledge of international law and comparison with municipal law.
CO 2	Jurisdiction of law and state & non state entities.
CO3	To acquire conceptual understanding of company Act.
CO4	Knowledge of share capital and importance of SEBI.

UNIT-1

Definition nature and basis of international law, sources of international law, Relationship between international and municipal law, Subjects of international law, position of individual in international law,
Prescribed Case Law: *North Sea continental shelf case ICJ Report 1969, P. 39*

UNIT-2

Nature of State, Non state entities, state jurisdiction, settlement of international disputes
Nationality: Extradition; Asylum; Diplomatic Agents and Treaties, Purpose and Principles of UNO.

UNIT-3

Emergence of corporations as business organizations and brief introduction of company Act, Company- Definition and kinds of companies; Nature of company, Corporate personality, lifting the corporate veil, Formation of company- Registration & incorporation, memorandum of association &its importance, Article of association and, its relation with memorandum of association,
Prescribed Case Law: *Salomon V. Salomon & company Ltd. (1897) A.C.22*

UNIT-4

Kinds of share and share capital, Issue of share at premium and discount
Debentures- Nature, scope and kinds of debentures
Dividend- Meaning, manner and time of payment of dividend
Composition and functions of SEBI

Book Recommended:

1. Kapoor, S.K. : International Law and Human Rights
2. Tandon, M.P. : Public International Law
3. The Companies Act 2013
4. Rai, Kailash: Company Law
5. The Securities and Exchange Board of India Act, 1992

OE23-OCA-206	Cyber Law and Ethics						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	-	-	3.0	70	30	100	3 Hrs.
Purpose	To gain a broad understanding in order to get cyber law and ethics.						
Course Outcomes							
CO1	To facilitate the basic knowledge of cyber Law.						
CO2	To learn about how to maintain the Confidentiality, Integrity and Availability of information technology act.						
CO3	To get enable to fix the various Cyber Law and Related Legislation.						
CO4	To deal with the Cyber Ethics.						

UNIT-1: Introduction to Cyber Law

Evolution of computer technology, emergence of cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

UNIT-2: Information Technology Act

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature, Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

UNIT-3: Cyber Law and Related Legislation

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

UNIT-4: Cyber Ethics

The Importance of Cyber Law, Significance of cyber Ethics, Need for Cyber regulations and Ethics. Ethics in Information society, Introduction to Artificial Intelligence Ethics: Ethical Issues in AI and core Principles, Introduction to Block chain Ethics.

Suggested Books:

1. Cyber Security : Understanding Cyber Crimes , Computer Forensics and Legal Perspectives By Nina Godbole, Sunit Belapur , Wiley
2. Understanding cybercrime: phenomena , and legal challenges response, ITU 2012.

B23-CAM-210	Machine Learning Lab						
L	**T**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Exam Time**
0	0	3	1.5	40	60	100	3 Hrs
Purpose	It provide students with hands-on experience in experimenting and analysing various machine learning algorithms.						
	Course Outcomes						
CO1	Implement Python Programs.						
CO 2	Implement Machine Learning Algorithms.						
CO 3	Compare and contrast Machine Learning Algorithms.						
CO 4	Analyse the trends in datasets using descriptive statistics.						

LIST OF PRACTICALS

1. Implement Python Program to demonstrate matrices addition, subtraction and multiplication.
2 Implement the Linear Regression algorithm using Python.
3. Implement the Logistic Regression algorithm using Python.
4. Implement the K-nearest Neighbour algorithm.
5. Implement the Decision Tree algorithm.
6. Implement the Random Forest algorithm.
7. Implement the Naive Bayesian Classification algorithm.
8. Implement the Support Vector Machine algorithm.
9. Implement the Perceptron Neural Learning Network.
10. Implement the Backpropagation Learning using Python.

B23-CSE-212	Design and Analysis of algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical Exam**	**Total**	**Time**
--	--	3	1.5	40	60	100	3 Hour
Purpose	The student will learn the algorithm analysis techniques, become familiar with the different algorithm design techniques and understand how to implement various algorithms						
Course Outcomes (CO)							
CO1	The student should be able to Design algorithms for various computing problems						
CO2	The student should be able to Analyse the time and space complexity of algorithms.						
CO3	The student should be able to critically analyse the different algorithm design techniques for a given problem.						
CO4	The student should be able to modify existing algorithms to improve efficiency.						

List of Practicals

1. Program to find the given element in Binary Search Tree.
2. Program to implement Binary Search Tree.
3. Program to implement Prim's algorithm using greedy method.
4. Program to implement Kruskal's algorithm using greedy method.
5. Program to implement graph traversal using Breadth First Search.
6. Program to implement graph traversal using Depth First Search.
7. Program to implement N queen's problem.
8. Program to implement all pairs shortest path.
9. Program to implement Activity Selection Problem.
10. Program to implement Knapsack problem.
11. Program to implement Graph Coloring Problem.
12. Program to implement Naïve String matching algorithm.

B23-CAM-214	DBS Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical**	**Total**	**Time**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3 Hours**
Purpose	**To familiarize the students with the basics of Data base management system.**						
Course Outcomes							
CO1	To understand basic DDL, DML and DCL commands.						
CO2	To learn about various integrity constraints & clauses.						
CO3	To understand the concept of relational algebra.						
CO4	To understand the sub queries, nested queries, views & trigger.						
CO5	To learn various queries using different types of operators & functions .						

1. Write the queries for Data Definition Language (DDL) in RDBMS.
2. Write the queries for Data Manipulation Language (DML) in RDBMS.
3. Write the queries for Data Control Language (DCL) in RDBMS.
4. To perform various integrity constraints on relational database.
5. Create a database and perform the Group by clause , having clause and Order by Clause.
6. Write SQL queries for relational algebra
7. Write SQL queries for extracting data from more than one table
8. Write SQL queries for sub queries and nested queries
9. Write SQL queries to implement views.
10. Write trigger for before and after insertion, deletion and updation process.
11. Implementation of different types of operations in SQL
    - Arithmetic Operator
    - Logical Operator
    - Comparison Operator
    - Special Operator
12. Implementation of different types of functions with suitable examples
    - Number Function
    - Aggregate Function
    - Character/string Function
    - Date Function

B23-MAC-201	Environmental Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Time**
3	--	--	1	30	70	100	3 Hour
Purpose							
Course Outcomes (CO)							
CO1	Students will be able to understand the importance of natural resources.						
CO2	Students will understand the concept of an ecosystem, its structure, and its functions.						
CO3	The students will be able to understand the causes and impacts of various environmental pollution.						
CO4	Students will be able to understand the relationship between human population and the environment.						

UNIT-1

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

UNIT-2

Ecosystems: Concept of an ecosystem, Structure, and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-3

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

UNIT-4

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Suggested Readings:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.

Down to Earth, Centre for Science and Environment (R).

B.Tech. Electronics and Communications Engineering (ECE)
KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f. session 2024-25
SEMESTER-III

Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
					End Semester Exam	Internal assessment	Practical Exam	Total	
B23-ESC-201	Integral Transforms & Numerical Techniques	3:1:0	4	4	70	30	--	100	3
B23-ECE-201	Electronic Devices	3:0:0	3	3	70	30	--	100	3
B23-ECE-203	Digital Electronics	3:0:0	3	3	70	30	--	100	3
B23-ECE-205	Signals and Systems	3:0:0	3	3	70	30	--	100	3
B23-ECE-207	Network Theory	3:0:0	3	3	70	30	--	100	3
B23-ECE-209	Analog Communication	2:1:0	3	3	70	30	--	100	3
B23-ECE-211	Electronic Devices Lab	0:0:3	3	1.5	--	40	60	100	3
B23-ECE-213	Digital Electronics Lab	0:0:3	3	1.5	--	40	60	100	3
B23-ECE-215	Signals and Systems Lab	0:0:2	2	1	--	40	60	100	3
B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	--	100	3
TOTAL			**30**	**24**	**490**	**330**	**180**	**1000**	

- **NCC/NSS/Sports/Yoga/Technical or cultural club/society activities may also be joined by students in second year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines.**

B23-ESC-201	INTEGRAL TRANSFORMS & NUMERICAL TECHNIQUES						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 h**
Purpose	To familiarize the prospective students with Laplace Transform to solve the differential equations and uses of numerical techniques to find out the approximate solutions.						

Course Outcomes	
CO1	Introduction about the concept of Laplace transform and how it is useful in solving the definite integrals and initial value problems.
CO 2	To introduce the tools of numerical methods for the solutions of system of linear equations.
CO 3	How polynomial and transcendental equations can be solved for approximated solution whose exact solution otherwise cannot be evaluated.
CO4	To familiar with essential tool of Numerical Integration needed to approximate solutions for the ordinary differential equations.

UNIT-I (12 Hrs)

Laplace Transform: Introduction, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ordinary differential equations by Laplace Transform method.

UNIT-II (07 Hrs)

Solution of system of Linear equations using Gauss Elimination and Gauss Seidel methods, row echelon form, LU factorization, Cholesky method.

UNIT-III (11 hrs)

Solution of polynomial and transcendental equations: Newton-Raphson method and Regula Falsi method, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

UNIT-IV (10 hrs)

Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules, Ordinary differential equations: Euler and modified Euler's methods. Runge-Kutta method of fourth order for solving first and second order equations, predictor-corrector method.

Suggested Books:

1. 1. S. D. Conte and Carl de Boor, Elementary Numerical Analysis- An Algorithmic Approach (3rd Edition), McGraw-Hill, 1980.
2. C. E. Froberg, Introduction to Numerical Analysis (2nd Edition), Addison-Wesley, 1981.
3. E. Kreyszig, Advanced engineering mathematics (8th Edition), John Wiley (1999).
4. Reena Garg, Advanced Engineering Mathematics, Khanna Book Publishing (2022).
5. K. E. Atkinson, An Introduction to Numerical Analysis (2nd edition), Wiley-India, 1989
6. R. Agor, Elements of Mathematical Analysis, Khanna Publishing House, 2015.
7. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
9. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECE-203	Digital Electronics

B23-ECE-201	Electronic Devices						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End Semester Exam	Internal Assessment	Total	Time
3	---	__	3	70	30	100	3 Hrs
Purpose	To familiarize the students with the concepts of semiconductors and their current transport phenomenon, basic electronic devices with their working and characteristics and different voltage regulators.						
Course Outcomes (CO)							
CO1	Understand the principles of semiconductor Physics and apply it to electronic devices						
CO2	Appreciate different devices for different applications.						
CO3	Understand and utilize the different electronic devices along with their applications.						
CO4	To Understand voltage regulation and different voltage regulators						

Unit 1

Introduction to Semiconductor Physics: Energy bands in intrinsic and extrinsic silicon; Fermi Level, Fermi Level in Intrinsic and Extrinsic Semiconductor, Carrier transport: diffusion current, drift current, mobility and resistivity, Generation and recombination of carriers; continuity equation.

Unit 2

P-N junction diode: Working of diode, Potential barrier, diode equation, I-V characteristics, and small signal switching models

P-N diode clipping circuits, Avalanche breakdown, Zener diode, Schottky diode its working and characteristics, Photodiode.

Unit 3

Bipolar Junction Transistor: Unbiased transistor, Biasing, Operation of a transistor, Configurations of a transistor, Different modes of BJT.

Field Effect Transistor: Types of FET, Working of FET, I-V characteristics, and small signal models of FET, Parameters of FET, MOS capacitor.

Unit 4

Voltage Regulation, DC regulated power supply, Zener diode shunt voltage regulator, Transistor series and shunt voltage regulator, Improved transistor voltage regulator.

Text /Reference Books

1. G. Streetman, and S. K. Banerjee, “Solid State Electronic Devices”, 7th edition, Pearson, 2014.
2. S. M. Sze and K. N.K wok “Physics of Semiconductor Devices”3rd edition, John Wiley &Sons

Lecture	Tutorial	Practical	Credit	End Semester Exam	Internal Assessment	Total	Time
3	-	-	3	70	30	100	3 Hrs.
Course Outcomes (CO)							
CO1	Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function upto six variables.						
CO2	Students will be able to design combinational circuits and applications relatedto them.						
CO3	Students will be able to write the truth table, excitation table, characteristic equations of various flip flops and to design the sequential circuits using Flipflops.						
CO4	Students will be able to familiarize with varied memory types and various A/D, D/A Converters and their characteristics.						

UNIT-I

Fundamentals of Digital Systems and Techniques: Digital signals, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, number systems: binary, signed binary, octal, hexadecimal number, binary arithmetic, one's and two's complements arithmetic, Codes :BCD codes, Excess-3, Gray codes, Error detecting and correcting codes: parity check codes and Hamming code

Minimization Techniques : Basic postulates and fundamental theorems of Boolean algebra: Standard representation of logic functions: SOP and POS forms, Simplification of switching functions using K-map and Quine-McCluskey tabular methods, Don't care conditions, Digital logic families: TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri- statelogic.

UNIT-II

Combinational Digital Circuits: Design procedure: Half adder, Full Adder, Half subtractor, Full subtractor , Parallel binary adder, parallel binary Subtractor, Carry Look Ahead adder, Serial Adder/Subtractor, BCD adder, Binary Multiplier, Binary Divider, Multiplexer/ De-multiplexer, decoder, encoder, parity checker, parity generators, code converters, Magnitude Comparator.

UNIT-III

Sequential circuits: A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, J- K, T and D types flip flops, applications of flip flops: shift registers, serial to parallel converter, parallel to serial converter, Synchronous and Asynchronous mod counter ,FSM, sequence generator and detector.

UNIT-IV

A/D and D/A Converters: Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, specifications for A/D converters **Semiconductor Memories and Programmable Logic Devices**: Characteristics of memories, read only memory (ROM), read and write memory (RAM), Programmable logic array, Programmable array logic, Introduction to Field Programmable Gate Array (FPGA)

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003.
3. Taub Schilling, Digital Integrated Electronics, TMH

Reference Books:

1. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.
2. A.K. Maini, Digital Electronics, Wiley India
3. R P Jain, Modern digital electronics, TMH.

B23-ECE-205	Signals and Systems						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Course Outcomes (CO) At the end of this course, students will demonstrate the ability to							
CO1	Analyze different types of signals.						
CO2	Represent continuous and discrete systems in time and frequency domain using different transforms.						
CO3	Understand sampling theorem and its implications.						

UNIT-I

Introduction to Signals: Continuous and discrete time signals, deterministic and stochastic signals, periodic and a periodic signals, even and odd signals, energy and power signals, exponential and sinusoidal signals and singular functions. Signal representation in terms of singular functions, orthogonal functions and their use in signal representation

Introduction to Systems: Linear and non-linear systems, time invariant and time varying systems, lumped and distributed systems, deterministic and stochastic systems, casual and non-causal systems, analog and discrete/digital memory and memory less systems.

UNIT-II

Random Variables: Introduction to Random Variables, pdf, cdf, moments, distributions, correlation functions.

Linear Time Invariant Systems: Introduction to linear time invariant (LTI) systems, properties of LTI systems, convolution integral, convolution sum, causal LTI systems described by differential and difference equations, Concept of impulse response.

UNIT-III

Discretization of Analog Signals: Introduction to sampling, sampling theorem and its proof, effect of undersampling, reconstruction of a signal from sampled signal.
Fourier Series : Continuous time Fourier series (CTFS), Properties of CTFS, Convergence of fourier series, Discrete time Fourier Series (DTFS), Properties of DTFS **,** Fourier series and LTI system, Filtering.

UNIT-IV

Fourier Transform: Continuous Time Fourier Transform (CTFT), Properties of CTFT, Systems characterized by linear constant- coefficient differential equations, Discrete time fourier transform (DTFT), Properties of DTFT, Duality, Systems characterized by Linear constant coefficient difference equations.

Laplace Transform: Introduction to Laplace transform, Region of convergence for Laplace transform, Inverse laplace transform, Properties of laplace transform, Analysis and characterization of LTI systems using laplace transform, System function algebra and block diagram representations, Unilateral laplace transform.

Text Books:

1. Alan V. Oppenheim, Alan S. Willsky, S. Hamid Nawab, Signals and Systems, Prentice Hall India, 2nd Edition, 2009

Reference Books:

1. Simon Haykins – "Signal & Systems", Wiley Eastern
2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.
3. H. P. Hsu, "Signals and systems", Schaum's series, McGraw Hill Education, 2010.
4. M. J. Robert "Fundamentals of Signals and Systems", McGraw Hill Education, 2007.
5. B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.

Note: Question paper template will be provided to the paper setter.

B23-ECE-207	Network Theory						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Understand basics electrical circuits with nodal and mesh analysis.						
CO2	Appreciate electrical network theorems.						
CO3	Apply Laplace Transform for steady state and transient analysis.						
CO4	Determine different network functions and appreciate the frequency domain techniques.						

UNIT I

Node and Mesh Analysis, matrix approach of network containing voltage and current sources, and reactances, source transformation and duality. Network theorems: Superposition, reciprocity, Thevenin's, Norton's, Maximum power Transfer, compensation and Tallegen's theorem as applied to AC circuits.

UNIT 2

Trigonometric and exponential Fourier series: Discrete spectra and symmetry of waveform, steady state response of a network to non-sinusoidal periodic inputs, power factor, effective values, Fourier transform and continuous spectra, three phase unbalanced circuit and power calculation.

UNIT 3

Laplace transforms and properties: Partial fractions, singularity functions, waveform synthesis, analysis of RC, RL, and RLC networks with and without initial conditions with Laplace transforms evaluation of initial conditions.

UNIT 4

Transient behavior, concept of complex frequency, Driving points and transfer functions poles and zeros of immittance function, their properties, sinusoidal response from pole-zero locations, convolution theorem and Two port network and interconnections, Behaviors of series and parallel resonant circuits, Introduction to band pass, low pass, high pass and band reject filters.

Text/Reference Books

1. Van, Valkenburg.; "Network analysis"; Prentice Hall of India
2. F. F. Kuo , "Network Analysis & Synthesis", John Wiley & Sons Inc
3. Alexander, Sadiku, "Fundamentals of Electric Circuits", McGraw-Hill Education
4. Sudhakar, A., Shyammohan, S. P.; "Circuits and Network"; Tata McGraw-Hill New Delhi,1994
5. A William Hayt, "Engineering Circuit Analysis", McGraw-Hill Education
6. Ashfaq Husain, Networks and Systems, Khanna Book Publishing, 2021.

B23-ECE-209	Analog Communication						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
2	**1**	**-**	**3**	**70**	**30**	**100**	**3 Hr.**
Course Outcomes							
CO1	Describe different types of noise and predict its effect on various analog communication systems and Understand the concepts of Analog Modulations in time and frequency domain.						
CO2	Understand and analyze various AM Transmitters & Receivers Methods and their circuits.						
CO3	Understand and analyze various FM Transmitters & Receivers Methods and their circuits.						
CO4	Understand and analyze various SSB Transmitters & Receivers Methods and Understand the concepts of Pulse Modulation and Demodulation circuits.						

Unit-I

Communication system and Noise: Constituents of communication system, Modulation, Bandwidth requirement, Noise, Classification of noise, Resistor noise, Multiple resistor noise sources, Noise Temperature, Noise bandwidth, Noise figure, its calculation and measurement, Bandpass noise representation, Noise calculation in Communication Systems, Noise in Amplitude Modulated System, Noise in angle modulated systems.

Analog Modulation Techniques: Theory of amplitude modulation, AM power calculations, AM modulation with a complex wave, Concepts of angle modulation, Theory of frequency modulation, Mathematical analysis of FM, Spectra of FM signals, Narrow band FM, Wide band FM, Phase modulation, Phase modulation obtained from frequency modulation, Comparison of AM, FM & PM.

Unit-II

AM Transmission: Generation of Amplitude Modulation, Low level and high level modulation, Basic principle of AM generation, Square law modulation, Vander bijl modulation, Suppressed carrier AM generation (Balanced Modulator) ring Modulator.

AM Reception: Tuned Ratio Frequency (TRF) Receiver, Super heterodyne Receiver, RF Amplifier, Image Frequency Rejection, Cascade RF Amplifier, Frequency Conversion and Mixers, Tracking & and Alignment, IF Amplifier, AM detector, Distortion in diode detectors, AM receiver characteristics.

Unit-III

FM Transmission: FM allocation standards, Generation of FM by direct method, Varactor diode Modulator, Indirect generation of FM, The Armstrong method RC phase shift method, Frequency stabilized reactance FM transmitter, FM stereo transmitter, Noise triangle.

FM Reception: Direct methods of Frequency demodulation, Frequency discrimination (Balanced slope detector), Foster seelay detector, phase discriminator, Ratio detector, Indirect method of FM demodulation, FM detector using PLL, Pre-emphasis / de-emphasis, The FM receiver, FM stereo receiver.

Unit-IV

SSB Transmission: Introduction, Advantages of SSB Transmission, Generation of SSB, The Filter method The Phase Shift Method, The Third Method, Pilot Carrier SSB, Vestigial Side-band Modulation (VSB), VSB-SC, Application of AM and FM in TV transmission.

SSB Reception: SSB Product Demodulator, Balanced Modulator as SSB Demodulator, Pilot Carrier SSB Receiver, SSB Double Super-hetrodyne Receiver, Modern Communication Receiver.

Analog Pulse Modulation: Introduction, Pulse amplitude modulation (PAM), PAM Modulator Circuit, Demodulation of PAM Signals, Pulse Time Modulation (PTM): Pulse Width Modulation (PWM), Pulse Position Modulation (PPM), PPM Demodulator,

Text Books

1. Kennedy, G., Electronic Communication Systems, McGraw-Hill (2008) 4th ed.
2. Lathi.B.P.,Modern Digital and Analog Communications Systems 3rd ed.

Reference Books

1. Taub, H., Principles of Communication Systems, McGraw-Hill (2008) 3rd ed.
2. Haykin, S., Communication Systems, John Willey (2009) 4th ed.
3. Proakis, J. G. and Salehi, M., Fundamentals of Communication Systems, Dorling Kindersley (2008) 2nd ed.
3. Mithal G K, Radio Engineering, Khanna Pub.
4. Singh & Sapre—Communication Systems: 2/e, TMH

Note: Separate paper template will be provided to the paper setter for setting the question paper of end term semester examinations.

B23-ECE-211	Electronic Devices Lab						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	Practical Exam	Internal Assessment	Total	Time
_____	---	3	1.5	60	40	100	3 Hrs
Purpose	To impart the practical knowledge of basic electronic devices and their applications						
Course Outcomes (CO)							
CO1	To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, zener diode etc. find the threshold voltage and zener breakdown voltage from the VI curve.						
CO2	To experimentally analyze different type of rectifiers and calculation of ripple factors.						
CO3	To experimentally teach the students the concept of different configurations of regulated power supplies using Zener diode.						
CO4	To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.						

List of Experiments:

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. To study the transfer and drain characteristics of JFET and calculate its various parameters.
9. To study the transfer and drain characteristics of MOSFET and calculate its various parameters.
10. To study the different types of negative feedback in two stage amplifier and to observe its effects upon the amplifier parameters.
11. To study the Zener diode as a transistor series voltage regulator.
12. To study the Zener diode as a transistor shunt voltage regulator.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.

2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Note: At least eight (8) experiments from the above list are mandatory to perform for the students.

B23-ECE-213	Digital Electronics Lab						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal Assessment	Total	Time
-	-	3	1.5	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	Students will be able to verify truth tables of basic logic gates and design various gates using universal gates.						
CO2	Students will be able to design various combinational circuits and verify their operation.						
CO3	Students will be able to design different sequential circuits by using flip flopsand verify their operation.						
CO4	Students will be to study and design various encoders and decoders.						

List of experiments:

1. Familiarization with Digital Trainer Kit and associated equipment.

2. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.

3. Design and realize a given function using K-Maps and verify its performance.

4. To verify the operation of Multiplexer and De-multiplexer.

5. To verify the operation of Comparator.

6. To verify the truth table of S-R, J-K, T, D Flip-flops.

7. To verify the operation of Bi-directional shift register.

8. To design and verify the operation of 3-bit asynchronous counter.

9. To design and verify the operation of asynchronous Up/down counter.

10. To design and verify the operation of asynchronous Decade counter.

11. Study of Encoder and Decoder.

12. Study of BCD to 7 segment Decoder

Text Books:

1. M. M. Mano, "Digital design", Pearson Education India, 2016.
2. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8thEdition, TMH, 2003.

Note: *At least ten (10) experiments from the above list are mandatory to perform for the students.*

B23- ECE-215	Signals and Systems Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Time**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Course Outcomes (CO)							
CO1	To understand the basic concepts of software.						
CO2	To explore properties of various types of signals and systems.						
CO3	To explore different properties of signals and systems.						
CO4	To understand the concept of sampling in time and frequency domain.						

List of experiments:

1. Introduction of the software.
2. To demonstrate some simple signal.
3. To explore the effect of transformation of signal parameters (amplitude-scaling, time-scaling and time- shifting).
4. To visualize the complex exponential signal and real sinusoids.
5. To identify a given system as linear or non-linear.
6. To explore the time variance and time invariance property of a given system.
7. To explore causality and non-causality property of a system.
8. To determine Fourier transform of a signal.
9. To determine Laplace transform of a signal.
10. To demonstrate the time domain sampling of bandlimited signals (Nyquist theorem).
11. To demonstrate the sampling in frequency domain (Discrete Fourier Transform).
12. To demonstrate the convolution and correlation of two continuous-time signals.
13. To demonstrate the convolution and correlation of two discrete-time signals.

Reference Books:

1. B. P. Lathi, “Linear Systems and Signals”, Oxford University Press, 2009.

2. Tarun Kumar Rawat , Signals and Systems , Oxford University Press.

Note: At least ten (10) experiments from the above list are mandatory to perform for the students.

B23-MAC-201	ENVIRONMENTAL STUDIES						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**1**	**70**	**30**	**100**	**3 Hrs.**
Purpose	**To learn the multidisciplinary nature, scope and importance of Environmental sciences.**						
Course Outcomes							
CO1	Students will be able to understand the importance of natural resources.						
CO2	Students will understand the concept of an ecosystem, its structure, and its functions.						
CO3	The students will be able to understand the causes and impacts of various environmental pollution.						
CO4	Students will be able to understand the relationship between human population and the environment.						

UNIT-I

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure, and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

UNIT-IV

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Reference Books:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R).

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

B.Tech. Electronics and Communications Engineering (ECE)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

Modified scheme of exams w.e.f. session 2024-25

SEMESTER-IV

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal assessment	Practical Exam	Total	
1	B23-BSC-202	Complex Variables and Statistics	3:1:0	4	4	70	30	--	100	3
2	B23-HSM-202	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
3	B23-ECE-202	Advanced Microprocessors and Interfacing	3:0:0	3	3	70	30	--	100	3
4	B23-ECE-204	Analog Circuits	3:0:0	3	3	70	30	--	100	3
5	B23-ECE-206	Electromagnetic Waves	3:0:0	3	3	70	30	--	100	3
6	B23-ECE-208	Analog Circuits Lab	0:0:3	3	1.5	--	40	60	100	3
7	B23-ECE-210	Electromagnetic Waves Lab	0:0:3	3	1.5	--	40	60	100	3
8	B23-ECE-212	Microprocessor & Interfacing Lab	0:0:3	3	1.5	--	40	60	100	3
9	B23-ECE-214	Electronic Design Workshop	0:0:3	3	1.5	--	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
TOTAL				30	23	350	410	240	1000	

Note: All students have to undertake the industrial training for 6 to 8 weeks after 4th semester which will evaluated in 5th semester.

B23-BSC-202	COMPLEX VARIABLES AND STATISTICS						
L	**T**	**P**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 h**
Purpose	To familiarize the prospective students with complex variables which is widely used in the field of Signal Processing and Electromagnetic, and the concept of probability& statistics to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.						
Course Outcomes							
CO1	To introduce the tools of differentiation and integration of functions of complex variable those are used in various techniques dealing engineering problems.						
CO 2	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.						
CO 3	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications..						
CO4	To make the students familiar about basic statistics including measures of central tendency, measures of dispersion, correlation, and regression.						

UNIT-I (08 Hrs)

Complex Variable – Differentiation: Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, findingharmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) andtheir properties;

Complex Variable – Integration: Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (withoutproof), Taylor's series,zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof).

UNIT-II (10 Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-III (10 hrs)

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables.

Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV (12 hrs)

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8.Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-HSM-202		Innovation, Startups and Entrepreneurship					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3** Hours

Course Outcomes	
Purpose	***The objective of this Course is to inspire students and help them imbibe entrepreneurial mindset.***
CO 1	*Understanding the essence of innovation and features of innovative processes; models and methods of innovative entrepreneurship, the role of innovation as a major factor in creating the value of companies*
CO 2	*Understanding, the dynamic role of entrepreneurship and small businesses, , types of business structure, organizing and managing a Small Business*
CO 3	*Understanding concept of start ups, Control Strategic Marketing Planning , concept of incubation and proto type, new Product Development, Business Plan Creation.*
CO 4	*Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship*

Unit -I

Introduction to Innovation and Entrepreneurial Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

Unit-II

Introduction to Entrepreneurship and Start – Ups - Definitions, Traits of an entrepreneur, Intrapreneurship, Entrepreneurial Motivation ,Functions of Entrepreneur, Concept, Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of startups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

Unit -III

Start ups - Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit -IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowdfunding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work

Suggested Readings:

- Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
- “Entrepreneurship development small business enterprises”, Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, “Entrepreneurship”, Oxford University Press, 2011.
- “Innovation and Entrepreneurship”,Harper business- Drucker.F, Peter, 2006.
- “Entrepreneurship”, Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- The Three-Box Solution: A Strategy for Leading Innovation By Vijay Govindarajan
- Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). Managing Global Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
- Brown K. and Stephen P. Osborne (2005) Managing change and innovation in public service organisation. New York: Routledge
- Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks Knowledge Creation and Innovation in Medium-technology Clusters. UK: Edward Elgar Publishing Limited.
- Eveleens, C. (2010). Innovation management; a literature review of innovation process models and their implications. Working Paper HAN University of Applied Sciences.
- Enterpreneurship Development- S.Chand & Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi –Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
- Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2007

B23-ECE-202	Advanced Microprocessors & Interfacing						
Lecture	Tutorial	Practical	Credit	Internal Assessment	End Semester Exam	Total	Time
3	-	-	3	70	30	100	3 Hrs.

Course Outcomes (CO)

Upon completion of the course, students will be able to

CO1	To learn the architecture 8086 Microprocessor.
CO2	To learn the instruction set of 8086 Microprocessor and assembly language programming of 8086 Microprocessor.
CO3	To learn about interfacing of 8086 with different types of Memories
CO4	To learn about interfacing of interrupts, basic I/O and DMA with 8086 Microprocessor.

Unit – I

8086 CPU ARCHITECTURE: 8086 Block diagram; description of data registers, address registers; pointer and index registers, PSW, Queue, BIU and EU. 8086 Pin diagram descriptions. Generating 8086 CLK and reset signals using 8284. WAIT state generation. Microprocessor BUS types and buffering techniques, 8086 minimum mode and maximum mode CPU module.

UNIT-II

8086 INSTRUCTION SET: Instruction formats, addressing modes, Data transfer instructions, string instructions, logical instructions, arithmetic instructions, transfer of control instructions; process control instructions; Assembler directives.

8086 PROGRAMMING TECHNIQUES: Writing assembly Language programs for logical processing, arithmetic processing, timing delays; loops, data conversions.

UNIT-III

MAIN MEMORY SYSTEM DESIGN: Memory devices, 8086 CPU Read/Write timing diagrams in minimum mode and maximum mode. Address decoding techniques. Interfacing SRAMS; ROMS/PROMS. Interfacing and refreshing DRAMS.

UNIT-IV

BASIC I/O INTERFACE: Parallel and Serial I/O Port design and address decoding. Memory mapped I/O Vs Isolated I/O Intel's 8255 and 8251- description and interfacing with 8086. ADCs and DACs, - types, operation and interfacing with 8086. Interfacing Keyboards, multiplexed displays, and stepper motor with 8086.

INTERRRUPTS AND DMA: 8086 Interrupt mechanism; interrupt types and interrupt vector table. Applications of interrupts, Intel's 8259. DMA operation. Intel's 8237.

Text Books:

1. Barry B. Brey, "The Intel Microprocessor8086/8088, 80186", Pearson Education, Eighth Edition, 2009
2. D.V. Hall, Microprocessors and Interfacing, McGraw Hill 3nd ed.
3. Liu, Gibson, "Microcomputer Systems: The 8086/88 Family", 2nd Edition, PHI.
4. Kenneth Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", Cengage Learning, Indian Edition, 2008.
5. Kip Irvine, "Assembly language for IBM PC", PHI, 2nd Edition, 1993
6. Uffenback, "The 8086 Family Design" PHI, 2nd Edition.
7. Walter A Triebel and Avtar Singh; The 8088 and 8086 Microprocessors, Programming, Interfacing, Software, Hardware and Applications, Fourth Edition, Pearson Education.

B23-ECE-204	**Analog Circuits**						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	End Semester Exam	Internal Assessment	Total	Time
3	---	__	3	70	30	100	3 Hrs
Purpose	To familiarize the students with the concepts of different analog circuits, their detailed analysis, different oscillators and operational amplifier.						
Course Outcomes (CO)							
CO1	To make the students understand the analysis of various BJT and FET amplifiers using small signal models.						
CO2	To teach the students the concept of describe the frequency response of multistage amplifiers and the detailed concept of feedback topologies.						
CO3	To make the students learn various oscillator circuits using both Op-Amp and BJT.						
CO4	To teach the students the various application circuits of Op-Amp and designing for a given specification.						

Unit 1

Amplifier Models: Amplifier types: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. Small signal analysis of BJT amplifiers: CE, CB and CC amplifiers using re model, small signal analysis of the CS JFET amplifiers, estimation of voltage gain, input resistance, output resistance etc.

Unit 2

Transistor Frequency Response: Class A, class B, class C amplifiers: calculation of maximum efficiency. Frequency response of the amplifiers: low frequency, mid-frequency and high frequency region. Effect of cascading of amplifiers on the frequency response, cut-off frequencies, Bandwidth and voltage gain. Miller effect, Feedback in amplifiers: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth, input impedance, output impedance.

Unit 3

Oscillators: Barkhausen criterion for oscillators, types of Oscillators: RC phase shift oscillator, Wien bridge oscillator, LC oscillators : Hartley oscillator, Collpit oscillator, derivation of frequency of oscillation. 555 timer: operation as astable and monostable multivibrator.

Unit 4

Op-Amp Applications: Simple op-amp circuits: adder, subtractor, Schmitt trigger, Differential amplifier: calculation of differential gain, common mode gain, CMRR, OP-AMP design: design of differential amplifier for a given specification, design of gain stages and output stages.

Text /Reference Books

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. A.S. Sedra and K.C. Smith, Microelectronic Circuits, Saunder's College Publishing, 1991.
4. S Salivahanan and N Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

B23-ECE-206	Electromagnetic Waves						
Lecture	Tutorial	Practical	Credit	End Semester exam	Internal Assessment	Total	Time
3	0	0	3	70	30	100	3 Hrs.
Objective	*To familiarize the students with the concepts of Electric field, Magnetic Field and relation between them so that students can develop understanding about the generation and propagation of electromagnetic waves.*						
CO1	*Students will be able to understand and apply the basic laws of Electrostatics for the generation and propagation of electric field in different media.*						
CO2	*Students will be able to understand and apply the basic laws of Magnetostatics for the generation and propagation of magnetic field in different media.*						
CO3	*Students will be able to understand and develop the relations between Electric field and Magnetic field.*						
CO4	*Students will be able to understand and analyze the propagation of wave in different media.*						

Unit-I

ELECTROSTATICS: Review of coordinate system and vectors: Cartesian, Cylindrical and Spherical coordinate systems. Review of vectors: Gradient, curl, and Divergence of vector. Review of integral calculus: Line integral, Surface integral and Volume integral. Coulomb's law. Electric Field Intensity, Electric Potential, Field of a Line Charge, Field of a Sheet of Charge, Electric Flux, Electric Flux Density, Gauss's Law and its applications, Boundary conditions for Electric Field. Method of Images, Poisson's and Laplace's Equations, Uniqueness Theorem.

Unit-II

MAGNETOSTATICS: Differential Current Element, Biot - Savart Law. Magnetic field of a linear conductor of infinite length. Magnetic field of a circular current carrying loop. Magnetic Vector potentials, Magnetic Circuit, Force on a moving charge in magnetic field, Force on a Current Carrying Conductor in Magnetic Field, Torque on a closed current carrying loop in magnetic field. Magnetic flux and Magnetic flux density. Ampere's Circuit law, Faraday's Law, Boundary Conditions for Magnetic field, Maxwell's Equations for Free space, Good Conductors & Lossy Dielectric for Static & Sinusoidal Time Variations Fields, Retarded potentials.

Unit-III

UNIFORM PLANE WAVE: Plane Waves & its properties, Uniform Plane waves, Wave Equation for Free Space and Conducting Medium, Propagation of Plane Waves in Lossy Dielectrics, Good Dielectrics & Good Conductors. Skin effect and Skin depth for different medium. The Poynting's Vector and Poynting theorem. Reflection of plane waves from perfect conductors and dielectrics under normal and oblique incidence.

Unit-IV

TRANSMISSION LINES AND WAVEGUIDES: Representation of transmission line. Reflection in Transmission Line. The Transmission Line Equations, Graphical methods for solving transmission line. Rectangular Waveguides: TE, TM, TEM waves in rectangular wave guide, Calculation of field in rectangular waveguide foe TE and TM mode. Cut-off & Guided frequency of waveguide.

REFERENCES:

1 E.C. Jordan & K.G. Balmain ,"Electromagnetic Waves and Radiating Systems, 2nd Edition, PHI

2 David K. Chang, "Field and Waves Electromagnetics" 2nd Edition, Addison Wesley.

3 W. H. Hayt, “Engineering Electromagnetics”, 7th Edition, Tata McGraw Hill.
4. Matthew N. O. Sadiku and S. V. Kulkarni, “Principles of Electromagnetics”, 6th Edition, Oxford University Press.

B23-ECE-208	**Analog Circuits Lab**						
Lecture (Hrs.)	Tutorial (Hrs.)	Practical (Hrs.)	Credit	Practical Exam	Internal Assessment	Total	Time
_____	---	3	1.5	60	40	100	3 Hrs
Purpose	To impart the practical knowledge of analog circuits and their applications						
Course Outcomes (CO)							
CO1	To design and calculate the gain , frequency response etc. of the various configuration of transistor amplifier.						
CO2	To make students Design various RC oscillators using Op-Amp 741 for a given frequency of oscillation.						
CO3	To make students Design various RC oscillators using BJT for a given frequency of oscillation.						
CO4	To teach the students the design of various Op-Amp circuits such as adder, subtractor etc.						

List of experiments:

1. To design a simple common emitter (CE) amplifier circuit using BJT and find its gain and frequency response.
2. To design a BJT emitter follower and determine is gain, input and output impedances.
3. To design and test the performance of Phase shift Oscillator using Op-Amp 741.
4. To design and test the performance of Wien bridge oscillator using Op-Amp 741.
5. To design and test the performance of BJT - RC Phase shift Oscillator for f0 ≤ 10 KHz.
6. To design and test the performance of BJT – Hartley Oscillators for RF range f0 ≥100KHz.
7. To design and test the performance of BJT – Colpitt Oscillators for RF range f0 ≥100KHz.
8. To design an astable multivibrator using 555 timer.
9. To design a monostable multivibrator using 555 timer.
10. To design Schmitt trigger using Op-amp and verify its operational characteristics.
11. To design an adder circuit using Op-Amp to add three dc voltages.
12. To design a subtractor using Op-Amp to subtract DC voltages v1 and v2.

Reference Books:

1. Millman & Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.

Note: Atleast eight (8) experiments from the above list are mandatory to perform for the students

B23-ECE-210	Electromagnetic Waves Lab						
Lecture	Tutorial	Practical	Credit	Practical Exam	Internal assessment	Total	Time
-	-	3	1.5	60	40	100	3 Hrs.
Course Outcomes (CO)							
CO1	To understand the concept of basic scattering parameters required to characterize the RF device.						
CO2	To be able to Design & Characterize the Microstrip Transmission line						
CO3	To be able to Design & Characterize the Rectangular and Circular Waveguide.						
CO4	To Design & Characterize the monopole, dipole antenna and patch antenna						

List of Experiments:

1. Introduction to simulation software for Electromagnetic.
2. To study the basics of scattering parameters required to characterize a RF device. .
3. Design & Characterization of Microstrip line using simulation software.
4. Design & Characterization of Rectangular Waveguide using simulation software.
5. Design & Characterization of Circular Waveguide using simulation software.
6. To study the propagation of signal in good conductor using simulation software.
7. Design & Characterization of monopole antenna.
8. Design & Characterization of dipole antenna.
9. Design & Characterization of microstrip patch antenna.
10. Design & Characterization of probe feed patch antenna.

B23-ECE-212	Microprocessor & Interfacing Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical exam**	**Total**	**Time**
0	**0**	**3**	**1.5**	**40**	**60**	**100**	**3 Hour**
Purpose	**Write the efficient Assembly Language Program for different problem statements and implement different system interfacing.**						
Course Outcomes							
CO 1	**Understanding different steps to develop program such as Problem definition, Analysis, Design of logic, Coding, Testing, Maintenance (Modifications, error corrections, making changes etc.)**						
CO 2	**To be able to apply different logics to solve given problem.**						
CO 3	**To be able to write program using different implementations for the same problem**						
CO 4	**Use of programming language constructs in program implementation**						

LIST OF EXPERIMENTS: (Verification of atleast 3 experiments may also be done usingTASM)

I a) Familiarization with 8086 Trainer Kit.
b) Familiarization with Digital I/O, ADC and DAC Cards.
c) Familiarization with Turbo Assembler and Debugger S/Ws.

II Write a program to arrange block of data in
i) ascending and (ii) descending order.

III Write a program to find out any power of a number such that $Z = X^N$.
Where N is programmable and X is unsigned number.

IV Write a program to generate.
i) Sine Waveform (ii) Ramp Waveform (iii) Triangular Waveform Using DAC Card.

V Write a program to measure frequency/Time period of the following functions.
(i) Sine Waveform (ii) Square Waveform (iii) Triangular Waveform
usingADC Card.

VI Write a program to increase, decrease the speed of a stepper motor and reverse its direction of rotation using stepper motor controller card.

VII Write a programmable delay routine to cause a minimum delay = 2MS and a maximum delay = 20 minutes in the increments of 2 MS

VIII Write a program that takes any two numbers as Input from the user through the input device (Keyboard) & Prints their sum on the standard output device (Screen).

IX Write a program that takes any two numbers as Input from the user through the input device (Keyboard) & Prints their sum on the standard output device (Screen) by giving appropriate messages to the user

X Write a program that initializes 100 positions in an array and loads them with 0.

XI Write a program that prints a Blinking character in the middle of the screen.

XII Write a program that accepts a number from the user through the input device (Keyboard), calculates its factorial and prints the result on the screen.

XIII ON/OFF control of SSR (Solid State Relay) using interface with 8255.

XIV Interfacing of LM35/RTD temperature sensor with 8086 and display the temp value on LCD.

XV To interface traffic light system using 8086 & 8255.

B23-ECE-214	Electronic design Workshop						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**Practical exam**	**Total**	**Time**
0	**0**	**3**	**1.5**	**40**	**60**	**100**	**3 Hour**
Purpose	**To design and develop any hardware based electronics projects.**						

Course Outcomes **At the end of the course, student will be able to**	
CO 1	**Identify different electronics components**
CO 2	**Design PCB**
CO 3	**Design an electronic circuit**
CO 4	**Develop a working project model**

Instructions:

All the students will be required to design and develop any hardware based electronic project approved by the concerned Faculty In-charge.

	B.Tech. (4th Semester) Electronics and Communication Engineering						
B23-MAC-202	**ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE**						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
2	**0**	**0**	**1**	**--**	**100**	**100**	**3**
Purpose	To impart basic principles of thought process, reasoning and inferencing.						
Course Outcome							
CO 1	*The students will be able to understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.*						

Course Contents

- Basic structure of Indian Knowledge System: अष्टादशविद्या -४वेद,४उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्ववेद, स्थापत्य आदि) ६वेदांग (शिक्षा, कल्प, निरुक्त, व्याकरण, ज्योतिष, छंद) ४ उपाङ्ग (धर्मशास्त्र, मीमांसा, पुराण, तर्कशास्त्र)
- Modern Science and Indian Knowledge System
- Yoga and Holistic Health care
- Case studies

References

- V. Sivaramakrishnan (Ed.), *Cultural Heritage of India-course material*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
- Swami Jitatmanand, *Modern Physics and Vedant*, Bharatiya Vidya Bhavan
- Swami Jitatmanand, *Holistic Science and Vedant*, Bharatiya Vidya Bhavan
- Fritzof Capra, *Tao of Physics*
- Fritzof Capra, *The Wave of life*
- VN Jha (Eng. Trans.), *Tarkasangraha of Annam Bhatta*, International Chinmay Foundation, Velliarnad, Arnakulam
- *Yoga Sutra of Patanjali*, Ramakrishna Mission, Kolkata
- GN Jha (Eng. Trans.), Ed. RN Jha, *Yoga-darshanam with Vyasa Bhashya*, Vidyanidhi Prakashan, Delhi 2016
- RN Jha, *Science of Consciousness Psychotherapyand Yoga Practices*, Vidyanidhi Prakashan, Delhi 2016
- P B Sharma (English translation), *Shodashang Hridayan*

Pedagogy: Problem based learning, group discussions, collaborative mini projects.

KURUKSHETRA UNIVERSITY, KURUKSHETRA

(ESTABLISHED BY THE STATE LEGISLATURE ACT XII OF 1956)
('A+' GRADE NAAC ACCREDITED)

Scheme & Syllabus of B.Tech. Degree in Electrical and Computer Engineering (ECO)

(w.e.f. session 2023-24 onwards)

Table of Contents

GENERAL COURSE STRUCTURE

&

CREDIT DISTRIBUTION

GENERALCOURSESTRUCTURE&THEME

A. Definition of Credit*:

1Hr. Lecture(L) per week	1Credit
1Hr.Tutorial(T)per week	1Credit
1Hr.Practical(P)per week	0.5Credit
2HoursPractical(P)per week	1Credit

*Except for the Manufacturing process workshop, mandatory and value-added courses

B. Range of Credits: The total number of credits proposed for the four-year B.Tech. degree in Electrical and Computer Engineering (ECO) is kept as 175. In addition, for a B.Tech. with Honors & specialization/minor degree, the student must acquire an additional 18-20 credits through MOOC courses offered at the SWAYAM/NPTEL portal.

C. Structure of UG Program in Electrical and Computer Engineering (ECO)**:** The structure of UG program in Electrical and Computer Engineering (ECO) has essentially the following categories of courses with the breakup of credits as given:

Sr. No.	Category	Credit Breakup for CSE
1	Humanities and Social Sciences including Management courses	16.5
2	Basic Science courses	24
3	Engineering Science courses including workshop, drawing, basics of electronics/ electrical/mechanical/computer etc.	13.5
4	Professional core courses	78
5	Program Elective courses relevant to chosen specialization/branch	15
6	Open subjects–Electives from other technical and/or emerging subjects	03
7	Project work, seminar and internship in industry or else where	17
8	Mandatory and Audit Courses [IDEA Workshop, IDEA Workshop Lab, Personality Development and Soft Skills, Environmental Studies, Induction Program, Constitution of India, Essence of Indian Knowledge Tradition, NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/ Society Activities]	08
	Total	**175**

D. Course code and definition:

Course code	Definitions
L:T:P	Lecture: Tutorial: Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSC/HSM	Humanities and Social Sciences including Management courses
ECO	Program Core Courses
EEP	Program Elective Courses
EEO	Open Elective Courses
VAC	Value Added Courses
MAC	Mandatory Courses

- **Category-wise Courses**

HUMANITIES & SOCIAL SCIENCES COURSES [HSC/HSM]

S.No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-HSC-101	English for Technical Writing	II	2	0	2	3
2	B23-HSC-102	Design Thinking	I	0	0	3	1.5
3	B23-HSM-101	Universal Human Values-II: Understanding Harmony And Ethical Human Conduct	I	3	0	0	3
4	B23-HSM-202	Innovation, Start ups and Entrepreneurship	V	3	0	0	3
5	B23-HSM-201	Organizational Behaviour	III	3	0	0	3
6	B23-HSM-302	Humanities–II Intellectual Property Rights (IPR) and Regulatory	IV	3	0	0	3
Total Credits							**16.5**

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BASIC SCIENCE COURSES [BSC]

S. No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-BSC-101	Semiconductor Physics	I	3	1	2	5
2	B23-BSC-107	Mathematics-I	I	3	1	0	4
3	B23-BSC-104	Engineering Chemistry	II	3	0	2	4
4	B23-BSC-108	Mathematics-II	II	3	1	0	4
5	B23-BSC-106	Biology	II	3	0	0	3
6	B23-BSC-203	Mathematics-III	IV	3	1	0	4
Total Credits							**24**

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ENGINEERING SCIENCE COURSE[ESC]

S. No	Course No./ Code	Subject	Semester	Hrs/week			Credits
				Lecture	Tutorial	Practical	
1	B23-ESC-102	Engineering Graphics and Design	I	1	0	4	3
2	B23-ESC-104	Basic Electrical Engineering	I	3	1	2	5
3	B23-ESC-101	Programming for Problem Solving	II	3	0	2	4
4	B23-ESC-107	Manufacturing Practices Workshop	II	0	0	3	1.5
Total Credits							**13.5**

PROGRAM CORE COURSES [ECO]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-ECO-201	Analog and Digital Electronics	III	3:0:2	4
2	B23-ECO-203	Computer Organization and Architecture	III	3:0:0	3
3	B23-ECO-205	Data Structure and Algorithms	III	3:0:2	4
4	B23-ECO-207	Electrical Machine-I	III	3:0:2	4
5	B23-ECO-209	Electric Power Generation	III	3:0:0	3
6	B23-ECO-202	Electrical Measurement and Instrumentation	IV	3:0:2	4
7	B23-ECO-204	Electrical Machine-II	IV	3:0:2	4
8	B23-ECO-206	Network Analysis and Synthesis	IV	4:0:0	4
9	B23-ECO-208	Object Oriented Programming	IV	3:0:2	4
10	B23-ECO-301	Control System	V	3:0:2	4
11	B23-ECO-303	Data Base Management System	V	3:0:2	4
12	B23-ECO-305	Electromagnetic Theory	V	3:0:0	3
13	B23-ECO-307	Operating System	V	3:0:0	3
14	B23-ECO-309	Power System-I	V	3:0:2	4
15	B23-ECO-302	Renewable Energy Resources	VI	3:0:0	3
16	B23-ECO-304	Power System-II	VI	3:0:2	4
17	B23-ECO-306	Python Programming	VI	3:0:2	4
18	B23-ECO-308	Signals and Systems	VI	3:0:2	4
19	B23-ECO-401	AIML	VII	3:0:2	4
20	B23-ECO-403	Big Data Analytics	VII	3:0:2	4
21	B23-ECO-405	Power System Protection and Relaying	VII	3:0:0	3
Total					**78**

SKILL ENHANCEMENT-BASED PROJECT WORK, SEMINAR AND INTERNSHIP

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-ECO-316	Project-1	VI	0:0:4	2
2	B23-ECO-411	Project-II	VII	0:0:6	3
3	B23-ECO-402	Project-III / Internship/ Startups/ Research Lab	VIII	0:0:24	10
4	B23-ECO-317	Industrial Training-I	V	0:0:2	1
5	B23-ECO-413	Industrial Training-II	VII	0:0:2	1
Total					**17**

LIST OF PROGRAMME ELECTIVE COURSES [EEP]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-EEP-302	Power Electronics and Drives	VI	3:0:0	3
2	B23-EEP-304	Transducer and Sensors	VI	3:0:0	3
3	B23-EEP-306	Soft Computing	VI	3:0:0	3
4	B23-EEP-308	Software Engineering	VI	3:0:0	3
5	B23-EEP-310	High Voltage Engineering and Facts Devices	VI	3:0:0	3
6	B23-EEP-312	Computer Added Power System Analysis	VI	3:0:0	3
7	B23-EEP-314	Internet Technology and Management	VI	3:0:0	3
8	B23-EEP-316	Computer Network	VI	3:0:0	3
9	B23-EEP-401	Digital Signal Processing	VII	3:0:0	3
10	B23-EEP-403	Microprocessor and Microcontroller	VII	3:0:0	3
11	B23-EEP-405	Industrial Automation	VII	3:0:0	3
12	B23-EEP-407	Software Verification, Validation and Testing	VII	3:0:0	3
13	B23-EEP-402	Electric Vehicle Technology	VIII	3:0:0	3
14	B23-EEP-404	Power System Restructuring and Deregulation	VIII	3:0:0	3
15	B23-EEP-406	Robotics and Automation	VIII	3:0:0	3
16	B23-EEP-408	Block Chain Technology	VIII	3:0:0	3
17	B23-EEP-410	Energy Audit and Conservation	VIII	3:0:0	3
18	B23-EEP-412	Smart Grid	VIII	3:0:0	3
19	B23-EEP-414	Data Mining	VIII	3:0:0	3
20	B23-EEP-416	Mobile App Development	VIII	3:0:0	3

LIST OF OPEN ELECTIVE COURSES [EEO]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-EEO-401	Biomedical Signal Processing	VII	3:0:0	3
2	B23-EEO-403	International and Corporate Law	VII	3:0:0	3
3	B23-EEO-405	Internet of Things	VII	3:0:0	3
4	B23-EEO-407	Digital Image Processing	VII	3:0:0	3

VALUE ADDED AND MANDATORY COURSES [VAC/MAC]

S. No.	Course No./ Code	Subject	Semester	Hrs/Week L:T:P	Credits
1	B23-VAC-101	Personality Development and Soft Skills	II	2:0:0	1
2	B23-VAC-110	IDEA Workshop	I	2:0:0	1
3	B23-VAC-112	IDEA Project Workshop	I	0:0:2	1
4	B23-VAC-302/304/306/308/310	Hindi Language Skills/ Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	V	2:0:0	1
5	B23-VAC-401/403/405/407/409/411	NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities	VII	0:0:2	1
6	B23-MAC-201	Environmental Studies	IV	3:0:0	1
7	B23-MAC-202	Essence of Indian Traditional Knowledge	III	2:0:0	1
8	B23-MAC-301	Constitution of India	VI	2:0:0	1
Total					**8**

SEMESTER WISE STRUCTURE

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-III

(w.e.f. 2024-25)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B23-ECO-201	Analog and Digital Electronics	3:0:0	3	3	70	30	--	100	3
2	B23- ECO -203	Computer Organization and Architecture	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-205	Data Structure and Algorithms	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-207	Electrical Machine-I	3:0:0	3	3	70	30	--	100	3
5	B23-ECO-209	Electric Power Generation	3:0:0	3	3	70	30	--	100	3
6	B23-HSM-201	Organizational Behaviour	3:0:0	3	3	70	30	--	100	3
7	B23-ECO-211	Analog and Digital Electronics Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-213	Data Structure and Algorithms Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-215	Electrical Machine Lab-I	0:0:2	2	1	--	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
TOTAL				**26**	**22**	**420**	**400**	**180**	**1000**	

Note:

- **NCC/NSS/Sports/Yoga/Technical or Cultural Club/society activities will be joined by students in the second year also and will be evaluated in the 7th semester by the institute based upon a continuous evaluation model as per guidelines.**

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-IV

(w.e.f. 2024-25)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B23-BSC-203	Mathematics-III	3:1:0	4	4	70	30	--	100	3
2	B23-ECO-202	Electrical Measurement and Instrumentation	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-204	Electrical Machine-II	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-206	Network Analysis and Synthesis	4:0:0	4	4	70	30	--	100	4
6	B23-ECO-208	Object Oriented Programming	3:0:0	3	3	70	30	--	100	3
7	B23-HSM-302	Intellectual Property Rights (IPR) and Regulatory	3:0:0	3	3	70	30	--	100	3
8	B23-ECO-210	Electrical Measurement and Instrumentation Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-212	Electrical Machine Lab-II	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-214	Object Oriented Programming Lab	0:0:2	2	1	--	40	60	100	3
11	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	--	100	3
TOTAL				**29**	**24**	**490**	**330**	**180**	**1000**	

Note:

- All students have to undertake the industrial training for 4 to 6 weeks after the 4th semester, which will be evaluated in the 5th semester.

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-V

(w.e.f. 2025-26)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B23-ECO-301	Control System	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-303	Data Base Management System	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-305	Electromagnetic Theory	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-307	Operating System	3:0:0	3	3	70	30	--	100	3
5	B23-ECO-309	Power System-I	3:0:0	3	3	70	30	--	100	3
6	B23-HSM-202	Innovation, Startups and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
7	B23-ECO-311	Control System Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-313	DBMS Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-315	Power System-I lab	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-317	Industrial Training-I	0:0:2	2	1	--	100	--	100	3
11	B23-VAC-302/304/306/308/310	Hindi Language Skills/ Sanskrit Language Skills/ German Language Skills/ Japanese Language Skills/ French Language Skills	2:0:0	2	1	--	100	--	100	3
TOTAL				**28**	**23**	**420**	**500**	**180**	**1100**	

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-VI

(w.e.f. 2025-26)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B23-ECO-302	Renewable Energy Resources	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-304	Power System-II	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-306	Python Programming	3:0:0	3	3	70	30	--	100	3
4	B23-ECO-308	Signals and Systems	3:0:0	3	3	70	30	--	100	3
5	--	Program Elective-I	3:0:0	3	3	70	30	--	100	3
6	--	Program Elective-II	3:0:0	3	3	70	30	--	100	3
7	B23-ECO-310	Power System-II Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-312	Python Programming Lab	0:0:2	2	1	--	40	60	100	3
9	B23-ECO-314	Signals and Systems Lab	0:0:2	2	1	--	40	60	100	3
10	B23-ECO-316	Project-I	0:0:4	4	2	--	100	--	100	3
11	B23-MAC-301	Constitution of India	2:0:0	2	1	--	100	--	100	3
TOTAL				**30**	**24**	**420**	**500**	**180**	**1100**	

Note:

- TheCourseofbothProgramElectiveandOpenElectivewillbeofferedat1/3rd strength or 20 students (whichever is smaller) of the section.
- All students have to undertake the industrial training for 6 to 8 weeks after the 6th semester, which will be evaluated in the 7th semester.

Program Elective-I		Program Elective-II	
B23-EEP-302	Power Electronics and Drives	B23-EEP-310	High Voltage Engineering and Facts Devices
B23-EEP-304	Transducer and Sensors	B23-EEP-312	Computer Added Power System Analysis
B23-EEP-306	Soft Computing	B23-EEP-314	Internet Technology and Management
B23-EEP-308	Software Engineering	B23-EEP-316	Computer Network

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-VII

(w.e.f. 2026-27)

S. No.	Course No./ Code	Subject	L:T:P	Hours / Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester	Internal Assessment	Practical Exam	Total	
1	B23-ECO-401	AIML	3:0:0	3	3	70	30	--	100	3
2	B23-ECO-403	Big Data Analytics	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-405	Power System Protection and Relaying	3:0:0	3	3	70	30	--	100	3
4	--	Program Elective-III	3:0:0	3	3	70	30	--	100	3
5	--	Open Elective-I	3:0:0	3	3	70	30	--	100	3
6	B23-ECO-407	Data Analytics Lab	0:0:2	2	1	--	40	60	100	3
7	B23-ECO-409	AIML Lab	0:0:2	2	1	--	40	60	100	3
8	B23-ECO-411	Project-II	0:0:6	6	3	--	40	60	100	3
9	B23-ECO-413	Industrial Training-II	0:0:2	2	1	--	100	--	100	3
10	B23-VAC-401/403/405/407/409/411	NCC/NSS/Sports/ Yoga/ Technical or Cultural Club/Society activities	0:0:2	2	1	--	100	--	100	--
TOTAL				**29**	**22**	**350**	**470**	**180**	**1000**	

Note:

- **The** course of both Program Elective and Open Elective will be offered at1/3rd strength or 20 students (whichever is smaller) of the section.
- B23-VAC-401/403/405/407/409/411 are single credit value added courses in which NCC/NSS/Sports/Yoga/Technical or Cultural Club/Society activities will be joined by students in first year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines**.**

Program Elective-III		Open Elective-I	
B23-EEP-401	Digital Signal Processing	B23-EEO-401	Biomedical Signal Processing
B23-EEP-403	Microprocessor and Microcontroller	B23-EEO-403	International and Corporate Law
B23-EEP-405	Industrial Automation	B23-EEO-405	Internet of Things
B23-EEP-407	Software Verification, Validation and Testing	B23-EEO-407	Digital Image Processing

B.Tech. Electrical and Computer Engineering (ECO)

KURUKSHETRA UNIVERSITY, KURUKSHETRA

SEMESTER-VIII

(w.e.f. 2026-27)

S. No.	Course No./Code	Subject	L:T:P	Hours / Week	Credits	Examination Schedule (Marks)				Duration of Exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	--	Program Elective-IV	3:0:0	3	3	70	30	--	100	3
2	--	Program Elective-V	3:0:0	3	3	70	30	--	100	3
3	B23-ECO-402	Project-III / Internship/ Startups/ Research Lab	0:0:20	20	10	--	200	200	400	3
TOTAL				**26**	**16**	**140**	**260**	**200**	**600**	

Note:

- The course of both Program Elective and Open Elective will be offered at 1/3rd strength or 20 students (whichever is smaller) of the section.
- In case of semester-long project work done in industry/external institute, the Program Elective- IV and Open Elective-IV may be offered in online mode through MOOC courses offered by SWAYAM/NPTEL portal. These courses may be done from 3rd semester till completion of the degree.

Program Elective -IV		Program Elective -V	
B23-EEP-402	Electric Vehicle Technology	B23-EEP-410	Energy Audit and Conservation
B23-EEP-404	Power System Restructuring and Deregulation	B23-EEP-412	Smart Grid
B23-EEP-406	Robotics and Automation	B23-EEP-414	Data Mining
B23-EEP-408	Block Chain Technology	B23-EEP-416	Mobile App Development

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Students of Electrical and Computer Engineering are offered to earn **ADDITIONAL 18-20 CREDITS** through MOOCs/SWAYAM courses as per the 'Guidelines to implement the SWAYAM/MOOCs/ other authorized online courses (OAOC) of Kurukshetra University, Kurukshetra' in any of the emerging areas mentioned below for the award of the degree of:

1. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Electric Vehicles
2. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Energy Engineering
3. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Artificial Intelligence and Machine Learning
4. B.Tech. (Hons.) Electrical and Computer Engineering with Specialization in Data Science
5. B.Tech. Electrical and Computer Engineering with a Minor Degree in Mechatronics
6. B.Tech. Electrical and Computer Engineering with a Minor Degree in VLSI Design
7. B.Tech. Electrical and Computer Engineering with a Minor Degree in Internet of Things (IoT)
8. B.Tech. Electrical and Computer Engineering with a Minor Degree in Cyber Security

B23-ECO-201		Analog and Digital Electronics					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3Hrs.**

Purpose: Students will grasp fundamental concepts of analog and digital electronics.	
Course Outcomes (CO)	
CO1	To understand the concept of carrier transport phenomena in semiconductors and diodes such as p-n Junction diode and tunnel diode.
CO2	To understand the detailed operation of BJT and the calculation of its parameters using transistor models.
CO3	Students will be able to understand the basic logic gates and will be able to apply minimization techniques for reducing a function up to four variables.
CO4	Students will be able to design combinational & Sequential circuits and their analysis.

UNIT-I

Charge Carriers Transport: Energy bands in intrinsic and extrinsic silicon; Carrier transport: diffusion current, drift current, mobility, and resistivity; Generation and recombination of carriers; Continuity equation, PN Junction: Basic Structure, small signal equivalent circuit of p-n diode, derivation of barrier potential and diode current equation, Simple diode circuits: clipping, clamping and rectifiers, Zener diode and its application as voltage regulator.

UNIT-II

Bipolar Junction Transistor: Basic principle of operation, Current gains: derivation of α, β, ϒ and their relationship. Various modes of operation of BJT, Base Width Modulation, Transistor hybrid model, h-parameter equivalent circuit of transistor, Analysis of transistor amplifier using h-parameters, calculation of input impedance, output impedance and voltage gain.

UNIT-III

Number Systems: Decimal, binary, octal, hexadecimal number system and conversion, binary weighted codes, signed numbers, 1s and 2s complement codes, Binary arithmetic

Boolean Algebra: Binary logic functions, Boolean laws, truth tables, associative and distributive properties, De-Morgans theorems, realization of switching functions using logic gates.

UNIT – IV

Combinational Logic: Switching equations, canonical logic forms, sum of product & amp; product of sums, Karnaugh maps, two, three and four variable K-maps, simplification of expressions.

Analysis & design of Combinational Logic: Introduction to combinational circuits, Adder and Subtractor circuits (half & amp; full adder & amp; subtractor, Encoder, Decoder, Comparator, Multiplexer, De-Multiplexer and Parity Generator

Sequential circuits: A 1-bit memory, clocked SR flip flop, J- K, T and D types flip flops

Text Books:

1. Millman & amp; Halkias: Integrated Electronics, TMH.
2. Boylestad & Nashelsky: Electronic Devices & Circuit Theory, PHI.
3. M. M. Mano, & quot; Digital design & quot;, Pearson Education India, 2016.
4. Donald P. Leach and Albert Paul Malvino, Digital Principles and Applications, 8th Edition, TMH, 2003

Reference Books:

1. B.G. Streetman, Solid State Electronic Devices, Prentice Hall of India, New Delhi, 1995.
2. E S. Yang, Microelectronic Devices, McGraw Hill, Singapore, 1988.
3. S. Salivahanan and Naresh Kumar, Electronics devices and circuits, McGraw Hill,1998.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-203		Computer Organization and Architecture					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3Hrs.**

Purpose: Students will grasp fundamental computer architecture concepts and learn essential skills for building cost-effective computer systems.

Course Outcomes (CO)	
CO1	Be familiar with the internal organization and operations of a computer.
CO2	Be familiar with the design tradeoffs in designing and constructing a computer processor.
CO3	Be aware of the CPU design, including the RISC/CISC architectures.
CO4	Be acquainted with the basic knowledge of I/O devices and select the appropriate interfacing standards for I/O devices.

UNIT- I

Data representation and Computer arithmetic: Introduction to Computer Systems, Organization and architecture, Von Neumann Architecture, evolution and computer generations.

Memory Organization: Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.

UNIT-II

Basic Computer organization and Design: Instruction codes, computer registers and common bus system, computer instructions, timing and control, instruction cycle: Fetch and Decode, Register reference instructions; Memory reference instructions. Input, output and Interrupt: Instructions, Program interrupt, Interrupt cycle, Control Memory, address sequencing, Micro program Example, micro instruction format, Horizontal Vs Vertical micro-programming, design of control Unit, microprogram sequencer, Hardwired v/s Micro-programmed Control.

UNIT-III

Central Processing Unit: General register organization, stack organization, instruction formats (Zero, One, Two and Three Address Instruction), addressing modes.

CISC and RISC: features and comparison. Pipeline and vector Processing, Parallel Processing, Flynn's taxonomy, Pipelining, Instruction Pipeline, Basics of vector processing and Array Processors.

UNIT-IV

Input-output organization: I/O interface. I/O Bus and interface modules, I/O versus Memory Bus. Asynchronous data transfer: Strobe control, Handshaking, Asynchronous serial transfer. Modes of Transfer: Programmed I/O, Interrupt-driven I/O. Direct memory Access, DMA controller and transfer.

Suggested Books:

1. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Sixth
2. Edition, Pearson Education, 2003.
3. Morris Mano, M., “Computer System Architecture,” 3/e, Pearson Education, 2005.
4. John P. Hayes, “Computer Architecture and Organization,” 3/e, TMH, 1998.
5. David A. Patterson and John L. Hennessy, “Computer Organization and Design: The
6. Hardware/Software interface”, Third Edition, Elsevier, 2005.
7. V.P. Heuring, H.F. Jordan, “Computer Systems Design and Architecture”, Second Edition, Pearson
8. Education, 2004.
9. Carl Hamacher, Zvonko Vranesic and Safwat Zaky, “Computer Organization”, Fifth Edition, Tata
10. McGraw Hill, 2002

B23-ECO-205		Data Structure and Algorithms					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To introduce Data Structure principles for software system design and implementation							
Course Outcomes							
CO 1	To elaborate elementary data organizations and identify different data structure operations such as insertion, deletion, and traversal.						
CO 2	To examine various operations of Stack and Queue.						
CO 3	To identify the role of link lists in data structure and discuss various types of linked lists.						
CO 4	To explore Terminologies of trees and graphs.						

Note: The paper setter will set the paper as per the question paper templates provided.

UNIT-I

Introduction: Basic Terminologies: Elementary Data Organizations, Data Structure Operations: Insertion, Deletion, Traversal, etc. Analysis of an Algorithm, Asymptotic Notations, and Time-Space Trade-Off. Searching: Linear Search and Binary Search Techniques and Their Complexity Analysis.

Sorting: Objectives and properties of different sorting algorithms: selection sort, bubble sort, insertion sort, quick Sort, and merge sort.

UNIT-II

Stacks and Queues: Describes the stack and its operations. Queue, Types of Queues: Simple queue, circular queue, priority queue; operations on each type of queue.

UNIT-III

Linked Lists: Linked lists and their types: Representation in memory: algorithms of several operations: traversing, searching, insertion, and deletion.

UNIT-IV

Trees: Basic Tree Terminologies, Different Types of Trees: Binary Tree, Binary Search Tree, and AVL Tree: tree operations on each of the trees.

Graph: Basic Terminologies and Representations, Graph Search, and Traversal.

TEXTBOOKS:

1. Fundamentals of Data Structures, Illustrated Edition by Ellis Horowitz, Sartaj Sahni, Computer Science Press.
2. Data Structures, Revised 1st Edition by Seymour Lipschutz, Scaum's Outline Series McGraw Hill

REFERENCE BOOKS:

1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison Wesley Publishing Company
2. How to Solve it by Computer, 2nd Impression by R. G. Dromey, Pearson Education.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-207	Electrical Machine-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To familiarize the students with electric machines and transformers.							
Course Outcomes							
CO1	To understand the concept, working, operation, and maintenance of single-phase transformer						
CO 2	To understand the concept, working, operation, maintenance of the phase transformer & conversion from three-phase to multiple phases						
CO 3	To understand the construction, working, and operation of D.C. Generator						
CO 4	To understand the concept, working, operation, and testing of D.C. Motor						

UNIT – I

TRANSFORMERS: Principle, construction of core, EMF equation, winding & tank, cooling, operation, testing of single-phase transformer, equivalent circuit, phasor diagram, parameters determination, P.U representation of parameters, regulation, losses & efficiency, separation of iron losses, parallel operation, all-day efficiency, Sumpner's test, specifications of transformer, maintenance of transformer, difference between power transformer and distribution transformer.

UNIT – II

Three phase transformers: Types and their comparative features.
Auto-Transformer: Principle, construction, comparison with two winding transformers, applications.
Nature of magnetizing current: plotting of magnetizing current from B-H curve, Inrush current.
Phase-Conversion: Three to two phases, three to six phases, and three to twelve phases of conversions. Introduction to three windings transformer, tap-changing & phase-shifting transformers.

UNIT – III

D.C. Generator- Principle & construction of D.C. generator, simplex lap, wave winding, E.M.F. equation, types, voltage build-up, armature reaction, compensating winding, the function of the commutator, methods of improving commutation, load characteristics, parallel operation.

UNIT- IV

D.C. Motor- Principle of DC motors, function of commutator in DC motors, torque and output power equations, load characteristics, losses, starting, starters, speed control, braking, testing, Swinburne test, Hopkinson test, Ward Leonard Method, efficiency & applications.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", New York, McGraw Hill Education, 2013.
2. A. E. Clayton and N. N. Hancock, "Performance and design of DC machines", CBS Publishers, 2004.
3. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
4. P. S. Bimbhra, "Electrical Machinery", Khanna Publishers, 2011.
5. I. J. Nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-209		Electrical Power Generation					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**

Purpose: Students will familiarize with power plants economics, cost factors, and overview of conventional power plants.

Course Outcomes

CO 1	To study, Load and loading forecasting, Power plant economics, Tariffs and power factor improvement used in power generation
CO 2	To understand tariffs, importance of power factor and working of Thermal power plants.
CO 3	To understand working of Thermal power plants.
CO 4	To understand working of Nuclear power plants, Diesel power plants & Combined working of thermal & hydel plants.

UNIT-I

Load and Load Forecasting: Load curves, maximum demand, load factor, diversity factor, capacity factor, utilization factor, types of load, load forecasting, base load and peak load.

Power Plant Economics: Choice of type of generation, size of generator and number of units, cost of electrical energy, depreciation of plant, effect of load factor on cost of Electrical Energy.

UNIT-II

Tariffs and Power Factor Improvement: Different types of tariffs and methods of power factor improvement.

Hydro power plants: Choice of site, classification of hydro electric plants, main parts and working of plants and their layouts, characteristics of hydro electric generators. Speed governing—Purpose, hydraulic type governor functioning

UNIT-III

Thermal Power Plants: Working of power plants and their layout, Main parts and working of stations-thermodynamic cycles, fuel handling, combustion and combustion equipment, problem of ash disposal, circulating water schemes and supply of makeup water, economizer, air pre-heater feed water heaters and dust collection.

UNIT-IV

Nuclear power plants: Choice of site, classification of plants, main parts, layout and their working, associated problems. Diesel Power Plants: Diesel plant equipments, diesel plant layout and their working, application of diesel plants.

Combined working of plants: Advantages of combined operation plant requirements of base load and peak load operation. Combined working of run-off river plant and steam plant**.**

REFERENCES:

1. C.L. Wadhwa, ―Electric Power Systemǁ (Willey Eastern Ltd).
2. I. J. Nagnath and D.P. Kothari ―Power System Engineeringǁ TMGH.
3. Power Genreation by B.R Gupta, S.Chand.
4. Power System Engg. By R.K Rajput, Luxmi Publication.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-HSM-201	Organizational Behavior						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**0**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: The objective of this course is to help students converse with the basic concepts of organizational behaviour to nurture managerial skills.							
Course Outcomes							
CO1	An overview of organizational behaviour as a discipline and understanding the concept of individual behaviour.						
CO2	Understand the concept and importance of personality and emotions and their importance in decision-making and effective leadership.						
CO3	Enabling the students to know about the importance of effective motivation and its contribution in group dynamics and resolving conflicts.						
CO4	Understand how to overcome organizational stress by maintaining proper organizational culture and effective communication.						

UNIT- I

Introduction to organizational behavior: Concept and importance of organizational behavior, role of Managers in OB, challenges and opportunities for OB.

Foundation of individual behavior: Biographical characteristics, concept and types of abilities, concept of values and attitude, types of attitude, attitude and workforce diversity.

UNIT- II

Introduction to personality and emotions: Definition and Meaning of Personality, Determinants of Personality, Personality Traits Influencing OB, Nature and Meaning of Emotions, Emotions dimensions, concept of Emotional intelligence.

Perception and individual decision making: meaning of perception, factors influencing perception, rational decision-making process, the concept of bounded rationality. Leadership-trait approaches, behavioural approaches, situational approaches, and emerging approaches to leadership.

UNIT-III

Motivation: Concept and theories of motivation, theories of motivation-Maslow, two-factor theory, theory X and Y, ERG Theory, McClelland's theory of needs, goal setting theory, application of theories in the organizational scenario, the linkage between MBO and goal setting theory.

Foundations of group behaviour and conflict management: Defining and classifying of groups, stages of group development, Informal and formal groups- group dynamics, managing conflict and negotiation, causes of group conflicts, managing intergroup conflict through resolution.

UNIT-IV

Introduction to Organizational Communication: Meaning and importance of communication process, importance of effective communication, organizational stress: definition and meaning sources and types of stress, impact of stress on organizations, stress management techniques.

Introduction to Organization Culture: Meaning and nature of organization culture, types of culture, managing cultural diversity, managing change and innovation-change at work, resistance to change, a model for managing organizational change.

Text Books:

1. Colquitt, Jason A., Jeffery A. LePine, and Michael Wesson. Organizational Behavior: Improving Performance and Commitment in the Workplace. 5th ed. New York: McGraw-Hill Education, 2017.
2. Hitt, Michael A., Miller, and Adrienne Colella. Organizational Behavior. 4th ed. Hoboken, NJ: John Wiley, 2015.
3. Robbins, Stephen P., and Judge. Organizational Behavior. 17th ed. Harlow, UK: Pearson Education, 2017.

Reference Books:

1. Schermerhorn, Hunt and Osborn, Organisational behavior, John Wiley.
2. Udai Pareek, Understanding Organisational Behaviour, Oxford Higher Education.
3. Mc Shane & Von Glinov, Organisational Behaviour, Tata Mc Graw Hill.
4. Aswathappa, K., Organisational Behaviour– Text and Problem, Himalaya Publication.

B23-ECO-211	Analog and Digital Electronics Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**

Purpose: The students will familiarize themselves with digital and analogue devices.	
Course Outcomes (CO)	
CO1	To teach the students how to experimentally plot the VI characteristics of various diodes such as p-n diode, Zener diode etc. find the threshold voltage and Zener breakdown voltage from the VI curve.
CO2	To teach the students how to experimentally find the values of various parameters of Transistor such as voltage gain, current gain etc.
CO3	To verify truth tables of basic logic gates and design various gates using universal gates.
CO4	To design various Combinational & Sequential circuits and verify their operation

Note: The paper setter will set the paper as per the question paper templates provided.

List of Experiments

1. To study the VI characteristics of p-n diode in forward and reverse bias and find the threshold voltage from the VI curve.
2. To study the operation of Zener diode as a voltage regulator.
3. To study the operation of half-wave and full wave rectifiers and calculate their ripple factor values.
4. To study the operation of series and parallel Clippers using P-N junction diodes.
5. To study the operation of clampers using P-N junction diodes.
6. To experimentally plot the input and output characteristics of a given BJT transistor in CE configuration and calculate its various parameters.
7. To experimentally Plot the input and output characteristics of a given BJT transistor in CB configuration and calculate its various parameters.
8. Familiarization with Digital Trainer Kit and associated equipment.
9. Study of TTL gates AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
10. Design and realize a given function using K-Maps and verify its performance.
11. To verify the operation of Multiplexer and De-multiplexer.
12. To verify the operation of Comparator.
13. To verify the truth table of S-R, J-K, T, D Flip-flops.

Note: At least eight (8) experiments from the above list are mandatory to perform for the students.

B23-ECO-213	Data Structure and Algorithms Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: To Introduce Data Structures principles and paradigms for designing and implementing software.							
Course Outcomes (CO)							
CO1	To introduce the basic concepts of Data structure, basic data types, searching and sorting based on array data types.						
CO2	To introduce the structured data types like Stacks and Queue and its basic operation's implementation.						
CO3	To introduce implementation of linked list.						
CO4	To introduce the concepts of Tree.						

List of Experiments

1. Write a program to implement array operations.
2. Write a program to implement memory allocation and de-allocation in array.
3. Write a program for search methods.
4. Write a program for insertion sort
5. Write a program for selection sort
6. Write a program for bubble sort.
7. Write a program to implement Stack and its operation.
8. Write a program to implement Queue and its operation.
9. Write a program to implement singly linked list for the following operations: Create, Display, searching, traversing and deletion.
10. Write a program to implement insertion, deletion and traversing in B tree.

Note: At least eight (8) experiments from the above list are mandatory to perform for the students.

B23-ECO-215	Electrical Machines Lab-I						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: The students will do various experiments on the Transformer and DC machine.							
Course Outcomes (CO)							
CO1	To teach the students how to experimentally find various parameters and losses of the single-phase transformer.						
CO2	Experimental analysis of parallel operation and Scott connection.						
CO3	To perform various tests on DC machines to analyse various parameters.						
CO4	To analyze various characteristics of DC machines and transformers.						

LIST OF EXPERIMENTS

1. To find turns ratio, polarity & mark dot convention of a 1-phase transformer.
2. To perform open & short circuit tests on a 1-phase transformer& find parameters.
3. To perform Sumpner's Back-to-Back test on 1-phase transformer& find parameters.
4. Parallel operation of two 1-phase transformers and observe load sharing.
5. To convert three phase supply to 2-phase by Scott-connection, compare line Currents theoretically & practically for unbalanced load.
6. To perform load test on DC shunt generator & find efficiency& observe speed at Different load.
7. Speed control of DC shunt motor by armature & field control method, draw graph Between speed & field current.
8. To perform Swinburne's test of DC shunts motor and find efficiency.
9. To perform Hopkinson's test of DC shunts M/Cs.
10. To perform Ward Leonard method for speed control DC shunts motor.
11. To make various types of three phase connections, using three single phase Transformers, study relevant features
12. Characteristics for compound, series shunt generators.

Note: At least eight experiments should be performed from above list.

B23-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
2	**-**	**-**	**1**	**100**	**-**	**100**	**3 Hrs.**

Purpose: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of the roots of the knowledge system, analyze and apply to their day-to-day life.

Course Outcomes

CO1	The students will be able to understand, connect and explain the basics of Indian traditional knowledge from a modern scientific perspective.
CO2	The students will be able to understand Holistic Health using the Indian Knowledge System.
CO3	The students will be able to Manage their thoughts and Emotions and will learn positivity, self-regulation, and control.
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System.

UNIT 1

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karam yoga, Benefits of Rajyoga and Karamyoga.

UNIT 2

Holistic Health using Indian Knowledge System: Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras. Physical, Mental, Emotional and Spiritual health using traditional knowledge.

UNIT 3

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self-Mastery.

UNIT 4

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self-motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well-being.

Reference and Text Books:

Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning

Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.

Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.

Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation.

Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.

Prakartik Swasthya Shastra, Publisher Natural Lifestyle

Note: The paper setter will set the paper as per the question paper templates provided.

B23-BSC-203	MATHEMATICS-III [For Mechanical, (Electrical & Comp. Engg.) students only]						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 Hrs.**

Purpose: To familiarize the prospective students with Laplace Transform to solve differential equations and how to apply the principles of probability & statistics to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.

Course Outcomes	
CO1	Introduction about the concept of Laplace transform and how it is useful in solving definite integrals and initial value problems.
CO 2	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.
CO 3	Probability theory provides models of probability distributions (theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications.
CO4	To make the students familiar with basic statistics, including measures of central tendency, measures of dispersion, correlation, and regression.

UNIT-I (08Hrs)

Laplace Transform: Introduction, Laplace Transform of Elementary Functions, Basic properties of Laplace transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ordinary differential equations by Laplace Transform method.

UNIT-II (10Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem. Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-III (10 hrs)

Continuous Probability distribution: Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV (12hrs)

Basic Statistics: Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons,2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8. Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-202	Electrical Measurement and Instrumentation						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3 Hrs.**

Program Objective (PO): To provide knowledge of Measurement of Electrical and Electronics Instruments to the students.

Course Outcomes (CO)

CO1	To understand the concept of units, errors, and measuring system fundamentals.
CO2	To understand the concept of measuring instruments
CO3	To understand the concept of low & high resistance measurements, A.C. bridges
CO4	To understand the concept of watt meters, energy meters& transducers

UNIT–I

UNITS, STANDARDS & ERRORS: S.I. units, Absolute standards (International, Primary, Secondary & Working Standards).True Value, Errors (Gross Systematic Random): Static characteristics of Instruments (Accuracy, precision, Sensitivity ,Resolution & threshold).

MEASURINGSYSTEMFUNDAMENTALS: Classification of instruments (Absolute & Secondary Instruments: indicating, recording &integrating instruments: based upon Principle of operation). Generalized instrument (Block diagram, description of blocks). Three forces in electromechanical indicating instrument (Deflecting, controlling &damping forces).

UNIT–II

MEASURING INSTRUMENTS: Construction, operating principle, Torque equation, shape of scale, use as Ammeter or as Voltmeter (Extension of Ranges). Use on AC/DC or both. Advantages & disadvantages, errors (both on AC/DC) of PMMC types, electrodynamics type, moving iron type (attraction, repulsion & combined types). Induction type, electrostatic type instruments. Introduction of Q meter, VTVM.

UNIT–III

LOW & HIGH RESISTANCE MEASUREMENTS: Wheat stone bridge; Kelvin's double bridge method, Difficulties in high resistance measurements, Measurement of high resistance by direct deflection, loss of charge method, Megaohm Bridge & meggar.

A.C. BRIDGES: General balance, Ckt. & Phasor diagram, applications, advantages/disadvantages of: Maxwell's inductance, inductance-capacitance, Hays, Anderson, Owens, De-Sauty's, and Schering & Weins Bridges. Shielding & earthling

UNIT–IV

TRANSDUCERS & THEIR APPLICATIONS: Types of Transducers, Classifications, Measurement of Displacement, pressure, force, temperature& light

WATTMETERS & ENERGY METERS: Construction, operating principle, torque equation, shape of scale, errors, Advantages & disadvantages of Electrodynamics & induction type watt meters; single phase induction type Energy meter.

REFERENCES:

A Course in Elect. & Electronics Measurement & Instrumentation by A.K. Sawhney; Khanna Pub.
Electronics & Electrical Measurement & Instrumentation by J.B. Gupta, Kataria & Sons.
Electronics Instrumentation & Measurement technique, W.D. Copper & A.dHelfrick.
Measuring Systems by E.O. Doeblin; TMH.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-204	Electrical Machines-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: To familiarize the students with the basics of Electrical Machines							
Course Outcomes							
CO1	Understand the concepts of rotating magnetic fields and three phase Induction machine.						
CO 2	Understand the operation of single-phase induction motors.						
CO 3	To Analyze performance characteristics of synchronous machines.						
CO 4	To study the concepts and operation of various special-purpose machines.						

UNIT-I

Induction Machines:

Basic concept of Induction machines: winding factors, generated e.m.f. and m.m.f distribution, a.c. winding, rotating magnetic field.

3-phase Induction Motor: Construction, features, production of torque, phasor diagram, equivalent circuit, performance analysis, torque–slip characteristics, running, light and blocked rotor test, load test on 3-ph I.M.

UNIT-II

Starting of 3-ph I.M. Starting methods of squirrel cage and wound rotor induction motor.

Induction Generator-Operation, applications, advantages.

Single-phase induction motors: -

Constructional features & double-revolving field theory, equivalent circuit, determination of parameters. Split phase, starting methods, types& applications.

UNIT-III

Three Phase Synchronous Generators: Principle, construction, EMF equation, armature winding, armature reaction, equivalent circuit, voltage regulation, Output power equation, power angle curve, two reactance theory, slip test, Transient and sub transient reactance, synchronization, parallel operation.

Three Phase Synchronous Motor: Construction, Principle of operation, Equivalent circuit, torque, power developed, starting, V-curve, Hunting-causes, effects & reduction, synchronous condenser applications.

Comparison between induction motor and synchronous motor.

UNIT-IV

Special Purpose Motors: Universal motor, Repulsion motor, Single-phase series motor, Single-phase Synchronous motor, Stepper Motor, Linear Induction motor, Reluctance motor, Servo motor, Hysteresis motor, Brushless DC motor, Permanent Magnet DC (PMDC) motor, Schrage motor.

Suggested Books:

1. A. E. Fitzgerald and C. Kingsley, “Electric Machinery”, McGraw Hill Education, 2013.
2. M. G. Say, “Performance and design of AC machines”, CBS Publishers, 2002.
3. P. S. Bimbhra, “Electrical Machinery”, Khanna Publishers, 2011.
4. I. J. Nagrath and D. P. Kothari, “Electric Machines”, McGraw Hill Education, 2010.
5. A. S. Langsdorf, “Alternating current machines”, McGraw Hill Education, 1984.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-206	Network Analysis and Synthesis						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
4	**0**	**0**	**4**	**70**	**30**	**100**	**3 Hrs.**
Purpose	To familiarize the students with the concepts of topology, transient analysis, network modelling, filters and methods of network analysis and synthesis for solving simple and complex circuits.						
Course Outcomes							
CO1	To understand the time domain analysis of first and Second-order linear circuits.						
CO2	To understand the concept of N/W topologies and network analysis using graph theory.						
CO3	To understand various parameters of two-port networks & their relationship.						
CO4	To understand the concept of synthesis of one port network.						

UNIT-I

TIME DOMAIN ANALYSIS: Transients in First and Second-order linear circuits-RL, RC and RLC. First-order differential equation and solution, Time constant, Second-order homogeneous differential equation and solution, RL, and RC sinusoidal transient.

UNIT-II

NETWORK FUNCTIONS & GRAPH THEORY: Basic Laplace and Inverse Laplace transformation rules, Laplace of Unit step, Ramp, Impulse waveforms, Initial and Final value theorem, Step response of RL, RC and RLC using Laplace transforms, Terminal pairs or Ports, Network functions for one-port and two-port networks, the concept of poles and zeros in Network functions, Restrictions on pole and zero. Locations for driving point functions and transfer functions. Principles of network topology, graph matrices, and network analysis using graph theory.

UNIT-III

TWO PORT NETWORKS: Characteristics and Parameters of two-port networks**,** Network Configurations**,** short circuit Admittance parameters, open-circuit impedance parameters, Transmission parameters, hybrid parameters, conditions for reciprocity & symmetry of two-port networks in different parameters representations. Inter-relationships between parameters of two-port network sets, Expression of input & output impedances in terms of two port parameters, Inter-connection of two port networks.

UNIT-IV

NETWORK SYNTHESIS: Hurwitz polynomials**,** Properties of Hurwitz polynomials**,** Positive real functions, procedure of testing of PR functions, concept and procedure of network synthesis, properties of expressions of driving point immitances of LC networks. LC Network synthesis: Foster's I & II Form, Cauer's I & II form, RC & RL Network.

REFERENCES:

1. Network Theory Analysis & Synthesis: Smarajit Ghosh; PHI.
2. Network Analysis & Synthesis: F.F. Kuo; John Wiley & Sons Inc.
3. Circuit Theory, A. Chakarbarti, Dhanpat Rai
4. Introduction to modern Network Synthesis: Van Valkenburg; John Wiley.
5. Network Analysis: Van Valkenburg; PHI.
6. Networks and Systems: D.Roy Choudhury; New Age International.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO- 208		Object Oriented Programming					
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**

Purpose: To introduce the principles and paradigms of Object-Oriented Programming Language for design and implement the Object-Oriented System.

Course Outcomes

CO 1	To elaborate the basic concepts of object-oriented programming language And the representation.
CO 2	To allocate dynamic memory, access private members of class and the behaviour of inheritance and its implementation.
CO 3	To explore polymorphism, interface design and overloading of operator.
CO 4	To examine general purpose template and handling of raised exception during programming.

UNITI

Object Oriented Concepts, Introduction to Objects and Object-Oriented Programming, Encapsulation, Polymorphism, Overloading, Inheritance, Abstract Classes, Accessifier (public/ protected/ private), Class Scope and Accessing Class.

UNIT-II

Friend Function and Friend Classes, This Pointer, Dynamic Memory Allocation and Deallocation (New and Delete), Static Class Members, Constructors, parameter Constructors and Copy Constructors, Deconstructors, Introduction of inheritance, Types of Inheritance.

UNIT-III

Polymorphism, Virtual Functions, Pure Virtual Function, Abstract Base Classes, Static and Dynamic Binding.
Fundamentals of Operator Overloading, Rules for Operators Overloading.

UNIT-IV

Basics of C++ Exception Handling, Try, Throw, Catch, multiple catch, Re-throwing an Exception, Exception specifications.
Fundamentals of Templates: Function Templates, Overloading Template Functions.

Suggested Books:

1. The complete reference C ++ by Herbert 30hield Tata McGraw Hill.
2. Object Oriented Programming in Turbo C++ by Robert Lafore, 1994, The WAITE Group Press.
3. Shukla, Object Oriented Programming in c++, Wiley India.
4. C++ How to Program by H M Deitel and P J Deitel, 1998, Prentice Hall.
5. Programming with C++ By D Ravichandran, 2003, T.M.H.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-HSM-302	Intellectual Property Rights (IPR) and Regulatory						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
3	**-**	**-**	**3**	**70**	**30**	**100**	**3 Hrs.**
Purpose: The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concepts and Theories, and international regimes relating to IPR.							
Course Outcomes							
CO1	Students will be familiarized with the introduction to the patent concept and legal implications.						
CO2	Students will be able to understand the concept of copyright in detail.						
CO3	Students will be able to understand trademarks and the laws associated with them.						
CO4	Students will be able to learn about geographical Indications, industrial design and IPR in Information Technology.						

UNIT-I

Indian patent law: The Patents Act, 1970, amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. The procedure of obtaining patents, working of patents. Infringement.

UNIT-II

Copyrights: Introduction, works protected under copyright law, infringement. Introduction to copyright, international protection of copyright and related rights- an overview Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright Industrial.

Designs: Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000, procedure for obtaining design protection, revocation, infringement and remedies.

UNIT-III

Trademarks: Objectives, types, rights, protection of goodwill, infringement, passing off, need for protection of trademark, kinds of trademark , Indian trademarks law, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, procedural requirements of protection of trademarks, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

UNIT-IV

Geographical Indications: Objectives, Justification, International Position, Multilateral Treaties, National Level, Indian Position. Industrial Designs: Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Protection of Semiconductor chips, Domain Name Protection, Implications of intellectual property rights on the commercialization of Biotechnology products.

References:

1. N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow
David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012
2. Susan K Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge Univ. Press, 2003
3. N.S. Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company,2nd Edition, 2014
4. Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001
5. Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008
6. Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual
7. Property Rights, Universal Publishing House, 2014
8. Paul Torremans, Intellectual Property and Human Rights, Kluwer Law International, 2008
9. Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.
10. Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005.

Note: The paper setter will set the paper as per the question paper templates provided.

B23-ECO-210	Electrical Measurements and Instrumentation Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
0	**0**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**

Program Objective (PO): The main objective of the course is to impart the students with the knowledge of various types of instruments and measurement of resistance, inductance and capacitance, displacement, pressure & temperature by bridges and transducers

Course Outcomes (CO)	
CO1	To understand the different types of meters.
CO2	To measure the low and high resistance
CO3	To calculate the inductance, capacitance and frequency using bridge.
CO4	To measure the displacement, pressure & temperature by transducers.

LIST OF EXPERIMENTS

1. To convert & calibrate a D'Arsonnal type galvanometer into a voltmeter & an ammeter.
2. To calibrate an energy meter with the help of a standard wattmeter & stop watch.
3. To measure capacitance by Schering bridge.
4. To measure inductance by Maxwell's bridge.
5. To measure inductance by Hay's bridge.
6. To measure frequency by Wien's bridge.
7. To measure low resistance by Kelvin's Double bridge.
8. To measure high resistance by loss of charge method.
9. To measurer R, L, C, by Q meter.
10. To measure displacement by LVDT Transducer.
11. To measure displacement by Capacitance Transducer.
12. To measure pressure by Strain Gauge Transducer.
13. To measure temperature by RTD Transducer.

Note: At least Eight experiments should be performed from above list.

B23-ECO- 212	Electrical Machines Lab-II						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: To get acquaintance with the experiments of motors.							
Course Outcomes							
CO1	To perform load test and find out various parameters of three-phase induction motor.						
CO2	To understand effects of variation in different parameters on the operation of induction machine.						
CO3	To perform various tests on synchronous machine.						
CO4	To analyze various characteristics of synchronous machine.						

LIST OF EXPERIMENTS

1. To perform load test on a 3-phase induction motor / DC generator set and to determine the efficiency of induction motor.
2. Determine mechanical losses by light running of a 3-phase induction motor.
3. Study and starting of 1-phase induction motor. To perform light running and block rotor test and to determine the parameters of the equivalent circuit.
4. To perform the open circuit test and block rotor test on 3-phase induction motor and draw the circle diagram.
5. To perform & study effect of rotor resistance on a poly phase slip ring induction motor.
6. To calculate regulation by synchronous impedance method: -
   a. Conduct open and short circuit test on a three-phase alternator.
   b. Determine and plot variation of synchronous impedance with If
   c. Determine SCR
   d. Determine regulations for 0.8 lagging power factor, 0.8 leading power factor and unity PF.
7. To plot V curves of a synchronous machine.
   a. Determination of Xo of a synchronous machine.
   b. Measurement Xd & Xq (Direct axis and Quadrature axis reactance) by slip test
8. To measure Xq of synchronous machine (negative sequence reactance).
9. To calculate regulation by ZPF method.
10. To perform and study parallel operation of synchronous generators.

Note: At least eight experiments should be performed from above list.

B23-ECO- 214	Object Oriented Programming Lab						
Lecture	**Tutorial**	**Practical**	**Credit**	**Practical Exam**	**Internal Assessment**	**Total**	**Duration of Exam**
-	**-**	**2**	**1**	**60**	**40**	**100**	**3 Hrs.**
Purpose: Introduce Object-Oriented Programming principles and paradigms to design and implement Object-Oriented Systems.							
Course Outcomes							
CO1	To introduce the basic concepts of object-oriented programming language and its representation.						
CO2	To allocate dynamic memory, access private members of class and the behaviour of inheritance and its implementation.						
CO3	To introduce polymorphism, interface design and overloading of operator.						
CO4	To explore exception handling.						

LIST OF EXPERIMENTS

1. WAP to find the sum of individual digits of a positive integer.
2. WAP to generate the first n terms of the sequence.
3. WAP to implement class with encapsulation.
4. WAP to implement access specifiers.
5. WAP to illustrate New and Delete Keywords for dynamic memory allocation
6. WAP to implement default constructor, parameterized constructor and copy constructors.
7. WAP to implement operator overloading.
8. WAP to implement inheritance.
9. WAP to implement types of inheritance.
10. WAP to implement abstract class.
11. WAP to implement virtual function.
12. WAP to implement function overriding.
13. WAP to implement exception handling.
14. WAP to implement templates.

Note: At least Eight experiments should be performed from the above list.

B23-MAC-201	Environmental Studies						
Lecture	**Tutorial**	**Practical**	**Credit**	**Internal Assessment**	**End Semester Exam**	**Total**	**Duration of Exam**
2	**--**	**--**	**1**	**30**	**70**	**100**	**3 Hrs.**
Purpose: The students will familiarize themselves with natural resources, ecosystems, factors affecting environments and human relationship with nature.							
Course Outcomes (CO)							
CO1	Students will be able to understand the importance of natural resources.						
CO2	Students will understand the concept of an ecosystem, its structure, and its functions.						
CO3	The students will be able to understand the causes and impacts of various environmental pollution.						
CO4	Students will be able to understand the relationship between the human population and the environment.						

UNIT-1

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

UNIT-II

Ecosystems: Concept of an ecosystem, Structure and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-III

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

UNIT-IV

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Suggested readings:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad -380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R).

Note: The paper setter will set the paper as per the question paper templates provided.

Bachelor of Technology (Mechanical Engineering)
Kurukshetra University, Kurukshetra
MODIFIED SCHEME OF EXAMINATIONS w.e.f: 2024-25
(Semester - III)

S. No.	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam (Hours)
						End Semester Exam	Internal Assessment	Practical Exam	Total	
1	B23-BSC-201	Oscillations, Waves and Optics	3:1:0	4	4	70	30	--	100	3
2	B23-BSC-203	Mathematics-III	3:1:0	4	4	70	30	--	100	3
3	B23-MEC-201	Theory of Machines	3:1:0	4	4	70	30	--	100	3
4	B23-MEC-203	Mechanics of Solids-I	3:1:0	4	4	70	30	--	100	3
5	B23-ESC -201	Engineering Thermodynamics	3:1:0	4	4	70	30	--	100	3
6	B23-ESC -203	Measurement and Control	3:0:0	3	3	70	30	--	100	3
7	B23-MEC-205	Theory of Machines Lab	0:0:2	2	1	--	40	60	100	3
8	B23-MEC-207	Mechanics of Solids Lab	0:0:2	2	1	--	40	60	100	3
9	B23-MAC-201	Environmental Studies	3:0:0	3	1	70	30	--	100	3
Total				**30**	**26**	**490**	**290**	**120**	**900**	

- **NCC/NSS/Sports/Yoga/Technical or cultural club/society activities may also be joined by students in second year and will be evaluated in 7th semester by the institute based upon continuous evaluation model as per guidelines**

Bachelor of Technology (Mechanical Engineering)
Kurukshetra University, Kurukshetra
MODIFIED SCHEME OF EXAMINATIONS w.e.f: 2024-25
(Semester - IV)

S. No	Course No./ Code	Subject	L:T:P	Hours/ Week	Credits	Examination Schedule (Marks)				Duration of exam
						End	Internal	Practical	Total	

						Semester Exam	**Assessment**	**Exam**		**(Hours)**
1	B23-ESC -202	Materials Engineering	3:0:0	3	3	70	30	--	100	3
2	B23-MEC-202	Fluid Mechanics and Machines	4:1:0	5	5	70	30	--	100	3
3	B23-MEC-204	Mechanical Vibrations and Tribology	3:1:0	4	4	70	30	--	100	3
4	B23-MEC-206	Mechanics of Solids-II	3:1:0	4	4	70	30	--	100	3
5	B23-MEC-208	Manufacturing Technology	3:0:0	3	3	70	30	--	100	3
6	B23-HSM-202	Innovation, Start-up and Entrepreneurship	3:0:0	3	3	70	30	--	100	3
7	B23-ESC-204	Materials Engineering Lab	0:0:2	2	1	--	40	60	100	3
8	B23-MEC-210	Fluid Mechanics and Machines Lab	0:0:2	2	1	--	40	60	100	3
9	B23-MEC-212	Mechanical Vibrations and Tribology Lab	0:0:2	2	1	--	40	60	100	3
10	B23-MAC-202	Essence of Indian Traditional Knowledge	2:0:0	2	1	--	100	--	100	3
Total				**30**	**26**	**420**	**400**	**180**	**1000**	

Note: All students have to undertake the industrial training for 4 to 6 weeks after 4th semester which will be evaluated in 5th semester.

	B. Tech (3rd Semester) Mechanical Engineering						
B23-BSC-201	**OSCILLATIONS, WAVES AND OPTICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3h**
Purpose	To introduce the students with fundamentals of SHM, waves and optics for the application in Engineering fields						
CO1	Introduce the basic concepts of oscillation						
CO2	Familiarize with basic phenomenon related to propagation of waves.						
CO3	Introduce the basic concepts of interference, diffraction and their applications						
CO4	To make the students aware to the Laser technology						

UNIT- I

Simple harmonic motion: Equation of simple harmonic motion and its solution, characteristics of SHM, Energy of harmonic oscillator; Damped harmonic oscillator: Equation of damped oscillator and its solution, Energy of weakly damped harmonic oscillator, Quality factor or Q-Value of damped oscillator; Forced oscillations and resonance: Forced damped harmonic oscillator, Power supplied to the forced oscillator, Band width of resonance and Quality factor.

Unit- II

Waves: Travelling waves, Characteristics of waves, Mathematical representation of travelling waves, General wave equation, Phase velocity, Light source emit wave packets, Wave packet and bandwidth, Group velocity and real waves.

Propagation of Light Waves: Maxwell's equations, Electromagnetic waves and constitutive relations, Wave equation for free space, Uniform plane waves, Wave polarization, Energy density, Pointing vector and intensity, Radiation pressure and momentum, Light waves at boundaries, Wave incident normally on boundary, Wave incident obliquely on boundary: Law of reflection, Snell's law.

Unit- III

Interference: Huygens' principle, superposition of waves, conditions of sustained interference, Young's double slit experiment, Division of wave front: Fresnel's Biprism and its application; Division of Amplitude: Interference due to reflected and transmitted light, wedge shaped thin film, Newton's rings and its applications, Michelson interferometer and its application.

Diffraction: Types of diffraction, Fraunhofer diffraction due to single slit, Plane transmission grating: Theory, secondary maxima and minima, width of principal maxima, absent spectra, overlapping of spectral lines, determination of wavelength; Rayleigh criterion for limit of resolution, Dispersive and resolving power of diffraction grating.

Unit- IV

Lasers: Elementary idea of laser production: Stimulated absorption, Spontaneous and Stimulated emission; Einstein's theory of matter radiation interaction and A and B coefficients, amplification of light by population inversion, pumping schemes, different types of lasers: gas lasers (He-Ne, CO2), solid-state lasers (ruby, Neodymium), semiconductor lasers; Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, applications of lasers.

Text/Reference books

1. P.K. Diwan, Applied Physics for Engineers, *Wiley India Pvt. Ltd., India*
2. S.P. Taneja, Modern Physics for Engineers, *R. Chand & Company Ltd., India*
3. N. Subrahmanyam, B.Lal, M.n. Avadhanulu, A Textbook of Optics, S. Chand &Company Ltd., India
4. A. Ghatak, Optics, *McGraw Hill Education (India) Pvt. Ltd., India.*
5. E. Hecht, A.R. Ganesan, Optics, *Pearson India Education Services Pvt. Ltd., India.*

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech (3rd Semester) Mechanical Engineering						
B23-BSC-203	**MATHEMATICS-III [For Mechanical, Electrical & Comp. Sc. Engg. students only]**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**-**	**4**	**70**	**30**	**100**	**3 h**
Purpose	To familiarize the prospective students with Laplace Transform to solve the differential equations and how to apply the principles of probabilty & statistics to model and analyze various phenomena in fields like finance, economics, and engineering, aiding in making informed decisions and predicting outcomes.						

Course Outcomes	
CO1	Introduction about the concept of Laplace transform and how it is useful in solvingthe definite integrals and initial value problems.
CO 2	To introduce the fundamental concepts of probability to analyze and predict outcomes in real-life situations.
CO 3	Probability theory provides models of probability distributions(theoretical models of the observable reality involving chance effects) to be tested by statistical methods which has various engineering applications..
CO4	To make the students familiar about basic statistics including measures of central tendency, measures of dispersion, correlation, and regression.

UNIT-I (08 Hrs)

Laplace Transform: Introduction, Laplace Transform of Elementary Functions, Basic properties of Laplace Transform, Laplace transform of periodic functions, finding inverse Laplace transform by different methods, Convolution theorem, solving ordinary differential equations by Laplace Transform method.

UNIT-II (10 Hrs)

Basic Probability: Introduction, additive law of probability, Conditional Probability, Independent Events, Bayes' Theorem.

Random Variables: Discrete random variables, probability distribution, Probability mass function and distribution function, Expectation, Moments, Variance and standard deviation of discrete random variables.

UNIT-III (10 hrs)

Continuous Probability distribution:

Continuous random variables, probability distribution, Probability density function and distribution function, Expectation, Moments, Variance and standard deviation of Continuous random variables. Probability distributions: Binomial, Poisson and Normal - evaluation of statistical parameters for these three distributions.

UNIT-IV (12 hrs)

Basic Statistics:

Measures of Central tendency: Mean, median, quartiles, mode, Geometric mean, Harmonic mean, Measures of dispersion: Range, Quartile deviation, mean deviation, standard deviation, coefficient of variation, Moments, Skewness and Kurtosis, Correlation, Coefficient of correlation, methods of calculations, Lines of regression.

Suggested Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed.,Wiley, 1968.
5. N.P. Bali and Manish Goyal, A textbook of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
7. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.
8.Veerarajan T., Engineering Mathematics (for semester III), Tata McGraw-Hill, New Delhi, 2010.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech (3rd Semester) Mechanical Engineering						
B23-MEC-201	**THEORY OF MACHINES**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose:	Students will be able to design, differentiate and analyze various types of linkage mechanisms for obtaining specific motion and their applicability for optimal functioning in governors, gears and gear trains.						
Course Outcomes							
CO 1	Students will be able to understand the concept of various types of kinematic links, pairs and joints used in a mechanism and be able to solve the problems on degree of freedom of mechanisms. Students will also be able to explain the basic concepts of four- bar chain, single slider and double slider-crank chain mechanism.						
CO 2	Students will be able to determine and calculate the velocity & acceleration of various mechanisms and to construct an instantaneous centre for various link-mechanisms.						
CO 3	Students will be able to determine and calculate the values of various forces on engine parts and will be able to understand the concepts of flywheel and Governors.						
CO 4	Students will be able to construct cam profiles for various types of follower motions and will also be able to explain the basic concepts of gears and gear trains.						

UNIT-I

Simple Mechanisms: Introduction to mechanism and machine, types of constrained motion, rigid and resistant body, Kinematic links and pairs, types of joint, degree of freedom, classification of kinematic pairs, kinematic chain, linkage.

Mechanism and structure: Mobility of mechanisms, equivalent mechanism, Four bar chain mechanism, inversion of four bar chain, single slider-crank chain mechanism, inversion of single slider-crank chain mechanism, double slider-crank chain mechanism, inversion of double slider-crank chain mechanism.

UNIT-II

Velocity Analysis: Absolute and relative motions, vectors, addition and subtraction of vectors, motion of a link, velocity images, angular velocity of links, velocity of four-link mechanism, velocity of rubbing, velocity of slider-crank mechanism, velocity of crank and slotted-lever mechanism, kennedy's theorem, instantaneous centre, locating I-centres, centroid, Problems.

Acceleration Analysis: Acceleration of four-link mechanism, acceleration of intermediate and offset points, acceleration of slider-crank mechanism, coriolis acceleration component, acceleration of crank and slotted-lever mechanism, Problems.

UNIT-III

Dynamic Force Analysis: Dynamic analysis of four-link, dynamic analysis of slider-crank mechanisms, velocity and acceleration of piston, angular velocity and angular acceleration of connecting rod, turning moment on crank-shaft, turning moment diagrams, fluctuation of energy, flywheels, Problems.

Governors: Introduction, types of governors, centrifugal governors, terms used in governors, watt governor, porter governor, proell governor, hartnell governor, hartung governor, wilson-hartnell governor, pickering governor, sensitiveness of governors, stability of governors, isochronous governor, hunting, effort and power of a governor.

UNIT-IV

Cams and Followers: Classification & terminology, Cam profile by graphical methods with knife edge and radial roller follower for uniform velocity, simple harmonic, constant acceleration and deceleration and cycloidal motion of followers, Problems.

Gears and Gear Trains: Classification of gears, gear terminology, law of gearing, velocity of sliding of teeth, forms of teeth, cycloidal profile teeth, involute teeth, interchangeable gear, non-standard gears, length of path of contact, length of arc of contact, contact ratio, types of gear trains, Simple gear train, compound gear train, reverted gear train, epicyclic gear train, velocity ratio of epicyclic gear train, compound epicyclic gear train (Sun and Planet Wheel).

Text Books:

1. Theory and Machines: S.S. Rattan, Tata McGraw Hill
2. Theory and Machines: R.S. Khurmi and J.K. Gupta, S.Chand publication.
3. Kinematics of Machines-Dr. Sadhu Singh, Pearson Education
4. Mechanism and Machine Theory: J.S. Rao and R.V. Dukkipati Second Edition New age International.

Reference Books:

1. Theory of Mechanisms and Machines: Amitabha Ghosh and Ashok Kumar Mallik, Third Edition Affiliated East-West Press.
2. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
3. Cleghorn W.L., Mechanisms of Machines, Oxford University Press, 2005. 3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Theory of Machines and Mechanisms: Joseph Edward Shigley and John Joseph Uicker, Jr. Second Edition, MGH, New York.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (3rd Semester) Mechanical Engineering						
B23-MEC-203	**MECHANICS OF SOLIDS-I**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose	The objective of this course is to make the students aware of Stress, Strain and deformation of solids with the applications to beams, shafts and column and struts. The course will help the students to build the fundamental concepts in order to solve engineering problems.						
Course Outcomes							
CO1	Apply fundamental principles of mechanics & principles of equilibrium to simple and practical problems of engineering, determine centroid and moment of inertia of different geometrical shapes and be able to understand its importance. Explain the basic concepts of stress and strain and solve the problems.						
CO 2	Determine and calculate the values of principal stresses on 2-D inclined planes. Understand the concepts of shear force and bending moment of beams. Able to construct shear force and bending moment diagrams for beams under different loading conditions						
CO 3	Understand the concept of torsion of circular shaft and be able to solve the problems on torsion of circular shaft. Illustrate and solve the problems on bending and shear stresses on beams.						
CO 4	Understand the concept of column and strut and be able to solve the problems. Derive the concept of slope and deflection and solve the problems on slope and deflection using different methods.						

Unit-I

Introduction: Force, types of forces, Characteristics of a force, System of forces, Composition and resolution of forces, forces in equilibrium, principle and laws of equilibrium, Free body diagrams, Lami's Theorem, conditions for equilibrium, Concept of center of gravity and centroid,

centroid of various shapes: Triangle, circle, semicircle and trapezium, theorem of parallel and perpendicular axes, moment of inertia of simple geometrical figures, polar moment of inertia. Numerical Problems.

Simple Stresses & Strains: Different types of stresses and strains, Poisson's ratio, stresses and strain in simple and compound bars under axial loading, stress strain diagrams, Hook's law, elastic constants & their relationships, temperature stress & strain in simple & compound bars under axial loading, Numerical problems.

Unit-II

Principle Stresses: Two dimensional stress systems, stress at a point on an inclined plane, principal stresses and principal planes, Mohr's circle of stresses, Numerical Problems.

Shear Force & Bending Moments: Definitions, SF & BM diagrams for cantilevers, simply supported beams with or without over-hang and calculation of maximum BM & SF and the point of contraflexture under (i) concentrated loads, (ii) uniformly distributed loads over whole span or a part of it, (iii) combination of concentrated loads and uniformly distributed loads, (iv) uniformly varying loads and (v) application of moments, relation between the rate of loading, the shear force and the bending moments, Numerical Problems.

. Unit-III

Torsion of Circular Members: Derivation of equation of torsion, Solid and hollow circular shafts, tapered shaft, stepped shaft & composite circular shafts, Numerical problems.

Flexural and Shear Stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T, Angle, channel sections, composite beams, shear stresses in beams with derivation, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections. Combined bending and torsion, equivalent torque, Numerical problems.

Unit-IV

Columns & Struts: Column under axial load, concept of instability and buckling, slenderness ratio, derivation of Euler's formula for crippling load for columns with different end conditions, concept of equivalent length, eccentric loading, Rankine formulae and other empirical relations, Numerical problems.

Slope & Deflection : Relationship between bending moment, slope & deflection, double integration method, Macaulay's method, calculations for slope and deflection of (i) cantilevers and (ii) simply supported beams with or without overhang under concentrated load, Uniformly distributed loads or combination of concentrated and uniformly distributed loads, Numerical problems.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.
4. Strength of Materials – D.S. Bedi, Khanna Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Schaum's Outline Series – McGraw Hill

4. Strength of Material – Rider – ELBS

	B. Tech. (3rd Semester) Mechanical Engineering						
B23-ESC - 201	**ENGINEERING THERMODYNAMICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**

Note: The paper setter will set the paper as per the question paper templates provided.

Purpose	The objective of this course is to make the students aware of Energy, Entropy, and Equilibrium, various laws of thermodynamics, concepts and principles. The course will help the students to build the fundamental concepts to apply in various applications like IC engines and Air conditioning systems
Course Outcomes	
CO1	Analyze the work and heat interactions associated with a prescribed process path and to perform an analysis of a flow system.
CO 2	Define the fundamentals of the first and second laws of thermodynamics and explain their application to a wide range of systems.
CO 3	Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.
CO 4	Understand the design and analysis of flow through steam nozzles. Solve the problems related to vapour power cycle and steam nozzle

Unit-I

Basic Concepts: Thermodynamics: Macroscopic and Microscopic Approach, Thermodynamic Systems, Surrounding and Boundary, Thermodynamic Property – Intensive and Extensive, Thermodynamic Equilibrium, State, Path, Process and Cycle, Quasi-static, Reversible and Irreversible Processes, Working Substance. Concept of Thermodynamic Work and Heat, Zeroth Law of Thermodynamics and its utility.

First Law of Thermodynamics: Energy and its Forms, Energy and 1st law of Thermodynamics, Internal Energy and Enthalpy, 1st Law Applied to Non-Flow Process, Steady Flow Process and Transient Flow Process, Throttling Process and Free Expansion Process.

Unit-II

Second Law of Thermodynamics: Limitations of First Law, Thermal Reservoir Heat Source and Heat Sink, Heat Engine, Refrigerator and Heat Pump, Kelvin- Planck and Clausius Statements and Their Equivalence, Perpetual Motion Machine of Second Kind. Carnot Cycle, Carnot Heat Engine and Carnot Heat Pump, Carnot's Theorem and its Corollaries, Thermodynamic Temperature Scale, Numericals.

Entropy: Clausius Inequality and Entropy, Principle of Entropy Increase, Temperature-Entropy Plot, Entropy Change in Different Processes, Introduction to Third Law of thermodynamics.

Unit -III

Availability, Irreversibility and Equilibrium: High and Low Grade Energy, Available Energy and Unavailable Energy, Loss of Available Energy Due to Heat Transfer Through a Finite Temperature Difference, Availability of a Non-Flow or Closed System, Availability of a Steady Flow System, Helmholtz and Gibb's Functions, Effectiveness and Irreversibility, Thermodynamic Relations.

Pure Substance: Pure Substance and its Properties, Phase and Phase Transformation, Vaporization, Evaporation and Boiling , Saturated and Superheated Steam, Solid – Liquid – Vapour Equilibrium, T-V, P-V and P-T Plots During Steam Formation, Properties of Dry, Wet and Superheated Steam, Property Changes During Steam Processes, Temperature – Entropy (T-S) and Enthalpy – Entropy (H-S) Diagrams, Throttling and Measurement of Dryness Fraction of Steam.

Unit-IV

Vapour Power Cycles: Simple and modified Rankine cycle; effect of operating parameters on Rankine cycle performance; effect of superheating; effect of maximum pressure; effect of

exhaust pressure; reheating and regenerative Rankine cycle; types of feed water heater; reheat factor; binary vapour cycle.

Steam Nozzle: Function of steam nozzle; shape of nozzle for subsonic and supersonics flow of stream; variation of velocity; area of specific volume; steady state energy equation; continuity equation; nozzle efficiency; critical pressure ratio for maximum discharge; physical explanation of critical pressure; super saturated flow of steam; design of steam nozzle.

Text Books:

1. Engineering Thermodynamics – C P Arora, Tata McGraw Hill
2. Engineering Thermodynamics – P K Nag, Tata McGraw Hill
3. Thermal Engineering- R. K. Rajput, Laxmi Publications

Reference Books:

1. Thermal Science and Engineering – D S Kumar, S K Kataria and Sons
2. Engineering Thermodynamics -Work and Heat transfer – G F C Rogers and Maghew Y R Longman.
3. Thermodynamics – An Engineering Approach; Y. A. Cengel, M. A. Boles; Tata McGraw Hill

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (3rd Semester) Mechanical Engineering						
B23-ESC -203	**MEASUREMENT AND CONTROL**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**

Purpose	To understand the fundamentals of mechanical instruments and enable the students for solving the problems related transfer function of control systems
Course Outcomes	
CO1	Students will understand the fundamentals of measurement systems and understand the static performance characteristics of measurement systems.
CO2	Student will be able to explain various instruments for the motion, force, torque measurement, length, angle and area measurement.
CO3	Student will be able to explain various related to pressure and temperature measurements.
CO4	Students will be able to understand the various concepts related to control systems and different types of controller.

UNIT-I

Fundamentals of Measurements: Definition, application of measurement instrumentation, functional elements of a generalized measuring system, measuring standards, types of measurement, types of input to measuring instruments and instrument system, classification of measuring instruments, merits and demerits of mechanical measuring systems, comparison of mechanical measuring system with electrical measuring systems, calibration.

Generalized Measurement System: Introduction, types of error, types of uncertainties, propagation of uncertainties in compound quantity, Static performance parameters: accuracy, precision, resolution, static sensitivity, linearity, hysteresis, dead band, backlash, and drift, sources of error, selection of measuring instruments, mechanical and electrical loading.

UNIT-II

Motion, Force and Torque Measurement: Introduction, relative motion, measuring devices, electro-mechanical, optical, photo electric, Moore-Fringe, pneumatic, absolute motion devices, seismic devices, spring mass & force balance type, calibration, hydraulic load cell, pneumatic load cell, elastic force devices, separation of force components, electro-mechanical methods, torque transducer, torque meter.

Metrology: Length, Angle and Area Measurement

Introduction, vernier caliper, micrometer, vernier height gauge, surface plate, dial gauge, surface plate, Angular measurement, Area measurement.

UNIT-III

Pressure Measurement: Terminology, manometers, elastic transducer, high pressure transducer, low pressure measurement, calibration and testing.

Temperature Measurement: Introduction, measurement of temperature, non-electrical methods – solid rod thermometer, bimetallic thermometer, liquid in- glass thermometer, pressure thermometer, electrical methods – electrical resistance thermometers, semiconductor resistance sensors (thermistors), thermo-electric sensors, thermocouple materials, radiation methods (pyrometry), total radiation pyrometer, selective radiation pyrometer.

UNIT-IV

Control Analysis: Introduction, classification of control systems, control system terminology, servomechanism, process control and regulators, manual and automatic control systems, physical systems and mathematical models, linear control systems, transfer function, block diagram,

signal flow graphs.
Mechanical Controllers: Basics of actuators: pneumatic controller, hydraulic controller and their comparison, Comparators, form and finish measurement.

Reference and Text Books:
1. Mechanical measurements & control- By D.S. Kumar, Metropolitan book
2. Instrumentation and Mechanical measurements- By A.K. Tayal, Galgotia Publ.
3. Measurements systems application and design-By Ernest Doebelin, McGraw-Hill
4. Automatic Control Systems- By S. Hasan Saeed

Note: The paper setter will set the paper as per the question paper template provided

	B. Tech (3rd Semester) Mechanical Engineering						
B23-MEC-205	**THEORY OF MACHINES LAB**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical Exam**	**Total**	**Time (Hrs.)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose :	Students will be able to analyze and explain various kinds of mechanisms and machines.						

	Course Outcomes
CO 1	Students will be able to explain various types of kinematic mechanisms and their applications in different machines.
CO 2	Students will be able to sketch a plot between displacement, velocity and acceleration and crank rotation for single slider crank mechanism and cam follower system.
CO 3	Students will be able to analyze the flywheel, belt drives, governor and gyroscopic couple of a motorized gyroscope.
CO 4	Students will be able to analyze various gear and gear trains.
CO5	Students will be able to describe various steering systems, brakes and dynamometers.

List of experiments

1. To study inversions of four bar mechanisms, single and double slider crank mechanisms.
2. To plot slider displacement, velocity and acceleration against crank rotation for single slider crank mechanism.
3. To find out experimentally the Coriolis component of acceleration and compare with theoretical value.
4. To determine the moment of inertia of a flywheel.
5. To plot follower displacement v/s cam rotation for various cam follower systems.
6. To find gyroscopic couple on motorized gyroscope and compare with applied couple.
7. To calculate the torque on planet carrier and torque on internal gear using epicycle gear train and holding torque apparatus.
8. To determine the coefficient of friction between belt and pulley and plot a graph between $\log_{10} T_1/T_2$ v/s θ
9. To study different types of centrifugal and interia governors and also determine the sleeve position relationship with motor speed.
10. To study different types of brakes and dynamometers with demonstration.
11. To study various types of steering mechanisms.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B.Tech. (3rd semester) Mechanical Engineering						
B23-MEC-207	**MECHANICS OF SOLIDS LAB**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Internal Assessment**	**Practical Exam**	**Total**	**Time (Hrs.)**
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	To make the students aware of different properties of materials using different						

	experimental set-up.
Course Outcomes	
CO1	Ability to design and conduct experiments, acquire data, analyze and interpret data
CO 2	Ability to determine the behavior of ferrous metals subjected to normal and shear stresses by means of experiments.
CO 3	Ability to determine the behavior of structural elements, such as bars subjected to tension, compression, shear, bending, and torsion by means of experiments.
CO 4	Physical insight into the behavior materials and structural elements, including distribution of stresses and strains, deformations and failure modes.
CO5	Write individual and group reports: present objectives, describe test procedures and results, synthesize and discuss the test results.

List of Experiments:

1. To study the Brinell hardness testing machine & perform the Brinell hardness test on given specimen.
2. To study the Rockwell hardness testing machine & perform the Rockwell hardness test on a given specimen.
3. To study the Vickers hardness testing machine & perform the Vickers hardness test on a given specimen.
4. To study the Erichsen sheet metal testing machine & perform the Erichsen sheet metal test on a given specimen.
5. To study the Impact testing machine and perform the Impact tests (Izod & Charpy) on a given specimen.
6. To study the Universal testing machine and perform the tensile, compression & bending tests on a given specimen.
7. To perform the shear test on UTM on a given specimen.
8. To study the torsion testing machine and perform the torsion test on a given specimen.
9. To draw shear Force, Bending Moment Diagrams for a simply Supported Beam under point and distributed Loads.
10. To prepare the composite specimen using a hot compression molding machine and test for different mechanical properties.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B. Tech. (3rd Semester) Mechanical Engineering						
B23-MAC-201	**ENVIRONMENTAL STUDIES**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**0**	**0**	**1**	**70**	**30**	**100**	**3**

Course Outcomes	
CO 1	Students will be able to understand the importance of natural resources.
CO 2	Students will understand the concept of an ecosystem, its structure, and its functions.
CO 3	The students will be able to understand the causes and impacts of various environmental pollution.
CO-4	Students will be able to understand the relationship between human population and the environment.

Unit-1

Introduction to Environmental studies: The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

Natural Resources: Forest resources: Use and Over-exploitation, deforestation. Timber extraction, mining, dams, and their effects, Water resources: Use and over-utilization of surface and groundwater, conflicts over water, dams benefits and problems, Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, Food resources: changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Energy resources: renewable and non-renewable energy sources, Land resources: land degradation, soil erosion, and desertification.

Unit-II

Ecosystems: Concept of an ecosystem, Structure, and function of an ecosystem, Energy flow in the ecosystem, Ecological succession, Food chains, food webs, and ecological pyramids. Major types of ecosystem-Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystem.

Biodiversity and its Conservation: Introduction-Definition: genetic, species, and ecosystem diversity. Biogeographical classification of India, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, India as a mega-diversity nation, Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, Endangered and endemic species of India, Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Unit-III

Environmental pollution: Causes, effects, and control measures of: - Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Nuclear hazards, and Solid waste Management: Causes, effects, and control measures of urban and industrial wastes, Disaster management: floods, earthquake, cyclone and landslides.

Social Issues and the Environment: Sustainable development, Water conservation, rainwater harvesting, Resettlement and rehabilitation of people; its problems and concerns. Environmental ethics: Issues and possible solutions, Climate change, global warming, acid rain, ozone layer depletion, and wasteland reclamation. Environment Protection Act, Air (Prevention and Control of Pollution) Act, Water (Prevention and Control of Pollution) Act, Wildlife Protection Act., and Forest Conservation Act.

Unit-IV

Human population and the Environment: Population growth, Population Explosion-Family welfare Programme, Environment and human health. Human Rights, Value Education, HIV/AIDS, Women and Child Welfare, Role of Information Technology in Environment and human health, Drugs and their effects; Useful and harmful drugs; Use and abuse of drugs; Stimulant and depressant drugs. Concept of drug de-addiction. Legal position on drugs and laws related to drugs.

Field Work (Practical)-

- Visit to a local area to document environmental assets -river/forest/grassland/ hill/mountain.
- Visit to a local polluted site- Urban/Rural/Industrial/Agricultural.
- Study of common plants, insects, and birds.
- Study of simple ecosystems- pond, river, hill slopes, etc.

Suggested readings:

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Publ. Ltd. Bikaner.
2. Kaushik, Anubha and Kaushik, C.P. (2004 Perspectives in Environmental Studies, New age International Publishers.
3. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad - 380013, India, Email: mapin@icenet. net (R).
4. Brunner R.C., 1989, Hazardous Waste Incineration, McGraw Hill Inc. 480p.
5. Clerk B.S., Marine Pollution, Clanderson Pross Oxford (TB).
6. Cunningham, W.P.Cooper, T.H. Gorhani, E & Hepworth, M.T.2001, Environmental Encyclopedia, Jaico Publ. House, Mumbai, 1196p.
7. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
8. Down to Earth, Centre for Science and Environment (R).

	B. Tech. (4th Semester) Mechanical Engineering						
B23-ESC-202	**MATERIALS ENGINEERING**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Purpose:	To develop capacity to identify crystal structure, designate various steels, create phase diagrams, analyse material failure mechanisms, perform heat treatment, study green energy materials and basic functioning of sophisticated material characterization techniques. with overall objective of developing the understanding of microstructure-property relations.						
Course Outcomes							
CO 1	Students will be able to identify and differentiate various types of the crystal structures and deformation mechanisms in various materials.						
CO 2	Students will be able to designate various types of steels as per BIS and AISI-SAE standard specifications of steels						
CO 3	Students will be able to draw various types of phase diagrams, Fe-C diagram and TTT curve.						
CO-4	Students will be able to classify heat treatment processes and will be able to select suitable heat treatment process for any industrial application.						
CO 4	Students will be able to explain various mechanisms of deformation and failure mechanisms like Creep and Fatigue.						
CO 5	Students will be able to study various materials used for green energy production.						
CO 6	Students will be able to explain the basic principles involved in the working of various types of material characterization techniques and will develop the capability to select a particular material characterization process for any given application.						

UNIT I

Crystallography: Review of Crystal Structure, Space Lattice, Co-ordination Number, Number of Atoms per Unit Cell, Atomic Packing Factor; Numerical Problems Related to Crystallography.

Imperfection in Metal Crystals: Crystal Imperfections and their Classifications, Point Defects, Line Defects, Edge & Screw Dislocations, Surface Defects, Volume Defects.

Introduction to Engineering materials and Standard Materials Designation: Introduction to Engineering materials, Steel Terminology, Indian Standard specifications for steels as per BIS: Based on *Ultimate Tensile Strength* and based on *Composition*, AISI-SAE standard designation for Steels and Aluminium Alloys

UNIT II

Phase Diagrams: Basic concepts and terms, Alloy Systems, Solid solutions, Hume- Rothery's Rules, Phase Diagrams, Gibbs Phase Rule, Cooling curves, Binary phase diagrams, The Lever

Rule, Applications of Phase Diagrams, Phase Transformation, Allotropic Forms of Iron, Micro-constituents of Fe-C system, Iron-iron carbide phase diagram, Modified Iron Carbon Phase Diagrams, Isothermal Transformation, TTT Curve, CCT curve.

Heat Treatment: Heat treatment of steels, Annealing, Normalising, Hardening, Tempering, Ageing, Austempering and Martempering, Surface hardening and Case hardening processes, Major Defects in Metals or Alloys due to faulty Heat treatment.

UNIT III

Deformation of Metal: Elastic and Plastic Deformation, *Mechanism of Plastic Deformation*: **Slip**; Critical Resolved Shear Stress, **Twinning**, Conventional and True Stress Strain Curves for Polycrystalline Materials, Yield Point Phenomenon, Bauschinger Effect, Work Hardening.

Fatigue Failure of Materials: Fatigue, fatigue-failure models, Fatigue loads, Mechanism of Fatigue Failure, Theories of Fatigue, Factors affecting fatigue, SN diagram, Fatigue Life calculations, Fatigue Tests.

Creep: Creep Curve, Types of Creep, Factors affecting Creep, Mechanism of Creep, Creep Resistant Material, Creep Tests, Improving creep resistance.

UNIT IV

Materials for green energy: Biodiesel, Bioethanol**,** Production methods of Biofuels**;** Overview of key fuel cell technologies- various types of fuel cells, materials for electrodes, electrolytes and other components, working mechanisms, hydrogen generation and storage; limitations, recent progress in fuel cells.

Materials Characterization Techniques: Characterization techniques such as X-Ray Diffraction (XRD), Scanning Electron Microscopy(SEM), Energy dispersive X-ray spectroscopy (SEM-EDX), Transmission Electron Microscopy(TEM), Atomic force microscopy(AFM), Scanning tunneling microscopy(STM).

Text Books:

1. Fundamentals of Material Science and Engineering by W. D. Callister, Wiley.
2. Material science and metallurgy by O.P Khanna, Dhanpat Rai Publication.
3. Material Science by S.L. Kakani, New Age Publishers.
4. The Science and Engineering of Materials by Donald R. Askeland , Chapman & Hall.
5. Material Science by Narula, TMH.
6. Machine Design by Robert Norton, Pearson.
7. Phase Transformation in Metals and Alloys by D. A. Porter & K. E. Easterling
8. Fuel Cell Systems Explained by Larminie and A. Dicks, , 2nd Edition, Wiley.
9. Principles of Fuel Cells by Xianguo Li, Taylor and Francis.
10. Fuel Cells: From Fundamentals to Applications by S. Srinivasan, Springer.
11. Fundamental of Light Microscopy and Electronic Imaging by Douglas B. Murphy, Kindle Edition 2001.
12. Concise Encyclopedia of Materials Characterization by Robert Cahn, 2nd Edition (Advances in Materials Science and Engineering) Elsevier Publication 2005.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester) Mechanical Engineering						
B23-MEC-202	**FLUID MECHANICS AND MACHINES**						
Lecture	**Tutorial**	**Practical**	**Credit**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
4	**1**	-	**5**	**70**	**30**	**100**	**3**
Purpose	To build a fundamental understanding of concepts of Fluid Mechanics and their application in rotodynamic machines.						
Course Outcomes							
CO 1	The students will be able to understand the basic concepts of fluid statics, kinematics and dynamics; and apply mass and momentum conservation laws to mathematically analyze simple flow situations.						
CO 2	The students will be able to understand laminar, turbulent and boundary layer flows and solve problems for the same.						
CO 3	The students will be able to apply dimensional analysis to simple flow problems and understand the basics of hydraulic machines.						
CO 4	The students will be able to design and evaluate the performance of hydraulic turbines and pumps.						

UNIT-I

Fluid Statics: Properties of fluids, Newton's law of viscosity, hydrostatic law, hydrostatic forces on submerged plane and curved surfaces, buoyancy, stability of floating and submerged bodies, Problems.

Fluid Kinematics: Types of fluid flows, stream, streak and path lines; flow rate and continuity equation, differential equation of continuity in cartesian and polar coordinates, rotation and vorticity, circulation, stream and potential functions, flow net. Problems.

Fluid Dynamics: Concept of system and control volume, Euler's equation, Navier-Stokes equation, Bernoulli's equation and its practical applications, Impulse momentum equation. Problems.

UNIT-II

Viscous Flow: Flow regimes and Reynold's number, relationship between shear stress and pressure gradient. Exact flow solutions, Couette and Poisuielle flow, laminar flow through circular conduits. Problems.

Turbulent Flow Through Pipes: Darcy Weisbach equation, friction factor, Moody's diagram, minor losses in pipes, hydraulic gradient and total energy lines, series and parallel connection of pipes, branched pipes; equivalent pipe, power transmission through pipes. Problems.

Boundary Layer Flow: Concept of boundary layer, measures of boundary layer thickness, Blasius solution, von-Karman momentum integral equation, laminar and turbulent boundary layer flows, separation of boundary layer and its control. Problems.

UNIT-III

Dimensional Analysis: Need for dimensional analysis – methods of dimensional analysis – Dimensionless parameters – application of dimensionless parameters. Problems.

Hydraulic Pumps: Introduction, theory of Rotodynamic machines, Classification, various efficiencies, velocity components at entry and exit of the rotor, velocity triangles; Centrifugal pumps: working principle, work done by the impeller, performance curves, cavitation in pumps; Reciprocating pumps: working principle, indicator diagram, effect of friction and acceleration, air vessels, Problems.

UNIT-IV

Hydraulic Turbines: Introduction, Classification of water turbines, heads and efficiencies, velocity triangles, axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines, working principles, work done, design of turbines, draft tube and types, specific speed, unit quantities, performance curves for turbines, governing of turbines. Problems.

Text Books:

1. Fluid Mechanics and Fluid Power Engineering – D.S. Kumar, S.K. Kataria and Sons
2. Introduction to Fluid Mechanics and Fluid Machines – S.K. Som and G. Biswas, Tata McGraw Hill.
3. Fluid Mechanics and Fluid Machines - S.S. Rattan, Khanna Publishing House.
4. Fluid Mechanics and Hydraulic Machines – R. K. Rajput, S. Chand & Company

Reference Books:

1. Introduction to Fluid Mechanics – R.W. Fox, Alan T. McDonald, P.J. Pritchard, Wiley Publications.
2. Fluid Mechanics – Frank M. White, McGraw Hill
3. Fluid Mechanics – Streeter V L and Wylie E B, Mc Graw Hill
4. Mechanics of Fluids – I H Shames, Mc Graw Hill
5. Fluid Mechanics: Fundamentals and Applications - Yunus Cengel and John Cimbala, McGraw Hill.
6. Fluid Mechanics: Pijush K. Kundu, Ira M. Cohen and David R. Rowling, Academic Press.

Note: The paper setter will set the paper as per the question paper templates provided.

	B. Tech. (4th Semester) Mechanical Engineering						
B23-MEC-204	**MECHANICAL VIBRATIONS AND TRIBOLOGY**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of exam (Hours)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**
Purpose:	To understand, analyze, derive and calculate various parameters of mechanical vibration systems with different degrees of freedom in different modes and conditions and to understand the basics of tribology.						
Course Outcomes							
CO1	Students will be able to understand the vibration fundamentals for a single degree of freedom system under free and damped vibrations, various spring/ shaft combinations and will also be able to solve mathematical problems based on the same.						
CO2	Students will be able to analyze different types of single degree of freedom forced vibration systems and damped, undamped, free and forced systems with two D.O.F. and will also be able to solve mathematical problems based on the same.						
CO3	Students will be able to evaluate frequencies and principal modes of vibrations for various spring-mass combinations and rotor-shaft systems and will be able to derive frequency expressions for continuous systems viz. transverse, longitudinal and torsional vibration for beams, bars and shafts respectively and will also be able to solve mathematical problems based on the same.						
CO4	Students will be able to understand the fundamentals of tribology, lubrication, friction and wear.						

UNIT-I

Fundamentals: Introduction, elements of a vibratory system, periodic and S.H.M., degrees of freedom (DOF), types of vibrations, work done by a harmonic force, beats, Problems.

Free vibration systems with single degree of freedom undamped systems: Introduction, differential equations, torsional vibrations, spring and shaft combinations: series & parallel, linear and torsional systems, compound pendulum, bifilar and trifilar suspensions, problems.

Free vibration systems with single degree of freedom damped systems: Introduction, types of damping, differential equations of damped free vibrations, initial conditions, logarithmic decrement, vibrational energy, Problems.

UNIT-II

Forced vibration systems with single degree of freedom damped systems: Introduction, excitation and sources, equations of motion, rotating and reciprocating unbalanced system, support motion, vibration isolation, force and motion transmissibility, forced vibration system with different types of damping, vibration measuring instruments, resonance, bandwidth, quality factor and half power points, critical speed of shaft with and without damping with single and multiple discs, problems.

Two degrees of freedom system: Introduction, torsional vibrations, principal modes of vibrations for two D.O.F., damped and undamped forced and free vibrations, semi-definite

systems, coordinate coupling, spring and mass type vibration absorber, problems.

UNIT-III

Multi-degree of freedom systems: Introduction, principal modes of vibrations for three or more DOF, influence coefficients, orthogonality principle, matrix method, matrix iteration method, Dunkerley's equation, Holzer's Method, Rayleigh Method, Stodola method, problems.

Continuous systems: Introduction, lateral vibrations of strings, longitudinal vibrations of bars, transverse vibration of beams, torsional vibration of uniform shafts, problems.

UNIT-IV

Tribology: Introduction, tribology in design, tribology in industry, economic aspects.

Lubrication: Introduction, basic modes of lubrication, lubricants, properties of lubricants: physical and chemical, types of additives, extreme pressure lubricants, recycling of used oils and oil conservation, disposal of scrap oil, oil emulsion.

Friction and wear: Introduction, laws of friction, kinds of friction, causes of friction, friction measurement, theories of friction, effect of surface preparation. Introduction to wear, types of wear, various factors affecting wear, measurement of wear, wear between solids and liquids, theories of wear.

Text Books:

1. Mechanical Vibrations by G. K. Grover, Nem Chand and Bros., Roorkee.
2. Elements of Mechanical Vibrations by Meirovitch, McGraw Hill.
3. Introductory course on theory and practice of Mechanical Vibration by J.S. Rao and K.Gupta, New Age International.
4. Friction and wear of Materials by E. Robinowicz, Johan Wiley
5. Tribology an Introduction by Sushil Kumar Srivastava
6. Introduction to Tribology and Bearings by B. C. Majumdar, S. Chand and Company Ltd. New Delhi.

Reference Books:

1. Mechanical Vibrations by S.S. Rao, Pearson Education Inc. Dorling Kindersley (India) Pvt. Ltd. New Delhi.
2. Mechanical Vibrations by V.P. Singh, Dhanpat Rai & Co. Pvt. Ltd., Delhi.
3. Engineering Tribology by Prashant Sahoo, PHI publications.
4. Principles of Tribology by J. Hailing, McMillan Press Ltd.

Note: The paper setter will set the paper as per the question paper template provided

	B. Tech. (4th Semester) Mechanical Engineering						
B23-MEC-206	**MECHANICS OF SOLIDS-II**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Time (Hrs.)**
3	**1**	**0**	**4**	**70**	**30**	**100**	**3**

Purpose	The objective of this course is to show the concept of strain energy and different stresses in springs, pressure vessels, rotating rims/discs, links, curved bars under different loads. The course will help the students to build the fundamental concepts in order to solve engineering problems.
Course Outcomes	
CO1	Understand the concepts of strain energy and various theories of failures and solve the problems.
CO 2	Differentiate different types of stresses induced in thin and thick pressure vessels and solve the problems. Use of Lame's equation to calculate the stresses induced in thick pressure vessels.
CO 3	Able to compute stresses in ring, disk and cylinder due to rotation. Classify the different types of spring and analyze the stresses produced due to loading.
CO 4	Determine the stresses in crane hook, rings, chain link for different cross sections and also the deflection of curved bars and rings. Analyze the stresses due to unsymmetrical bending and determine the position of shear centre for different sections.

Unit I

Strain Energy & Impact Loading: Definitions, expressions for strain energy stored in a body when load is applied (i) gradually, (ii) suddenly and (iii) with impact, strain energy of beams in bending, beam deflections, strain energy of shafts in twisting, energy methods in determining spring deflection, Castigliano's theorem, Numerical.

Theories of Elastic Failures: Various theories of elastic failures with derivations and their limitations, comparisons and applications to problems of 2- dimensional stress system, Numerical.

Unit II

Thin Walled Vessels: Hoop & Longitudinal stresses & strains in cylindrical & spherical vessels & their derivations under internal pressure, wire wound cylinders, Numerical.

Thick Cylinders & Spheres: Derivation of Lame's equations, radial & hoop stresses and strains in thick and compound cylinders and spherical shells subjected to internal fluid pressure only, hub shrunk on a solid shaft, Numerical.

Unit III

Rotating Rims & Discs: Stresses in uniform rotating rings & discs, rotating discs of uniform strength, stresses in (I) rotating rims, neglecting the effect of spokes, (ii) rotating cylinders, hollow cylinders & solid cylinders. Numerical.

Springs: Stresses in closed coiled helical springs, Stresses in open coiled helical springs

subjected to axial loads and twisting couples, leaf springs, flat spiral springs, concentric springs, Numerical.

Unit IV

Bending of Curved Bars : Stresses in bars of initial large radius of curvature, bars of initial small radius of curvature, stresses in crane hooks, rings of circular & trapezoidal sections, deflection of curved bars & rings, stresses in simple chain links, deflection of simple chain links, Problems.

Unsymmetrical Bending: Introduction to unsymmetrical bending, stresses due to unsymmetrical bending, deflection of beam due to unsymmetrical bending, shear center for angle, channel, and I- sections, Numerical.

Text Books:

1. Strength of Materials – R.K. Rajput, Dhanpat Rai & Sons.
2. Strength of Materials – Sadhu Singh, Khanna Publications.
3. Strength of Materials – R.K. Bansal, Laxmi Publications.
4. Strength of Materials – D.S. Bedi, Khanna Publications.

Reference Books:

1. Strength of Materials – Popov, PHI, New Delhi.
2. Strength of Materials – Robert l. Mott, Pearson, New Delhi
3. Strength of Material – Schaum's Outline Series – McGraw Hill
4. Strength of Material – Rider – ELBS

Note: The paper setter will set the paper as per the question paper templates provided

	B. Tech. (4th Semester) Mechanical Engineering						
B23-MEC-208	**MANUFACTURING TECHNOLOGY**						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of exam (Hours)**
3	**0**	**0**	**3**	**70**	**30**	**100**	**3**
Purpose:	To build a foundation in different manufacturing processes related to castings, metal forming, joining, powder metallurgy and plastic material shaping processes.						
Course Outcomes							
CO 1	After completing the course, students will be able to understand the casting fundamentals, and different casting processes.						
CO 2	The students will be able to understand and analyse the different metal forming processes.						
CO 3	The students will understand different welding processes with their applications.						
CO 4	The student will have the basic understanding of powder metallurgy processes and different plastic shaping processes.						

UNIT-I

Fundamentals of castings: Introduction to casting; basic requirements of casting processes, casting terminology, solidification process: cooling curves, prediction of solidification time, fluidity and pouring temperature, role of gating system, solidification shrinkage, casting defects.

Expandable-mould casting processes: Sand casting, cores and core making, other expendable-mould processes with multiple use patterns, shakeout, cleaning and finishing.

Multiple-use-mould casting processes: Permanent mould casting, die casting, squeeze casting and semisolid metal casting, centrifugal casting, cleaning, finishing and heat treating of castings, automation in foundry operations.

UNIT-II

Metal forming processes: Classifications of metal forming processes, bulk deformation processes, material behaviour in metal forming, temperature in metal forming, rolling: flat rolling, shape rolling, rolling mills, forging: open-die forging, impression-die forging, flashless forging, extrusion: types of extrusion, extrusion dies and presses, defects in extruded products, wire and bar drawing, tube drawing.

Sheet metal working: Cutting operations: shearing, blanking, and punching, engineering analysis of sheet-metal cutting, other sheet-metal-cutting operations, bending operations: v-bending and edge bending, springback effect, drawing: mechanics of drawing, defects in drawing.

UNIT-III

Joining processes: Principles of fusion welding processes, arc welding processes, consumable electrodes: shielded metal arc welding, gas metal arc welding, flux-cored arc welding, submerged arc welding, Arc welding processes-non-consumable electrodes: gas tungsten arc welding, plasma arc welding, resistance welding processes, electron-beam welding, laser beam welding, thermit welding.

Principles of solid-state welding processes: friction welding, explosive welding, ultrasonic welding processes. **Brazing, soldering, and adhesive bonding:** Principles of adhesive, brazing and soldering processes, origins of welding defects.

UNIT-IV

Powder metallurgy: Characterization of engineering powders: geometric features, other features production of metallic powders: atomization: other production methods, conventional pressing and sintering: blending and mixing of the powders, compaction, sintering, heat treatment and finishing, design considerations in powder metallurgy.

Shaping processes for plastics: Properties of polymer melts, extrusion, production of sheet and film, fiber and filament production (spinning), coating processes, injection moulding, compression and transfer moulding, blow moulding and rotational moulding, thermoforming.

Text Books:

1. Fundamentals of modern manufacturing: materials processing and systems by Mikell P. Grover,
   John Wiley and Sons.
2. Materials and processes in manufacturing by J.T. Black and R.A. Kohser, John Wiley and Sons.
3. Principles of Manufacturing Materials & Processes by Campbell J. S., Publisher – Mc Graw Hill.
4. Production Technology by R. K. Jain, Khanna Publishers
5. Manufacturing Technology-Foundry, Forming and Welding by P.N. Rao, Tata McGraw Hill
6. Advanced Manufacturing Process by Hofy, H.E., B and H Publication.
7. Manufacturing Science by Ghosh, A. and Mullik, A, East –West private Limited.

Reference Books:

1. Welding and Welding Technology by Richard L. Little Tata McGraw Hill Ltd.
2. Manufacturing Processes and Systems by Ostwald Phillip F., Munoz Jairo, John Wiley & Sons
3. Elements of Manufacturing Processes by B.S. Nagendra Parasher, RK Mittal, PHI N. Delhi

4. Manufacturing Engineering and Technology by Serope Kalpakjian and Steven R. Schmid, Pearson publications.

Note: The paper setter will set the paper as per the question paper template provided.

	B. Tech. (4th Semester) Mechanical Engineering
B23-HSM-202	**INNOVATION, START-UP AND ENTREPRENEURSHIP**

Lecture	Tutorial	Practical	Credits	End Semester Exam	Internal Assessment	Total	Duration of exam (Hours)
3	**-**	**-**	**3**	**70**	**30**	**100**	**3**
Purpose	The objective of this Course is to inspire students and help them imbibe entrepreneurial mindset.						
CO 1	Understanding the essence of innovation and features of innovative processes; models and methods of innovative entrepreneurship, the role of innovation as a major factor in creating the value of companies						
CO 2	Understanding, the dynamic role of entrepreneurship and small businesses, types of business structure, organizing and managing a Small Business.						
CO 3	Understanding concept of start-ups, Control Strategic Marketing Planning, concept of incubation and proto type, new Product Development, Business Plan Creation.						
CO 4	Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship						

Unit -I

Introduction to Innovation and Entrepreneurial Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, Innovation - features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

Unit-II

Introduction to Entrepreneurship and Start – Ups - Definitions, Traits of an entrepreneur, Intrapreneurship, Entrepreneurial Motivation ,Functions of Entrepreneur, Concept, Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of startups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

Unit -III

Start ups - Initial idea generation and planning stages, and incubation referring to the development process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit -IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy,

and succession and harvesting strategy, venture capital, angel investment, and crowdfunding.
Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work

Suggested Readings:

1. Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
2. "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
3. Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
4. "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
5. "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
6. The Three-Box Solution: A Strategy for Leading Innovation By Vijay Govindarajan
7. Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). Managing Global Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
8. Brown K. and Stephen P. Osborne (2005) Managing change and innovation in public service organisation. New York: Routledge
9. Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks Knowledge Creation and Innovation in Medium-technology Clusters. UK: Edward Elgar Publishing Limited.
10. Eveleens, C. (2010). Innovation management; a literature review of innovation process models and their implications. Working Paper HAN University of Applied Sciences.
11. Enterpreneurship Development- S.Chand & Co.,Delhi- S.S.Khanka 1999
12. Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi – Vasant Desai 2003.
13. Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
14. Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2007

	B. Tech. (4th Semester) Mechanical Engineering
B23-ESC-204	**MATERIALS ENGINEERING LAB**

Lecture	Tutorial	Practical	Credits	Internal Assessment	Practical Exam	Total	Time (Hrs.)
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	To make the students prudent in metallographical sample preparation, microstructure analysis, basic heat treatment operations and production of Biofuels.						
Course Outcomes							
CO 1	Students will have the ability to design and conduct experiments, acquire data, analyze and interpret data						
CO 2	Students will have the ability to determine the grain size and microstructure in different Ferrous alloys by means of experiments.						
CO 3	Students will have the ability to identify and differentiate microstructures of different Non-Ferrous alloys.						
CO 4	Students will be able to perform various heat treatment processes using muffle furnace in the lab.						
CO 5	Students will have the ability to analyse microstructure of Heat-treated specimens and perform Fatigue and creep test on different materials.						
CO6	Students will be able to perform lab scale production of Biofuel.						

List of Experiments:

1. To Study various Crystal Structures through Ball Models.
2. To study the components and functions of Metallurgical Microscope.
3. To learn about the process of Specimen Preparation for metallographic examination.
4. To perform Standard test Methods for Estimation of Grain Size.
5. To perform Microstructural Analysis of Carbon Steels and low alloy steels.
6. To perform Microstructural Analysis of Cast Iron.
7. To perform Microstructural Analysis of Non-Ferrous Alloys: Brass & Bronze.
8. To perform Microstructural Analysis of Non-Ferrous Alloys: Aluminium Alloys.
9. To Perform annealing of a steel specimen and to analyze its microstructure.
10. To Perform Hardening of a steel specimen and to analyze its microstructure.
11. To perform Jominy End-Quench Hardenability Test.
12. To perform Fatigue test on fatigue testing machine.
13. To perform Creep test on creep testing machine.
14. To produce a sample of Biodiesel.
15. To study the functioning of fuel cells.

Note: At least eight experiments are required to be performed by students from the above list and two may be performed from the experiments developed by the institute.

	B. Tech. (4th Semester) Mechanical Engineering
B23-MEC-210	**FLUID MECHANICS AND MACHINES LAB**

Lecture	Tutorial	Practical	Credit	Internal Assessment	Practical Exam	Total	Time
-	-	2	1	40	60	100	3
Purpose	**To familiarize the students with the equipment and instrumentation of Fluid Mechanics and Machines**						
Course Outcomes							
CO1	**Collect, analyse and interpret data using fluid mechanics principles and experimentation methods.**						
CO2	**Determine the coefficient of discharge for various flow measurement devices.**						
CO3	**Calculate flow characteristics such as Reynolds number, friction factor from laboratory measurements.**						
CO4	**Analyze the performance characteristics of hydraulic pumps and turbines.**						
CO5	**Write individual and group reports, present objectives, describe test procedures and results, synthesize and discuss the test results.**						

List of Experiments:

1. To determine the meta-centric height of a floating body.
2. To verify the Bernoulli's Theorem.
3. To determine coefficient of discharge of an orifice meter.
4. To determine the coefficient of discharge of venturimeter.
5. To determine the coefficient of discharge of Notch.
6. To find critical Reynolds number for a pipe flow.
7. To determine the friction factor for the pipes.
8. Determination of the performance characteristics of Pelton Wheel.
9. Determination of the performance characteristics of a Francis Turbine.
10. Determination of the performance characteristics of a Kaplan Turbine.
11. Determination of the performance characteristics of a centrifugal pump.
12. Determination of the performance characteristics of a reciprocating pump.
13. Determination of the performance characteristics of a gear pump.
14. Determination of the performance characteristics of a Hydraulic Ram.

Note: Any 8 experiments from the above list are required to be performed by students in the laboratory.

	B. Tech. (4th Semester) Mechanical Engineering
B23-MEC-212	**MECHANICAL VIBRATIONS AND TRIBOLOGY LAB**

Lecture	Tutorial	Practical	Credits	Internal Assessment	Practical Exam	Total	Time (Hrs.)
0	**0**	**2**	**1**	**40**	**60**	**100**	**3**
Purpose	To provide practical knowledge of free and forced vibration system fundamentals and the mechanisms of friction, wear and lubrication.						
Course Outcomes							
CO1	The students will be able to know practically the concepts of free and forced vibrations for a spring mass system and will determine the natural frequency.						
CO2	The students will be able to diagnose the machinery faults, their causes and sources using Machinery Fault Simulator (MFS).						
CO3	The students will understand the concept of sliding wear and abrasive wear using wear and friction monitoring apparatus and dry abrasion tester respectively.						
CO4	The students will be capable of measuring the extreme pressure properties of different lubricants using four ball tester.						

LIST OF EXPERIMENTS:

1. To study undamped free vibrations and determine the natural frequency of:
   - 1.1 Spring mass system
   - 1.2 Simple Pendulum
   - 1.3 Torsional spring type double pendulum and compare them with theoretical values.
2. To study the torsional vibration of a single rotor shaft system and determine the natural frequency.
3. To study the free vibration of system for different damper settings. Draw decay curve and determine the log decrement and damping factor. Find also the natural frequency.
4. To verify the Dunkerley's rule.
5. To determine the radius of gyration for:
   - 5.1 Bifilar suspension.
   - 5.2 Compound pendulum.
   - 5.3 Trifilar suspension.
6. To study the forced vibration system with damping, Load magnification factor vs. Frequency and phase angle vs frequency curves. Also determine the damping factor.
7. To find out and locate machinery faults viz. vibrations and unbalancing using Machinery Fault Simulator (MFS) in:
   - 7.1 Direct Driven reciprocating pump;
   - 7.2 Direct Driven centrifugal pump;
   - 7.3 Defective straight tooth gearbox pinions.
8. To determine the wear rate, friction force and coefficient of friction of a metallic pin/ball by using wear and friction monitor apparatus.
9. To determine abrasion index of a material with the help of dry abrasion test rig.
10. To evaluate the wear and extreme pressure properties of a lubricating oil by using four ball tester.
11. To determine the roughness of a specimen using surface roughness tester.

Note: At least eight experiments are required to be performed by students from the above

list and two may be performed from the experiments developed by the institute.

B23-MAC-202	Essence of Indian Traditional Knowledge						
Lecture	**Tutorial**	**Practical**	**Credits**	**End Semester Exam**	**Internal Assessment**	**Total**	**Duration of exam (Hours)**
2	**-**	**-**	**1**	**-**	**100**	**100**	**3**
Purpose	To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the importance of roots of knowledge system, analyse and apply to their day to day life.						
	Course Outcomes						
CO 1	The students will be able to understand , connect up and explain basics of Indian traditional knowledge in modern scientific perspective						
CO2	The students will be able to understand Holistic Health using Indian Knowledge System						
CO3	The students will be able to Manage thoughts and Emotions , will learn positivity, self-regulation and control						
CO4	The students will be able to Achieve Consciousness through Indian Knowledge System						

Unit-I

Introduction to Indian Traditional knowledge: Define traditional knowledge, importance, kinds of traditional knowledge. Philosophical systems, Basics of Rajyoga and Karamyoga, Benefits of Rajyoga and Karamyoga.

Unit-II

Holistic Health using Indian Knowledge System: Basic principles of natural life style, Benefits through five elements. Healing through food, Chakras and Mudras. Physical, Mental, Emotional and Spiritual health using traditional knowledge.

Unit-III

Positivity: Traditional approaches. Happiness: objective and subjective measures of wellbeing, life satisfaction. Resilience, Self-regulation and self-control, optimism, self-esteem. Managing thoughts and Emotions with the help of Rajyoga. Achieving Powers for Self Mastery.

Unit-IV

Achieving Consciousness through Indian Knowledge System: Emotional intelligence, Indian approach to Psychology. Consciousness; levels, body-mind relationship, self motivation, Self and Identity in modern Psychology and Indian thought., Spirituality and well being.

Refrence and Text Books:

- Mahadevan, M., Bhat, V.R. & Pavana N. (2022). Introduction to Indian Knowledge System: Concepts and Applications. PHI Learning
- Baumgardner, SR & Crothers, MK (2009). Positive Psychology. Prentice Hall/Pearson Education.
- Cornelissen, R.M., Misra G. & Varma S. (2014). Foundations & Applications of Indian Psychology. Pearson Education.
- Rajyoga Education and Consciousness Improvement Programme for Educators, Rajyoga Education and Research Foundation. Rajyoga Meditation Course, Thoughkart, Jaipur(Rajasthan), India.
- Prakartik Swasthya Shastra, Publisher Natural Lifestyle

Bachelor of Technology (Biotechnology), UIET, KUK
Credit-Based (w.e.f. 2024-2025)
Modified SCHEME OF STUDIES/EXAMINATIONS (Semester-VII)

S.No	CourseNo./Code	Subject	L:T:P	Hours/Week	Credits	Examination Schedule (Marks)				Duration Of exam (Hours)
						MajorTest	MinorTest	Practical	Total	
1	PTC-401	Food and Nutrition Technology	3:0:0	3	3	75	25	0	100	3
2	PTC-403	Biocatalysis and Biotransformation	3:0:0	3	3	75	25	0	100	3
3	PTE-III	Program Elective-III*	2:0:0	2	2	75	25	0	100	3
4	PTE-IV	Program Elective-IV *	2:0:0	2	2	75	25	0	100	3
5	OTS-III	Open Subject-III**	3:0:0	3	3	75	25	0	100	3
6	OTS-IV	Open Subject-IV**	2:0:0	2	2	75	25	0	100	3
7	HSMC-II	Elective-II***	3:0:0	3	3	75	25	0	100	3
8	PTC-405	Food and Nutrition Biology Lab	0:0:3	3	1.5	-	40	60	100	3
9	PTS-401	Project-I	0:0:4	4	2	-	40	60	100	3
10	PTS-403	Industrial Training	0:0:1	1	0.5	-	100	-	100	3
		Total	18:0:8	26	22	525	355	120	1000	-

Students shall have to select one elective from each group of Program Elective-III/IV, Open Subjects-III/IV and HSMC Elective-II.

Program Elective-III*

PTE-401 Gene Expression and Transgenics
PTE-403 Quality Control Management in Biotechnology
PTE-405 Tissue Engineering
PTE-407 Biostatistics

Program Elective-IV*

PTE-409 Essentials of Virology
PTE-411 Biosensors & Bioinstrumentation
PTE-413 Biomedical Engineering
PTE-415 Omics Technology

Open Subject-III**	Open Subject-IV**	HSMC Elective-II***
OTS-401 Robotics	OTS-409 Bioterrorism and National Security	HSMC-401 Introduction to Industrial Management
OTS-403 Virtual Reality	OTS-411 Biosimilar Technology	HSMC-402 Industrial Psychology
OTS-405 Pharmaceutical Biotechnology	OTS-413 Comparative and Functional Genomics	HSMC-403 Innovation, Startups & Entrepreneurship
		HSMC-404 Intellectual Property Rights (IPR) & Regulators

Open subject III and IV may also be offered in online mode through MOOC offered by SWAYAM & NPTEL.

PTC-401	Food and Nutrition Technology (B.Tech. Biotechnology) Semester VII						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To familiarize the students with various aspects of Food Biotechnology**						
Course outcome							
CO1	**Student to learn about significance of fermentation and know about fermented foods and waste disposal methods from food industries**						
CO2	**To learn the development of novel food and food ingredients.**						
CO3	**Able to understand various methods of preservation**						
CO4	**Student will learn about monitoring of food quality and packaging techniques.**						

UNIT I

1. **Classification of foods.**
2. **Food Fermentation Technology:** Important fermented foods and beverages, Significance of fermentation.
3. **Waste Disposal:** Methods of waste disposal from various food industries.

UNIT II

4. **Novel Food and Functional Foods:** Artificial sweeteners, food supplements, food colorings, probiotics, cereals.
5. **Neutraceuticals:** Sources, Classification, Types, Significance.

UNIT III

6. **Food Spoilage :** Factors affecting spoilage- Intrinsic and extrinsic factors affecting microbial growth in foods: Intrinsic factors (Nutrient contents, pH, moisture contents/water activity, Antimicrobial substances), Extrinsic factors (relative humidity, temperature, gaseous atmosphere).
7. F**ood Processing and preservation**- Objectives of food processing.Thermal processing- Pasteurization, Canning. Cold preservation – Freezing and Chilling. Chemical preservatives and food dehydration, Class I and Class II preservatives, Use of Radiations for food preservation. Preservation by fermentation.

UNIT IV

8. **Monitoring of food quality - HACCP.**
9. **Packaging of Food:** Need for packaging, requirements for packaging, Containers for packaging (glass, metal, plastics and aluminium foil). Types of Packaging- Primary, Secondary and Tertiary; Flexible Packaging, Biodegradable Packaging, Edible films. Aseptic Packaging, Modified Atmosphere Packaging.

Text Books:

1 Food Science and Nutrition: Sunetra Roday (2013) Oxford University Press, New Delhi.

2 Food Microbiology: Fundamentals and Frontier. Beuchat, Doyle & Montville. (2001). Blackwell Synergy.

3 Food Microbiology. Frazier, W.C. and Westhoff, D.C. (2010) Tata Mc-Graw Hill, New Delhi.

4 Modern Food Microbiology. Jay, J.M. (1996) CBS Publishers and Distributors, New Delhi

5 Foods: Facts and Principles. N. Shakuntala Manay and M. Shadakshara Swami.(2012) New Age International (P) Ltd, Publishers.

Reference Books:

6. Biotechnology Food Fermentation Vol. I & II. Eds. Joshi, V.K. & Pandey, A. (1999) Educa tional Publishers and Distributers, Kerala.

7. Biotechnological Strategies in Agroprocessing. Eds. Marwaha S.S & Arora, J.K. (2003)

8. Ray, Bibek.(1996). Fundamental Food Microbiology .CRC Press.

9. Food Microbiology: 2nd ed, Adam, M. R. and Moss (2003) Panima Pub, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PTC 403	Biocatalysis & Biotransformation (B.Tech. Biotechnology Semester-VII)						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
3	-	-	3	75	25	100	3 Hrs
Purpose	To familiarize the students with Concepts of Biocatalysis and Biotransformation						
Course outcome	After completion of this course the students will be able						
CO1	To articulate the concepts of Biocatalysis and Biotransformation.						
CO2	To differentiate between different strategies for production of succinic acid.						
CO3	To appreciate the use of peptide in pharmaceutical industry..						
CO4	To compare computational tools for enzyme function prediction.						

UNIT I

1. **Introduction to biocatalysis, Current market of biocatalysis, fermentation, concept of biotransformation and advantages and limitations of biotransformation.**
2. **Development of chemo enzymatic processes: synthetic route design and integration of biocatalysis, chemo-enzymatic process development.**

UNIT II

3. **Production of Dicarboxylic Acid Using Yeasts: Current Uses and Production of Dicarboxylic Acids, Selection and Improvement of Yeast Strains, Selection and Improvement of Yeast Strains, Metabolic Engineering Strategies for Biotechnological Production of Succinic Acid.**
4. **Engineering Proteases for Industrial Applications: Proteases in Industry, Serine Proteases and Subtilisins, serine and cysteine protease for peptide synthesis . Protease discovery.**

UNIT III

5. **Biocatalysis for drug discovery and development: Introduction, hydrolytic reactions, reduction, oxidation, whole cell biocatalyst, biocatalyst for pharmaceutical industry.**
6. **Transaminases: Transaminases as a Biosynthetic Route for Chiral Amines, Kinetic Resolution of Amines Employing ATAs, Recent Advances in Industrially Relevant Asymmetric Reductive Amination Reactions, ATA Screening Kit.**

UNIT IV

7. **Structural Bioinformatics and Biocatalysis Research: Computational Tools for Function Prediction and Analysis of Enzymes.**
8. **Recent development in biotransformation: current challenges and future scopes of biotransformation process.**

Reference/Text books

1. **Green Biocatalysis edited by Ramesh N. Patel, John Wiley and Sons, 2016.**
2. **Biotransformation of Agricultural Waste and By-Products edited by Palmiro Poltronieri and Oscar Fernando D'Urso, Elsevier Inc, 2016.**
3. **Applied Biocatalysis edited by Lutz Hilterhaus, Andreas Liese, Ulrich Kettling, and Garabed Antranikian, Wiley-VCH, 2016.**
4. **Journal of Biocatalysis and Biotransformation.**

PTC-405	Food and Nutrition Biology LAB (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Practical**	**Total**	**Time**
-	**-**	**3**	**1.5**	**40**	**60**	**100**	**3 Hrs**
Purpose	**To learn the practical aspects of Food and Nutrition Technology**						
Course Outcomes							
CO1	**Students will microbiologically analyse different food samples.**						
CO2	**Students will learn to test the quality of water and milk**						
CO3	**Students will learn the technique of analyzing protein, fat , carbohydrates and fibre in different food samples**						
CO4	**Students will explore the vermicomposting and biogas plant and learn the technique of vermicomposting and biogas formation**						

LABORATORY EXPERIMENTS

1. Estimation of proteins in different food samples.
2. Microbiological analysis of water and food samples.
3. Determination of pH and TDS in water samples.
4. Analysis of carbohydrates in various food products.
5 Testing of Milk and M ilk Products- Testing the adulterants present in milk.
6. Analysis of fibre using Fibre Analyzer in various food products.
7 Analysis of proteins using protein analyzer in various food products
8. Analysis of fats using fat analyzer in various food products.
9. Analysis of Phytochemical activity of medicinal plants.
10. Visit to Vermicomposting and Biogas Plant.

Text Books:

1 Food Science and Nutrition: Sunetra Roday (2013) Oxford University Press, New Delhi.
2 Food Microbiology: Fundamentals and Frontier. Beuchat, Doyle & Montville. (2001). Blackwell Synergy.
3 Food Microbiology. Frazier, W.C. and Westhoff, D.C. (2010) Tata Mc-Graw Hill, New Delhi.
4 Modern Food Microbiology. Jay, J.M. (1996) CBS Publishers and Distributors, New Delhi
5 Foods: Facts and Principles. N. Shakuntala Manay and M. Shadakshara Swami.(2012) New Age International (P) Ltd, Publishers.

Reference Books:

6. Biotechnology Food Fermentation Vol. I & II. Eds. Joshi, V.K. & Pandey, A. (1999) Educa tional Publishers and Distributers, Kerala.
7. Biotechnological Strategies in Agroprocessing. Eds. Marwaha S.S & Arora, J.K. (2003) 8. Ray, Bibek.(1996). Fundamental Food Microbiology .CRC Press.
9. Food Microbiology: 2nd ed, Adam, M. R. and Moss (2003) Panima Pub, New Delhi.

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

PTE-401	Gene Expression and Transgenics (B. Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	-	**-**	**2**	**75**	**25**	**100**	**3 Hrs**
Purpose	**To provide detail about various aspects of protein expression in different expression system and creation of transgenic animals**						
Course Outcomes							
CO 1	**Students will learn about the different expression vectors**						
CO 2	**Students will have knowledge nabout different gene expression systems for over expression of recombinant proteins and protein complexes for different applications.**						
CO 3	**Students will learn about purification of proteins expressed in different expression systems**						
CO 4	**Students will learn the methods of transgenic animals generation and their applications in research.**						

UNIT I

Overview of recombinant protein expression vectors and promoters, Vectors with tags His, GST, MBP, GFP, Cleavable tag and non-cleavable tags, Vectors for tag free protein expressions.

UNIT II

Over-expression of integral membrane proteins, Over-expression in E. coli, B. subtilis, yeasts like S. cerevisiae Mammalian cell line like Chinese Hamster ovary (CHO) and Human embryonic kidney (HEK), Plant single cell. Chloroplast transformation and protein expression in chloroplasts

UNIT III

Cell free protein Expression-Cell free extracts from E. coli, rabbit, wheat germ, insects. Purification of tagged and tag-free proteins,

UNIT-IV

Use of transgenic animals. History, safety and ethics of transgenic animals. Methods for creation of transgenic animals-DNA microinjection, Embryonic stem cell-mediated gene transfer, Retrovirus-mediated gene transfer. Use transgenic animals in toxicology, in mammalian developmental genetics, in molecular biology in the pharmaceutical industry, in biotechnology, Humanized animal models

Text Books:

1. Gene Expression Systems, Using Nature for the Art of Expression. Edited by Joseph M. Fernandez and James P. Hoeffler.
2. Regulation of Gene Expression, By Perdew, Gary H., Vanden Heuvel, Jack P., Peters, Jeffrey M. Springer.
3. Prokaryotic Gene Expression. Edited by Simon Baumberg. Oxford Press

Reference Books:

1. Transgenic Animal Technology,3rd Edition, A Laboratory Handbook By Carl Pinkert. Elsevier.
2. Ethical Use of Transgenic Animals (English, Paperback, Shah Krunal V). Lambert.
3. Transgenic Animals as Model Systems for Human Diseases. Edited E. F. Wagner F. Theuring. Springer

PTE-403	Quality Control Management in Biotechnology (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credits**	**Minor Test**	**Major Test**	**Total**	**Time**
2	**-**	**-**	**2**	**25**	**75**	**100**	**3 Hrs**
Purpose	**To learn various aspects of Quality control management in Biotechnology**						
Course Outcomes							
CO1	**Students will learn the regulatory requirements governing quality control management in Biotechnology**						
CO2	**Students will be able to understand the principles of quality assurance, including Good Laboratory Practices (GLP), Good Manufacturing Practices (GMP), and Good Documentation Practices (GDP).**						
CO3	**Students will learn how to interpret analytical data obtained from quality control testing and make informed decisions regarding the quality and safety of biotechnological products.**						
CO4	**Students will understand the principles of risk management as applied to biotechnological processes and products and familiarity with quality management systems.**						

UNIT-I

1. **Regulatory Compliance**: Ensure adherence to relevant regulations and standards such as Good Manufacturing Practices (GMP), Good Laboratory Practices (GLP), and ISO standards applicable to the biotechnology industry.
2. **Training and Education**: Provide regular training to personnel involved in quality control competency and awareness of regulatory requirements.
3. **Documented Procedures**: Develop and maintain comprehensive standard operating procedures (SOPs) for all quality control processes including sampling, testing, and data analysis.

UNIT-II

4. Instrumentation and Equipment: Regularly calibrate and maintain laboratory equipment and instrumentation to ensure accurate and reliable results.

5. Raw Material Testing: Perform thorough testing of raw materials to verify their identity, purity, and quality before use in manufacturing processes.

6. In-process Testing: Implement in-process testing at various stages of production to monitor critical parameters and ensure product quality and consistency.

UNIT-III

7. Finished Product Testing: Conduct comprehensive testing of finished biotechnology products to assess their safety, efficacy, and compliance with specifications.

8. Monitoring: Monitor environmental conditions in manufacturing facilities to prevent contamination and ensure product integrity.

Unit IV

9. Data Management and Analysis: Establish robust systems for data management, analysis, and documentation to maintain traceability and facilitate regulatory compliance.

10. Continuous Improvement: Implement a system for ongoing review and improvement of quality control processes through methods such as root cause analysis, corrective and preventive actions (CAPA), and risk assessment.

Text Books:

1. “Quality Control” by Dale H. Besterfield et al. Statistical.
2. “Quality Control” by Eugene L. Grant and Richard S. Leavenworth.
3. “Introduction to Statistical Quality Control” by Douglas C. Montgomery.
4. “Quality Management for Organizational Excellence: Introduction to Total Quality” by David L. Goetsch and Stanley Davis.
5. “Quality Management: Essential Planning for Breweries” by Mary Pellettier.

Reference Books:

1. “Quality Management: Introduction to Total Quality Management for Production, Processing, and Services” by Stanley E. Portny et al.
2. “The Lean Six Sigma Pocket Toolbook”: A Quick Reference Guide to 100 Tools for Improving Quality and Speed” by Michael L. George, John Maxey, David Rowlands, and Malcolm Upton.
3. “Six Sigma: The Breakthrough Management Strategy Revolutionizing the World’s Top Corporations” by Mikel Harry and Richard Schroede.
4. “Quality Planning and Analysis”: From Product Development Through Use” by J.M. Juran and F.M. Gryna.

PTE-405	TISSUE ENGINEERING (B. Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Minor Test**	**Major Test**	**Total**	**Time**	**Credit**
2	**-**	**-**	**25**	**75**	**100**	**3 Hrs.**	**2**
Purpose	**To introduce the basics of Tissue Engineering to the students for applications in Biotechnology**						
Course Outcomes							
CO1	**The students will gain knowledge of biomaterials**						
CO 2	**To make the students aware of the basic biology involved in the cell-polymer interactions.**						
CO 3	**To introduce various methods involved to develop scaffolds for tissue engineering**						
CO 4	**To make aware of the applications of tissue engineering in the organ regeneration**						

UNIT-I

1. **Biomaterials**: Natural and synthetic polymers.

UNIT-II

2. **Basic biology**: Fibrous extracellular matrix of the human body and their characteristic features, Cell-Polymer interaction.

UNIT-III

3. **Methods to develop Scaffolds for Tissue engineering**: hydrogel, porous scaffold, and Textile-based techniques used for medical application, Rapid prototyping/3D printing, Wound healing.

UNIT-IV

4. **Organ regeneration**: Cartilage, Skin, Liver, Blood Vessel, Kidney, Urinary bladder, Tendons, Ligaments, Cornea.

Text Books-

1. Principles of Tissue Engineering 2013. Eds: Robert Lanza, Robert Langer, Joseph Vacanti, eBook, 4/e. Imprint: Academic Press.
2. Tissue Engineering: Principles and Practices. 2012. John P. Fisher, Antonios G. Mikos, Joseph D. Bronzino, Donald R. Peterson, 1/e CRC Press.
3. Biomaterials for Musculoskeletal Regeneration- Applications 2017. By Bikramjit Basu, Sourabh Ghosh, Springer.

PTE-407	Biostatistics (B. Tech Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2**	**75**	**25**	**100**	**3**
Purpose	To Introduce statistical concept for biological data interpretation						
	Course Outcomes						
CO 1	To develop basic understanding about statistics.						
CO 2	To develop basic knowledge of probability and different tests.						
CO 3	To derive numerical approach between data correlation and their variations.						
CO 4	To understand the numbers and errors						

Unit- I

Introduction: Basic concept of statistics, Difference between statistics and mathematics, Samples and variables, Frequency distribution curve and basic quantitative method: Mean median, mode, standard deviation and variance.

Unit-II

Probability distribution: Basic concept of probability, binomial distribution, Poisson Distribution and normal distribution.

Hypothesis testing: Students Ttest, estimation of null hypothesis, confidence limit of variance and chisquare test.

Unit-III

Analysis of Variance: F-test, One way ANOVA and Two way ANOVA.

Correlation and Regression: Analysis of correlation and their different types, analysis of covariance and multiple regressions.

Unit-IV

Approximation and error: Introduction, Accuracy of numbers: approximate number, significant number, rounding off. Different types of error.

Role of computer in solving biostatical problem: Genetic Algorithm, Application of statistical methods in biotechnology.

Text Books

1. 1. Statistical Methods. S.P.Gupta. Sultan chand and sons, New delhi.

Reference Books:

1. Introduction to Biostatistics. Glover T. and Mitchell K. (2002). MacGraw Hill, New York.
2. 2. Fundamentals of Biostatistics. Rosner Bernard. (1999), Duxbury Press.

PTE-409	Essentials of Virology (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**2**	**75**	**25**	**100**	**3 Hrs**
Purpose	This course will introduce students to the key concepts in virology that will help to understand how viral replication and multiplication occur in Prokaryotes as well as in Eukaryotes.						
Course Outcomes							
CO 1	Knowledge regarding the basics of Virology.						
CO 2	Building the foundation of Viral Replication & Multiplication.						
CO 3	Students will learn about Viruses of Prokaryotes.						
CO 4	Students will learn about Viruses of Eukaryotes.						

Unit 1

Introduction:
Virus and Virion: General properties of viruses, nature of the virion. Nomenclature and Classification of Viruses. Subviral particles- Viroids and Prions.

Unit 2

Viral Replication & Multiplication:
Growth & Quantification: The virus host, Quantification of virus. Virus replication: General features of Viral replication, virus multiplication- attachment and penetration, production of viral nucleic acid and Protein.

Unit 3

Viral Diversity-Viruses of Prokaryotes:
Overview of bacterial viruses, Virulent Bacteriophage, Temperate Bacteriophages, Bacteriophage Lambda. RNA Bacteriophages; Icosohedral single stranded DNA Bacteriophages, Filamentous single Stranded DNA Bacteriophages- T7, Mu: Double Stranded transposable DNA Bacteriophage.

Unit 4

Viral diversity- Viruses of Eukaryotes:
Plant viruses. Positive strand RNA Viruses of animals- Poliovirus and Coronavirus. Negative strand RNA Viruses of animals- Rabies & Influenza. Double stranded DNA Viruses-Herpesvirus and Adenovirus. Viruses with reverse transcriptase- Retroviruses.

REFERENCES:

1. Brock: Biology of Microorganisms. By Madigan and Martinko. 11th Ed. 2005. Prentice Hall-Pearson Publications. New Jersey, US.

2. Microbiology. Pelczar, M.J., Chan, E.C.S. and Kreig, N.R. Tata McGraw Hill, New Delhi.
3. Introduction to Modern Virology. Dimmock, N.J. and Primrose, S.B.4th Ed. Blackwell Science Publications, Oxford.
4. Medical Virology. Morag, C & Tinbury, M.C. Churchil Livingstone, London.
5. Functionals of Plant virology. Mathew, R.E. Academic Press. San Diego, US.
6. The genetics of bacteria and their viruses. William Hayes. Blackwell Scientific Publishers, Oxford.

PTE-411	Biosensors and Bioinstrumentation (B.Tech. Biotechnology) Semester- VII						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**2**	**75**	**25**	**100**	**3**
Purpose	**To familiarize the students with the Biosensors and Bioinstrumentation**						
Course Outcomes							
CO1	Students will become familiar to transducer and laboratory instruments						
CO2	Students known about assay and automation						
CO3	Students will know about the sensor used in cardiac and respiratory system						
CO4	Students will focus on the application part of biosensor						

Note: The Examiner will be given the question paper template and will have to set the question paper according to the template provided along with the syllabus.

UNIT – I

Transducers: Classification, resistive strain gauges, piezoelectric transducers, Electromagnetic transducers, Optical transducers, Transducers for biomedical science and their applications.

Analytical Instruments: pH meters, radiometric devices, fluorescence spectrophotometers, chromatology (chromatographic techniques- GC and HPLC), lab on a chip – related instrumentation, Validation, commissioning and maintenance of the above equipment's.

UNIT – II

Assay Technologies: Radiometric assay, scintillation proximity assay, fluorescence methodology to cover all types of fluorescence measurements and instrumentation.

Automation and Robotics: Introduction: management and services issues of a centralized robotics HTS (high throughput screening) core, flexible use of people and machines, Bar-code technology and a centralized database.

UNIT – III

Cardiac and vascular system: Overview of cardiovascular system, types of blood pressure sensors, Lumped parameters modeling of a catheter- sensor/system, heart sounds, cardiac catheterization, measuring blood flow rate, pacemakers, cardiac-assist devices and heart valves- related instrumentation of equipments and involved sensors.

Respiratory system: Modeling the respiratory system, measuring gas flow rate and lung volume, tests of respiratory mechanics, measuring gas concentration, ventilators, anesthesia machines- related instrumentation of equipments and involved sensors.

UNIT – IV

Biosensors: Introduction and concepts, biosensors for personal diabetes management, micro fabricated sensors, commercial development of biosensors, electrochemical sensors, chemical fibrosensors, noninvasive blood-gas monitoring, blood-glucose sensors BIA core- an optical biosensors. Noninvasive biosensors in clinical analysis, Applications of biosensors based instruments to bioprocess industry. Applications of biosensors to environmental samples, Biochips and their application to genomics

REFERNECES:

1. Introduction to Bio-analytical Sensors by Alice J Cunningham New York, John Wiley, 1998.
2. Biosensors and their applications by C Yang Victor & TNgo That, Plenum Press NY, 2000.
3. Biosensors- An Introduction by R. Eggins Brain.
4. Transducers and instrumentation by D V S Murthy, Prentice Hall, 1995.
5. Commercial sensors by Graham Ramasay, John Wiley & Son, INC, 1998.
6. Biosensors by Jon Cooper and Tony Cass, Oxford University Press, 2004

PTE- 413	Biomedical Engineering (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**2**	**75**	**25**	**100**	**3 Hrs**
Purpose	To enlighten student's knowledge about biomedical Engineering by acquiring knowledge of equipments and techniques involved						
Course Outcomes							
CO 1	Students will learn about basics of bioelectric signals and electrodes						
CO 2	Students will learn about various equipments involved in diagnostic						
CO 3	Students will be able to understand the working principle of various therapeutic equipments						
CO 4	Students will have learn calibration and testing of equipments						

UNIT I

Basics of Biomedical Engineering: - Sources of Biomedical Signals, Basic medical Instrumentation system, Microprocessors & Computers in medical instruments. Bioelectric Signals and Electrodes: Bio-potentials and their origin: ECG, EEG, EMG, ENG, ERG, EOG, MEG. Bio-potential electrodes, generalized medical instrumentation system-Man machine interface.

UNIT II

Diagnostic Equipments: Specifications of instruments, ECG: normal and abnormal waveform, diagnosis interpretation, ECG leads connections, Einthoven triangle, Plethysmography, Blood pressure measurement: direct and indirect methods, Cardiac output measurements, Respiratory volume measurement, Impedance pneumograph, Spirometers, Pneumotachometers. EEG: signal amplitudes and frequency bands, EEG machine. Blood cell counter, Endoscopes, Laparoscopes and Camera pill.

UNIT III

Therapeutic Equipments: Heart lung machine, Dialyzers: basic principle of dialysis, different types of dialyzer, membranes, portable type. Cardiac pacemakers: external and Implantable pacemaker. Cardiac defibrillator: DC defibrillator, implantable defibrillator and defibrillator analyzer. Ventilators, Anesthesia machine, Short wave diathermy, microwave diathermy, ultrasonic therapy unit, electrotherapy

UNIT IV

Patient Safety: Selection of system parameters, Electric shock hazards, leakage currents, electrical safety analyzer, testing of biomedical equipments. Calibration and testing of biomedical equipments. Modern biomedical equipments and systems: Market scenario.

Books Recommended:

1. John G. Webster, "Medical Instrumentation Application and Design" 4th Ed, Wiley, 2011.
2. Joseph J Carr, John M Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, NewDelhi, 2011.

3. L. J. Street, “Introduction to Biomedical Engineering Technology”, 2 nd Ed, CRC Press, 2011.
4. Khandpur R S, “Medical Instrumentation: Application and Design”, 3Rd Ed, John Wiley & Sons, 2009.

PTE-415	Omics Technology (B.Tech. Biotechnology Semester VII)						
Lecture	Tutorial	Practical	Credit	Major Test	Minor Test	Total	Time
2	0	-	2	75	25	100	3 Hrs.
Purpose	To familiarize the students with the concepts of technologies pertinent to Genomics, Transcriptomics, and Proteomics, and to demonstrate their applications..						
Course Outcomes							
CO1	Analyse the genome of a simple organism to understand its functioning						
CO2	Appreciate the usage of proteomics and transcriptomics approaches to obtain a global picture of cellular activities						
CO3	Understand the concept of Metabolomic and data anaylsis.						
CO4	Appreciate the use of Omics in different fields						

UNIT 1

Brief overview of prokaryotic and eukaryotic genome; Extrachromosomal DNA: bacterial plasmids, mitochondria and chloroplast; Organization of the genome, Genome mapping

UNIT-II

Basics of protein chemistry and proteomics; Separation of proteins, Detection of post-translational modifications Yeast Two Hybrid System, overview of transcriptomics and its applications

UNIT-III

Basics of Metabolomics, Analysis of metabolome: NMR for metabolomics, Gas chromatography, High-performance liquid chromatography , Mass spectrometry and data anaysis.

UNIT-IV

Applications of Omics: Genomics & proteomics in Medicine, personalized medicine, Microbial genomes , Proteomics and metabolomics for biomarker discovery & disease diagnosis .

Recommend Books:

Textbooks:

1. S. B. Primrose and R. M. Twyman , Blackwell Publishing (2006) 7 th Edition.

Reference Books 1. A. M. Lesk, Introduction to Genomics, Oxford University Press (2017), 3rd Edition.

2. R. Twyman, Principles of Proteomics, CRC Press (2013), 2nd Edition.

Self-Learning Material 1. https://nptel.ac.in/courses/102/103/102103017/

3) Functional Genomics (Methods in Molecular Biology) by Kaufmann, Michael, Klinger, Claudia, Savelsbergh, Andreas, Humana Press; ISBN: 978-1-4939-7230-2.

4) Proteomics: From Protein Sequence to Function. Stephen Pennington, Michael J Dunn, Viva Books Private Limited, ISBN: 9789386105998.

5) Discovering genomics, proteomics, and bioinformatics, by A Malcolm Campbell; Laurie J Heyer; Cold Spring Harbor Laboratory Press.; Benjamin/Cummings Publishing Company, ISBN: 0805382194 9780805382198.
6) Principles of Gene manipulation and Genomics, 7th edition/S. By Sandy B. Primrose, Richard Twyman. Wiley-Blackwell, ISBN: 978-1-405-13544-3.

B. Tech. 7th Semester Biotechnology Engineering							
Code OTS-401	**ROBOTICS**						
Lecture	**Tutorial**	**Practical**	**Credits**	**Major Test**	**Minor Test**	**Total**	**Time (Hrs.)**
3	**0**	**0**	**3**	**75**	**25**	**100**	**3**
Purpose	The purpose of this course is to make the students understand about the fundamental of robotics technology, its components and robotics cell design and control.						
Course Outcomes							
CO1	Students will be able to understand the fundamentals of robotics and find its applications.						
CO2	Students will be able to explain the use of different sensors and end effectors in robotics.						
CO3	Students will be able to describe the application of robotics in manufacturing.						
CO4	Students will be able to design and analyze the work cell and robotic motion.						

UNIT-I

Introduction: Automation and robotics, a brief history of robotics, Introduction, Definition, Functions, Advantages, Disadvantages, applications,

Fundamental of robotics: Robot anatomy, robotic components, classification of robots, Robotic specifications

UNIT-II

Sensors in robotics: Type of sensors in robotics, force and torque sensors, proximity sensors (position sensors), range sensors, machine vision sensors, velocity sensors, acceleration sensors. tactile sensor, use of sensor in robotics.

Robot end effectors: Types of end effectors, characteristics of end-of-arm tooling, elements of end-of-arm tooling.

UNIT-III

Material transfer and equipment: General consideration in robot material handling, material transfer applications, machine loading and unloading,

Grippers: Tool selection of gripper, gripping mechanism, types of gripper, mechanical gripper, vacuum and magnetic grippers.

UNIT-IV

Robot cell design and control: Robot cell layouts, multiple robots and machine interface, other considerations in work cell design, work cell control, interlocks, the work cell controller, robot motion

analysis and control: introduction to manipulator kinematics, manipulator path control, robot dynamics, and configuration of robot control.

Text books:

1. Robot Analysis and Control- Asada, H., and J. J. Slotine, Wiley.
2. CAD/CAM: Computer Aided Design and Manufacturing- Groover M.P. and Zimmers E. W., Prentice Hall International, New Delhi.

Reference Books:

1. Robotics and Control-R. K. Mittal, I. J. Nagrath, McGraw Hill.
2. Fundamental of Robotics Analysis and Control-Robert J Schilling, Pearson
3. Industrial Automation and Robotics-J K Arora, Laxmi Publications

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Note: The paper setter will set the paper as per the question paper templates provided.

OTS-403	Virtual Reality						
L	**T**	**P**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	0	0	3	75	25	**100**	3Hrs

Purpose	To introduce the concept of virtual reality along with augmented & mixed reality and their applications in real world.
CO 1	Describe how VR systems work and list the applications of VR.
CO 2	Study of various input & output devices used in VR systems.
CO3	Learning about the applications of virtual reality.
CO4	To Understand about Augmented and mixed reality

UNIT- 1

Virtual Reality And Virtual Environments: The historical development of VR: Scientific landmarks Computer Graphics, Real-time computer graphics, Flight simulation, Virtual environments, Requirements for VR, benefits of Virtual reality.

Introduction, Components of a VR system, 3D User Interface Input and Output devices, 3D viewing, Designing & Building VR Systems

UNIT- II

3d User Interface Input Hardware: Input device characteristics, Desktop input devices, Tracking Devices, 3D Mice, Special Purpose Input Devices, Direct Human Input, Home - Brewed Input Devices, Choosing Input Devices for 3D Interfaces.

UNIT- III

Travel and Wayfinding in Virtual Environments, Strategies for Designing and Developing 3D UIs, Evaluation of 3D User Interfaces.

Virtual Reality Applications: Engineering, Architecture, Education, Medicine, Entertainment, Science, Training.

UNIT- IV

Introduction to Augmented and Mixed Reality, Taxonomy, technology and features of augmented reality, difference between AR and VR, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality, wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, enhancing interactivity in AR environments, evaluating AR systems.

Text/Refrence Books:

1. Alan B Craig, William R Sherman and Jeffrey D Will, “Developing Virtual Reality Applications: Foundations of Effective Design”, Morgan Kaufmann, 2009.

2. Gerard Jounghyun Kim, “Designing Virtual Systems: The Structured Approach”, 2005.
3. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, “3D User Interfaces, Theory and Practice”, Addison Wesley, USA, 2005.
4. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Meging Real and Virtual Worlds”, 2005.
5. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.
6. John Vince, “Virtual Reality Systems”, Addison Wesley, 1995.

Note: The paper setter will set the paper as per the question paper templates provided.

7th Semester B.Tech (Bio-Technology)

OTS-405	Pharmaceutical Biotechnology (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Minor Test**	**Major Test**	**Total**	**Time**
3	**-**	**-**	**3**	**25**	**75**	**100**	**3 Hrs**
Purpose	**To learn various aspects of pharmaceutical biotechnology**						
Course Outcomes							
CO1	**Students will learn the procedure for discovery and development of drugs**						
CO2	**Students will be able to understand the metabolism of drug in the body and effects of drug on the human body**						
CO3	**Students will learn the basic concepts involved in the preparation of various drugs and their formulations**						
CO4	**Students will understand the management of different Life Style Diseases and know the procedure of Quality control and assurance.**						

UNIT-I

1. Introduction and Different Disciplines of Pharmacy

2. New Drug Discovery and Development Procedure – Preclinical and Clinical trials of drugs. Pharmacogenomics.

UNIT-II

3. ADME: Drug Bioavailability, route of administration (oral, parental, inhalations, topical) Basic Principle of Drug Absorption, Distribution, Metabolism and Excretion.
Pharmacodynamics, Drug receptors.

4. Therapeutic applications of radioisotopes, Applications of Nano technology in Pharmaceuticals.

UNIT-III

5. Basic concepts involved in the preparations of different Drugs and their Dosage forms.

Solid Dosage Forms- Tablets , Capsules, Powders
Semisolid Dosage Forms -Creams, Ointments, Pastes, lotions,
Liquid Dosage Forms like Mixtures, Solutions, Emulsion, Ophthalmic etc.

6. Additives and Excipients used in drug formulations- Colors , flavours, sweeteners, binders, Disintegrating agents and other additives used in prescriptions.

UNIT- IV

7. Management of Life style diseases like obesity, diabetes, B.P., cholesterol heart stroke, cancer, joint problems etc**. -** Precautions, symptoms and treatment. Use of herbs in management of these diseases.

8. **Pharmaceutical products and their Types**
Laxatives, Analgesics, Antiseptics, Antacids, Antibiotics.

9**. Quality control and assurance**- GMP, GLP, ISO- 9000, ISO-9001 validation and Drug Regulatory affairs.

Text Books:

1. Principles of Medicinal Chemistry Vol. 1 Dr. S.S.Kadam, Dr. K.R. Mahadik, Dr. K.G.Bothara
2. Principles of Medicinal Chemistry Vol. 1 Dr. S.S.Kadam, Dr. K.R. Mahadik, Dr. K.G.Bothara
3. Pharmaceutical Dispensing.(2010) Pratibha Anand and Roop K. Khar. CBS Publishers and Distributors Pvt. Ltd.
4. R. M. Mehta, "*Dispensing Pharmacy*", Vallabh Prakashan, New Delhi.
5. Brahmankar, CBS Publishers.

Reference Books:

6. Lipin Cott's Illustrated Reviews Pharmacology. Richard Maria, Pamela, Mary, Sheldon .
7. . Cooper and Guunn's,*"Dispensing for Pharmaceutical Students",* CBS Publishers, Delhi
8. A Owunwonne, *"Hand Book of Radiopharmaceuticals",* Narosa Publishing House, New Delhi.
9. . H C Ansel, *" Introduction to Pharmaceutical Dosage Forms",* K M Varghese& Co., Mumbai.
10. S.N.Pandeya: A Textbook of Inorganic Medicinal Chemistry, S.G.Publishers, Varanasi.
11. Clarke, E. C. G., "*Isolation and Identification of Drugs*", The Pharmaceutical Press, London

OTS-409	Bioterrorism and National Security (B. Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	-	**-**	**2**	**75**	**25**	**100**	**3 Hrs**
Purpose	**To familiarize the students with various aspects of Bioterrorism with concern to security of Nation.**						
Course Outcomes							
CO 1	**Student to learn the types of terrorism and historical concept of different weapons used in terrorism.**						
CO 2	**To learn the development of pathogenesis using microbes as weapons and pathogenecity mechanism**						
CO 3	**Able to understand various methods of prevention, enforcement, and government protocols regarding control measures.**						
CO 4	**Student will learn about monitoring techniques by Government and Health Agencies in management of nation wise threat and panic**.						

UNIT I

Terrorism and Bioterrorism- Definition-Traditional Terrorists-New Terrorists-Nuclear, chemical, and radiological weapons-The psychology of Bioterrorism-Historical perspective.

Bioterrorism agents – Bacteria-Anthrax(*Bacillus anthracis*), Botulism(*Clostridium botulinum* toxin),Plague(*Yersinia pestis*)Small Pox(*Variola major*) Virus- Filoviruses(Ebola ,Marburg), Arenaviruses(Lassa,Machupo) and VHF.

UNIT II

Bioterrorism Weapons and Techniques
Characteristics of microbes and the reasons for their use-Symptoms-Pathogenecity-Epidemiology-natural and targeted release-The biological, techniques of dispersal, and case studies reported in literature.

UNIT III

Prevention and Control of Bioterrorism –
Surveillance and detection- Detection equipment and sensors – Diagnosis-Treatment-Vaccinations-Supplies- Effectiveness-Liability-Public Resistance-Response-First Responders-Infectious Control-Hospital-Prevention- Protection-Decontamination-Notification-Role of Law Enforcement-Economic impact.

UNIT-IV

Bioterrorism Management
Ethical issues: personal, national, the need to inform the public without creating fear, cost-benefit Rations- Information Management-Government control and industry Support-Microbial forensics.

Text Books:

1. Bioterrorism: Guidelines for Medical and Public Health Management, Henderson, Donald, American Medical Association, 1st Edition, 2002.

2. Biological Weapons: Limiting the Threat (BCSIA Studies in International Security), Lederberg, Joshua (Editor), MIT Press, 1999.

3. Bioterrorism and Infectious Agents: A New Dilemma for the 21st Century (Emerging Infectious Diseases of the 21st Century), I.W. Fong and Kenneth Alibek, Springer, 2005.

Reference Books:

1. The Demon in the Freezer: A True Story, Preston, Richard, Fawcett Books, 2003.

2. The Anthrax Letters: A Medical Detective Story, Cole, Leonard A., Joseph Henry Press, 2003.

3. Biotechnology research in an age of terrorism: confronting the dual use dilemma, National Academies of Science, 2003.

4.http://www.centerforhealthsecurity.org/our-work/pubs_archive/pubs-pdfs/2012/sloan_book/Preparing%20for%20Bioterrorism_Gigi%20Kwik%20Gronvall_December%202012.pdf

OTS-411	Biosimilar Technology (B.Tech. Biotechnology Semester VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**-**	**-**	**2**	**75**	**25**	**100**	**3 Hrs.**
Purpose	**To introduce the students with the concepts of Biosimiliar Technology**						
Course Outcomes							
CO1	**To introduce students about design and development of biologics.**						
CO2	**To learn about different biomolecules as biosimilar drugs**						
CO3	**To learn different characterization techniques**						
CO4	**To have knowledge of regulatory framework about biosimilars.**						

Unit I

Introduction to Biopharma:Generics in Biopharma, definition of biologics, biosimilars, super biologics, differences between chemical genetics and biosimilars, The developmental and regulatory challenges in biosimilar development, Prerequisites for Biosimilar development, Biosimilar market potential.

UNIT II

Types of biosimilar drugs*:* Peptides, proteins, antibodies, Enzymes, Vaccines, Nucleic acid based therapies (DNA, RNA, etc), Cell based therapies (including stem cells)

UNIT III

Characterization methods: Aggregation-precipitation, floccules strength, adsorption of proteins & peptides on surfaces, effect of temperature on protein structure, hydration & thermal stability of proteins - solid powders, suspension on non-aqueous solvents, reversed micelles, aqueoussolution of polyols, analytical and spectrophotometric characterization of proteins.

UNIT IV

Bioequivalence studies: Immunogenicity & allergenicity of biosimilars; factors affectingimmunogenicitystructural,postranslationalmodifications,formulations,impurities,manufacturingand formulation methods for biosimilars; Casestudies Indian companies working in this space & their product pipeline (Biocon, Intas, Dr Reddy's, Bharat Biotech, Lupin, Cipla, Shanta, etc);productsErythropoietin,growthhormone,granulocytestimulatingfactors,interferons,streptokinase,monoclonal antibodies.

Text Books/References:

1.LaszloEndrenyi,PaulDeclerckandSheinChungChow,BiosimilarDrugDevelopment, Drugs and Pharmaceutical Sciences, Vol 216, CRC Press.
2.Cheng Liu and K. John Morrow Jr., Biosimilars of Monoclonal Antibodies: A Practical Guide to Manufacturing, Preclinical and Clinical Development, Wiley, Dec 2016.
3.https://www.drugs.com/medical-answers/many-biosimilars-approved-united states-3463281/

Bioequivalence studies: Immunogenicity & allergenicity of biosimilars; factors affectingimmunogenicitystructural,postranslationalmodifications,formulations,impurities,manufacturingand formulation methods for biosimilars; Casestudies Indian companies working in this space & their product pipeline (Biocon, Intas, Dr Reddy's, Bharat Biotech, Lupin, Cipla, Shanta, etc);productsErythropoietin,growthhormone,granulocytestimulatingfactors,interferons,streptokinase,monoclonal antibodies.

Text Books/References:

1.LaszloEndrenyi,PaulDeclerckandSheinChungChow,BiosimilarDrugDevelopment, Drugs and Pharmaceutical Sciences, Vol 216, CRC Press.

2.Cheng Liu and K. John Morrow Jr., Biosimilars of Monoclonal Antibodies: A Practical Guide to Manufacturing, Preclinical and Clinical Development, Wiley, Dec 2016.

3.https://www.drugs.com/medical-answers/many-biosimilars-approved-united states-3463281/

OTS-413	Comparative and Functional Genomics (VII)						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
2	**0**	**0**	**2.0**	**75**	**25**	**100**	**3 Hours**
Course Outcomes							
CO1	Students will have a clear idea about various genomic technologies such as whole genome mapping & sequencing, genome annotation, global gene cloning and gene expression technologies, comparative genomics, introduction to pharmacogenomics						
CO2	The students will know the vast amount of genome information in publically available databases and how to access and best utilize for practical purposes.						
CO3	Able to analyze the gene expression data sets to derive the biologically meaning information						
CO4	Able to apply the knowledge of function genomics in public health						

Unit-I

Introduction to genomics: Genome organization of Model organism- E. coli, Yeast, Mice, A. thaliana, Human etc. Genome statistics

Unit-II

First and 2nd generation sequencing: Sanger sequencing and next generation sequencing; Reverse termination sequencing, Single cell RNA sequencing or single cell RNA sequencing and Applications

Unit-III

Comparative genomics: Genome Annotation i.e. Mining Genomic Sequence Data, gene prediction methods, Physical mapping, Metagenomics, evolutionary relationship, Genome Analysis, Functional maps (Transcriptome, proteome, metabolome) Metabolic network maps

Functional genomics tools: Hybridization and sequencing based approaches. Serial Analysis of Gene Expression-SAGE, DNA- Microarray, Application of DNA Microarray, cDNA-PCR, etc.

SNP: SNP Technologies: Platforms & Analysis Haplotyping: Concepts and Applications and relevance in cancer Biology

Unit-IV

Regulation of gene expression:Gene Function Technologies (Gene Targeting, Gene Silencing (RNAi), micro RNA-human and Drosophila
Biomarkers Pharmacogenomics: Concepts and Applications in Healthcare Role of genotype in drug metabolism Identification & Utilisation of cancer bio-marker

Suggested Text Book(s):

1. Discovering Genomics, proteomics & bioinformatics. Second edition by A Malcolm Campbell, Davidson College; Laurie J. Heyer Davidson College ; With Foreword by Francis S. Collins
2. Molecular Biology of the Gene (1987) Watson J. D., Hopking N., Robast J. and Steiz, J.
3. BIOINFORMATICS: A Practical Guide to the Analysis of Genes and Proteins (Third edition) Andreas D. Baxevanis& B. F. Francis Ouellette Suggested

Reference Book(s):

1. Ronaghi M. Pyrosequencing sheds light on DNA sequencing. Genome Res. 2001 10. Jan;11(1):3-11. Review. PubMed PMID: 11156611
2. Schulze A, Downward J. Navigating gene expression using microarrays—a technology review. Nat Cell Biol. 2001 Aug;3(8):E190-5. Review. PubMed PMID: 11483980
3. Kim JB, Porreca GJ, Song L, Greenway SC, Gorham JM, Church GM, Seidman CE, Seidman JG. Polony multiplex analysis of gene expression (PMAGE) in mouse hypertrophic cardiomyopathy. Science. 2007 Jun 8;316(5830):1481-
4. PubMed PMID: 17556586 4. MacBeath G, Schreiber SL. Printing proteins as microarrays for high-throughput function determination. Science. 2000 Sep 8;289(5485):1760-3. PubMed PMID: 10976071.
5. Shankar J, Wu TD, Clemons KV, Monteiro JP, Mirels LF, et al. (2011) Influence of 17b-Estradiol on Gene Expression of Paracoccidioides during Mycelia-to- Yeast Transition. PLoS ONE 6(12): e28402. doi:10.1371/journal.pone.0028402
6. Mary V. Relling, William E. Evans Nature. Author manuscript; available in PMC 2016 Jan 13.
7. Published in final edited form as: Nature. 2015 Oct 15; 526(7573): 343–350. doi: 10.1038/nature15817

HSMC-401	Introduction to Industrial Management						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hours**
Purpose	The aim of undergoing this course is to enable the students to gain understanding of concepts and the environment of industrial management.						
	Course Outcomes						
CO1	The students will become familiar with the detailed concept of industrial management.						
CO2	The students will understand the concept of Industrial Productivity and Work Environment						
CO3	The students will become familiar with concept of Total Quality Management, it's methods and quality standards						
CO4	The students will be able to understand the importance of Industrial Safety and Occupational Health						

Unit I

Introduction to Industrial Management:
Concept of Industrial Management – Importance of Industrial Management. Scientific approach to Industrial Management- Concept, principles and significance of scientific management. Meaning and factors determining factory location. Concept, objectives and importance of plant layout, factors influencing layout, types of layout, problems of layout.

Unit II

Industrial Productivity and Work Environment :
Meaning of Productivity: Factors affecting Industrial Productivity – Significance of higher Industrial Productivity — Suggestions for Productivity improvement.
Work environment - Factors affecting Work Environment - Lighting, air, ventilation, temperature, water, sanitation and noise. Occupational Hazards- Meaning and types - Biological Hazards, Chemical Hazards and Psychological Hazards. Measures to minimize occupational hazards.

Unit III

Total Quality Management
Concept of TQM ,Principles of TQM – Benefits of TQM.Methods of TQM –Benchmarking, Deming Wheel, Just in time- Objectives and Characteristics of Just in Time, Quality Circles-Concept and features of Quality Circles, Six Sigma Analytical methods – Critical Path Method – Process and advantages of Critical Path Method, Force Field Analysis – Driving and restraining forces, decision making, Failure Mode and Effect Analysis –Meaning and steps in Failure Mode and effect analysis. ISO-9000-Concept, Standards and guidelines.

Unit IV

Industrial Safety and Occupational Health :Definition of safety – Objectives of Safety Management. Industrial Accidents – Causes of Accidents (a) Mechanical causes (b) Human Causes Effects of Industrial accidents on employers, workers and society. Code of practices for accident prevention. Occupational Health- Concept- Health program in industries – Role of National Institute of Occupational Health(NIOH) - legal provisions regarding health-OHSAS 18000- (Occupational Health and Safety Standards)

References:
1) Industrial Safety Chronicle, Quarterly Journal published by National Safety Council.
2) Khanna, O.P. Industrial Engineering and Management. Dhanpat Rai Publications, New Delhi.
3) Ahuja, K.K. Industrial Management and Organisational Behaviour. Khanna Publishers, Delhi.
4) Rao, Thukaram. Industrial Management. Himalaya Publishing House, Mumbai.
5) Aswathappa, K. Factory Organisation and Management. Himalaya Publishing House, Mumbai.
6) Telsang. Martand. Industrial and Business Management. S Chand Publications, New Delhi. 7) Deshpande, A.S. Industrial Organisation and Management. Vora & Co Publishers,Mumbai. 8) Rao, Sunil S. & Jain R.K., Industrial Safety, Health and Environment Management Systems. Khanna Publishers, Delhi.
9) Sarma, A.M., Industrial Health and Safety Management. Himalaya Publishing House, Mumbai.
10) Mukherjee, P.N. Total Quality Management. Prentice Hall, New Delhi.

Note: The paper setter will set the paper as per the question paper templates provided.

HSMC-402	Industrial Psychology						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hours**
Purpose	The aim of undergoing this course is to develop an awareness of the major perspectives underlying the field of Industrial Psychology and understanding for the potential Industrial Psychology has for society and organizations now and in the future.						
	Course Outcomes						
CO1	The student will be able to understand the key concepts, theoretical perspectives, and trends in industrial psychology.						
CO2	The students will be able to evaluate the problems thorough and systematic competency model.						
CO3	The students will be able to analyze the problems present in the environment and design a job analysis method.						
CO4	The students will be able to understand consumer behavior and organization culture.						

UNIT-I

Introduction: Nature and Meaning of Industrial Psychology, Role of Industrial Psychology, Organizational Attitude.
Motivation & Work behavior. (Theory X and Y, McClelland's, Need Theory, Herzberg's Two Factor Theory, Cultural Differences in Motivation.

UNIT-II

Design of Work Environments: Human engineering and physical environment techniques of job analysis, Social environment: Groups & work teams, Group Behavior, Group formation & development, Decision making process, individual influences, group decision process.

UNIT-III

Work Methods: Efficiency at work, the concept of efficiency, the work methods; hours of work, nature of work, fatigue and boredom. The personal factors; age abilities, interest, job satisfaction, the working environment, noise, atmospheric conditions, increasing efficiency at work; improving the work methods, Time and motion study, its contribution and failure resistance to time and motion studies, need for allowances in time and motion study.

UNIT-IV

Functions of organizational culture, Organizational Socialization, Assessing Cultural Values and Fit, Cross Cultural issues, Meaning, Application of Personality theory in organization, traits, Common personality measurement tools.
Understanding Consumer Behavior: Consumer behavior, study of consumer preference, effects of advertising, Industrial morale: The nature and scope of engineering psychology, its application to industry.

Suggested readings:

1. Nelson, Quick and Khandelwal, ORGB : An innovative approach to learning and teaching Organizational Behavior. A South Asian Perspective, Cengage Learning, 2012
2.Luthans, Fred, Organizational Behavior, McGraw Hill 2008
3. Gilmer, B. V. H. (1961). *Industrial psychology.* McGraw-Hill.
4. Dunnete, M.D., Handbook of Industrial and Organizational Psychology. (1992)
5. Blum & Taylor, Industrial Psychology.

HSMC-403		Innovation, Start ups and Entrepreneurship					
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	Time
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hours**
Purpose	**The objective of this Course The purpose is to inspire students and help them imbibe entrepreneurial mindset.**						
	Course Outcomes						
CO 1	Understanding the essence of innovation and features of innovative processes; models and methods of innovative entrepreneurship, the role of innovation as a major factor in creating the value of companies						
CO 2	Understanding, the dynamic role of entrepreneurship and small businesses, , types of business structure, organizing and managing a Small Business						
CO 3	Understanding concept of start ups, Control Strategic Marketing Planning , concept of incubation and proto type, new Product Development, Business Plan Creation.						
CO 4	Understanding risk analysis in business, financing methods, role of government in supporting entrepreneurship						

Unit -I

Introduction to Innovation : Idea Generation and Identifying Business Opportunities, Management Skills for Entrepreneurs, Innovations and their forms, it's features and characteristics, Factors initiating innovations, Innovation process and its stages, Statistical measurement of innovation, Model of innovation, Source of innovation, Technological transfer, Information technology to support innovation, difference between technological and non-technological innovation

Unit-II

Introduction to Entrepreneurship - Definitions, Traits of an entrepreneur, Intrapreneurship,Entrepreneurial Motivation ,Concept and Growth of Entrepreneurship in India, Types of Business Structures, Similarities /differences between entrepreneurs and managers, Business Ideas and their implementation, Discovering ideas and visualizing the business, Activity map, Types of start ups, role of entrepreneurs in economic development, future of entrepreneurs, entrepreneurial process

Unit –III

Start ups - Initial idea generation and planning stages, and incubation referring to the development, process of identifying and developing new ideas for products, services, or processes, and creating a working model or prototype to test the feasibility of the concept.

Market Analysis – Identifying the target market, Competition evaluation and Strategy Development, Five Cs of Opportunity Identification, Market Opportunity Identification in emerging technology companies, Process of creating and growing a new business venture, Business plan of the innovation project.

Unit –IV

Risk Analysis: Risk management in venture projects, Financing and Protection of Ideas- Financing methods available for start-ups in India, Communication of Ideas to potential investors – Investor Pitch, Patenting and Licenses, Exit strategies for entrepreneurs, bankruptcy, and succession and harvesting strategy, venture capital, angel investment, and crowd funding.

Government support- programs and initiatives aimed at supporting the development of new ideas, innovations, and startups, funding and mentorship, IPR - legal protection of a person's or organization's rights to their invention, brand, or creative work.

Text Books/Reference Books

- Shrutin N Shetty, (2018), Design the Future: Simplifying Design Thinking to Help You, Notion Press
- "Entrepreneurship development small business enterprises", Pearson, Poornima M Charantimath,2013.
- Roy Rajiv, "Entrepreneurship", Oxford University Press, 2011.
- "Innovation and Entrepreneurship",Harper business- Drucker.F, Peter, 2006.
- "Entrepreneurship", Tata Mc-graw Hill Publishing Co.ltd new Delhi- Robert D. Hisrich, Mathew J. Manimala, Michael P Peters and Dean A. Shepherd, 8th Edition, 2012
- The Three-Box Solution: A Strategy for Leading Innovation By Vijay Govindarajan
- Boutellier, Roman; Gassmann, Oliver; von Zedtwitz, Maximilian (2000). Managing Global Innovation. Berlin: Springer.. ISBN 3-540-66832-2.
- K. and Stephen P. Osborne (2005) Managing change and innovation in public service organisation. New York: Routledge
- Cappellin R. and Wink R. (2009) International Knowledge and Innovation Networks Knowledge Creation and Innovation in Medium-technology Clusters. UK: Edward Elgar

Publishing Limited.

- Eveleens, C. (2010). Innovation management; a literature review of innovation process models and their implications. Working Paper HAN University of Applied Sciences.
- Entrepreneurship Development- S.Chand & Co.,Delhi- S.S.Khanka 1999
- Small-Scale Industries and Entrepreneurship. Himalaya Publishing House, Delhi – Vasant Desai 2003.
- Entrepreneurship Management -Cynthia, Kaulgud, Aruna, Vikas Publishing House, Delhi, 2003.
- Entrepreneurship Ideas in Action- L. Greene, Thomson Asia Pvt. Ltd., Singapore, 2007

Note: The paper setter will set the paper as per the question paper templates provided.

HSMC-404	Intellectual Property Rights (IPR) & Regulatory						
Lecture	**Tutorial**	**Practical**	**Credit**	**Major Test**	**Minor Test**	**Total**	**Time**
3	**-**	**-**	**3**	**75**	**25**	**100**	**3 Hours**
Course Outcomes							
Purpose	The course is designed to provide comprehensive knowledge to the students regarding the general principles of IPR, Concept and Theories, International Regime Relating to IPR						
CO1	Students will be familiarized with the introduction about patent concept and legal implications						
CO2	Students will be able understand the concept of copyright in detail						
CO3	Students will be able to understand trademark and law associated with it						
CO4	Students will be able to know about geographical Indications and various IPR matters concerning biotechnology						

Unit-I

Indian patent law: The patents act, 1970,amendments to the patents act, patentable subject matter, patentability criteria, procedure for filing patent applications, patent granting procedure, revocation, patent infringement and remedies, relevant provisions of the biological diversity act, 2002, access and benefit sharing issues, objectives, rights, patent act 1970 and its amendments. procedure of obtaining patents, working of patents. infringement.

Unit-II

Copyrights :Introduction, works protected under copyright law, infringement. introduction to copyright, conceptual basis, international protection of copyright and related rights- Indian copyright act, 1957 with its amendments, copyright works, ownership, transfer and duration of copyright, renewal and termination of copyright

Industrial Designs: Need for protection of industrial designs, subject matter of protection and requirements, the designs act, 2000,procedure for obtaining design protection, revocation, infringement and remedies.

Unit-III

Trademarks : Objectives, types, rights, protection of goodwill, infringement, passing off, need for

protection of trademark, kinds of trademark, process of protection of trademarks, content of the rights, exhaustion of rights, content of the rights, exhaustion of rights, assignment under licensing, infringement, right of goodwill, passing off, domain names and effects of new technology (internet).

Unit-IV

Geographical Indications: Objectives, features, Industrial Designs: Objectives, Rights, Assignments, Infringements, Information Technology Related Intellectual Property Rights, Computer Software and Intellectual Property, Database and Data Protection, Domain Name Protection, Patentability of Biotechnology invention and its commercialization, Budapest treaty , Special issues in Biotechnology Patents: Disclosure Requirements, Collaborative research,competitive research, Necessity of Bioethics and Biosafety measures, Ethical issues against the molecular technologies, Biosafety Levels of Specific Microorganisms.

References:

1 N.S. Gopalakrishnan & T.G. Agitha, Principles of Intellectual Property (2009), Eastern Book Company, Lucknow

2 David I. Bainbridge, Intellectual Property, Longman, 9th Edition, 2012

3 Susan K Sell, Private Power, Public Law: The Globalization of Intellectual Property Rights, Cambridge University Press, 2003

4 N.S. Gopalakrishnan & T.G. Ajitha, Principles of Intellectual Property, Eastern Book Company,2nd Edition , 2014

5 Jayashree Watal, Intellectual Property Rights in the WTO and Developing Countries, Oxford University Press, 2001

6 Lionel Bently & Brad Sherman, Intellectual Property Law, Oxford University Press, 3rd Edition, 2008

7 Duggal Pavan, Legal Framework on Electronic Commerce & Intellectual Property Rights, Universal Publishing House, 2014

8 Paul Torremans, Intellectual Property And Human Rights, Kluwer Law International, 2008

9 Steven D Anderman, Interface Between Intellectual Property Rights and Competition Policy, Cambridge University Press, 2007.

10 Philippe Cullet, Intellectual Property Protection and Sustainable Development, Lexis Nexis, 2005

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