RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY
Faculty of Engineering & Technology
Syllabus for

Third Semester B.Tech (Biotechnology)

Subject: BTBIT 301T (BBT) Microbiology (Theory)
Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I: Historical background of microbiology. Microbial taxonomy, Construction and working principles of different types of microscopes – compound, dark field, phase contract, fluorescence and electron microscope. Study of bacteria, yeasts, molds & actinomyces on the basis of morphology, physiological requirements and reproduction.

Unit II: Nutritional requirements of microorganisms. Autotrophic & hetertrophic mode of Nutrition. Composition and classification of different types of Nutrient media. Methods of isolation & characterisation of pure culture and methods of storage of pure cultures.

Unit III: Growth of microorganisms. Phases of growth curve. Specific growth rate and Generation Time. Growth inhibitors and methods of evaluation of antimicrobial agents. Synchronised & balanced growth . Different methods of enumeration of microorganisms.

Unit IV: Defnation of terms , factors influencing antimicrobial activity, mechanism of cell injury, physical control of growth(moist heat, dry heat, osmotic pressure,radiation, filtration etc) Chemical control (heavy metals, detergents, gaeciour sterilization etc). Effect of heat, water activity, and irradiation on growth of microorganisms, D_{10} value, F value, Z value and TDT curve. standardization of disinfectants.

Unit V: Viruses – Introduction, structure and classification. DNA and RNA viruses, plant and animal viruses. Structure of Bacteriophage, Viral reproduction.- lytic and lysogenic cycle.virus cultivation and assay.

Unit VI: Microbial genetics – Transformation, conjugation and transduction. Economically important bacteria, fungi and viruses and their industrial application.

Books Recommended:

1. Microbiology , Pelezer M.J.Chan ECS & Krieg NR,Tata McGraw Hill
2. Foundation in Microbiology, Talaro K, Talaro A, Cassida Pelzar and Reid W.C.Brown Pub.
3. General Microbiology , R.Y. Stanier
4. General Microbiology , Prescott.
5. General Microbiology , Brook.
6. A textbook of Microbiology by Dr.R.C.Dubey and Maheshwari
7. Textbook of microbiology- R.Ananthanarayana CKJ Paniker
8. General Microbiology vol I and vol II by Powar and Daginawala

Subject: BTBIT 302T (BBT) Bio-Process Calculations (Theory)
Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I: Basic principles, the concept of gram atom and gram mole. Conversion of units from one system to another, concept of excess reactant, conversion and yield, selectivity and degree of completion of reaction.

Unit II: Ideal gases, partial pressure, vapour pressures, application of ideal gas laws, volume changes with changes of composition, dissociating gases, humidity and saturation, solubility and crystallisation.

Unit III: Material balance without chemical reaction, recyle, purge and bypass calculations, material balance with chemical reaction.

Unit IV: Energy balance without chemical reaction, combined material and energy balances.

Unit V: Energy balance with chemical reaction, combined material and energy balances.
Unit VI: Materials and energy balance for biotech systems with specific examples.

Books Recommended:

1. Chemical Process Principles : Hougen and Watson, Vols I & II
2. Stoichiometry : B I Vora and Bhatt
3. Stoichiometry : Williams and Johnson
4. Basic principles and calculation in chemical engineering –David mautner ,himmelblau, james B.Riggs.
5. Biochemical engineering and biotechnology- Ghasem.D. Najafpour
6. Stoichiometry and process calculation- B.Lakshmiktty

Subject: BTBIT 303T (BBT) **Bio-Organic Chemistry** (Theory)
Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I: Chemistry of Carbohydrates: Classification and structure of carbohydrates. Chemical reactions of carbohydrates, physical and chemical properties of sugars, starch, pectin, gums and other polysaccharides.

Unit II: Chemistry of Lipids: Definition and classification of lipids. Chemistry of fatty acids, and fats And compound lipids. Characterization of fats: Saponification and iodine value. Chemistry of processing of oils, hydrogenation of fats, shortening agents, confectionery fat etc. Rancidity of fats and oils, its prevention and antioxidants. Importance of lipid in cell structure.

Unit III: Chemistry of Proteins: Classification and structure of amino acids, Classification and structure Of protein (primary, secondary, tertiary & quaternary). Isolation and purification of proteins. Denaturation and renaturation of protein. Salting in and salting out of protein. Ramachandran plot.

Unit IV: Chemistry of Nucleic acids: Structure of DNA and RNA, Structure of nucleotides and their nucleosides, classification, isolation, separation and assay. Types of RNA: mRNA, rRNA and tRNA and structures. Sequencing of nucleic acids.

Unit V: Chemistry of Enzymes: Introduction, classification and nomenclature of enzymes. Enzyme. regulation. Assay techniques, isolation and purification of enzymes and their importance

Unit VI: Chemistry of Steroids, Vitamins, chemistry of plant and animal pigments, alkaloids, tannins and other phytochemicals.

Books Recommended

1. Principles of Biochemistry- AlbertL. Lehninger CBS Publishers & Distributors
2. Biochemistry – Lubert stryer Freeman International Edition.
3. Biochemistry – Keshav Trehan Wiley Eastern Publications
4. Fundamentals of Bochemistry-J.L.Jain S.Chand and Company
5. Biochemistry- Prasaranga, Bangalore University
6. Fundamental of Biochemistry – Dr.A.C.Deb
7. Textbook of Organic Chemistry (A Modern Approach)
8. The Biochemistry of Nucleic acid – Tenth Edition-Roger L.P.Adams, John T. Knowler and
9. David P.Leader, Chapman and Hall Publications

Subject: BTBIT 304T (BGE) **Applied Mathematics III** (Theory)
Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20 Marks**

Duration of Examination: 3Hours

UNIT I: Integral Transforms-Laplace transform, inverse Laplace transforms, Applications of Laplace transforms in solving ordinary and partial differential equations.

UNIT II : Analytical function, Cauchy-Riemann conditions, conjugate functions, singularities, Cauchy's integral theorem and integral formula, Residue theorem, Evaluation of integral by residue theorem, contour integration,

UNIT III: Partial Linear Differential Equations of first & higher orders, Laplace Equations, Poission equation,Wave equation, Solution of these equations by substitution, Separation of variables.

UNIT IV: Numerical methods using finite difference technique for the solution of parabolic, hyperbolic and elliptic partial differential equations.

UNIT V: Operations Research- Optimization by linear programming, Fundamental theorems of linear programming, simplex methods, Basic variables ,basic solutions ,artificial variables, minimax theorems, Convex set, Vertex of convex set, the external solution to linear programming problems, Charnbig-M-method,

UNIT VI: Statistical Analysis- Test of significance in Large samples, small samples, sampling of attributes, χ^2, t, F, Z distributions. Theory of testing hypothesis in application to acceptance sampling regression and correlation coefficients, Rank correlation coefficients and Test of significance for them.

Books Recommended:

1. Numerical Methods for Scientists and Engineering by Barron and Salvodori.
2. Fundamentals of Mathematical Statistics by Gupta and Kapoor.
3. Elements of Statistics by Elhance.
4. Introduction to Statistics by Goon Gupta and Das gupta.
5. Linear Programming:Methods and Applications by P.K. Gupta and Mannmohan.

Subject: BTBIT 305T (BGE) Applied Physical Chemistry II (Theory)
Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20 Marks**

Duration of Examination: 3Hours

Unit I: Thermodynamics I: The chemical potential, Gibb's Duhem equation, Fugacity, Activity, Determination of fugacity,Chemical equilibria only for Homogeneous system- Reaction Relation Isotherm, between Kp,Kc,Kx, The Van't Hoff equation

Unit II: Thermodynamics II: The Clausius Clapeyron Equation, The Phase Rule and its derivation, its application to water system and CO_2 system, Simple Eutectic system- Lead Silver system, Nernst distribution law, its applications- Solvent extraction theory and principle

Unit III: Thermodynamics of solutions I : Raoult's Law, Vapour Pressures of ideal solutions, Activity of ideal solution, chemical potential of ideal solution, Gibb- Duhem- Margules Equation, Free energy, entropy, and enthalpy of mixing

Unit IV : Thermodynamics of solutions II : Vapour Pressures of real solutions, Vapour Pressure- method composition and Boiling Point composition Curves of completely Miscible Binary Solutions, of Distillation immiscible liquids : Fractional distillation and steam distillation, Colligative point properties-vapour pressure lowering, Osmotic pressure, Elevation of boiling point, depression of freezing

Unit V : Electrochemistry I : Specific, Equivalent and Molecular conductance, effect of temperature on conductivity, Transport Number, their determination- Hittorf's method and Moving Boundary Method, Kohlrausch's Law, its applications, Debye Huckel Theory of strong electrolytes

Unit VI : Electrochemistry II : Reversible electrodes, Reference electrodes, standard electrode potential, Thermodynamics of reversible electrodes, The Nernst Equation, Concentration cells with and without transference, liquid junction potential, Applications of Emf measurements, Hydrolysis of salts

Books Recommended:

1. Thermodynamics for Chemists : S.Glasston, D Van Nostrand Co,New York,USA
2. An Introduction to Thermodynamics : R P Rastogi and R R Mishra
3. Introduction to Electrochemistry : S.Glasston, D Van Nostrand Co,New York,USA
4. Physical Chemistry : G Barrow, Benjamin Publisher, New York,US
5. Physical Chemistry : Vemupalli, Wiley East West
6. Principles of Physical Chemistry : Puri Sharma and Pathania

Subject: BTBIT 306P (BBT Microbiology Laboratory (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 8 Hours

List of Experiments

1. Introduction to parts and working of microscope.
2. Preparation of culture media/ agar slants /plates
3. Demonstration of techniques of pure culture of microorganism.
4. Staining of bacteria (simple and Gram's stain) and fungi.
5. The quantitative bacteriological examination of water/milk by SPC method.
6. Determination of growth curve of bacteria
7. Presumptive test for coliform group of bacteria.
8. IMVic test of enteric bacteria
9. Determination of phenol coefficient.
10. Determination of antibiotic sensitivity test of the UTI causing organism.

Subject: BTBIT 307P (BBT) Bioorganic chemistry Laboratory (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 4 Hours

List of Experiments

1. Preparation of buffers- Citrate and phosphate buffers.
2. Determination of reducing sugar by dinitro-salicylic (DNS) method.
3. Protein estimation by Lowry's method.
4. Protein estimation by Biuret method.
5. Estimation of DNA by diphenylamine reagent method.
6. Estimation of RNA by orcinol reagent method.
7. Determination of isoelectric point of casein.
8. Estimation of inorganic phosphate by Subbarao's method.
9. Quantitative estimation of Ascorbic acid.

Subject: BTBIT 308P (BGE) **Applied Physical Chemistry II** (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 4 Hours

List of Experiments

BT BIT 308P (BGE)

1. To study the $KI_3 \rightarrow KI + I_2$ equilibrium in aqueous solution.
2. To study the ternary system of Toluene-Acetic acid-water
3. To study the adsorption of acetic acid on charcoal and verify the Freundlich adsorption isotherm

4. To determine the heat of crystallization of $CuSO_4$. $5H_2O$.
5. To determine the integral and differential heats of solution of a salt.
6. To determine the thermometric titration curve in the neutralization of strong and weak acids against a strong base.
7. To find the constant of a conductivity cell and hence determine the dissociation constant of a weak acid.
8. To determine the solubility of sparingly soluble salts conductometrically
9. To find the pH of buffers and the dissociation constant of an acid using Quinhydrone electrode.
10. To determine the transport number by the e.m.f. method.
11. To study the kinetics of saponification of methyl acetate by sodium hydroxide by conductometry.
12. To verify the Kohlrausch's law.

RASHTRASANT TUKADOJI MAHARAJ NAGPUR UNIVERSITY

Faculty of Engineering & Technology

Syllabus for

Fourth Semester B.Tech (Biotechnology)

Subject: BTBIT 401T (BBT) **Biochemistry-Metabolism** (Theory)

Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I : Carbohydrate Metabolism: Gluconeogenesis, glycolysis, and TCA cycle, Glycogen metabolism, Hormonal regulation of carbohydrate metabolism. Electron transport chain.

Unit II: Lipid Metabolism- Beta oxidation, oxidation of saturated and unsaturated fatty acids, fatty acid biosynthesis, ketone bodies. Synthesis of phospholipid.

Unit III: Protein and amino acid metabolism (aromatic and sulfur). Nucleic acid metabolism

Unit IV: Plant metabolism – Photosynthetic apparatus (bacterial system), cyclic and non-cyclic Photophosphorylation , Dark reaction. Plant hormones and its regulation in plants. Glyoxylate cycle.

Unit V: Microbial Metabolism

A) Respiration: EMP, HMP and ED Pathways, Oxidative phosphorylation.

B) Metabolism of Xenobiotics (detoxification), free radicals and antioxidants.

Unit VI: Biochemical Energetics: Energy Yielding and Energy Requiring Reactions, Calculations of Equilibrium Concentrations, Oxidation-Reduction Reactions, Metabolism and ATP Yield, Monooxygenase system and ATP pump, Active Transport, Second Law of Thermodynamics, Enthalpy and Entropy, Activation Energy.

Books Recommended:

1. Principles of Biochemistry- AlbertL. Lehninger CBS Publishers & Distributors
2. Biochemistry – Lubert stryer Freeman International Edition.
3. Biochemistry – Keshav Trehan Wiley Eastern Publications
4. Fundamentals of Biochemistry- J.L.Jain S.Chand and Company
5. Biochemistry by U. Satyanarayana and U. Chakrapani
6. Fundamental of Biochemistry – Dr. A. C. Deb
7. Harper's Biochemistry by Robert K. Murray, Harold A. Harper
8. The Biochemistry of Nucleic acid – Tenth Edition-Roger L. P. Adams, John T. Knowler and David P. Leader, Chapman and Hall Publications.
9. Atext book of Biochemistry by Dr.AVSS Ramarao and Suryalakshmi.

Subject: BTBIT 402T (BBT) ***Plant Utilities (Theory)***

Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

UNIT I : THERMODYNAMICS: Laws of perfect gases, thermodynamics processes, First and Second Law of thermodynamics, Entropy, The clausius inequality, Steady Flow Processes, carnot Cycle. **PROPERTIES OF STEAM:** Use of steam tables, measurement of dryness fraction, entropy of steam, temperature entropy and mollier charts, clausius clapeynon equation, Rankine Cycle.

UNIT II: STEAM GENERATORS: General Description, Boiler Mounting and Accessories, Natural and Artifical Draught, Equivalent Evaporation and Thermal efficiency. Fuels use in boilers – liquids, gaseous and hydrocarbon

UNIT III: TURBINE: Theory and working of impulse, reaction and gas turbine. Bleeding and reheating.

UNIT IV: INTERNAL COMBUSION ENGINES: Cycle of operation, two and four stroke cycle, general description of S.I and C. I. engines, ignition, injection and governing.

UNIT V: WATER Sources, conditioning and management of water for cooling of hot gases, cooling towers, cooling ponds. Design of chimney. Constructional details and design aspects.

UNIT VI: ENVIRONMENTAL ASPECTS OF PLANT LOCATION
Environmental issues for site selection, natural disasters.

BOOKS RECOMMENDED

1. Fundamental of Engineering Thermodynamics – John and Howel
2. Introduction to Engineering Thermodynamics – M Gengel and Boles
3. Applied Thermodynamics – Aestop

4. Applied Thermodynamics – R N Joel
5. Energy and Environmental Management in Industries- Gupta

Subject: BTBIT 403T (BBT) *Analytical Biotechnology* ***(Theory)***

Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I: Centrifugation: Principle of centrifugation. Sedimentation, sedimentation constant. Types of centrifugation, swing, fixed angle centrifugation. Introduction to ultracentrifugation and its application.

Unit II: Radiosotopy: Tracer techniques: Radioactive and nonradioactive. Radiotracers. Geiger Muller Counter (GM Counter), Proportional and Scintillation counters, autoradiography. Detection of nonradioisotopes.

Unit III: Spectroscopy: Introduction and Principle of spectroscopy, Beer-Lamberts law, Single beam and double beam spectrophotometer. Types of sphectroscopy techniques and their applications, Infrared and Raman spectroscopy (IR), FTIR Spectroscopy for structural determination of hydrocarbons, aminoacids, carbohydrates. Atomic Absorption Spectrometry – measurement of trace elements,

Unit IV: Chromatography: Classification of techniques, distribution coefficients, retention quantitative chromatography, sorption mechanisms, retention parameters, factors affecting retention, qualitative and aspects of chromatography, peak shape sorption isotherms, column efficiency, band broadening processes, selectivity and resolution. Types of chromatography TLC, paper chromatography, chiral, Gas Chromatography, Liquid Chromatography, HPLC.

Unit V: Electrophoresis: Electrophoresis of proteins and nucleic acids; ID & 2D Gels; pulsed field electrophoresis; capillary electrophoresis; western southern and northern blotting; dot and slot, gel documentation.

Unit VI : Determination of homogeneity of molecular weight of proteins. Mass Spectrometry and its Application - LCMS, MALDI-TOFF and SELDI. Spectrophotometry (UV & Visible) and Spectroflourimetry, , Optical Resonance Dichroism (ORD) and circular dichroism (CDR), Nuclear magnetic Resonance (NMR) and Electron Spin Resonance Spectroscopy (ESRS), Magnetic Resonance Imaging (MRI).

Books recommended:

1) Analytical Biotechnology 01 Edition: Thomas
2) Analytical Biotechnology: Capillary Electrophoresis And Chromatography: Horvath
3) Biophysical Chemistry :Upadhyay and Upadhyay Nath

Subject: BTBIT 404T (BBT) **Cell Biology** ***(Theory)***

Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

Unit I: Biophysics of Membrane: salient features of membrane, chemical composition of membrane, molecular structure, modification of cell membrane and biophysical importance, types of of membrane (nuclear, RBC, mitochondria, cell wall),conformational properties of membrane, permeability of membrane, membrane receptors, Scatchard plots.

Unit II: Membrane transport – simple and facilitated diffusion; active transport, passive transport, uniport, symport and antiport, group translocation and macromolecules as carriers (glucose transport system), Donnan membrane equilibria, membrane hydrolysis, Ultra filtration and Dialysis.

Unit III : Signal Transduction: Types of receptors, legand molecules, mechanisms of signal transduction. Tyrosine kinase, ras, raf, G-protein etc.

Unit IV: Introduction to Cell components of prokaryotes and eukaryotes. Cytoskeleton: Membrane structure and function, extracellular membrane and its role in cell behavior and regulation, microfilament, microtubule, and intermediate filament, Morphogenesis and model organism.

Unit V: Cell cycle and its regulation:Chromosomal organization and introduction to Meiosis and Mitosis, Regulation phase of cell cycle, cell cycle check points, factors involved in cell cycle regulation, Apoptosis and Cancer.

Unit VI: T**echniques of cell biology**: Brief introduction to Stem Cell Biology: History, definitions, basic technology, applications. Flow cytometry, chemical composition of karyotype, Fluorescence insitu hybridization (FISH)

Books Recommended

1. Molecular Biology of cell – Bruce Alberts et al, Garland publications
2. Animal Cytology & Evolution – MJD, White Cambridge University Publicatins
3. Molecular Cell Biology – Daniel , Sceintific American Books.
4. Cell Biology – Jack D.Bruke, The William Twilkins Company.
5. Principles of Gene Manipulations – Old & Primrose, Black Well Scientific Publications.
6. Fundamentals of Biochemistry- Donald Voet, Judith Voet and Charlotte Pratt.
7. Cell Biology Genetics,Molecular Biology Evolution and Ecology by P.S.Verma and V.K. Agrawal.

Subject: BTBIT 405T (BGE) **Electronics and Instrumentation** ***(Theory)***

Lectures: 03 Hours **Tutorial: 01 (Hour)** **No. of Credits: 04**

University: 80 Marks **College Assessment- 20Marks**

Duration of Examination: 3Hours

UNIT I: Diode rectifiers, power supply, transistor series with zener, short circuit protection, power supply using SCR, triac, diac, three pin IC regulators.

UNIT II : Characteristics of BJT Amplifiers: Input-Output impedance, gain, bandwidth, basic design of amplifiers.

UNIT III: Class A and Class B power amplifiers, push pull, complementary, symmetry connections.

UNIT IV: Wien bridge oscillator, multivibrators, astable and bistable, analog signal conditioning, filtering and impedance matching, bridge and potentiometric circuits.

UNIT V: Operational amplifiers, op-amp parameters, inverting amplifiers, non inverting amplifiers, differential amplifier, voltage to current converter, current to voltage converter, integrator, differentiator, linearization.

UNIT VI: Digital signal conditioning – Digital information, Binary numbers, Gates, Comparators, Digital to analog converters, Analog to digital converters, Thermistors , Thermocouples, Transducers, strain gauge , LVDT.

Books recommended

1. A course in Electrical & Electronic Measurements & InstrumentationBy A.K.Sawhney
2. Principles of Electronics by V.K.Mehta
3. Electronics Devices & Circuits by Sanjeev Gupta
4. Process Control & Instrumentation Technology by C.D.Johnson
5. Instrumentation by R.P.Jain
6. Handbook of Electronics by Gupta & Kumar
7. Electronics Measurements & Instrumentation by V. A. Bakshi & A. V. Bakshi

8. Electronics Principles by Malvino
9. Digital & Analog Technique by Kale & Gokhale
10. Power Electronics by Khanchandani

Subject: BTBIT 406P (BBT) **Analytical Biotechnology** (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 4 Hours

List of Experiments

1. Chromatographic separation of bio-molecules.
2. Determination of adsorption spectrum and extinction coefficient.
3. Demonstration of Gel-permeation chromatography/Ion-exchange/Affinity chromatography.
4. Electrophoresis of Biomolecues i.e. proteins and nucleic acid.
5. Purification of proteins and enzymes by salt precipitation, solvent etc.
6. Turbidometric assay of microbial growth.

Subject: BTBIT 407P (BBT) Biochemistry **Metabolism Laboratory** (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 4 Hours

List of Experiments

1. Determination of Michaelis constant of enzymes.
2. Assay of amylase enzyme activity from sweet potato.
3. Assay of phosphatase enzyme activity from potato.
4. Assay of lactate dehydrogenase enzyme activity.
5. Assay of succinate dehydrogenase activity.
6. Assay of alanine aminotransferase activity.
7. Assay of aspartate aminotransferse activity.
8. Isolation and crystallization of enzyme urease from jack beans.
9. Effect of Inhibitor on Enzyme activity

Subject: BTBIT 408P (BGE) *Electronics and Instrumentation Laboratory* (Practical)
Practical: 04 Hours **No. of Credits: 02**

University: 25 Marks **College Assessment- 25 Marks**

Duration of Examination: 4 Hours

List of Experiments

1. To study the zener diode as a voltage regulator.
2. Study of logic gates.
3. A to D converter
4. D to A converter
5. Study of Bridge rectifier
6. Diac characteristics
7. Study of Thermistor
8. Full wave rectifier
9. Triac characteristics
10. CB, CE amplifier
11. Current to voltage converter

12. Voltage to current converter