M.D. UNIVERSITY, ROHTAK

SCHEME OF STUDIES AND EXAMINATION

B.TECH (ELECTRICAL ENGINEERING)

SEMESTER 3RD & 4th

Scheme effective from 2019-20

COURSE CODE AND DEFINITIONS

Course Code	Definition
L	Lecture
T	Tutorial
P	Practical
BSC	Basic Science Courses
ESC	Engineering Science Courses
HSMC	Humanities and Social Sciences including Management courses
PCC	Professional Core Courses
LC	Laboratory Courses
MC	Mandatory Courses
PT	Practical Training
S	Seminar

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
B.Tech. (Electrical Engineering)
III[rd] semester w.e.f 2019-20

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total Marks	Credits	Duration of Examination (in hours)
			L	T	P		Theory	Practical			
1.	PCC-EE-201G	Electric Circuit Analysis	3	1	0	25	75	0	100	4	3
2.	LC- EE-203G	Electric Circuit Analysis Laboratory	0	0	2	25	0	25	50	1	3
3.	PCC-EE-205G	Analog Electronics	3	0	0	25	75	0	100	3	3
4.	LC- EE-207G	Analog Electronics Laboratory	0	0	2	25	0	25	50	1	3
5.	PCC-EE-209G	Electrical Machines-I	3	1	0	25	75	0	100	4	3
6.	LC- EE-211G	Electrical Machines-I Laboratory	0	0	2	25	0	25	50	1	3
7.	PCC-EE-213G	Electromagnetic Fields	3	1	0	25	75	0	100	4	3
8.	ESC-ME-209G	Engineering Mechanics (Common with ME)	3	1	0	25	75	0	100	4	3
9.	*MC-106-G	Environmental Science	3	0	1	25	75	0	-	0	3
Total									650	22	

*__MC-106G__ is a mandatory non –credit course in which the students will be required passing marks in theory.

Electric Circuit Analysis

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-201G**		
Category	**Engineering Science Course**		
Course title	**Electric Circuit Analysis**		
Scheme	**L**	**T**	**P**
	3	**1**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to;

- Apply network theorems for the analysis of electrical circuits.
- Obtain the transient and steady-state response of electrical circuits.
- Analyze circuits in the sinusoidal steady-state (single-phase and three-phase).
- Analyze two port circuit behavior.

SECTION-A

Network Theorems (AC Circuit)

Superposition theorem, Thevenin theorem, Norton theorem, Maximum power transfer theorem, Reciprocity theorem, Compensation theorem. Analysis with dependent current and voltage sources. Node and Mesh Analysis. Concept of duality and dual networks.

SECTION-B

Solution of First and Second order networks (AC and DC circuits)

Solution of first and second order differential equations for Series and parallel R-L, R-C, R-L-C circuits, initial and final conditions in network elements, forced and free response, time constants, steady state and transient state response.

SECTION-C

Sinusoidal steady state analysis

Hurwitz polynomials, positive real functions. Properties of real immittance functions, Synthesis of LC driving point immittances, Synthesis of RC driving point impedances, Synthesis of RC impedances or RL admittances, properties of RL impedances and RC admittances. Three-phase circuits. Mutual coupled circuits, Dot Convention in coupled circuits.

SECTION-D

Electrical Circuit Analysis Using Laplace Transforms

Review of Laplace Transform, Analysis of electrical circuits using Laplace Transform for standard inputs, convolution integral, inverse Laplace transform, transformed network with initial conditions. Transfer function representation. Poles and Zeros.

Two Port Network and Network Functions

Two Port Networks, terminal pairs, relationship of two port variables, impedance parameters, admittance parameters, transmission parameters and hybrid parameters, interconnections of two port networks. Synthesis of Y21 and Z21 with R ohm terminations Network Tropology and Graph Theory.

Text / Reference Books:

1. M. E. Van Valkenburg, “Network Analysis”, Prentice Hall, 2006.
2. D. Roy Choudhury, “Networks and Systems”, New Age International Publications, 1998.
3. W. H. Hayt and J. E. Kemmerly, “Engineering Circuit Analysis”, McGraw Hill Education, 2013.
4. C. K. Alexander and M. N. O. Sadiku, “Electric Circuits”, McGraw Hill Education, 2004.
5. K. V. V. Murthy and M. S. Kamath, “Basic Circuit Analysis”, Jaico Publishers, 1999.

Electric Circuit Analysis Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**LC-EE-203G**		
Category	**Engineering Science Course**		
Course title	**Electric Circuit Analysis** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

(iii) Group of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. Introduction of circuit creation & simulation software like MATLAB etc.
2. Study of Transient response of RC, RL circuit.
3. To find the resonance frequency, Band width of RLC series circuit.
4. To calculate and verify "Z" & “Y” parameters and "ABCD" parameters of a two port network.
5. To determine equivalent parameter of parallel-series, cascading and parallel connections of two port network.
6. To calculate and verify Compensation theorem and Tellegen’s theorem.
7. To synthesize a network of a given network function and verify its response.
8. To calculate and verify Maximum power transfer and Reciprocity theorem.

Note: Use appropriate Software or simulation tool for experiments.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Analog Electronics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-205G**		
Category	**Engineering Science Course**		
Course title	Analog Electronics (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the characteristics of transistors.
- Design and analyse various rectifier and amplifier circuits.
- Design sinusoidal and non-sinusoidal oscillators.
- Understand the functioning of OP-AMP and design OP-AMP based circuits.

Section-A

P-N junction diode, I-V characteristics of a diode; review of half-wave and full-wave rectifiers, Zener diodes, clamping and clipping circuits. Structure and I-V characteristics of a BJT; BJT as a switch. BJT as an amplifier: small-signal model, biasing circuits, current mirror; common-emitter, common-base and common-collector amplifiers; Small signal equivalent circuits, high-frequency equivalent circuits

Section-B

MOSFET structure and I-V characteristics. MOSFET as a switch. MOSFET as an amplifier: small-signal model and biasing circuits, common-source, common-gate and common-drain amplifiers; small signal equivalent circuits - gain, input and output impedances, trans-conductance, high frequency equivalent circuit.

Section-C

Operational Amplifier: Inverting and non-inverting configurations, difference amplifier, Effect of finite open loop gain and bandwidth on circuit performance, Large signal operation of op-amp. Differential Amplifier: MOS differential pair, small signal operation of the MOS differential pair, BJT differential pair, other non-ideal characteristic of the Differential amplifier (DA), DA with active load
Feedback: The general feed back structure, properties of negative feed back, the four basic feed back topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier.

Section-D

Linear applications of op-amp: Idealized analysis of op-amp circuits. Inverting and non-inverting amplifier, differential amplifier, instrumentation amplifier, integrator, active filter, P, PI and PID controllers and lead/lag compensator using an op-amp, voltage regulator, oscillators (Wein bridge and phase shift). Analog to Digital Conversion.
Nonlinear applications of op-amp: Hysteretic Comparator, Zero Crossing Detector, Square-wave and triangular-wave generators. Precision rectifier, peak detector. Monoshot.

Text/References Book:

1. A. S. Sedra and K. C. Smith, “Microelectronic Circuits”, New York, Oxford University Press, 1998.
2. J. V. Wait, L. P. Huelsman and G. A. Korn, “Introduction to Operational Amplifier theory and applications”, McGraw Hill U. S., 1992.
3. J. Millman and A. Grabel, “Microelectronics”, McGraw Hill Education, 1988.
4. P. Horowitz and W. Hill, “The Art of Electronics”, Cambridge University Press, 1989.
5. P.R. Gray, R.G. Meyer and S. Lewis, “Analysis and Design of Analog Integrated Circuits”, John Wiley & Sons, 2001.

Analog Electronics Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**LC-EE-207G**		
Category	**Engineering Science Course**		
Course title	**Analog Electronics** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

(iii) Gruoup of students for practical should be 15 to 20 in number.

List of Experiments

1.To Study the following devices: (a) Analog & digital multimeters (b) Function/ Signal generators (c) Regulated d. c. power supplies (constant voltage and constant current operations) (d) Study of analog CRO, measurement of time period, amplitude, frequency & phase angle using Lissajous figures.
2.To Plot V-I characteristic of P-N junction diode & calculate cut-in voltage, reverse Saturation current and static & dynamic resistances.
3.To Plot V-I characteristic of zener diode and study of zener diode as voltage regulator. Observe the effect of load changes and determine load limits of the voltage regulator.
4. To Plot frequency response curve for single stage amplifier and to determine gain bandwidth product.
5.To Plot drain current - drain voltage and drain current – gate bias characteristics of field effect transistor and measure of Idss & Vp
6.To Plot gain- frequency characteristic of emitter follower & find out its input and output resistances.
7.To Plot input and output characteristics of BJT in CB, CC and CE configurations. Find their h-parameters.
8.To Study half wave rectifier and effect of filters on wave. Also calculate theoretical & practical ripple factor.
10.To Study bridge rectifier and measure the effect of filter network on D.C. voltage output & ripple Factor.
11. To plot the characteristics of MOSFET.
12. To determine the following parameters of OP-AMP.a) Input Bias Current. b) Input Offset Current.

c) Input Offset Voltage. d) CMRR

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Electrical Machine-I

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-209G**		
Category	**Engineering Science Course**		
Course title	**Electrical Machine- I** (Theory)		
Scheme	**L**	**T**	**P**
	3	1	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to

- Understand the concepts of magnetic circuits.
- Understand the operation of dc machines.
- Analyse the differences in operation of different dc machine configurations.
- Analyse single phase and three phase transformers circuits.

Section A

Magnetic fields and magnetic circuits
Review of magnetic circuits - MMF, flux, reluctance, inductance; review of Ampere Law and Biot Savart Law; Visualization of magnetic fields produced by a bar magnet and a current carrying coil - through air and through a combination of iron and air; influence of highly permeable materials on the magnetic flux lines.

Electromagnetic force and torque
B-H curve of magnetic materials; flux-linkage vs current characteristic of magnetic circuits; linear and nonlinear magnetic circuits; energy stored in the magnetic circuit; force as a partial derivative of stored energy with respect to position of a moving element; torque as a partial derivative of stored energy with respect to angular position of a rotating element. Examples - galvanometer coil, relay contact, lifting magnet, rotating element with eccentricity or saliency

Section B

DC machines
Basic construction of a DC machine, magnetic structure - stator yoke, stator poles, pole-faces or shoes, air gap and armature core, visualization of magnetic field produced by the field winding excitation with armature winding open, air gap flux density distribution, flux per pole, induced EMF in an armature coil. Armature winding and commutation - Elementary armature coil and commutator, lap and wave windings, construction of commutator, linear commutation Derivation of back EMF equation, armature MMF wave, derivation of torque equation, armature reaction, air gap flux density distribution with armature reaction.

Section C

DC machine - motoring and generation
Armature circuit equation for motoring and generation, Types of field excitations - separately excited, shunt and series. Open circuit characteristic of separately excited DC generator, back EMF with armature reaction, voltage build-up in a shunt generator, critical field resistance and critical speed.V-I characteristics and torque-speed characteristics of separately excited, shunt and series motors. Speed control through armature voltage. Losses, load testing and back-to-back testing of DC machines

Section D

Transformers
Principle, construction and operation of single-phase transformers, equivalent circuit, phasor diagram, voltage regulation, losses and

efficiency Testing - open circuit and short circuit tests, polarity test, back-to-back test, separation of hysteresis and eddy current losses Three-phase transformer - construction, types of connection and their comparative features, Parallel operation of single-phase and three-phase transformers, Autotransformers - construction, principle, applications and comparison with two winding transformer, Magnetizing current, effect of nonlinear B-H curve of magnetic core material, harmonics in magnetization current, Phase conversion - Scott connection, three-phase to six-phase conversion, Tap-changing transformers - No-load and on-load tap-changing of transformers, Three-winding transformers. Cooling of transformers.

Text / Reference 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.

Electrical Machines-I Laboratory

Class Work:	25
Exam :	25
Total :	50

Course Code	**LC-EE-211G**		
Category	**Engineering Science Course**		
Course title	**Electrical Machines-I** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus.

(iii) Gruoup of students for practical should be 15 to 20 in number.

LIST OF EXPERIMENTS:

1. To study conversion of 3 Phase to six phase using 3 single phase transformers..
2. To study three phase rectifiers & supply configuration . In 3 phase.
3. To perform Sumpner's Back to back test on 1-phase transformers.
4. To study Parallel operation of two 1-phase transformers.
5. To perform load test on DC shunt generator.
6. To study Speed control of DC shunt motor.
7. To study Swinburne's test of DC shunt motor.
8. To study Hopkinson's test of DC shunt M/Cs.
9. To syudy Ward Leonard method of speed control.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Electromagnetic Fields

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-213G**		
Category	**Engineering Science Course**		
Course title	**Electromagnetic Fields** (Theory)		
Scheme	**L**	**T**	**P**
	3	1	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of the course, students will demonstrate the ability to:

1. Understand the basic laws of electromagnetism.
2. Obtain the electric and magnetic fields for simple configurations under static conditions.
3. Analyse time varying electric and magnetic fields.
4. Understand Maxwell's equation in different forms and different media. To understand the propagation of EM waves.

SECTION - A

Review of Vector Calculus

Vector algebra-addition, subtraction, components of vectors, scalar and vector multiplications triple products, three orthogonal coordinate systems (rectangular, cylindrical and spherical). Vector calculus differentiation, partial differentiation ,integration, vector operator del, gradient ,divergence and Curl; integral theorems of vectors. Conversion of a vector from one coordinate system to another.

SECTION - B

Static Electric Field

Coulomb's law, Electric field intensity, Electrical field due to point charges. Line, Surface and Volume charge distributions. Gauss law and its applications. Absolute Electric potential, Potential difference, Calculation of potential differences for different configurations. Electric dipole, Electrostatic Energy and Energy density.

Conductors, Dielectrics and Capacitance

Current and current density, Ohms Law in Point form, Continuity of current, Boundary conditions of perfect dielectric materials. Permittivity of dielectric materials, Capacitance, Capacitance of a two wire line, Poisson's equation, Laplace's equation, Solution of Laplace and Poisson's equation, Application of Laplace's and Poisson's equations.

SECTION – C

Static Magnetic Fields

Biot-Savart Law, Ampere Law, Magnetic flux and magnetic flux density, Scalar and Vector Magnetic potentials. Steady magnetic fields produced by current carrying conductors.

Magnetic Forces, Materials and Inductance

Force on a moving charge, Force on a differential current element, Force between differential current elements, Nature of magnetic materials, Magnetization and permeability, Magnetic boundary conditions, Magnetic circuits, inductances and mutual inductances.

SECTION – D

Time Varying Fields and Maxwell's Equations
Faraday's law for Electromagnetic induction, Displacement current, Point form of Maxwell's equation, Integral form of Maxwell's equations, Motional Electromotive forces. Boundary Conditions. **Electromagnetic Waves**
Derivation of Wave Equation, Uniform Plane Waves, Maxwell's equation in Phasor form, Wave equation in Phasor form, Plane waves in free space and in a homogenous material. Wave equation for a conducting medium, Plane waves in lossy dielectrics, Propagation in good conductors, Skin effect. Poynting theorem.

Text / References Books:

1. M. N. O. Sadiku, "Elements of Electromagnetics", Oxford University Publication, 2014.
2. A. Pramanik, "Electromagnetism - Theory and applications", PHI Learning Pvt. Ltd, New Delhi, 2009.
3. A. Pramanik, "Electromagnetism-Problems with solution", Prentice Hall India, 2012.
4. G. W. Carter, "The electromagnetic field in its engineering aspects", Longmans, 1954.
5. W. J. Duffin, "Electricity and Magnetism", McGraw Hill Publication, 1980.
6. W. J. Duffin, "Advanced Electricity and Magnetism", McGraw Hill, 1968.
7. G. Cullwick, "The Fundamentals of Electromagnetism", Cambridge UniversityPress, 1966.
8. B. D. Popovic, "Introductory Engineering Electromagnetics", Addison-Wesley Educational Publishers, International Edition, 1971.
9. W. Hayt, "Engineering Electromagnetics", McGraw Hill Education, 2012.

Engineering Mechanics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**ESC-ME-209G**		
Category	**Engineering Science Course**		
Course title	**Engineering Mechanics** (Theory)		
Scheme	**L**	**T**	**P**
	3	1	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes: At the end of this course, students will demonstrate the ability to

1. Understand the concepts of co-ordinate systems.
2. Analyse the three-dimensional motion.
3. Understand the concepts of rigid bodies.
4. Analyse the free-body diagrams of different arrangements. Analyse torsional motion and bending moment.

UNIT-I

Introduction to vectors and tensors and co-ordinate systems: Introduction to vectors and tensors and coordinate systems; Vector and tensor algebra; Symmetric and anti-symmetric tensors; Eigen values and Principal axes.
Three-dimensional Rotation: Three-dimensional rotation: Euler's theorem, Axis-angle formulation and Euler angles; Coordinate transformation of vectors and tensors.

UNIT-II

Kinematics of Rigid Body: Concept of rigid body, velocity and acceleration, relative velocity, translation and rotation of rigid bodies, equations of motion for translation and rotation, problem. Centroid, Centre of mass and Centre of gravity, Determination of centroid, centre of mass and centre of gravity by integration method of regular and composite figures and solid objects, Problems.

Kinetics of Rigid Bodies: Kinetics of rigid bodies: Angular momentum about a point; Inertia tensor: Dentition and computation, Principal moments and axes of inertia, Parallel and perpendicular axes theorems; Mass moment of inertia of symmetrical bodies, cylinder, sphere, cone etc., Area moment of inertia and Polar moment of inertia, Forces and moments; Newton-Euler's laws of rigid body motion.

UNIT-III

Free Body Diagram: Free body diagrams; Examples on modelling of typical supports and joints and discussion on the kinematic and kinetic constraints that they impose.
General Motion: Examples and problems. General planar motions. General 3-D motions. Free precession, Gyroscopes, Rolling coin.

UNIT-IV

Bending Moment: Transverse loading on beams, shear force and bending moment in beams, analysis of cantilevers, simply supported beams and overhanging beams, relationships between loading, shear force and bending moment, shear force and bending moment diagrams.

Torsional Motion: Torsion of circular shafts, derivation of torsion equation, stress and deformation in circular and hollow shafts.

Friction: Concept of Friction; Laws of Coulomb friction; Angle of Repose; Coefficient of friction.

Text / References:

1. Mechanics by R.C. Hibbler, Pearson Publication
2. J. L. Meriam and L. G. Kraige, "Engineering Mechanics: Dynamics", Wiley, 2011.
3. M. F. Beatty, "Principles of Engineering Mechanics", Springer Science & Business Media, 1986.

Environmental Studies

Objective: To provide the basic knowledge in Environmental Sciences to students of Engineering. It will guide the students living in a historic transitional period of burgeoning awareness of the conflict between human activities and environmental constraints to help and save the fragile and endangered planet with the natural resources already overexploited.

Course code: MC-106-G

Environmental Studies (Semester 1)							
Lecture	Tutorial	Practical/Field visit	Credit	Theory	Field visit	Total	Time
3	0	1	-	75	25	100	3Hrs

MC-ENV : (ENVIRONMENTAL SCIENCE)

Objective: To provide the basic knowledge in Environmental Sciences to students of Engineering. It will guide the students living in a historic transitional period of burgeoning awareness of the conflict between human activities and environmental constraints to help and save the fragile and endangered planet with the natural resources already overexploited.

Course code: MC-GES-106-G

Environmental Studies (Semester 1)							
Lecture	Tutorial	Practical/Field visit	Credit	Theory	Field visit	Total	Time
3	0	1	-	75	25	100	3Hrs

Theory 75 Marks Field Work 25 Marks (Practical/Field visit)

Unit-1 The Multidisciplinary nature of environmental studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit-3 Ecosystems :

* 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 eco-system :

a. Forest ecosystem.

b. Grassland ecosystem. c. Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) (6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.

* 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.

(8 lectures)

Unit-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution c) Soil pollution

d) Marine pollution e) Noise pollution

f) Thermal pollution g) Nuclear hazards

* Solids 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.

(8 lectures)

Unit-6 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.

* Consumerism and waste products.
* 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.
* Public awareness. (7 lectures)

Unit-7 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.

Woman and Child Welfare

Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* 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. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd. Bikaner.
2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).
3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T. 2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai 1196 p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay Natural History Society, Bombay (R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity Assessment, Cambridge Uni. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing

Co. (TB).

15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders Co. USA, 574p.
16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford & TBH Publ. Co. Pvt. Ltd. 345p.
17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ. House, Meerut.
18. Survey of the Environment, The Hindu (M).
19. Townsend C., Harper J. and Michael Begon. Essentials of Ecology, Blackwell Science (TB).
20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).
21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno Science Publications (TR).
22. Wagner K.D., 1998, Environmental Management, W.B. Saunders co. Philadelphia, USA 499p.
23. A text book environmental education G.V.S. Publishers by Dr. J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations. Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A : Short Answer Pattern	:	15 marks	Part- B : Essay Type with inbuilt	
choice	:	60 marks	Part-C : Field Work	
(Practical)	:	25 marks	Instructions for Examiners :	

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

MAHARSHI DAYANAND UNIVERSITY, ROHTAK
B.Tech. (Electrical Engineering)
4TH semester w.e.f 2019-20

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total Marks	Credits	Duration of Examination (in hours)
			L	T	P		Theory	Practical			
1.	PCC-EE-202G	Digital Electronics	3	0	0	25	75	0	100	3	3
2.	LC- EE-204G	Digital Electronics Laboratory	0	0	2	25	0	25	50	1	3
3.	PCC-EE-206G	Electrical Machines-II	3	1	0	25	75	0	100	4	3
4.	LC- EE-208G	Electrical Machines-II Laboratory	0	0	2	25	0	25	50	1	3
5.	PCC-EE-210G	Power Electronics	3	0	0	25	75	0	100	3	3
6.	LC- EE-212G	Power Electronics Laboratory	0	0	2	25	0	25	50	1	3
7.	PCC-EE-214G	Signals and Systems	3	0	0	25	75	0	100	3	3
8.	BSC-MATH-204G	Mathematics-III (Probability and Statistics)	3	1	0	25	75	0	100	4	3
9.	*MC-105G	Indian Constitution	0	0	2	50				-	
10.	BSC-BIO-201G	Biology-I	2	1	0	25	75	0	100	3	3
	TOTAL								750	23	

NOTE: At the end of 4th semester each student has to undergo Practical Training of 4/6 weeks in an Industry/ Institute/ Professional Organization/ Research Laboratory/ training centre etc. and submit typed report along with a certificate from the organization & its evaluation shall be carried out in the 5th Semester.

*MC 105G is a mandatory non credit course in which the student will be required passing marks in class work.

Digital Electronics

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-202G**		
Category	**Engineering Science Course**		
Course title	**Digital Electronics** (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

- Understand working of logic families and logic gates.
- Design and implement Combinational and Sequential logiccircuits.
- Understand the process of Analog to Digital conversion and Digital to Analog conversion.
- Be able to use PLDs to implement the given logical problem.

SECTION-A

Fundamentals of Digital Systems and logic families:

Digital signals, digital circuits, AND, OR, NOT, NAND, NOR and Exclusive-OR operations, Boolean algebra, examples ofICgates, number systems-binary, signed binary, octal hexadecimal number, binary arithmetic, one's and two's complements arithmetic, codes, error detecting and correcting codes, characteristics of digital lCs, digital logic families, TTL, Schottky TTL and CMOS logic, interfacing CMOS and TTL, Tri-statelogic.

SECTION-B

Combinational Digital Circuits:

Standard representation for logic functions, K-map representation, simplification of logic

functions using K-map, minimization of logical functions. Don't care conditions, Multiplexer, De- Multiplexer/Decoders, Adders, Subtractors, BCD arithmetic, carry look ahead adder, serial adder, ALU, elementary ALU design, popular MSI chips, digital comparator, parity checker/generator, code converters, priority encoders, decoders/drivers for display devices, Q-M method of function realization.

SECTION-C

Sequential circuits and systems:

A 1-bit memory, the circuit properties of Bistable latch, the clocked SR flip flop, Master Slave J- K, T and D types flip flops, applications of flip flops, shift registers, applications of shift registers, serial to parallel converter, parallel to serial converter, ring counter, sequence generator, ripple(Asynchronous) counters, synchronous counters, counters design using flip flops, special counter IC's, asynchronous sequential counters, applications of counters.

SECTION-D

A/D and D/A Converters:

Introduction to Digital to analog converters: weighted resistor/converter, R-2R Ladder D/A converter, specifications for D/A converters, sample and hold circuit, Introduction to analog to digital converters: quantization and encoding, parallel comparator A/D converter, successive approximation A/D converter, counting A/D converter, dual slope A/D converter.

Semiconductor memories and Programmable logic devices:

Memory organization and operation, expanding memory size, classification and characteristics of memories, sequential memory, read only memory (ROM), read and write memory(RAM), content addressable memory (CAM), charge de coupled device memory (CCD), commonly used memory chips, ROM as a PLD, Programmable logic array, Programmable array logic.

Text/Reference books:

1. R. P. Jain, "Modern Digital Electronics", McGraw Hill Education, 2009.
2. M. M. Mano, "Digital logic and Computer design", Pearson Education India, 2016.
3. A. Kumar, "Fundamentals of Digital Circuits", Prentice Hall India, 2016.

Digital Electronics Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**LC-EE-204G**		
Category	**Engineering Science Course**		
Course title	**Digital Electronics** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS

1. To study of TTL gates – AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR.
2. To design & realize a given function using K-maps and verify its performance.
3. To verify the operation of multiplexer & Demultiplexer.
4. To verify the operation of comparator.
5. To verify the truth tables of S-R, J-K, T & D type flip flops.
6. To study FLIP-FLOP conversion.
7. To verify the operation of bi-directional shift register.
8. To design & verify the operation of 3-bit synchronous counter.
9. To design and verify the operation of synchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
10. To design and verify the operation of asynchronous UP/DOWN decade counter using J K flip-flops & drive a seven-segment display using the same.
11. To design a 4 bit shift register and verify its operation.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

ELECTRICAL MACHINES-II

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-206G**		
Category	**Engineering Science Course**		
Course title	**Electrical Machines-II** (Theory)		
Scheme	**L**	**T**	**P**
	3	1	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course, students will demonstrate the ability to:

1. Understand the concepts of rotating magnetic fields.
2. Understand the operation of ac machines.
3. Analyse performance characteristics of ac machines.
4. Impart knowledge on construction, principle of operation and performance of ac machine.
5. Prepare the students to have a basic knowledge about motoring, generating and braking mode of ac machines

UNIT-I

Poly-phase Induction Motor: Constructional features, Principal of operation, production of rotating magnetic field, induction motor action, torque production, testing, development of equivalent circuit, performance characteristics, circle diagram, starting methods, double cage and deep bar motors.

UNIT-II

Poly-phase Induction Motor: Methods of speed control - stator voltage control, stator resistance control, frequency control, rotor resistance control, slip power recovery control

Induction Generator: Principle of operation, types and applications.

Single Phase Induction motors: Double revolving field theory, cross field theory, different types of single phase induction motors, circuit model of single phase induction motor.

UNIT-III

Synchronous Generator: Principle, construction of cylindrical rotor and salient pole machines,winding, EMF equation, Armature reaction, testing, model of the machine, regulation – synchronous reactance method, Potier triangle method. Output power equation, power angle curve.

UNIT-IV

Three Phase Synchronous Generators: Transient and sub-transient reactance, synchronization, parallel operation.
Synchronous Motor: Principles of synchronous motor, power angle curve, V-curve, starting, damper winding, synchronous condenser, applications.

TEXT/ REFERENCE BOOKS:

1. Principle of Electrical Machines, V K Mehta, Rohit Mehta, S Chand
2. Electric Machines ,Ashfaq Hussain, Dhanpat Rai
3. Electric Machines: I.J.Nagrath and D.P. Kothari, TMH, New Delhi.
4. Generalized theory of Electrical Machines: P.S. Bhimbra(Khanna Pub.)
5.Electric Machinery, Fitzgerald and Kingsley, MGH.

Electrical Machines-II Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**LC-EE-208G**		
Category	**Engineering Science Course**		
Course title	**Electrical Machines-II** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS:

1. To perform the open circuit test and block rotor test on 3 phase induction motor and draw the circle diagram.
2. To study the speed control of induction motor by rotor resistance control.
3. To conduct the load test to determine the performance characteristics of the I.M.
4. To compute the torque v/s speed characteristics for various stator voltages.
5. To perform the open circuit test and block rotor test on single-phase induction motor and determine equivalent circuit parameters.
6. To perform O.C. test on synchronous generator and determine the full load regulation of a three phase synchronous generator by synchronous impedance method.
7. To Study and Measure Synchronous Impedance and Short circuit ratio of Synchronous Generator .
8. Study of Power (Load) sharing between two Three Phase alternators in parallel operation Condition.
9. To plot V- Curve of synchronous motor.
10. Synchronization of two Three Phase Alternators by

a) Synchroscope Method
b) Three dark lamp Method
c) Two bright one dark lamp Method

11. Determination of sequence impedances of synchronous machine for various stator voltages.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

POWER ELECTRONICS

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-210G**		
Category	**Engineering Science Course**		
Course title	Power Electronics (Theory)		
Scheme	**L**	**T**	**P**
	3	-	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

At the end of this course students will demonstrate the ability to;

- Understand the differences between signal level and power level devices.
- Analyse controlled rectifier circuits.
- Analyse the operation of DC-DC choppers.
- Analyse the operation of voltage source inverters.

SECTION-A

Power switching devices

Diode, Thyristor, MOSFET, IGBT: I-V Characteristics; Protections, series and parallel connections, Firing circuit for thyristor; Voltage and current commutation of a thyristor; pulse transformer and opto-coupler.

AC REGULATORS: Types of regulator, equation of load current, calculation of extinction angle, output voltage equation, harmonics in load voltage.

SECTION-B

Thyristor rectifiers

Single-phase half-wave and full-wave rectifiers, Single-phase full-bridge thyristor rectifier with R- load and highly inductive load; Three-phase full-bridge thyristor rectifier with R-load and highly inductive load; Input and output wave shape and power factor.

DC-DC buck converter

Elementary chopper with an active switch and diode, concepts of duty ratio and average voltage, power circuit of a buck converter, analysis and waveforms at steady state, duty ratio control of output voltage.

SECTION-C

DC-DC boost converter

Power circuit of a boost converter, analysis and waveforms at steady state, relation between duty ratio and average output voltage.

Single-phase voltage source inverter

Power circuit of single-phase voltage source inverter, switch states and instantaneous output voltage, square wave operation of the inverter, concept of average voltage over a switching cycle, bipolar sinusoidal modulation and unipolar sinusoidal modulation, modulation index and output voltage

SECTION-D

Three-phase voltage source inverter

Power circuit of a three-phase voltage source inverter, switch states, instantaneous output voltages, average output voltages over a sub-cycle, three-phase sinusoidal modulation.

CYCLOCONVERTERS : Basic principle of frequency conversion, types of cycloconverter, non-circulating and circulating types of cycloconverters

Text/References Books:-

1. M. H. Rashid, "*Power electronics: circuits, devices, and applications*", Pearson Education India, 2009.
2. N. Mohan and T. M. Undeland, "Power Electronics: Converters, Applications and Design", John Wiley & Sons, 2007.
3. R. W. Erickson and D. Maksimovic, "Fundamentals of Power Electronics", Springer Science & Business Media, 2007.
4. L. Umanand, "Power Electronics: Essentials and Applications", Wiley India, 2009.

Power Electronics Laboratory

Class Work: 25
Exam : 25
Total : 50

Course Code	**LC-EE-212G**		
Category	**Engineering Science Course**		
Course title	**Power Electronics** (Laboratory)		
Scheme	**L**	**T**	**P**
	-	**-**	**2**

Notes:

(i) At least 10 experiments are to be performed by students in the semester.

(ii) At least 7 experiments should be performed from the list, remaining three experiments may either be performed from the above list or designed and set by the concerned institution as per the scope of the syllabus

LIST OF EXPERIMENTS

1. To Study Static Characteristics of Power Diode and Thyristor and to study reverse recovery of Power Diode & Thyristor.
2. To Study Characteristics of IGBT &MOSFET.
3. To study R, RC and UJT firing Circuit .
4. To Study of Pulse transformer & optocoupler technique
5. To Study of SCR Communication Technique Class A-E.
6. To Study of AC voltage Regulator .
7. To control speed of small motor using Single Phase Half wave & Full wave fully controlled Converter
8. To control speed of a small DC motor using MOSFET based Chopper with output voltage control technique
9. To Study of Mc Murray - Bed ford Half & Full Bridge Inverter
10. To control speed of small AC induction motor using Single Phase non circulating type bridge by frequency conversion.
11. To Study single phase cycloconverter.

Note:

1. Each laboratory group shall not be more than about 20 students.
2. To allow fair opportunity of practical hands on experience to each student, each experiment may either done by each student individually or in group of not more than 3-4 students. Larger groups be strictly discouraged/disallowed.

Mathematics-III

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**BSC-MATH-204G**		
Category	**Basic Science Course**		
Course title	Mathematics-III (Numerical methods, Probability and Statistics)		
Scheme	**L**	**T**	**P**
	3	**1**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes:

The students will learn:

1. To find roots of polynomial and transcendental equations using numerical methods.
2. To conduct numerical differentiation and numerical integration.
3. To solve differential equations using numerical methods.
4. To formulate and solve problems involving random variables.
5. To apply statistical methods for analysing experimental data.

Unit-I

Numerical Methods 1: Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method, Finite differences, Interpolation using Newton's forward and backward difference formulae, Newton's divided difference and Lagrange's formulae, Numerical integration, Trapezoidal rule and Simpson's 1/3rd and 3/8 rules

Unit-II

Numerical Methods 2: Taylor's series, Euler and modified Euler's methods, Runge-Kutta method of fourth order for solving first and second order ordinary differential equations, Finite difference solution of two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation

Unit-III

Probability: Probability spaces, Conditional probability, Bayes' theorem, Discrete random variables, Bernoulli distribution, Binomial distribution, Poisson distribution, Poisson approximation to the Binomial distribution, Expectation of discrete random variables, Moments, Variance of a sum, Correlation coefficient, Continuous random variables and their properties, Distribution functions and Densities, Normal, Exponential and Gamma densities

Unit-IV

Sampling: Measures of central tendency, Moments, Skewness and Kurtosis, Testing of hypothesis, Test of significance, Large sample test for single proportion, Difference of proportions, Tests for single mean, Difference of means and Difference of standard deviations, Test for ratio of variances, Chi-square test for goodness of fit and Independence of attributes

Reference Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons
2. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand and Company
3. S. S. Sastry, Introductory Methods of Numerical Analysis, PHI
4. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall
5. S. Ross, A First Course in Probability, Pearson Education India
6. W. Feller, An Introduction to Probability Theory and its Applications, Wiley India

Signals and Systems

Theory :	75
Class Work :	25
Total :	100
Duration of Exam :	3 Hrs.

Course Code	**PCC-EE-214G**		
Category	**Engineering Science Course**		
Course title	**Signals and Systems** (Theory)		
Scheme	**L**	**T**	**P**
	3	**0**	**-**

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Outcomes :

On completion of the course, student will able to

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform
5. Understand the basic concept of various signals and system
6. To understand the new tool in Z transform and numerical ability to analyze the circuit in Z domain.

SECTION-A

Signals: Definition, types of signals and their representations: continuous-time, discrete-time, periodic, non-periodic, even, odd, energy, power, deterministic, random, one-dimensional, multi-dimensional, Shifting and scaling operations, Linear Time Invariant and Causal systems; commonly used signals (in continuous-time as well as in discrete-time): unit impulse, unit step, unit ramp (and their inter-relationships), exponential, rectangular pulse, sinusoidal; operations on continuous-time and discrete-time signals (including transformations of independent variables).

SECTION-B

Fourier Transforms (FT):(i) Definition, conditions of existence of FT, properties, magnitude and phase spectra, Some important FT theorems, Parseval's theorem, Inverse FT, relation between LT and FT(ii) Discrete time Fourier transform (DTFT), inverse DTFT, convergence, properties and theorems, Comparison between continuous time FT and DTFT, Sampling theorem, Applications of Fourier Transform.

SECTION-C

Time and frequency domain analysis of systems, Analysis of first order and second order systems, continuous-time (CT) system analysis using LT, system functions of CT systems, poles and zeros, block diagram representations; discrete-time system functions, block diagram representation, illustration of the concepts of system bandwidth and rise time through the analysis of a first order CT low pass filter

SECTION-D

Laplace-Transform (LT) and Z-transform (ZT): (i) One-sided LT of some common signals, important theorems and properties of LT, inverse LT, solutions of differential equations using LT, Bilateral LT, Regions of convergence (ROC) (ii) One sided and Bilateral Z-transforms, ZT of some common signals, ROC, Properties and theorems, solution of difference equations using one-sided ZT, s- to z-plane mapping .

Text/ Reference Books:

1. 'Signal and Systems' I J NAGRATH, R. RANJAN & Sharan, 2009 Edn., TMH, New Delhi
2. V. Oppenheim, A.S. Willsky and S. Hamid Nawab, 'Signals & System',PEARSON Education, Second Edition, 2003.
3. Signals & System by A Anand Kumar, Third edition PHI.
4. Schaume Series on Signals & Systems, HSU & RANJAN, TMH,India

Course code	BSC-BIO-201G			
Category	Basic Science Course			
Course title	Biology-I			
Scheme and Credits	L	T	P	Credits
	2	1		3
Branches (B. Tech.)	Common For All Branches			
Class work	25 Marks			
Exam	75 Marks			
Total	100 Marks			
Duration of Exam	03 Hours			

Note: Examiner will set nine questions in total. Question c compulsory. Question one will have 6 parts of 2.5 marks ea units and remaining eight questions of 15 marks each to be se two questions from each unit. The students have to at questions in total, first being compulsory and selecting one unit.

Course Objectives

To convey that Biology is as an important scientific discipline.

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine

To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

To study the biomolecules that are basis of life.

To understand the tools used in modern genetic engineering and its role.

To understand the role of biotechnology in different fields.

UNIT-I

Introduction to living world: Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

Genetics : Mendel's laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction.
Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

UNIT-II

Introduction to Biomolecules: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids
Proteins- structure and function. Primary secondary, tertiary and quaternary structure.
Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

UNIT-III

Introduction to Genetic Engineering: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

UNIT-IV

Applications of Biotechnology: Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.
Course Outcomes
After studying the course, the student will be able to:
Understand about living organisms, type of cells and microbes.
Identify DNA as a genetic material in the molecular basis of information transfer.
Get knowledge that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.
Highlight the concepts of genetic engineering and application or sustainable development.
Understand the impact of biotechnology on ennironment, health agriculture and industry.
References:
1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M,

L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B.
Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H.
John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman
and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and
company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C.
Brown Publishers
6) https://onlinecourses.nptel.ac.in/noc18_bt23 by K. Suraishkumar and Madhulika Dixit
7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)

CONSTITUTION OF INDIA

Class Work : 50

Course Code	MC-105G		
Category	**Engineering Science Course**		
Course title	**Constitution of India** (Theory)		
Scheme	**L**	**T**	**P**
	0	0	2

CONSTITUTION OF INDIA– BASIC FEATURES AND FUNDAMENTAL PRINCIPLES

The Constitution of India is the supreme law of India. Parliament of India can not make any law which violates the Fundamental Rights enumerated under the Part III of the Constitution. The Parliament of India has been empowered to amend the Constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by the Supreme Court of India in its historical judgments. The Constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The Constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement, however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "static" and therefore the Constitution of India has also been amended more than one hundred times. These amendments reflect political, social and economic developments since the year 1950.

The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the text of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

COURSE CONTENTS

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the Constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the Fundamental Duties and its legal status.
6. The Directive Principles of State Policy – Its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the Union and the States.
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Amendment of the Constitutional Powers and Procedure
10. The historical perspectives of the constitutional amendments in India
11. Emergency Provisions : National Emergency, President Rule, Financial Emergency
12. Local Self Government – Constitutional Scheme in India
13. Scheme of the Fundamental Right to Equality
14. Scheme of the Fundamental Right to certain Freedom under Article 19
15. Scope of the Right to Life and Personal Liberty under Article 21

REFERENCES:

1. The Constitutional Law Of India 9th Edition, by Pandey. J. N.
2. The Constitution of India by P.M.Bakshi
3. Constitution Law of India by Narender Kumar
4. Bare Act by P. M. Bakshi

Course code	BSC-BIO-201G				
Category	Basic Science Course				
Course title	**Biology-I**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	2	**1**		**3**	
Branches (B. Tech.)	**Common For All Branches**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

To convey that Biology is as an important scientific discipline.
To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"
To study the biomolecules that are basis of life.
To understand the tools used in modern genetic engineering and its role.
To understand the role of biotechnology in different fields.

UNIT – I

Introduction to living world: Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

Genetics : Mendel's laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction.

Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

UNIT – II

Introduction to Biomolecules: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids

Proteins- structure and function. Primary secondary, tertiary and quaternary structure.

Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

UNIT – III

Introduction to Genetic Engineering: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

UNIT – IV

Applications of Biotechnology: Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.

Course Outcomes

After studying the course, the student will be able to:
Understand about living organisms, type of cells and microbes.
Identify DNA as a genetic material in the molecular basis of information transfer.
Get knowledge that all forms of life have the same building blocks and yet the manifestations are as diverse as one can imagine.
Highlight the concepts of genetic engineering and application or sustainable development.
Understand the impact of biotechnology on ennironment, health agriculture and industry.

References:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers
6) https://onlinecourses.nptel.ac.in/noc18_bt23 by K. Suraishkumar and Madhulika Dixit
7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)

Course code	BSC-BIO-201G				
Category	Basic Science Course				
Course title	**Biology For Engineers**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	2	**1**		**3**	
Branches (B. Tech.)	**Common For All Branches**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

To convey that Biology is as an important scientific discipline.

To convey that all forms of life has the same building blocks and yet the manifestations are as diverse as one can imagine
To convey that "Genetics is to biology what Newton's laws are to Physical Sciences"

To study the biomolecules that are basis of life.
To understand the tools used in modern genetic engineering and its role.
To understand the role of biotechnology in different fields.

UNIT – I

Introduction to living world: Concept and definition of Biology; Aspect of biology. Need to study biology. Characteristic features of living organisms; Cell theory, Structure of Prokaryotic and Eukaryotic cell. Distinguish between animal and plant cell. Concept of single celled organisms, Types of microbes and their important properties. Economic importance of microbes.

Genetics : Mendel's laws of inheritance, Concept of allele. Concepts of recessiveness and dominance . Gene interaction.
Cell division- Mitosis and Meiosis. Evidence of nucleic acid as a genetic material. Concept of genetic code, Central Dogma.

UNIT – II

Introduction to Biomolecules: Definition, structure and important functions of carbohydrates (glucose, fructose, disaccharides, starch and cellulose), lipids (phospholipid, cholesterol), Amino acids

Proteins- structure and function. Primary secondary, tertiary and quaternary structure.

Nucleic acid- Structure of DNA and RNA, types of RNA, Watson and Crick model of DNA

UNIT – III

Introduction to Genetic Engineering: Concept of genetic engineering. Tools used in recombinant DNA Technology. Restriction enzymes and DNA modifying enzymes, ligases. Gene cloning; plasmid vector. Transgenic plants and animals

UNIT – IV

Applications of Biotechnology: Applications of biotechnology in Agriculture, Medicine, Environment (sewage treatment), enzyme technology.

Course Outcomes

Students will be able to understand about living organisms, prokaryotic cell and eukaryotic cell.
Students will be able to understand structure and function of various biomolecules
Students will be able to understand gene structure, DNA replication, genetic engineering and application for sustainable development
Students will be able to understand the scope of biotechnology in field of environment, health, agriculture and industry.

References:

1) Biology: A global approach: Campbell, N. A.; Reece, J. B.; Urry, Lisa; Cain, M, L.; Wasserman, S. A.; Minorsky, P. V.; Jackson, R. B. Pearson Education Ltd
2) Outlines of Biochemistry, Conn, E.E; Stumpf, P.K; Bruening, G; Doi, R.H. John Wiley and Sons
3) Principles of Biochemistry (V Edition), By Nelson, D. L.; and Cox, M. M.W.H. Freeman and Company
4) Molecular Genetics (Second edition), Stent, G. S.; and Calender, R. W.H. Freeman and company, Distributed by Satish Kumar Jain for CBS Publisher
5) Microbiology, Prescott, L.M J.P. Harley and C.A. Klein 1995. 2nd edition Wm, C. Brown Publishers

6) https://onlinecourses.nptel.ac.in/noc18_bt23 by K. Suraishkumar and Madhulika Dixit

7) Campbell, NA and Reece JB, Biology, International edition, 7th edition or later, Benjamin Cummings, New York (2007 or later)
8) Karp, G, Cell and Molecular Biology: Concepts and Experiments, 7th edition, Wiley, New York (2013)

Course code	ESC-BT-203G				
Category	Engineering Science Course				
Course title	**Thermodynamics of Bioprocesses**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3	**1**		**4**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

1. To have understanding of basic concepts of thermodynamics
2. To get aware of heat, enthalpy, internal energy, work, energy and power etc.
3. To gain knowledge about laws of thermodynamics
4. To have understanding of energy balances in biological systems

UNIT-I

Introduction and basic concepts Scope and limitations of thermodynamics, Force, pressure and energy, Equilibrium state and the phase rule, Temperature and Zeroth law of thermodynamics, Heat reservoirs and heat engines, reversible and irreversible processes.

UNIT-II

First and second law of Thermodynamics, activity coefficients and phase equilibrium, Biological systems as open , non-equilibrium systems, failure of classical (closed equilibrium).

UNIT-III

Third law of thermodynamics : Concept of entropy production , constitutive equations, Gibbs free energy-theory Effect of solutes on boiling points and freezing points, Ionic solutions, Equilibrium constant

UNIT-IV

Thermodynamics of coupled Biochemical reactions , cells as non equilibrium, Thermodynamics of passive and active transport , Prigogine – Curie law , Thermo analysis of oxidative phosphorylation, Gibbs free energy- application, Biological clocks.

Course outcomes

1. Students will be familiar with basic concepts of thermodynamics
2. They will be able to understand and apply the laws of thermodynamics.
3. They will be able to analyze energy flows in a biological system.
4. They will be able to understand Gibbs free energy and calculate obtainable work for biological systems.

Text and Reference Books:

1. Kinetics & Thermodynamics in Biochemistry : Bray & White.
2. Biophysical Chemistry Vol. I : Edsall & Wyman.
3. Non equilibrium Thermodynamics in Biophysics : Katchalasky & Curran.
4. Physical Biochemistry : Van Holde .
5. Biological Thermodynamics – D.T. Haynie (Cambridge University Press)
6. A textbook of Chemical Engineering Thermodynamics – K. V. Narayanan (Prentice Hall of India)
7. Introduction to Chemical Engineering Thermodynamics – Smith, Van Ness, Abbott (TMH)
8. Chemical, Biochemical and Engineering Thermodynamics – Stanley I. and Sandler (Wiley India Edition)

Course code	PCC-BT-205G				
Category	Professional Core Course				
Course title	**Biochemistry**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3			**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

Understanding of water and its properties, pH, pKa etc.
Understanding of amino acids proteins and carbohydrates.
Understanding of lipids, nucleic acids, vitamins and their properties.
Understanding of bioenergetics and metabolism of biomolecules.

UNIT-I

Introduction to Biochemistry: Physical properties of water and their role in biology. Concepts of pH, ionic strength and buffers . Structure of atoms, molecules and chemical bonds.
Forces that stabilize biomolecules: Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction, etc. Hasselbach Hendersson equation and its implications.

UNIT-II

Composition, Structure and Function of Biomolecules: Amino acids, proteins, nucleic acids, carbohydrates, lipids and vitamins.
Conformation of Nucleic acids: Structural characteristics of A, B and Z-DNA. 3D
structure of t-RNA, micro-RNA ,ribozymes and riboswitches

UNIT-III

Protein Structure: Structural characteristics of alpha-helix, beta-sheet and -turn. Ramachandran plot. Protein domains and domain architecture. Quaternary structure of proteins. Protein denaturation and renaturation
Enzymology: Principles of catalysis, enzymes. Types of enzymatic reaction mechanisms, Michaelis-Menten kinetics. Competitive, Non-competitive and Un-competitive inhibition.

Allostery, isozymes

Unit-IV

Bioenergetics and Metabolism: Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, and biological energy transducers.

Metabolism of lipids, synthesis of triacylglycerols, biosynthesis of fatty acids, fatty acid oxidation. Amino acids Metabolism, amino acid synthesis, biological nitrogen fixation, amino acid catabolism.

Course Outcomes

- Students will be able to understand physio chemical properties of water, bonds and buffers.
- Students will be able to understand structure of amino acids, proteins, carbohydrates, lipids, nucleic acids and vitamins.
- Student will be able to understand about, structure of nucleic acids and protein.
- Students will be able to understand concept of bioenergetics and metabolism of biomolecules.

List of Text / Reference Books:

1. A.L. Lehninger, D.L. Nelson, M.M. Cox, “Principles of Biochemistry”, 3rd Edn.,worth Publishers, 2000.

2. L. Stryer, J.M. Berg, J.L. Tymoezko, “Biochemistry”, 5th Edition, W.H. Freeman andCo., 2002.

3. 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.

4. Fundamentals of Biochemistry by Donald Voet and Judith G Voet (1999), JohnWiley & sons, NY

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

6. 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.

Course code	PCC-BT-207G				
Category	Professional Core Course				
Course title	**Cell Biology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3			**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

UNIT- I

Cell: An introduction, Cell Theory, classification of organisms by cell structure, compartmentalization of eukaryotic cells, cell fractionation.

Cell membrane and permeability: Chemical components of biological membranes, organization and fluidity of membrane components, the membrane as a dynamic entity and membrane transport.

Cell Wall: Chemical composition and structure of cell wall

UNIT- II

Cytoskeleton: Structure and functions of microtubules, microfilaments, intermediate filaments.

Structure and Functions of Cellular Organelles: Endoplasmic Reticulum, Golgi complex, Lysosomes, Vacuoles and Microbodies, Ribosomes, Mitochondria, Chloroplast.

UNIT- III

Nucleus: Structure, cell-cycle and regulation of cell cycle.

Extracellular matrix: Composition, molecules that mediate cell adhesion, membrane receptors for extracellular matrix macromolecules, cell signaling.

UNIT- IV

Muscle contraction: Different muscle types in the body, Structure of muscle, structural proteins of muscles, energetics and regulation of muscle contraction.

Neurons and neurotransmission: Resting potential, action potential, synaptic transmission, neurotransmitters, and the generation of action potential by sensory stimuli and mechanism of nerve-impulses.

Course Outcomes :

CO1- Students will learn basic principles of cell biology especially the structure and functions of Biological Membranes

CO2 - Students will come to know about various cellular organelles and their integrated functioning.

CO3 - This unit will enable the students to learn the concept of inhibition and activation of biological phenomenon by simple methods.

CO4 - Students will be able to gain knowledge of different factors affecting the normal functioning of muscular and nervous system.

Text / References Books:

1. Cell Biology: Organelle structure and function, Sadava, D E.(2004) Panima pub., New Delhi.
2. Molecular Biology of cell, 4th ed. Alberts, Bruce (*et. al)(2002)* Garland Science Publishing, New York..
3. Cell Biology- Smith and Wood by Chapman and Hall.
4. Cell and Molecular Biology, 8th ed. Robertis, EDP De and Robertis, EMF De (2002) Lippincot Williams and Wilkins Pvt. Ltd.,(International Student Edition) Philadelphia.
5. Molecular Cell Biology 4th ed. Lodish, Harvey and .Baltimore, D(2000) W.H. freeman & Co. New York

Course code	PCC-BT 209 G				
Category	Professional Core Courses				
Course title	**Genetics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
	3	**0**	**0**	**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives:

In this course, emphasis is placed on the molecular basis of heredity, chromosome structure, patterns of Mendelian and non-Mendelian inheritance, principles of population, evolutionary and quantitative genetics.

UNIT-I

Classical and Non-Classical Genetics.

Introduction, History, Classical and molecular, Genetics , Mendel's Laws of inheritance and its applications, Monohybrid and Dihybrid Crosses, Types of dominance, Test cross and back cross, common gene interactions: Complementary genes, Supplementary genes, Cumulative genes, Duplicate genes, Inhibiting genes, Lethal genes, Penetrance Expressivity, Plieotropy, Atavism, Modifiers, Qualitative and Quantitative characters, Physical basis of heredity., genetic basis of continuous phenotypic variety, Analysis of genetic data.

UNIT-II

Chromosomes:

General Features of chromosomes: Morphology, Chemical composition, Structure and functions, Chromosomal aberrations: Structural and Numerical changes, The chromosomal theory of inheritance, Sex determination, Sex influenced characters, sex limited inheritance.

Organization of chromosomes:
Chromosome organization and molecular structure, The structure of bacterial chromosomes, the structure of Eukaryotic Chromosome Special chromosomes: Lampbrush Chromosomes, Polytene Chromosomes, and Accessory Chromosomes, euchromatin, heterochromatin, Repetitive and non repetitive DNA.
Linkage, Crossing Over and Recombination: Linkage, Crossing Over, Recombination in Chromosomes, Chromosome mapping, Genetic mapping: Gene mapping from two point and three point test cross, mapping by tetrad analysis, Complementation.

UNIT-III

Cytoplasmic Inheritance: Cytoplasmic inheritance in Eukaryotes, Maternal Inheritance, Cytoplasmic Inheritance by Cell Organelles, Cytoplasmic Inheritance by Endosymbionts, Cytoplasmic inheritance in haploids, cytoplasmic inheritance in Prokaryotes.
Mutation: Characteristics, Classification and Molecular basis, Physical Mutagens and Chemical Mutagens, Detections of Mutation, Directed Mutagenesis, Application of Mutation, Mechanism of DNA repair.

UNIT-IV

Population Genetics: Gene frequency, Genotype Frequency, Gene pool, Hardy- Weinberg law, Random Union of gametes, Random mating among Genotypes, Factors affecting gene frequencies : Migration, Mutation, Natural Selection, Random Drift and Founder's Principle, Inbreeding and Outbreeding.
Inheritance of Quantitative Characters: Quantitative and Qualitative Character, Inheritance of Quantitative Characters, Multiple factor hypothesis, Analysis of quantitative data: Mean, Range, Variance, Standard Deviation, Coefficient of Variation, Effect of Environment on Quantitative characters. Cause of Variations.
Genetic And Man: Human Genetics: Introduction to human Genome, genetic Studies: Genetic Diseases, Blood Groups, Disputed Parentage, Histocompatibility, Immune response, Linkage Studies, Somatic Cell Hybridization, Antibodies and Antigens Variability, Cytogenetics, Evolutionary Genetics.

Course Outcomes:

On completion of this course, students will have the knowledge and skills to:

Recognize and describe genetic phenomena and demonstrate knowledge of important genetic principles.

Describe the structure and functions of chromosomes

Understand and explain the phenomenon of cytoplasmic inheritance and mutations

Explain the key concepts in population, evolutionary and quantitative genetics including: the basis of genetic variation; heritability; Hardy-Weinberg Equilibrium; roles of migration, mutation.

List of Text / Reference Books:
1. Principles of Genetics by Gardner published by John Wiley & Sons.
2. Genetics: Analysis and Principles by Robert J. Brooker, 3rd Edition published by MC Graw Hill Science.

3. Genetic by M.W Strickberger Published by Prentice Hall College Division.
4. Genetic: Analysis of genes and genomes by Daniel Harti, 7th Edition published by jones and Bartlet.
5. Genetic by P.J Russel, 5th Edition published by Addison Wesley Longman, Inc. California.
6. Concept of Genetics by William S. Klug, Michael Charlotte Spencer and Michael A , Palladino, 9th Edition published by Benjamin Cumming.
7. Genetics by Benjamin Pierce, 3rd Edition Published by W.H. Freeman.
8. Essential of Genetics: A genomic perspective by Daniel L Harti and Elizabeth W.

Course code	**HSMC-211G**				
Category	Humanities and Social Science Including Management Courses				
Course title	**ENGLISH III**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- III**
	3	**0**	**0**	**3**	
Branches (B. Tech.)	**BIO TECH**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Objective

The course aims at developing the desired language (English) skills of students of engineering and technology so that they become proficient in communication to excel in their professional lives. The course aims at developing competence for report writing with a focus on its complex writing techniques and procedures.

Course Content

UNIT I

Communication Process Types and Levels, Scopes and significance, Technical and Tools of Effective communication

UNIT II

Speaking files and Personality Development Oral Presentation, Body Language, Voice Modulation, Negotiation, Group Discussion, Interview techniques

UNIT III

Advanced Technical Writing Job Application, CV writing, Business Letters, Memos, Minutes, Notices, Report Writing and structure, Blog writing.

UNIT IV

Communication and Media Recent Developments in Media, Context of Communication

SUGGESTED READING

1. Borowick, Jerome. N. *Technical Communication and its Applications*. New Delhi: PHI, 2000
2. Guffey, Mary Ellen. *Business Communication: Process & Product*. USA: South western College Publishing, 2000.
3. Kumar, Sanjay and Pushp Lata. *Communication Skills*. Delhi: OUP, 2011

Environmental Sciences

Course code	MC-106G				
Category	Mandatory Course				
Course title	Environmental Sciences				
Scheme and Credits	L	T	P	Credits	
	3	0	1	0	
Branches (B. Tech.)	Common For All Branches				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Unit-1 The Multidisciplinary nature of environmental studies. Definition, scope and importance. (2 lecture)

Unit-2 Natural Resources :

Renewable and non-renewable resources : Natural resources and associated problems.

a) Forest resources : Use and over-exploitation : deforestation, case studies. Timber extraction, mining dams and their effects on forests and tribal people.

b) Water resources : Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams- benefits and problems.

c) Mineral resources : Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources : World food problems, changes, caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, Water logging, salinity, case studies.

e) Energy resources : Growing energy needs; renewable and non- renewable energy sources, use of alternate energy sources, case studies.

f) Land resources : Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

* Role of an individual in conservation of natural resources.

* Equitable use of resources for sustainable lifestyles.

(8 lectures)

(8 lectures)

Unit-3 Ecosystems :

* 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 :

a. Forest ecosystem.

b. Grassland

ecosystem. c.

Desert ecosystem.

d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)
(6 lectures)

Unit-4 Biodiversity and its conservation

* Introduction - Definition : Genetic, Species and ecosystem diversity.
* 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-5 Environmental pollution :

Definition, causes, effects and control measures of :

a) Air pollution.

b) Water pollution c) Soil pollution

d) Marine pollution e) Noise pollution

f) Thermal pollution g) Nuclear hazards

* Solids 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.

(8 lectures)

Unit-6 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.

* Consumerism and waste products.

* 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.

* Public awareness. (7 lectures)

Unit-7 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. Woman and Child Welfare Role of Information Technology in Environment and human health.

Case Studies. (6 lectures)

Unit-8 Field Work :

* 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. (Field work equal to 10 lecture hours).

References

1. Agarwal, K.C. 2001 Environmental Biology, Nidi Pub. Ltd.
   Bikaner.
2. Bharucha, Frach, The Biodiversity of India, MApin Publishing Pvt. Ltd. Ahmedabad-380013, India, E-mail : mapin@icenet.net (R).
3. Brunner R.C. 1989, Hazardous Waste Incineration, Mc. Graw
   Hill Inc. 480p.
4. Clark R.S., Marine pollution, Slanderson Press Oxford (TB).
5. Cunningham, W.P. Cooper, T.H. Gorhani, E & Hepworth, M.T.
   2001, Environmental Encyclopedia, Jaico Pub. House, Mumbai
   1196 p.
6. De A.K., Environmental Chemistry, Wiley Eastern Ltd.
7. Down to Earth, Centre for Science and Environment (R).
8. Gleick, H.P., 1993. Water in crisis, Pacific Institute for Studies in Dev. Environment & Security Stockholm Env. Institute, Oxford Univ. Press, 473p.
9. Hawkins R.E. Encyclopedia of Indian Natural History, Bombay
   Natural History Society, Bombay (R).
10. Heywood, V.H. & Watson, R.T. 1995. Global Biodiversity
    Assessment, Cambridge Uni. Press 1140p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws. Himalaya Pub. House, Delhi 284p.
12. Mackinney, M.L. & Schoch, RM 1996, Environmental Science systems & solutions, Web enhanced edition. 639p.
13. Mhaskar A.K., Mayyer Hazardous, Tekchno-Science
    Publications (TB).
14. Miller T.G. Jr. Environmental Science, Wadsworth Publishing

Co. (TB).

15. Odum, E.P. 1971, Fundamentals of Ecology. W.B. Saunders
Co. USA, 574p.

16. Rao M.N. & Datta, A.K. 1987 Waste Water Treatment. Oxford
& TBH Publ. Co. Pvt. Ltd. 345p.

17. Sharma, B.K. 2001, Environmental Chemistry, Goal Publ.
House, Meerut.

18. Survey of the Environment, The Hindu (M).

19. Townsend C., Harper J. and Michael Begon. Essentials of
Ecology, Blackwell Science (TB).

20. Trivedi R.K., Handbook of Environmental Laws, Rules, Guidelines, Comliances and Standards, Vol. I and II Enviro Media (R).

21. Tridevi R.K. and P.K. Goal, Introduction to air pollution, Techno
Science Publications (TR).

22. Wagner K.D., 1998, Environmental Management, W.B.
Saunders co. Philadelphia, USA 499p.

23. A text book environmental education G.V.S. Publishers by Dr.
J.P. Yadav.

(M) Magazine (R) Reference (TB) Textbook

The scheme of the paper will be under :

The subject of Environmental Studies will be included as a qualifying paper in all UG Courses and the students will be required to qualify the same otherwise the final result will not be declared and degree will not be awarded.

The duration of the course will be 40 lectures. The examination will be conducted along with the semester examinations.

Exam. Pattern : In case of awarding the marks, the paper will carry 100 marks. Theory : 75 marks, Practical/ Field visit : 25 marks. The structure of the question paper will be :

Part- A : Short Answer Pattern : 15 marks Part- B : Essay Type

with inbuilt choice : 60 marks Part-C : Field Work

(Practical) : 25 marks Instructions for

Examiners :

Part- A : Question No. 1 is compulsory and will contain five short- answer type question of 3 marks each covering the entire syllabus.

Part-B : Eight essay type questions (with inbuilt choice) will be set from the entire syllabus and the candidate will be required to answer any four of them. Each essay type question will be of 15 marks.

The examination of the regular students will be conducted by the concerned college/Institute. Each student will be required to score minimum 40% marks separately in theory and practical/Field visit. The marks in this qualifying paper will not be included in determining the percentage of marks obtained for the award of degree. However, these marks will be shown in the detailed marks certificate of the students.

Course code	LC-BT-213G				
Category	Professional Core Course				
Course title	**Biochemistry Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
			3	**1.5**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LIST OF EXPERIMENTS/PRACTICALS

1. To adjust the pH of solution.
2. To prepare buffer solution using Hasselbach Hendersson equation.
3. Biochemical test for proteins.
4. Biochemical test for carbohydrates.
5. Biochemical test for lipids.
6. To check the activity of enzyme.
7. Chromatographic analysis of biomolecules (Column/TLC/Paper).
8. HPLC analysis of biomolecules.
9. Separation of biomolecules by size exclusion chromatography.

Course Outcome

Students will be able to
Prepare different type of buffers.
Carry out biochemical tests for different biomolecules
Learn about separation techniques or biomolecules
Learn about characterization of enzymes.

TEXT / REFERENCES BOOKS

1. Principles and Techniques of Biochemistry and Molecular Biology by K.Wilson and J.Walker Cambridge University Press
2. Introductory Practical Biochemistry Randhir Singh and SK Sawhney Alpha Science International Ltd

Course code	LC-BT-215G				
Category	Professional Core Course				
Course title	**Cell Biology Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-III**
			3	**1.5**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LIST OF EXPERIMENTS:

1. Study of different types of microscopes.
2. To study and observe the structure of prokaryotic cell
3. To study and observe the structure of eukaryotic cell
4. To prepare temporary stained mounts of onion root tip to study mitotic cell division
5. To prepare temporary stained mounts of Polytene chromosomes.
6. To prepare temporary stained mounts of insect gonads/flower bud.
7. To study cell membrane properties.
8. Fluorescence labeling of cellular organelles.
9. Study of Drosophila as a model organism and its life-cycle.
10. Isolation of DNA.

Course Outcomes :

CO1 - Students will be able to operate compound microscope
CO2 - Preparation of temporary and permanent slides will be known by students.
CO3 - Students will come to know about the procedure of isolation of different organelles of the cell by means of techniques of Centrifugation on the basis of density gradient.
CO4 - Students will learn Techniques of DNA extraction

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.

Course code	PCC-BT-202G				
Category	Professional Core Course				
Course title	**Microbiology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3			**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

Course Objectives

To convey that Microbiology is an important a scientific discipline.

To learn the Microbial diversity and systems of classification.

The fundamental principles of microbial nutrition, growth and control.

UNIT-I

Introduction to Microbiology: Importance and brief history of microbiology. Members of microbial world- General characteristics of Archaebacteria, Eubacteria. Algae, Fungi and Protozoa. Scope and relevance of microbiology, the future of microbiology.

Microbial Cell Structure and Function: Overview of prokaryotes and eukaryotes. The prokaryotic cell, size, shape and arrangement of bacterial cells. Structure and chemical composition of prokaryotic cell. Bacterial endospore.

Viruses:Introduction and general characteristics, the bacteriophages, Structure and life cycle of virus (Lytic and Lysogenic)

UNIT-II

Microbial taxonomy, systems of classification, microbial phylogenetic groups, Bergey's manual; Criteria for classification including molecular approaches.
Microscopic Techniques: The light microscopy, electron microscopy, preparation and staining of specimens, simple stains, differential and special stains.

UNIT-III

Microbial Nutrition: Microbial nutrient requirements, Classification of microorganisms on nutritional basis. Uptake of nutrients by cell. Culture media, types of media. Preservation techniques for microbial cultures.

Microbial Growth: Bacterial Modes of cell division and process of sporulation. Growth curve (log, exponential, stationary and cell death), mathematical expression of growth, diauxic growth, synchronous and continuous growth, methods of growth measurement, effects of environmental factors on growth: temperature, pH, water availability and oxygen.

UNIT-IV

Microbial Control: Basic principle of microbial control, selection of microbial control method, use of Physical and Chemical method in microbial control.
Microbial Metabolism: An overview of Metabolism, Carbohydrate catabolism: glycolysis, alternate to glycolysis-ED pathway, pentose phosphate pathway; cellular respiration: aerobic and anaerobic; fermentation, photosynthesis; overview of lipid and protein metabolism.

Course Outcomes

Students would be able to explain the basic of microbiology, relevance, microbial diversity and details of prokaryotic cell.
Students would be able to understand classification of microorganisms and techniques of microscopy.
Students would be having familiarization about microbial nutrition, preservation and growth.
Students would be able to appreciate microbial control techniques, microbial metabolism and photosynthesis.

List of Text / References Books:

1. Jeffery C. Pommerville. Alcamo's Fundamentals of Microbiology (Tenth Edition). Jones and Bartlett Student edition.

2. Gerard J. Tortora, Berdell R. Funke, Christine L. Case. Pearson - Microbiology: An Introduction. Benjamin Cummings.

3. Lansing M. Prescott, John P. Harley and Donald A. Klein. Microbiology. Mc Graw Hill companies.

4. Microbiology, Pelczar. M.J , Chan E.C.S, Kreig N.R, 5th edition (2007)

5. Biology, Raven and Jhonson, 6 th edition (2001)

Course code	PCC-BT-204G				
Category	Professional Core Course				
Course title	**Molecular Biology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3			**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

Course Objectives

To convey the importance of molecules of life and their processes.

To convey the role of central dogma related processes in practical applications.

UNIT-I

DNA: Introduction, structure, properties: physical and chemical, biological significance of double strand, DNA bending, DNA super coiling, cruciform and ZDNA structure, DNA Triplex, Denaturation and renaturation of DNA-Tm values and cot curves analysis, C-value paradox, Repetitive and non-repetitive DNA and its relevance to plants and animals, inverted and tandem repeats. Gene, split genes, housekeeping genes.

Genome organization:Genome organization in eukaryotes and prokaryotes, euchromatin and heterochromatin,DNA protein interactions, packaging in nucleosomes, Meiosis, mitosis and practical applications.

UNIT-II

DNA Replication: Origin of replication, DNA polymerase, mechanism of DNA replication in prokaryotes and eukaryotes, DNA replication models, DNA damage, mutations, DNA repair and practical applications.

Transcription: Mechanism in prokaryotes and eukaryotes, RNA polymerase, sigma factor, regulation of transcription, transcriptional factors, post transcriptional processing (5' and capping and 3' polyadenylation), Zinc finger motifs, helix loop helix, leucine Zippers. RNA splicing: Intron and exon, splicing mechanism for mRNA,tRNA, spliceosome, lariat formation, Ribozymes, cis splicing and trans splicing, practical application of transcription.

UNIT-III

Translation: Genetic code, Wobble hypothesis, Component of protein synthesis, ribosomes, tRNA, mRNA, rRNA, mechanism of protein synthesis, regulation of protein synthesis, post transitional modification, chaperones, transport and degradation of proteins and practical applications of translation.

Gene Regulation: Operon model, Regulation of gene expression in prokaryotes and eukaryotes; Lactose and Tryptophan operon, inducible and repressible systems; positive and negative control.

Applications of gene regulations in diseases, control and evolution.

UNIT-IV

Transposons: The dynamic genome: Mobile genetic elements in prokaryotes-insertion sequences, composite and non-compositetransposons, replicative and conservative transposition, retrotransposon, eukaryotic jumping genes and practical applications.

Introduction to stem cells and cellular differentiation; RNA interference, epigenetic regulation of genes (DNA methylation and histone modifications), oncogenes, tumour suppressor genes and apoptosis, oncogenes and cancer. Genome editing tools, CRISPR, applications, future prospective and drawbacks.

Course Outcomes

Students will be able to understand and apply the principles of basic molecular biology in real life applications.

List of Text/ Reference Books:

1. DNA Structure and Function by Richard.
2. Genes by Lewin.
3. Molecular Cell Biology by Alberts and Watson.
4. The Cell-AMolecular Approach by Cooper.
5. Cell and Molecular Biology byRobertis.

Course code	PCC-BT 206 G				
Category	Professional Core Courses				
Course title	**Immunology**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester- IV**
	3	**0**	**0**	**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Instructions for setting of paper: Nine questions are to be set in total. First question will be short answer question covering whole syllabus and will be compulsory to attempt. Next eight questions will comprise of two questions each from the four sections. Student will be required to attempt four questions selecting one from each section. Each question will be of 15 marks.

Course Objectives:

In this course, emphasis will be on :

- The structural features of the components of the immune system and their functions.
- Understanding the mechanisms involved in immune system development and responsiveness.
- To understand about how immunologists think and work.

UNIT-I

Basic Immunology : Types of immunity: innate and acquired: cells and organs of immune system B-Lymphocytes and T- Lymphocytes, Primary and secondary lymphoid organs, humoral and cell mediated immune response.

UNIT-II

Immune System : Antigens, immunoglobulins : structure and function, antigenic determinants : Isotype, allotype & idiotype; Monoclonal Ab , Hybridoma techonology Organization and expression of immunoglobulin genes, Generation of Ab. Diversity, class switching , and Ab. Engg.

UNIT-III

Generation of B-Cell and T-Cell Responses : Major histocompatibility complex , Peptide binding by class I and class II molecules , Ag. Processing presentation, T-Cell receptor ,T-cell maturation , activation & differtiation, Positive & negative selection, • ignaling pathways.
Immunological Techniques : ELISA , Radio immunoassay , immuno-precipitin reactions.

UNIT-IV

Immune Effector Responses : Cytokines properties , The complement system, Role of T- helper cells in cytokine production , cell mediated effector responses.
Immune system in Health & Disease : Hypersensitive reaction, auto immunity, and immune response to infectious disease, tumor immunity, tissue and organ transplant , vaccines & peptide vaccines.

Course Outcomes:
After completing the course, students will know :

Types of immunity and its importance and relevance in our daily life

Antigens, immunoglobulin's structure, function and organization

Major histo-compatibility complex and its importance in transplantation

Autoimmune disease and Hypersensitive reaction and vaccines.

TEXT / REFERENCE BOOKS
1. Kuby,s Immunology 4th edition) R.A. Goldsby ,T. J. Kindt, B.A. Osborne, W.H.Freeman & company, New.York.
2. Essential Immunology (10th edition), Ivon Roitt, Peter Delves, Blackswell, Scientific Publications. Oxford.
3. Fundanental of immunology . Paul W.E.(Eds) Raven press ,New York.
4.**Immunology** by Presscot .

Course code	ESC-BT-208G				
Category	Engineering Science Courses				
Course title	**Bioprocess Engineering**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3	**0**		**3**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	75 Marks				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

Understanding of basic principles of bioprocesses, mass transfer, heat transfer and fluid mechanics.
Understanding basic principles of sterilization.
Understanding fundamental of downstream processing of fermented products

UNIT – I

Introduction to Bioprocess Engineering: Overview of Bioprocess including upstream and downstream processing. Bioprocess development: An interdisciplinary challenge. Steps in bioprocess development, Role of bioprocess engineering in biotechnology.

Introduction to Engineering calculation: Physical variables, dimensions and units, dimensionally homogeneous and non-homogeneous equations, Concept of materials balance, types of material

balance,mass balance in steady and unsteady state, elemental balance ,electron balance and energy balance, Enthalpy calculations.

UNIT-II

Fermentation: Bioreactor- general characteristics , components, and types of bioreactors**.**
Formulation of fermentation medium, factors influencing the choice of various carbon and nitrogen sources.
Sterilization: Thermal death kinectics of microorganisms, Batch sterilization- design aspects, del factors during heating and cooling, methods for evaluating del factors, Continuous sterilization, sterilization of gases and liquids by filtration.

UNIT – III

Rheology of Fermentation Fluids: Nature of fluids and their classification, Bernoulli's equation.boundary layer concept, flow through pipes, Newtonian and non Newtonian fluids, mixing in fermentation broth.
Microbial Growth Kinetics: Growth kinetics in batch culture, effect of substrate concentration in batch culture, growth yield coefficient, heat generation during microbial growth, fed batch culture, continuous culture and continuous growth kinetics

UNIT-IV

Transport Phenomena in Bioprocess: Mass Transfer- molecular diffusion, role of diffusion in bioprocessing, film theory. Convective mass transfer; liquid solid mass transfer, liquid liquid mass transfer, Gas-Liquid mass transfer. Oxygen uptake in cell cultures, factors affecting oxygen transfer in fermentations. Heat Transfer- Basic concept of heat transfer in bioreactor, Principle and mechanism of Heat transfer by Conduction, Convection, and Radiation. Process equipment for heat transfer, double pipe heat exchanger, shell and tube heat exchangers, condensers.

Course Outcomes

After studying the course, the student will be able to:

- Students will be able to understand basic principles and role of bioprocess engineering in biotechnology, mass and energy principles involved in bioprocesses.
- Students will be able to understand fermentation, sterilization of bioprocess equipments, materials, downstream processing of fermented
- Students will be able to understand role of fluid mechanics and microbial growth kinetics during bioprocesses
- Students will be get familiar with mass and heat transfer in bioprocess engineering.

References:

1. Bioprocess Engineering Principles, PM Doran, Academic Press, Elsevier
2. Bioprocess engineering Basic concepts M.A Shuler, Fikiret Kargi, PHI, India
3. Introduction to Biochemical Engineering D G Rao Second edition
4. Biochemical Engineering Fundamentals James E. Bailey, David F. Ollis Mc Graw Hill Education

Course code	**BSC-BS 210G**				
Category	Basic Science Course				
Course title	**Biostatistics**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	3	**1**		**4**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25				
Exam	75				
Total	100 Marks				
Duration of Exam	03 Hours				

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

Course Objectives

Understanding the fundamental of statistics.
Understanding the types of data, data collection and data representation
Understanding the measure of central tendency
Understanding the principles of probability
Understanding the principles of correlation and regression

UNIT – I

Introduction to Biostatistics: Definition, types of data and Application, data collection, random and non random, Data representations, Bar, Histogram, Frequency Polygon, frequency curve, relative frequency curve, pie chart (with merits and demerits).
Descriptive Statistics: Introduction to basic quantities methods, Measure of central tendency, mean , mode, median, Harmonic mean, Geometrical mean, Partitions, measure of dispersion, Range, Quartile deviation, mean deviation, standard deviation and, coefficient of variation.

UNIT – II

Probability Distributions: Introduction to probability and types of probability with applications in biostatistics. Probability theorems (addition, multiplication), independent events, Baye's theorem. Probability Distributions, properties and application of binomial, poisson and Normal distributions.

UNIT – III

Sampling:Introduction to sampling, Types of sampling, errors, standard error, confidence limits, large sample test, single probability test, deference of probability, single mean difference of mean difference of standard deviation. Student's t-distribution test (applications only), F-test, Chi-square test of goodness of fit.

UNIT – IV

Correlation and regression: Introduction, definition and types to correlation, properties, covariance and methods of studying correlation. Karl Pearson's Coefficient of Correlation, Rank Correlation methods. Properties of regression, Introduction to regression lines, regression coefficients, properties of regression. Advantages and disadvantages of Correlation and regression.

Course Outcomes

Students will be able to understand the fundamental of statistics such as data, data collection and representation of data
Students will be able to understand the concepts of mean, median and mode.
Students will be able to understand the principles of probability and probability theorems
Students will be able to understand the study of correlation, regression and coefficients

References books:

1Biostastics, K Balaji, AVS Raghavaiah, KN Jayavera. I.K. International publishing House Pvt. Ltd, New Delhi
2. An Introduction to Biostastics, N Gurumani, MJP Publisher
3. Principles and Application of Biostastics, B. Antonosamy, PS Premkumar, S Christopher, Elsevier

Course code	**HSMC-02G**				
Category	Humanities and Social Sciences				
Course title	**ORGANIZATIONAL BEHAVIOUR**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	
	3	**0**	0	**3**	
Branches (B. Tech.)					
Class work	25				
Exam	75				
Total	100 Marks				
Duration of Exam	03 Hours				

The objective of this course is to expose the students to basic concepts of management and provide insights necessary to understand behavioral processes at individual, team and organizational level.

Note: Examiner will set nine questions in total. Question one will be compulsory. Question one will have 6 parts of 2.5 marks each from all units and remaining eight questions of 15 marks each to be set by taking two questions from each unit. The students have to attempt five questions in total, first being compulsory and selecting one from each unit.

SYLLABUS

UNIT - 1

Introduction of Management- Meaning, definitions, nature of management; Managerial levels, skills and roles in an organization; Functions of Management: Planning, Organizing, staffing, Directing & Controlling, Interrelationship of managerial functions, scope of management & Importance of management. Difference between management and administration.

UNIT - 2

Introduction of organization:- Meaning and process of Organization, Management v/s Organization; **Fundamentals of Organizational Behavior:** Concepts, evolution, importance and relationship with other Fields; Contemporary challenges and opportunities of OB. **Individual Processes and Behavior-Personality**- Concept, determinants and applications; **Perception-** Concept, process and applications, **Learning**- Concept (Brief Introduction) ; **Motivation-** Concept, techniques and importance

UNIT - 3

Interpersonal Processes- Teams and Groups- Definition of Group, Stages of group development, Types of groups, meaning of team, merits and demerits of team; difference between team and group, **Conflict-** Concept, sources, types, management of conflict; **Leadership:** Concept, function, styles & qualities of leadership. **Communication –** Meaning, process, channels of communication, importance and barriers of communication.

UNIT 4

Organizational Processes: Organizational structure - Meaning and types of organizational structure and their effect on human behavior; **Organizational culture -** Elements, types and factors affecting organizational culture. **Organizational change:** Concept, types & factors affecting organizational change, Resistance to Change.

Course Outcomes: By the end of this course the student will be able to:

1. Students will be able to apply the managerial concepts in practical life.
2. The students will be able to understand the concept of organizational behavior at individual level and interpersonal level.
3. Students will be able to understand the behavioral dynamics in organizations.
4. Students will be able to understand the organizational culture and change

Suggested Books:

1. Robbins, S.P. and Decenzo, D.A. Fundamentals of Management, Pearson Education Asia, New Delhi.

2. Stoner, J et. al, Management, New Delhi, PHI, New Delhi.
3. Satya Raju, Management – Text & Cases, PHI, New Delhi.
4. Kavita Singh, Organisational Behaviour: Text and cases. New Delhi: Pearson Education.
5. Pareek, Udai, Understanding Organisational Behaviour, Oxford University Press, New Delhi.
6. Robbins, S.P. & Judge, T.A., Organisational Behaviour, Prentice Hall of India, New Delhi.
7. Ghuman Karminder, Aswathappa K., Management concept practice and cases, Mc Graw Hill education.
8. Chhabra T. N., Fundamental of Management, Sun India Publications- New Delhi.

Course code	LC-BT-212G				
Category	Professional Core Course				
Course title	**Microbiology Lab.**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
			3	**1.5**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LIST OF EXPERIMENTS/PRACTICALS

1. Microscopy: Different parts of compound microscope and its use.
2. Morphology study of microorganisms using permanent slides.
3. Preparation of culture media.
4. Sterilization techniques used in microbiology laboratory.
5. Isolation and enumeration of microorganisms from soil.
6. Pure culture techniques – Streak plate, Pour plate, Spread plate
7. Sub culturing of isolate to get pure culture.
8. Preparation of bacterial smear and simple staining.
9. Gram staining of bacterial culture.
10. Measurement of bacterial growth using turbidity method.
11. Effect of temperature on microbial growth.
12. Effect of pH on bacterial growth. Biochemical tests useful in bacterial taxonomy.
13. Milk Microbiology –Standard Plate Count.

Course Outcome

Students will be able to

- Students get familiarity with principle of simple and compound microscopes and their application for morphological study of microorganisms.
- Students would learn the techniques of smear preparation, simple staining and Gram staining of microbial cultures.
- Students would be able to prepare liquid and solidified media by using the sterilization technique.
- Students would be able to enumerate microbes and isolate the pure culture of microorganisms from the soil and water.

TEXT / REFERENCES BOOKS

1. Experiment in Microbiology, Plant pathology,Tissue Culture & Mushroom production technology: Aneja K.R, .2001, 3RD Edition, New Age International

Publishers, New Delhi.
2. Microbiology –A Lab manual, Cappuccino J. & Sheeman N, 2000, 4th Edition, Addison Wesley California .

Course code	LC-BT-214G				
Category	Professional Core Course				
Course title	**Molecular biology Lab.**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
			3	**1.5**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

LIST OF EXPERIMENTS/PRACTICALS (Any ten)

1. Isolation of Prokaryotic genomic DNA
2. Isolation of Prokaryotic plasmid DNA
3. Isolation of DNA from Eukaryotes
4. mt-DNA/Y-Chromosome isolation
5. Isolation of DNA from saliva/blood/different tissues/dried blood/hair
6. RNA/s isolation
7. Simultaneous extraction of RNA, DNA and proteins
8. Purification of DNA/RNA/Protein
9. Molecular weight characterization of a given DNA/Protein
10. Electrophoresis/AgroseGel Extraction/SDS/PAGE of DNA/Protein.
11. Polymerase Chain Reaction/PCR
12. Blotting Techniques
13. RAPID
14. RFLP

Course Outcome:

Students will be able to isolate, identify, purify and amplify the molecules of life.

Students will be able to apply the theoretical knowledge of molecular biology for practical applications.

List of References/ Suggestive Books.

1. Molecular Cloning-a laboratory manual by Sambrook and Russell.
2. Cell and Molecular Biology: Concepts and Experiments by Karp.

3. Genomes by Brown.
4. Molecular Cell Biology by Alberts and Watson.

NOTE: A College must offer 70% of the above listed experiment. The remaining 30% experiment may be modified by college according to facilities available.

Course code	LC-BT-216G				
Category	Professional Core Courses				
Course title	**Immunology Lab**				
Scheme and Credits	**L**	**T**	**P**	**Credits**	**Semester-IV**
	0	**0**	**3**	**1.5**	
Branches (B. Tech.)	**Biotechnology Engineering**				
Class work	25 Marks				
Exam	25 Marks				
Total	50 Marks				
Duration of Exam	03 Hours				

Course Objectives:

To acquire knowledge on immunological techniques

To train in various techniques involving antigen and antibody reactions

LIST OF EXPERIMENTS:

1. Double diffusion, Immuno-electrophoresis and Radial Immuno diffusion.

2. Rocket electrophoresis

3. Antibody titre by ELISA method.

4. ELISA for detection of antigens and antibodies-DOT ELISA

5. Sandwich ELISA

6. Blood group mapping

7. Separation of leucocytes by dextran method

8. Separation of mononuclear cells by Ficoll-Hypaque

9. Preparation of antigens from pathogens and parasites

10. Slide and tube agglutination reaction

11. Complement fixation test.

12. Immunofluorescence technique

13. Lymphoproliferation by mitogen / antigen induced

14. SDS-PAGE, Immunoblotting, Dot blot assays

Course Outcomes:

Students will be able to perform diagnostics assays involving antigen-antibody reaction.
Students will be able to learn the preparation of antigen.
Students will be able to learn the immuno-diffusion & immuno-precipitation
Students will be able to learn ELISA test and SDS-PAGE.

REFERENCES:

1. Rose et al., Manual of Clinical laboratory Immunology, 6th Ed ASM Publications, 2002.

2. Lefkovis and Pernis. Immunological methods. Academic Press, 1978.

3. Hudson L. and Hay F.C. Practical Immunology. Black Well publishers, 1989