MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY, BATHINDA

[Established by Govt. of Punjab under Punjab Act 5 of 2015 and UGC Act 2 (f) and 12(B)]

AGENDA: 4th MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY

MEETING VENUE: ONLINE

DATE: 27-08-2021

TIME: 10:30 A.M.

MAHARAJA RANJIT SINGH PUNJAB TECHNICAL UNIVERSITY
DABWALI ROAD, BATHINDA-151001
(Estb. by Govt. of Punjab Act 5(2015) & Approved u/s 2(f) & 12(b) of UGC Act, 1956)
www.mrsptu.ac.in

Ref. No.: 8088 **Date:** 23/08/2021

SUBJECT: 4TH MEETING OF FACULTY OF ENGINEERING & TECHNOLOGY TO BE HELD ON 27.08.2021

To

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To

Sir/Madam,

It is to inform you that 4th Meeting of Faculty of Engineering & Technology of Maharaja Ranjit Singh Punjab Technical University has been scheduled on 27/08/2021 at 10.30 a.m in on-line mode through Google hangsout meet. Link for the same will be shared on the same day. You are requested to make it convenient to attend this online meeting. Honorarium will be paid as per MRSPTU, Bathinda norms.

23/8/2021

Dr. S. K. Bath
Member Secretary,
Faculty of Engg. & Tech.,
MRSPTU, Bathinda

Copy to:

1. PA to Vice Chancellor, MRSPTU, Bathinda for information to Vice Chancellor please.
2. Registrar, MRSPTU, Bathinda
3. Professor I/C, Finance, MRSPTU, Bathinda
4. Dean Academic Affairs, MRSPTU, Bathinda

ITEM NO. 04.01 TO APPROVE THE MINUTES OF 6TH MEETING OF BOARD OF STUDIES IN AERONAUTICAL & AEROSPACE ENGG. HELD ON 11.06.2021

The minutes of 6th meeting of Board of Studies in Aeronautical & Aerospace Engg. held on 11.06.2021 are attached herewith **ANNEXURE-I**.

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 04.02 APPROVAL OF SYLLABI OF UG-ENGG PROGRAMMES

In the light of AICTE model curriculum 2K18, Syllabi of B. Tech Engineering Programmes have been prepared by the concerned Board of Studies as per following details:

S. No.	ITEM	Annexure-II	
		Sub Page	Main Page Nos.
1.	Scheme and Syllabus of B. Tech. (Aerospace Engg.) 5th–6th Sem. for Batch 2K19 onwards	01-29	3-31
2.	Syllabus of B. Tech. (Civil Engg.) 7th – 8th Sem. for Batch 2K18 onwards	01-27	32-58
3.	Syllabus of B. Tech. (Civil Engg.) 5th – 8th Sem. Batch 2K19 onwards	01-62	59-120
4.	Syllabus of B. Tech. (Electronics & Communication Engg.) 7th – 8th Sem. for Batch 2K18 onwards	01-29	121-149
5.	Scheme & Syllabus of B. Tech. (Mechanical Engg.) 7th – 8th Sem. for Batch 2K18 onwards	01-42	150-191

Put up before Faculty of Engineering & Technology for deliberations and approval for further recommending it to Academic Council please.

ITEM NO. 04.03 TO IMPLEMENT THE DESION OF 4TH MEETING OF ACADMIC COUNCIL REGARDING INCORPORATION OF "UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY" AS A MANDATORY CREDIT COURSE FOR ALL UNDERGRADUATE (B.TECH) STUDENTS FROM ACADEMIC YEAR 2020-21.

Consequent upon the decision of Academic Council of MRSPTU Bathinda in its 4th Meeting held on 10.06.2021 vide agenda item no. 04.36, it was decided that the course be incorporated in curriculum by Board of Studies as per the directions of AICTE **(ANNEXURE-III)**

The matter is placed before the Faculty of Engineering & Technology for implementation.

ITEM NO. 04.04 Any other agenda Item/Items with the permission of the chair.

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MINUTES OF MEETING

The 6th meeting of BOS for B.Tech.(Aerospace Engineering) was held on 11/06/2021 at Google meet platform from 3.00 pm to 5.00. The main agenda was to finalise the Scheme and syllabus of 5th and 6th Semester of B.Tech.(Aerospace Engineering).

Following members of BOS were present:-

1) Prof (Dr.) Rakesh Kumar, PEC Chandigarh- Chairman BOS
2) Prof (Dr.) Amarjit Singh, Retd Prof, PEC Chandigarh - Member
3) Er. Tushar Siag, PEC- Assistant Professor, PEC Chandigarh-Member
4) Er. J S Tiwana, GZSCCET, Associate Professor, GZSSCET Bathinda, - Member
5) Sh. Subhash Chander,Member Joint Director PDS, TBRL, Ministry of defence, Chandigarh
6) Dr. Anju Sharma, Assistant Professor, PSAEC Patiala-Special Invitee
7) Er. Vinod Kumar, Assistant Professor, PSAEC Patiala-Special Invitee

1. Details of Subject "Space Flight Mechanics" of 5th semester in B Tech (Aerospace Engineering) have been discussed by members of BoS and contents of this course have been approved by the BoS members.

2. “Automatic control” subject of 5th semester in B Tech(Aerospace engineering) has been renamed As “Automatic Flight Control” with some amendments in the contents of its syllabus. The detailed contents have been approved.

3. "Aerospace Structures" course has been added as compulsory subject in the study scheme of 5th semester B. Tech. (Aerospace Engineering) instead of Department Elective. The contents have also been approved.

4. “Viscous Flow Theory” and “Wind Turbines” courses have been proposed as departmental electives subject in the study scheme of 5th semester in Aerospace Engineering. The contents of both subjects have also been approved.

5. Contents of "Computational Fluid Dynamics" theory and Lab have been approved for 6th semester in B Tech. (Aerospace Engineering) by the BOS. The contents of both (Theory and Lab) have been approved.

6. "Advanced Aerospace Structures" have been approved as Compulsory Subject for 6th semester in B.Tech. (Aerospace Engineering) instead of Space Mission and Optimization. The contents of this new approved subject have been approved.

7. Bucket of Following courses have been approved for departmental Elective- II and III for 6th semester in B. Tech. (Aerospace Engineering)

- Avionics
- Helicopter Dynamics
- Missile Engineering
- Space mission design and optimization
- Unmanned Aerial vehicles

As approved by BOS, the contents of all above subjects shall be same as that of PEC Chandigarh.

The meeting ended with the thanks to the chair.

1. Prof. (Dr.) Rakesh Kumar

2. Prof (Dr.) Amarjit Singh

3. Er. Tushar Siag

4. Er. J S Tiwana

5. Sh. Subhash Chander

6. Dr. Anju Sharma

7. Er. Vinod Kumar

B.Tech. Aerospace Engineering (5th SEMESTER)								
		Contact Hrs.			Marks			Credits
Code	Name	L	T	P	Int.	Ext.	Total	
BASES1-501	Space Flight Mechanics	3	1	0	40	60	100	4
BASES1-502	Automatic Flight Control	3	1	0	40	60	100	4
BASES1-503	Aerospace Structure Analysis	3	0	0	40	60	100	3
BASES1-504	Flight Controls lab	0	0	2	60	40	100	1
BASES1-505	Training-II	-	-	-	60	40	100	3
	Humanities Course* (Select Any One)	3	0	0	40	60	100	3
BHSMC0-005	*Effective Technical Communication*							
BHSMC0-016	*Organizational Behavior*							
	Departmental Elective-I (Select One)	3	1	0	40	60	100	4
BASED1-511	Aerospace Materials and Processes							
BASED1-512	Viscous Flow Theory							
BASED1-513	Wind Turbines							
	Mandatory Courses (Any One)	2	0	0	100	0	100	0
BMNCC0-001	*Constitution of India*							
BMNCC0-006	*Essence of Indian Knowledge Tradition*							
Total		**-**	**-**	**-**	**420**	**380**	**800**	**22**

***Detailed syllabus of Humanities/Management subjects may be seen on the UG Open Electives Page of University website by clicking on "MRSPTU List of Humanities, Social Science and Management Subjects_BHSMC0-XXX"**

SPACE FLIGHT MECHANICS

Subject Code – BASES1-501	L	T	P	Cr	Duration:60 Hrs
	3	1	0	4	

COURSE OBJECTIVES

- To acquaint the students with the concepts of space flight, time derivatives of moving vectors, equation of motions in inertial frame, Orbit Maneuvers, Lunar/ Interplanetary Trajectories

COURSE OUTCOMES

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

1. To apply the concepts of numerical integration.
2. Analyze equation of motion in inertial frame
3. Solve the problems of orbital tracking
4. Carry out design of Orbit Maneuvers.
5. Understand the concepts of Lunar/ Interplanetary Trajectories.

UNIT-I (20 hrs)

Dynamics of Particles: Introduction, Vectors, Kinematics, Mass, force, and Newton's law of gravitation Newton's law of motion, Time derivatives of moving vectors Relative motion Numerical integration, RK method, RK1 (Euler's method), RK2 (Heun's method), RK3, RK4, Heun's predictor–corrector method, RK with variable step size

Reference frames and rotations: Equations of motion in an inertial frame, Equations of relative motion, Angular momentum and the orbit formulas, The energy law, Circular orbits (e= 0), Elliptical orbits (0 < e < 1), Parabolic trajectories (e =1), Hyperbolic trajectories (e > 1)

UNIT-II (18 hrs)

Two Body Motion: equations of motion – Kepler laws – solution to two-body problem – conics and relations – vis-viva equation – Kepler equation – orbital elements – orbit determination – Lambert problem – satellite tracking – different methods of solution to Lambert problem.

UNIT-III (12 hrs)

Non-Keplerian Motion: perturbing acceleration – earth aspherical potential – oblateness – third body effects – atmospheric drag effects – application of perturbations.

Orbit Maneuvers: Hohmann transfer – inclination change maneuvers, combined maneuvers, bi-elliptic maneuvers.

UNIT-IV (10 hrs)

Lunar/ Interplanetary Trajectories: Introduction, Interplanetary Hohmann transfers, Rendezvous opportunities, Sphere of influence, Method of patched conics, Planetary departure, Sensitivity analysis, Planetary rendezvous, Planetary flyby, Planetary ephemeris, non-Hohmann interplanetary trajectories

RECOMMENDED BOOKS

1. Curtis, H. D., "Orbital Mechanics for Engineering Students", 2nd ed., Elsevier (2009).
2. Chobotov, V. A., "Orbital Mechanics, 3rd ed.", AIAA Edu. Series (2002).
3. Wiesel, W. E., "Spaceflight Dynamics", 2nd ed., McGraw-Hill (1996).
4. Brown, C. D., "Spacecraft Mission Design, 2nd ed.", AIAA Edu. Series (1998).
5. Escobal, P. R., "Methods of Orbit Determination", 2nd ed., Krieger Pub. Co. (1976).

AUTOMATIC FLIGHT CONTROL

Subject Code – BASES1-502 **L T P Cr** **Duration 60 Hrs**
3 1 0 4

COURSE OBJECTIVES

- To acquaint the students with the concepts of stability derivatives, automatic flight control, design of autopilot systems, transfer functions and control design, to design longitudinal and lateral-directional controls for various types of aircrafts.

COURSE OUTCOMES

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

1. To identify open and closed loop control systems.
2. Analyze linear feedback control systems and acquaint with block diagram algebra
3. Carry out the system stability analysis
4. Analyze feedback control systems including steady state and frequency response.
5. Carry out design of control systems.

UNIT-I (18 Hrs)

Introduction: Classical and modern control theory, Open loop and closed loop (feedback) control systems, Types of feedback control systems.

Feedback control system: Transfer function of linear systems. Impulse response of linear systems, Block diagrams of feedback control systems, Multivariable systems, and Block diagram algebra.

UNIT-II (12 Hrs)

System stability; Routh-hurwitz criterion, the root locus Method, Governing rules for plotting root locus, Effect of addition of Zeroes and Poles, Gain and phase margin from root locus.

Analysis of Feedback Control Systems: Typical test input signals, Frequency domain techniques, Time domain performance characteristics of feedback control systems. Effects of derivative and integral control. Steady state response of feedback control system, Steady state error, Frequency response.

UNIT-III (18 Hrs)

Control System Design: Control system design, Compensation, Forward-path compensation, Feedback-path compensation, Proportional, proportional-integral and proportional-integral-derivative (P, PI and PID) controller.

Longitudinal Auto-Pilots: Short period and phugoid dynamics, Longitudinal auto pilots: Brief description through block diagrams and root locus, Displacement autopilot, pitch-displacement autopilot, Acceleration control system, Fly-By-Wire control system, Stability augmentation system, Instrument Landing System.

UNIT-IV (12 Hrs)

Lateral Auto-Pilots: Introduction, Roll dynamics, Dutch roll approximation, Damping of Dutch Roll, Roll attitude autopilot, Methods of obtaining coordination, Yaw orientation control system.

RECOMMENDED BOOKS:

1. R. C. Nelson, "Flight Stability and Automatic Control", 2nd Ed., McGraw Hill Education(2017).
2. E. H. J. Pallett, Shawn Coyle, "Automatic Flight Control", 4th Ed., Wiley-Blackwell(1993).
3. Donald McLean, "Automatic Flight Control Systems", 1st Ed., Prentice Hall(1969).
4. C. D. Perkins & R. E. Hage, "Airplane Performance Stability and Control", Wiley India Pvt. Ltd(2011).
5. R.V. Jategaonkar, "Flight Vehicle System Identification: A Time Domain Methodology", 2nd Ed., AIAA Series(2015).

AEROSPACE STRUCTURAL ANALYSIS

Subject Code – BASES1-503 | **L T P Cr** | **Duration 45 Hrs**
3 0 0 3

COURSE OBJECTIVES

- To equip the student with the knowledge about the mechanics of different aircraft structural members, and their design and analysis. The student should also be able to know the basic concepts of the advanced material utilized in the aerospace structures.

COURSE OUTCOMES

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

1. Have an understanding of aerospace materials along with the skills to analyze the basic elements of aircraft structures, and to calculate loads acting on the aircraft. Analyze linear feedback control systems and acquaint with block diagram algebra.
2. Apply the concept of structural idealization for stress analysis of open and closed section beams, and understand the concept of shear flow in cell-structures. Analyze feedback control systems including steady state and frequency response.
3. Do stress analysis of aircraft wing including the tapered wing and wings with variable stringer area. Design various autopilots (longitudinal/ lateral) for various types of aircrafts.
4. Evaluate stresses in various aircraft components like fuselage, wing ribs, etc., and understand the wing-fuselage interaction and fuselage detailed design.
5. Understand the basic concept of static and dynamic aeroelasticity including the flutter and buffeting.

UNIT-I (11Hrs)

Introduction to Aircraft Structure And Materials: Aerospace Materials, Composite materials: Classifications and characteristics of composite materials, Types of Fibres, Matrix materials, Sandwich and Laminate Composite, Basic structural elements in aircraft structures, wing and fuselage, aircraft materials. Airworthiness, Factor of safety, Flight envelope, Airframe loads: Inertial loads, Maneuver loads, Gust loads, Fatigue: Fail safe and safe life

UNIT-II (12 hrs)

Thin-walled Beams: Bending of open and closed thin walled beams, Shear of beams, Torsion of beams, Combined open and closed section of beams, Structural idealization.

Single and multi – cell structures, Approximate methods, Shear flow in single & multi-cell structures under torsion. Shear flow in single and multi-cell under bending with walls effective and ineffective.

UNIT-III (10Hrs)

Design and analysis of Aircraft Wings: Wing spars and box beams, tapered wing spars, open and closed section beams, wings with variable stringer area, Three boom shell, Bending torsion, shear center, tapered wings, Deflections, Cut-outs.

UNIT-IV (12 Hrs)

Design and analysis of Fuselage: Bending, shear, torsion, cut-outs in fuselage, Principles of stiffener web construction, Fuselage frames, wing ribs, Fuselage detail design, Wing fuselage interaction, Landing gears, Engine mounts.

Aero elasticity: Static and dynamic aero elastic phenomenon, Critical speeds, Divergence of 2-D wing section and an idealized cantilever wing, Loss and reversal of aileron control, flutter and buffeting.

RECOMMENDED BOOKS:

1. C.T.Sun , "Mechanics of aircraft structures" , 3rd Ed , John Wiley publishers(1998).
2. Allen, David H., Haisler, Walter, "Introduction to Aerospace Structural Analysis" (1985).
3. T.H.G.Megson, "Aircraft Structures for Engineering Students", 4th Ed. Elsevier Ltd(2012).
4. D.J.Peery, "Aircraft structures", McGraw Hill(1950)
5. R.L.Bisplinghoff Holt Ashley R.L.Halfman, "Aeroelasticity", Addison Wesley Publishing Co. Reading, Mass(1965).

FLIGHT CONTROLS LAB

Subject Code – BASES1-504 | **L T P Cr** | **Duration 30 Hrs**
0 0 2 1

COURSE OBJECTIVES

- The objective of this lab is to teach students and give knowledge about the simulation of aircraft performance in the flight simulator and access the parameters that are affecting the performance of the flight with different boundary conditions. This lab also enables the students to write the MATLAB scripts for the analysis of problems like evaluating equations of motion with one DOF, two DOF and three DOF and also the dynamics of the aircraft. This laboratory also enhances experimental skills to the students to assess the performance and static stability of an aircraft.

COURSE OUTCOMES

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

1. Learn the basic MATLAB simulation of un-accelerated flight for takeoff, cruise and landing conditions by solving equations of motions.
2. Understand the concept behind the conventional and unconventional airfoil performance and stability conditions.
3. Identify the functions of the basic controls like ailerons, elevators and rudders used in typical airplanes.
4. Understand the dynamics of the aircraft flight simulator and it's functioning in different flight conditions like takeoff, landing and cruise condition.

LIST OF EXPERIMENTS

1. To solve basic mathematical equations related to pressure and density used in aircraft performance with basic loops using MATLAB Software.
2. To extract data of atmospheric conditions at different altitudes for aircraft equation of motion using MATLAB Software.
3. To solve the equation of motion governed by one DOF using MATLAB tools.
4. Carryout aerodynamic performance study of a symmetrical airfoil and draw a plot for C_L/C_D verses angles of attack.
5. Carryout aerodynamic performance study of a symmetrical corrugated airfoil and draw a plot for C_L/C_D verses angles of attack.
6. Carryout aerodynamic performance study of a Delta Wing aircraft model and draw a plot for C_L/C_D verses angles of attack.
7. Carryout aerodynamic static stability study of a symmetrical airfoil and draw a plot for Cm verses angles of attack.
8. Carryout aerodynamic static stability analysis of a corrugated airfoil and draw a plot for Cm verses angles of attack and ascertain its stability at given Speed and Reynolds number.
9. Carryout aerodynamic longitudinal static stability study of a delta wing aircraft and draw a plot for Coefficient of Moment verses angles of attack.
10. To perform take off, cruise, co-ordinate turn and landing with aircraft in the flight simulator in the normal weather conditions, the flight is from 'Begumpet airport' to 'Hakimpet airport'

11. To perform take off, cruise, co-ordinate turn and landing with aircraft in the flight simulator in the gusty weather conditions, the flight is from 'Begumpet airport' to 'Hakimpet airport'.

TRAINING-II

Subject Code – BASES1-505

L	T	P	Cr
0	0	0	3

EFFECTIVE TECHNICAL COMMUNICATION

Subject Code – BHSMC0-005

L	T	P	Cr
3	0	0	3

ORGANIZATIONAL BEHAVIOUR

Subject Code – BHSMC0-016

L	T	P	Cr
3	0	0	3

AEROSPACE MATERIALS AND PROCESSES

Subject Code – BASED1-511

L	T	P	Cr
3	1	0	4

Duration 60 Hrs

COURSE OBJECTIVES

- At the end of this course, the student should be able to describe the concepts related to composite materials and matrix materials, and apply the knowledge during fabrication of composites in aircraft and allied industry.

COURSE OUTCOMES

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

1. Gain the knowledge of various types of composites materials in Aerospace Industry.
2. Have an understanding on various types of fibers, its advantage and its application in aerospace industry.
3. Have the knowledge of various types of matrix along its properties and usage.
4. Have an understanding of sandwich and laminated composite materials and its mechanics and applications.
5. Learn the knowledge of manufacturing processes of composite materials and be able to fabricate composite based on their own requirements.

UNIT-I (15 Hrs)

Introduction: Definition, Characteristics, Classification, comparison with metallic materials, Particulate Composites, Fiber-reinforced composites, Applications of composites in Aerospace Industry.

Fibers: Glass fibers, Carbon & Graphite fibers, Aramid fibers, Boron fibers and other fibers. Properties and applications of various types of fibers. Fiber finishing, Weave pattern of fibers.

UNIT-II (14 hrs)

Matrix Materials: Definition, Functions of a matrix, Thermosetting, thermoplastic, Carbon, Metal and Ceramic matrix materials. Curing of resins. Prepregs, characteristics, handing and storing of prepregs.

Sandwich and Laminate Composites: Sandwich construction, Face and Core material, Honeycomb structures and their properties, Honeycomb manufacturing, Fabrication of sandwich structures, Laminate lay-up, importance of ply orientation, lay-up code, Joining of laminate structures, Tooling required.

UNIT-III (15 Hrs)

Manufacturing Processes: Open mold processes, Closed mold processes, Continuous processes, their merits and demerits.

Repair of Composites: Defects in composites, Non-destructive inspection techniques, Damage assessment, evaluation and classification, Repair of composites.

UNIT-IV (16 Hrs)

Advanced Composites: Introduction to Carbon Nanotube (CNT) and Graphene, Graphenated Carbon Nanotubes (g-CNT), Categories of CNT based on structures, Properties, characterization, fabrication and applications of these materials.

RECOMMENDED BOOKS:

1. Autar K Kaw, “Mechanics of Composite Materials”, CRC Press
2. Lalit Gupta, “Advanced Composite Materials”, Himalayan Books Publication
3. B. D. Aggarwal, L. J. Broutman and K. Chandrashekhara, “Analysis and Performance of Fiber Composites”, John Wiley & Sons
4. R.M. Jones, “Mechanics of Composite Materials”, Taylor & Francis

VISCOUS FLOW THEORY

Subject Code – BASED1-512 **L T P Cr** **Duration 60 Hrs**
3 1 0 4

COURSE OBJECTIVES

- To enable the students to understand the characteristics of viscous flows, the Navier-Stokes equations and its properties and determine laminar and turbulent boundary layer thickness over flat plate and in pipes.

COURSE OUTCOMES

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

1. Calculate the boundary layer thickness, displacement thickness, momentum and energy thickness for two dimensional flows..
2. Solve and analyze various two and three dimensional flow problems. Have the knowledge of various types of matrix along its properties and usage.
3. Analyze the Navier-Stokes Equation and its properties for various two dimensional flow problems.
4. To understand the concept of laminar boundary layer and analyze the stability of laminar flows.
5. To understand the concept of turbulent boundary layer and determine the turbulent boundary layer thickness in pipes and flat plate.

UNIT-I (15 Hrs)

Viscous Flow Properties: Viscous fluid flow with historical outlines of viscous flow, Boundary conditions for viscous flow problems, Development of boundary layer- Prandtl's hypothesis, Estimation of boundary layer thickness- Displacement thickness, momentum and energy thickness for two-dimensional flows. Viscosity and thermal conductivity, thermodynamic properties

Slow Viscous Flow: Introduction, Stokes Flows, Two – Dimensional Flows, Three – dimensional Stokes Flows, analysis of Stokes's Solution, The Oseen Equations, Three-Dimensional Oseen Flows, Hele Shaw flow, Problems

UNIT-II (14 hrs)

Navier-stokes Equations And Solution: General stress system in a deformable body, the rate at which the fluid element is strained in a flow, Relation between stress and rate of deformation, Stoke's hypothesis, bulk viscosity and thermodynamic properties, The Navier – Stokes Equation (N-S) , General properties of Navier – Stokes Equation.

Two dimensional flow through a straight channel. Hagen- Poiseuille flow, Suddenly accelerated plane wall, Stagnation in plane flow (Hiemenz problem), Flow near a rotating disk, Very slow motion, Parallel flow past a sphere.

UNIT-III (15 Hrs)

Laminar Boundary Layer: Analysis of Boundary layer temperature profiles for constant wall temperature, Falkner-Skan Wedge flows, Free shear flows- plane laminar jet, plane laminar wake. Integral equation of Boundary layer, Karman-Pohlhausen method. Thermal boundary layer calculations- One parameter (U_o) and two parameters (U_0 and ΔT) integral methods. Stability of laminar flows.

UNIT-IV (16 Hrs)

Turbulent Boundary Layer: Two dimensional turbulent boundary layer equations, Integral relations, Eddy-Viscosity theories, Velocity profiles; The law of the wall, The law of the wake. Turbulent flow in pipes and channels. Turbulent boundary layer on a flat pate, Boundary layers with pressure gradient.

RECOMMENDED BOOKS:

1. Joseph A. Schetz, "Boundary Layer Analysis", 2nd Ed., Prentice Hall (1993).
2. H. Schlichting, "Boundary Layer theory", 6th Ed., McGraw Hill (1968).
3. John Bertin, "Aerodynamics for Engineers", 4th Ed., Pearson (2004).
4. Frank M White, "Viscous Fluid Flow", 3rd Ed., McGraw Hill (2006).
5. A. J. Reynolds, "Turbulent Flow in Engineering", 1st Ed., Wiley–Blackwell (1974).

WIND TURBINES

Subject Code – BASED1-513 **L T P Cr** **Duration 60 Hrs**
3 1 0 4

COURSE OBJECTIVES

- To acquaint students with working principles, analysis, design and applications of wind turbines and its parts.

COURSE OUTCOMES

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

1. Understand different wind turbine concepts and its configuration.

2. Select wind turbine and its parts according to given operating conditions using scientific methods and procedures.
3. Understand various applications and characteristics of wind turbines.
4. Analyze and estimate parameters related to performance of wind turbines.
5. Integrate the fundamental knowledge to design wind turbine with optimum performance.

UNIT-I (15 Hrs)

Introduction and Classification of Wind Turbines: History of wind power technology, wind resources, economic viability, experience in Europe and America, The Indian experience, factors in favor of wind energy, environmental effects. Types of wind energy collectors: horizontal axis rotors; Head on, fixed pitch and variable pitch blade rotors, cross wind. Vertical axis rotors; Savonius type and its variants, Darrieus type .lift based devices and drag devices.

UNIT-II (14 hrs)

Design Features: Description of various types of wind energy conversion systems (WECS) in use through their design features from 1kW range onwards. Considerations of complexities getting into the design and operation with increase in size and power output.

Applications and Characteristics of Wind Turbines: Standalone system; water pumping, direct heating and electric generation applications. Wind energy farms; Grid connected mode, hybrid mode. Wind histories, wind characteristics, power in wind stream, recording wind streams, wind rose, and choice of site.

UNIT-III (15 Hrs)

Performance of Wind Turbines: Power extraction from the wind stream, Ideal power coefficient, typical performance curves for various types, maximum power coefficients, speed-torque curves, power density of a wind stream, ducted system, vortex generator.

UNIT-IV (16 Hrs)

Complete System Design: Objectives, power requirements, wind availability, type and size of WECS required, cost of energy delivered, WECS viability, system characteristics, system requirements, system evaluation, design optimization, wind system design synthesis. Independent design project.

RECOMMENDED BOOKS:

1. Frank R. Eldridge, "Wind Machines", 2nd Ed., Van Nostrand Reinhold(1982).
2. Martin O. L. Hansen, "Aerodynamics of Wind turbines" 3rd Ed., Routledge(1980).
3. Hau, Erich, "Wind Turbines: Fundamentals, Technologies, Application, Economics", 3rd Ed., Springer(2013).
4. Paul Gipe, "Wind Power", 1st Ed., Chelsea Green(2004).

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001	L	T	P	C	Duration: 30 Hrs.
	2	0	0	0	

Course Contents:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of 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 the 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.

ESSENCE OF INDIAN KNOWLEDGE TRADITION

Subject Code- BMNCC0-006 **L T P C** **Duration: 30 Hrs.**

2 0 0 0

COURSE OBJECTIVE:

The course is introduced

1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

COURSE OUTCOMES:

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

COURSE CONTENTS:

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

UNIT – II

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – III

Indian Fine Arts & Its Philosophy(Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – IV

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

RECOMMENDED BOOKS:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition'', ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007

3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X, 2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M.Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978- 8120810990,2014
7. Chatterjee. S & Dutta "An Introduction to Indian Philosophy".

B. Tech. Aerospace Engineering (6th SEMESTER)

		Contact Hrs.			Marks			Credits
Code	**Name**	**L**	**T**	**P**	**Int.**	**Ext.**	**Total**	
BASES1-601	Computational Fluid Dynamics	3	1	0	40	60	100	4
BASES1-602	Aerospace Vehicle Design	3	1	0	40	60	100	4
BASES1-603	Advanced Aerospace structures	3	1	0	40	60	100	4
BASES1-604	Computational Fluid Dynamics Lab	0	0	2	60	40	100	1
	Departmental Elective-II (Select One)	3	0	0	40	60	100	3
BASED1-611	Space Mission design and Optimization							
BASED1-612	Avionics							
BASED1-613	Helicopter Dynamics							
	Departmental Elective-III (Select One)	3	0	0	40	60	100	3
BASED1-621	Unmanned Aerial Vehicles							
BASED1-622	Missile Engineering							
XXXX	**Open Elective***	3	0	0	40	60	100	3
	Total	**-**	**-**	**-**	**300**	**400**	**700**	**22**

***Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.**

COMPUTATIONAL FLUID DYNAMICS

Subject Code –BASES1-601 **L T P Cr** **Duration:60 Hours**
3 1 0 4

COURSE OBJECTIVE

- The course will introduce the discretization techniques to solve the essential flow equations like N-S equation and RANS which are in complex partial differential forms.
- The course will enable students to acquire techniques to model the entire flow domain into regular and irregular grid system and adopting the suitable boundary condition to solve them.
- The course will also teach the common errors and solution instabilities in numerical analysis of any flow problem.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Explain partial differential, Navier strokes and Euler equations of the flow over the body.
- Describe Discretization techniques, equation transformation and grid generation.
- Apply different CFD techniques to assess pressure, pressure coefficient, forces and moments over different aerodynamic shapes.

UNIT –I (15 Hrs.)

Governing Equations and Boundary Conditions: General introduction about the scope of the subject, Models of flow, Concept of substantial derivative and divergence of velocity, Different Types of Flows, Integral form of conservation equations, Differential form of conservation equations, Navier-Stokes and Euler Equations, Classification of partial differential equations using Cramer's Rule, General behaviour of different classes of PDEs and their impact on physical computational fluid dynamics.

UNIT –II (14 Hrs.)

Discretization, Transformation and Grid Generation: Basic discretization techniques, Introduction to Finite Differences, Difference Equations, Explicit and Implicit approaches, concept of stability. General transformation of equations, Metrics and Jacobians, Form of governing equations suited for CFD, Stretched grids, Boundary-fitted coordinate systems-Elliptic grid generation, Adaptive grids, Some modern developments in grid generation.

UNIT –III (15 Hrs.)

Simple CFD Technique : Lax-Wendorff technique, Maccormack's technique, Relaxation technique, Pressure correction technique, Philosophy of pressure correction method. Numerical procedure for SIMPLE algorithm, Boundary conditions for pressure-correction method. Brief discussion of some computer graphic techniques used in CFD.

UNIT –IV (16 Hrs.)

Finite Volume Method: The finite volume method for one-dimensional steady state diffusion problems and for two-dimensional steady state diffusion problems, The finite volume method for one-dimensional convection and diffusion, The central differencing scheme, The upwind differencing scheme. The pressure-velocity coupling.

RECOMMENDED BOOKS

1. John D. Anderson, Computational Fluid Dynamics: The Basics with Applications, Mc Graw Hill, 1995.
2. H.K. Versteeg and W. Malalasekera, An Introduction to Computational Fluid Dynamics – The Finite Volume Method, Pearson Education. 2007.
3. D.C. Wilcox, Turbulence Modelling for CFD, 1993.
4. S.V. Patankar, Numerical Heat Transfer and Fluid Flow, McGraw-Hill,1981.
5. Patrick Knupp and Stanly Steinberg, Fundamentals of Grid Generation, CRC Press, 1994.

AEROSPACE VEHICLE DESIGN

Subject Code –BASES1-602 **L T P Cr** **Duration:60 Hours**
3 1 0 4

COURSE OBJECTIVE

- Comprehend the flight vehicle design process.
- Acquire the knowledge of vehicle configuration and structural components.
- Understand the stability & control and subsystems.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Calculate the thrust to weight ratio and wing loading.
- Compute the flight vehicle performance.
- Select the subsystems as per vehicle design.

UNIT –I (15 Hrs.)

Overview of Design Process: Introduction, Requirements, Phases of design, Conceptual Design Process, Initial Sizing, Take-off weight build up, Empty weight estimation, Fuel fraction estimation, Take- off weight calculation.

Thrust to Weight Ratio & Wing Loading: Thrust to Weight Definitions, Statistical Estimate of T/W. Thrust matching, Spread sheet in design, Wing Loading and its effect on Stall speed, Take-off Distance, Catapult take-off, and Landing Distance. Wing Loading for Cruise, Loiter, Endurance, Instantaneous Turn rate, Sustained Turn rate, Climb, & Glide, Maximum ceiling.

UNIT –II (14 Hrs.)

Configuration Layout & loft:Conic Lofting, Conic Fuselage Development, Conic Shape Parameter, Wing-Tail Layout & Loft. Aerofoil Linear Interpolation. Aerofoil Flat-wrap Interpolation. Wing aerofoil layout-flap wrap. Wetted area determination. Special considerations in Configuration Layout: Aerodynamic, Structural, Detect ability. Crew station, Passenger, and Payload arrangements.

UNIT –III (15 Hrs.)

Design of Structural Components: Fuselage, Wing, Horizontal & Vertical Tail. Spreadsheet for fuselage design. Tail arrangements, Horizontal & Vertical Tail Sizing. Tail Placement. Loads on Structure. V-n Diagram, Gust Envelope. Loads distribution, Shear and Bending Moment analysis.

Engine Selection & Flight Vehicle Performance

Turbojet Engine Sizing, Installed Thrust Correction, Spread Sheet for Turbojet Engine Sizing. Propeller Propulsive System. Propeller design for cruise. Take-off, Landing & Enhanced Lift Devices:- Ground Roll, Rotation, Transition, Climb, Balanced Field Length, Landing Approach, Braking, Spread Sheet for Take-off and Landing. Enhanced lift design -Passive & Active. Spread Sheet

UNIT –IV (16 Hrs.)

Static Stability & Control: Longitudinal Static Stability, Pitch Trim Equation. Effect of Airframe components on Static Stability. Lateral stability. Contribution of Airframe components. Directional Static stability. Contribution of Airframe components. Aileron Sizing, Rudder Sizing. Spread Sheets. Flying qualities. Cooper Harper Scale. Environmental constraints, Aerodynamic requirements.

Design Aspects of Subsystems: Flight Control system, Landing Gear and subsystem, Propulsion and Fuel System Integration, Air Pressurization and Air Conditioning System, Electrical & Avionic Systems, Structural loads, Safety constraints, Material selection criteria.

RECOMENDED BOOKS

1. Sadraey, M. H., Aircraft Design: A Systems Engineering Approach, Wiley (2012).
2. Griffin, M. D. and French, J. R., Space Vehicle Design,
3. Raymer, D. P., Aircraft Design: A Conceptual Approach, 4thed., AIAA Edu. Series (2004).
4. Anderson, J. D., Aircraft Performance and Design, McGraw-Hill (1999).
5. Corke, T. C., Design of Aircraft, Prentice Hall (2002).

ADVANCED AEROSPACE STRUCTURES

Subject Code –BASES1-603 | **L T P Cr** | **Duration:60 Hours**

3 1 0 4

COURSE OBJECTIVE

Appreciate the roles that structures and structural materials play in aerospace vehicles.
Understand general design concepts for aerospace structures, components, vehicles, and materials.
Develop the analysis tools and skills needed to analyse the static and dynamic performance of aerospace structures.
Gain experience in identifying, formulating, and solving aerospace structural engineering problems.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Recognize phenomena such as deformation, stress and strain in simple aerospace structural elements
- Solve the simple1 Daxial deformation, torsion and bending problems.
- Compute shear stresses and twist angles in torsion for solid sections, closed thin-walled sections and open thin-walled sections.
- Understand the shear centre of abeamandan ability to predictits location.
- Evaluate the suitability of composite materials for the simple structural elements for specific aerospace applications.

UNIT –I (15 Hrs.)

Introduction: Semi-monocoque aerospace structures – Loads and Design considerations – construction concepts – layout – nomenclature and structural function of parts – strength vs stiffness-based design – Energy Method – Beam bending.

Bending, Shear And Torsion Of Thin-Walled Beams (TWB):Bending and shear of open, closed, and thin-walled beams – torsion on single-cell thin-walled beams – torsion on multiple-cell thin-walled beams.

UNIT –II (14 Hrs.)

Buckling Of Thin-Walled Beams: Concept of structural instability – flexural buckling analysis – bending of beams under combined axial and lateral loads – short column and inelastic buckling – Pure torsional buckling and coupled flexural-torsional buckling of open TWBs – concept of buckling of plates, local buckling of TWBs – buckling and post-buckling of stiffened skin panels – ultimate load carrying capacity of a typical semi-monocoque TW box section – tension-field beams.

UNIT –III (15 Hrs.)

Plate Theory: Two Dimensional and Three-Dimensional Transformation of Stresses and strains – Thin Plate Theory – Stress Resultants and Kinematics – Thin Plate Governing Equations and Boundary Conditions.

UNIT –IV (16 Hrs.)

Composite and Sandwich Structures: Introduction to Advanced Fibre Composites – Analysis of Orthotropic Composite Plies – Laminate theory – Analysis of Composite Laminates: Stiffness Matrix – Stress and Strain – Thermal Expansion – Failure Mechanisms and Analysis – failure criteria – composite beams – sandwich structures.

RECOMENDED BOOKS:

1. Megson, T. H. G., Aircraft Structures for Engineering Students, 4th ed., Butterworth-Heinemann (2007).
2. Timoshenko, S. P. and Goodier, J. N., Theory of Elasticity, 3rded., McGraw-Hill (1970).
3. Timoshenko, S. P. and Woinowsky-Krieger, S., Theory of Plates and Shells, 2nd ed., McGraw-Hill (1964).
4. Bruhn, E. F., Analysis and Design of Flight Vehicle Structures, 2nd ed., Jacobs Publishing NC. (1973).

COMPTATIONAL FLUID DYNAMICA LAB

Subject Code –BASES1-604 | **L T P Cr** | **Duration:30 Hours**
0 0 2 1

COURSE OBJECTIVES

- The course will enable the student to develop modeling techniques.

DETAILED CONTENTS

- Modeling a 2-D object with structured mesh using GAMBIT software.
- Modeling a 2-D object with unstructured mesh using GAMBIT software.
- Modeling a 3-D object with structured mesh using GAMBIT software.
- Solving a simple 2-D flow problem using Fluent software.
- Solving a simple axisymmetric flow problem using FLUENT software.

SPACE MISSION AND DESIGN OPTIMIZATION

Subject Code –BASED1-611 | **L T P Cr** | **Duration:45 Hours**
3 0 0 3

UNIT-I (10 Hrs)

Orbital Maneuvers and Control: Launch Vehicle Trajectories, Orbit Injection, Single-Impulse Maneuvers, Hohmann Transfer, Interplanetary Flight, Orbital Rendezvous, Halo Orbit Determination and Control

UNIT-II (12 Hrs)

Launch vehicle ascent trajectory design – reentry trajectory design – low thrust trajectory design – satellite constellation design – rendezvous mission design – ballistic lunar and interplanetary trajectory design

UNIT-III (13 Hrs)

Basics of optimal control theory – mission design elements for various missions – space flight trajectory optimization – direct and indirect optimization techniques –
Restricted.

UNIT-IV (10 Hrs)

3-body problem – Lagrangian points – mission design to Lagrangian point.

RECOMENDED BOOKS

1. Osborne, G. F. and Ball, K. J., Space Vehicle Dynamics, Oxford Univ. Press (1967).
2. Hale, F. J., Introduction to Space Flight, Prentice Hall (1994).
3. Naidu, D. S., Optimal Control Systems, CRC Press (2003).
4. Chobotov, V., Orbital Mechanics, AIAA Edu. Series (2002).
5. Griffin, M. D. and French, J. R., Space Vehicle Design, 2nd ed., AIAA (2004).

AVIONICS

Subject Code –BASED1-612 **L T P Cr** **Duration:45 Hours**
3 0 0 3

COURSE OBJECTIVE

The course enables the student to understand the role of avionic systems and their architecture. Introduction to the various avionic systems such as display systems, air-data sensors, communication, and navigation systems will be discussed thoroughly. It also focuses on the fundamental principles and their functioning in detail.

LEARNING OUTCOMES

- After undergoing the subject, student will be able to: Comprehend and explain the functioning of various avionic systems and sub systems.
- Understand and describe the functioning of various air data sensors employed in an aircraft and comprehend their limitations for civil and military aircraft.
- Explain working of various display systems and their functioning so as to visualize the required data during the operation of various avionics systems.

- Describe working of various communication systems and their functioning so as to facilitate the communication between the pilot and ATC.
- Explain working of various navigation systems and their functioning so as to facilitate the navigation between the pilot, aircraft and ATC.
- Explain working of various autopilot systems and their functioning so as to facilitate comfortable and hands-off flight.

UNIT-I (10 Hrs)

Avionics Technology: Processors, Memory Devices, Digital Data Buses –MIL-STD-1553B, ARINC 429, ARINC 629, Fiber Optic Buses, LRU architecture for avionics packaging, software, environmental effects, difference in avionics architecture of commercial and military aircraft.

UNIT-I (12 Hrs)

Sensors: Air Data Sensing – Use of pitot static probe, static probe to derive air data indications; Role of Air Data Computer (ADC), Magnetic Sensing – Magnetic Heading Reference System (MHRS),

Inertial Sensing – Position Gyros, Rate Gyros, Accelerometers

Radar Sensing - Radar Altimeter (RADALT), Doppler Radar, Weather Radar.

UNIT-III (13Hrs)

Display: Comparison of earlier flight deck (Electromechanical type instruments) to modern flight deck (glass fight deck), Cathode Ray Tube (CRT), Active Matrix Liquid Crystal Display (AMLCD), Head Down Display (HDD), Head Up Display (HUD),Helmet Mounted Display (HMD), Integrated Standby Instrument System (ISIS)

Communication: HF, U/VHF, Satellite Communication, Air Traffic Control (ATC) Transponder, Traffic Collision & Avoidance System (TCAS), Identification of Friend & Foe (IFF)

UNIT-IV(10 Hrs)

Navigation: Automatic Direction Finding, Very High Frequency Omni-Range (VOR), Distance Measuring Equipment (DME), Tactical Air Navigation (TACAN), VORTAC (VOR+TACAN), Satellite Navigation System-Global Positioning System (GPS), Differential GPS, Instrument Landing System (ILS), Transponder Landing System (TLS), Microwave Landing System (MLS), Astronavigation.

Automatic Flight Control System: Longitudinal, Lateral & Direction Autopilot

RECOMMENDED BOOKS

1. Ian Moir, Allan Seabridge and Malcom Jukes, "Civil Avionics Systems", Wiley
2. Thomas Eismin, "Aircraft Electricity and Electronics", McGraw Hill, 6the edition
3. R. P. G. Collison., "Introduction to Avionics Systems", Springer Netherlands.
4. E.H.J. Pallett, "Aircraft Instruments and Integrated Systems", Longman

HELICOPTER DYNAMICS

Subject Code –BASED1-613 **L T P Cr** **Duration:45 Hours**
3 0 0 3

COURSE OBJECTIVE

To help the students understand the concepts and estimate the performance and stability aspects of helicopters, analyze the vibrations of blade and helicopters under various dynamic conditions

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Understand the basic concepts and phenomena involved in helicopter engineering and dynamics.
- Estimate the power requirement for various flight conditions such as hovering, climbing, forward flights etc. and understand the aerodynamics of the main rotor.
- Estimate various performance parameters during hovering and vertical flight.
- Estimate different performance parameters during forward flight.
- Analyze stability and vibration levels in blades and helicopters under various conditions.

UNIT-I (10 Hrs)

Introduction and Basic Concepts: Historical development of helicopter and overview, Classification based on main rotor configuration and tail rotor configuration. Comparative analysis, Major components of conventional helicopter, Composite structure. Rigid, semi-rigid and articulated rotors, Feathering, flapping and lead-lag motion, Rigid, Semi-rigid and articulated helicopter control system, Collective and cyclic pitch control, Yaw control, Throttle control, Anti-torque control, Solidity, Tip-speed ratio, In-flow ratio, Figure of merit.

UNIT-II (12 Hrs)

Aerodynamics Of Main Rotor: Coning of rotor, Dissymmetry of lift, Precession, Coriolis effect, Compressibility effects, retreating blade stall, Reverse flow region, Flapping, feathering and lead-lag motion, Autorotation, Schrenk's diagram, Various types of autorotative landings.

Performance During Hovering and Vertical: The actuator-disc theory, Working states of rotor, Optimum rotor, Efficiency of rotor, Ground effect on lifting rotor, The effect of finite number of blades, Induced velocity and induced power, Total power.

UNIT-III (13 Hrs)

Performance During Forward Flight: Blade forces and motion in forward flight, Force, torque and flapping coefficient, Induced velocity and induced power in forward flight – Mangler and Squire method, Flight and wind tunnel test, The vortex wake, Aerofoil characteristics in forward flight, Helicopter trim analysis, Performance in forward flight.

UNIT-IV (10 Hrs)

Dynamic Stability and Vibrations: Longitudinal and lateral stability, Equations of motion, Stability characteristics, Auto stabilization, Control response. Sources of vibration, Active and passive methods for vibration control, Fuselage response, Measurement of vibration in flight.

RECOMMENDED BOOKS

1. A.R.S. Bramwell, G. Done and D. Balmford, "Helicopter Dynamics", 2nd Ed., Butterworth Heinemann.
2. Jacob Shapiro, "Principles of Helicopter Engineering", 1st Ed., McGraw Hill.
3. C. Venkatesan, "Fundamentals of Helicopter Dynamics", 1st Ed., CRC Press.
4. E. Rathakrishnan, "Helicopter Aerodynamics", 1st Ed., PHI Learning

UNMANNED AERIAL VEHICLES

Subject Code –BASED1-621 **L T P Cr** **Duration:45 Hours**
3 0 0 3

COURSE OBJECTIVE

- Comprehend the basic aviation history and UAV systems.
- Acquire the knowledge of basic aerodynamics, performance, stability and control.
- Understand the propulsion, loads and structures.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Apply the basic concepts of UAV systems.
- Explain the basic aerodynamics, performance, stability and control required for UAV.
- Select the propulsion system and materials for structures.

UNIT-I (10 Hrs)

Introduction: Aviation History and Overview of UAV systems, Classes and Missions of UAVs, Definitions and Terminology, UAV fundamentals, Examples of UAV systems-very small, small, Medium and Large UAV

UNIT-II (12Hrs)

The Air Vehicle Basic Aerodynamics: Basic Aerodynamics equations, Aircraft polar, the real wing and Airplane, Induced drag, the boundary layer, Flapping wings, Total Air-Vehicle Drag

Performance: Overview, climbing flight, Range and Endurance–for propeller-driven aircraft, range-ajet-driven aircraft, Guiding Flight

UNIT-III (13 Hrs)

Stability and Control: Overview, Stability, longitudinal, lateral, dynamic stability, Aerodynamics control, pitch control, lateral control, Autopilots, sensor, controller, actuator, airframe control, inner and outer loops, Flight-Control Classification, Overall Modes of Operation, Sensors Supporting the Autopilot.

Propulsion: Overview, Thrust Generation, Powered Lift, Sources of Power, The Two-Cycle Engine, The Rotary Engine, The Gas Turbine, Electric Motors, Sources of Electrical Power

UNIT-IV(10 Hrs)

Loads and Structures: Loads, Dynamic Loads, Materials, Sandwich Construction, Skin or Reinforcing Materials, Resin Materials, Core Materials, Construction Techniques

Mission Planning and Control: Air Vehicle and Payload Control, Reconnaissance/ Surveillance Payloads, Weapon Payloads, Other Payloads, Data-Link Functions and Attributes, Data-Link Margin, Data-Rate Reduction, Launch Systems, Recovery Systems, Launch and Recovery Tradeoffs

RECOMMENDED BOOKS

1. PaulGerinFahlstrom,ThomasJamesGleason,IntroductiontoUAVSystems,4thEdition, WileyPublication, 2012 John Wiley & Sons, Ltd
2. Landen Rosen, Unmanned Aerial Vehicle, Publisher: Alpha Editions.
3. UnmannedAerialVehicles:DOD'sAcquisitionEfforts,Publisher:AlphaEditions,.
4. Valavanis,KimonP.,UnmannedAerialVehicles,Springer,2011.
5. Valavanis,K.,Vachtsevanos,GeorgeJ.,HandbookofUnmannedAerialVehicles,Springe r,2015.

MISSILE ENGINEERING

Subject Code –BASED1-622 | **L T P Cr** | **Duration:45 Hours**
3 0 0 3

COURSE OBJECTIVE

The course will provide the fundamental aerodynamics of the missiles. It focuses on the different types of control systems employed and the stability analysis for various missiles. This course will also provide a basic understanding of missile navigation and control.

LEARNING OUTCOMES

After undergoing the subject, student will be able to:

- Understand the fundamental concepts of missile and distinguish the various types of missiles.
- Describe the forces and moments acting on an slender body vehicle.
- Analyze and describe the types of controls for various configurations.
- Evaluate the types of drag acting on a slender and non-slender missile nose.
- Analyze the static stability on an aerospace vehicle.
- Understand and describe the navigation and its stability aspects.

UNIT-I (10 Hrs)

Introduction: History of development of missiles, missiles versus airplanes aerodynamics, classification of missiles, axes, angle of bank, included angle, angle of attack and side slip, Indian missiles and their configurations and mission applications.

Slender Body Theory: Slender body at supersonic speeds, body of revolution at zero angle of attack, sources and doublets, slender body theory at angle of attack, slender body of general cross section at supersonic speeds, pressure coefficient, lift, side force, pitching moment and yawing moment, drag force, drag due to lift.

UNIT-II (12 Hrs)

Aerodynamic Controls: Types of controls, conventions, all moveable controls for planar configurations and cruciform configuration, coupling effects, trailing edge controls, non-linear effect in aerodynamic controls, estimation of hinge moments.

UNIT-III (13 Hrs)

Missile drag: Components of drag, pressure force drag of slender body of given shape, drag due to lift, pressure force drag of non-slender missile noses at zero angle of attack, shapes of bodies of revolution for least pressure force drag at zero angle of attack, pressure drag of wing alone, pressure force drag of wing-body combination at zero angle of attack, base drag, skin friction drag.

Stability Analysis: References axes, notation, general nature of aerodynamic forces, stability derivatives and its properties resulting from missile symmetries, Maple Synge analysis for cruciform, triform and other missiles. Bryson method, stability derivatives of slender flat triangular wing.

UNIT-IV(12 Hrs)

Missile Navigation and Control: Fully gimbaled gyroscope, rate gyroscope, integrating gyroscope, laser gyroscope, single axis stable platform, the stable platform, inertial navigation, stability of inertial navigation

RECOMMENDED BOOKS

1. Martin J.L. Turner., "Rocket and spacecraft propulsion", Springer publishers.
2. William E. Wiesel., "Spaceflight Dynamics", Mcgraw Hill.
3. J. N. Nielsen., "Missile Aerodynamics McGraw Hill publishers
4. Rama K. Yedavalli., "Flight Dynamics and Control of Aero and Space Vehicles", John Wiley & Sons.

Total Credits= 16

Semester-VII (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	**Subject Name**	**L**	**T**	**P**	**Int.**	**Ext.**		
BCIES1-701	Design of Concrete Structures-II	3	0	0	40	60	100	3
BCIES1-702	Professional Practice & Law	3	0	0	40	60	100	3
Departmental Elective-VI (Select any one)		2	0	0	40	60	100	2
BCIED1-711	Irrigation Engineering-II							
BCIED1-712	Air & Noise Pollution and Control							
BCIED1-713	Geotechnical Design							
Departmental Elective-VII (Select any one)		2	0	0	40	60	100	2
BCIED1-721	Prestressed Concrete							
BCIED1-722	Solid & Hazardous Waste Management							
BCIED1-723	Repair & Rehabilitation of Structures							
BCIES1-703	Project-I	0	0	6	60	40	100	3
BCIES1-704	Software Lab	0	0	2	60	40	100	1
BCIES1-705	Training-III*	0	0	0	60	40	100	2
BMNCC0-006	Essence of Indian Knowledge Tradition (Mandatory Course)	2	0	0	100	---	100	0
Total		**-**	**-**	**-**	**440**	**360**	**800**	**16**

*Internship will be imparted at the end of 6thsemesteras per AICTE Internship Policy.

Total Credits= 15

Semester-VIII (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BCIES1-801	Transportation Engineering-II	3	0	0	40	60	100	3
Departmental Elective-VIII (Select any one)		3	0	0	40	60	100	3
BCIED1-811	Design of Steel Structures-II							
BCIED1-812	Port & Harbour Engineering							
BCIED1-813	Environmental Impact Assessment and Life Cycle Analyses							
Departmental Elective-IX (Select any one)		2	0	0	40	60	100	2
BCIED1-821	Engineering Hydrology							
BCIED1-822	Bridge Engineering							
BCIED1-823	Soil Reinforcing Techniques							
BCIED1-824	Industrial Structures							
XXXXX	Open Elective*	3	0	0	40	60	100	3
BCIES1-802	Advance Inspection & Testing Lab	0	0	2	60	40	100	1
BCIES1-803	Project-II	0	0	6	60	40	100	3
Total		**-**	**-**	**-**	**280**	**320**	**600**	**15**

***Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.**

Overall Marks / Credits

Semester	Marks	Credits
1st	800	19
2nd	900	20
3rd	1200	25
4th	1500	26
5th	1100	25
6th	900	21
7th	700	16
8th	600	15
Total	**7700**	**167**

DESIGN OF CONCRETE STRUCTURES-II

Subject Code: BCIES1-701 **L T P C** **Duration: 45 hrs.**

3 0 0 3

Course Objectives:

1. Learn the plastic behaviour of concrete in flexure.
2. Learn the behaviour of different types of concrete structures.

Course Outcomes:

1. Identify and compute the design loads on RCC components.
2. Able to analyze and design with detailing RCC members.
3. Ability to design and check for serviceability (crack and deflection) and ultimate limit state conditions.
4. Apply relevant Indian Standard provisions to ensure safety and serviceability of RCC structural elements.

Note: Indian Standards-IS 456, IS 3370 and Design Aid SP-16 are permitted in examination.

UNIT-I (12 Hours)

Design of Foundations – Concept, Application, Types, Components of Footing, Design of Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal & Strap footing) and Raft Foundation.
Design of Stairs: Introduction, Elements of Stairs-Tread, Rise, Flight, Landing, Types of Stairs, Design and Reinforcement detail of Stairs.

UNIT-II (11 Hours)

Design of Compression Members: Classifications (According to Shape, Length and loading conditions), Assumptions, Guidelines as per Indian Standards, Behavior of Compression Members, Short Compression Members under Axial Load with Uni-axial and Bi-axial Bending, Design of Slender (Long) Columns.

UNIT-III (11 Hours)

Design of Beams (Continuous and Curved): Definition, Behavior, Design of Continuous beams and Curved beams, Reinforcement detailing.
Design of Retaining Walls: Classification, Elements-Stem, Base, Heel, Toe, Behavior and design of Cantilever and Counter fort type retaining wall.

UNIT-IV (11 Hours)

Design of Domes: Types, Components, Design of Spherical and Conical Dome.
Water Tanks: Introduction, Types & uses of Underground water tanks, ground water tanks, Design of Circular and Rectangular water tanks resting on ground.

Recommended Text Books / Reference Books:

1. N. Subramanian, 'Design of Reinforced Concrete Structures', Oxford University Press.
2. Pillai & Menon, 'Reinforced Concrete Design', Tata McGraw Hill Education.
3. P.C. Varghese, 'Limit State Design of Reinforced Concrete', Prentice Hall of India Pvt. Ltd.
4. Raju N. Krishna 'Reinforced Concrete Elements'.
5. Mallick and Rangasamy, 'Reinforced Concrete', Oxford-IBH.

PROFESSIONAL PRACTICE & LAW

Subject Code: BCIES1-702 **L T P C** **Duration: 45 hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. Provide the ability to estimate the quantities of item of works involved in buildings, water supply & sanitary works, road works and irrigation works etc.
2. Equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.
3. Understand the technical specifications for various works to be performed for a project.
4. Impact the cost of a structure and also able to understand how competitive bidding works
5. How to submit a competitive bid proposal.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Understand the preparation of an abstract estimate for a residential building, roads, irrigation projects, bridges, etc.
2. Analyse the units for various quantities of items of work.
3. Evaluate the rates for various items of work
4. Design and prepare bar bending schedule for reinforcement works.
5. Understand how to prepare a Notice inviting tender document for bidding.
6. Evaluate the valuation of building.
7. Preparation of standard specifications for different items of building construction.

UNIT-I (13 Hours)

Estimating: Different types of estimates, methods of estimating and scheduling quantities for the following works: Building, irrigation works, road works, canal works, sanitary and water supply works, roofs, R.C.C. work.

Analysis of Rates: Schedule of rates (As per CSR Punjab-2016), Analysis of rates: earth work, brick masonry, stone masonry, cement concrete, RCC work, plastering, flooring, white washing, painting, road work.

UNIT-II (11 Hours)

Specifications: Detailed specifications of the following: earth work in foundation, lean concrete in foundation, cement concrete, RCC, brick work, plastering, painting, C.C. floor, mosaic floor, white washing, distempering, varnishing, painting, doors and windows, DPC, centering and shuttering, cement mortar, brick ballast and sand.

UNIT-III (11 Hours)

Valuation: Gross income, net income, outgoing, scrap value, salvage value, obsolescence, annuity, capitalized value, year's purchase, sinking fund, depreciation, book value, valuation of building, determination of depreciation, method of valuation, life of various items of works, different types of lease, fixation of rates, plinth area required for residential & commercial building, Arbitration.

UNIT-IV (10 Hours)

Accounts Procedures: Regular and work charged establishment, pay bill, ACR, classifications of works, contract, tender, tender notice, earnest money, security money, arranging contract, power of accepting tender, daily labour, muster roll, classification of contracts, penalty, measurement book, account procedures of stores, stock accounting, Introduction to forms and bills, Advance payment, hand receipt, refund of security money, cash book, imprest, deposit works, temporary advances, treasury challan, inventory, administrative approval, competent authority, building bye laws.

Recommended Text Books / Reference Books:

1. Estimating & Costing in Civil Engineering: Theory & Practice by B.N. Dutta, UBS Publishers Distributors Ltd.
2. Estimation and Costing in Civil Engineering, by Birdie, G.S., Dhanpat Rai Publishing Co. ltd, New Delhi, 2011.
3. Estimation, Costing, Specifications and Valuation in Civil Engineering, Chakraborti M, National Halftone Co. Calcutta
4. Estimating and Costing for Building & Civil Engineering Works by P.L. Bhasin.
5. Standard Schedule of rates and standard data book by Public Works Department.
6. National building code of India.
7. I.S. 1200 (Parts I to XXV – 1974/method of measurement of building and Civil Engineering works – B.I.S.

IRRIGATION ENGINEERING-II

Subject Code: BCIED1-711 **L T P C** **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

The course should enable the students to understand the:

1. Types of diversion headworks, seepage theories.
2. Design of weirs.
3. Spillways
4. Design of canal regulators, canal falls, cross drainage works.
5. Classification of canal outlets, design of types of outlets.

Course Outcomes:

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

1. To study types of diversion headworks, seepage theories
2. To design weirs
3. To learn about spillways
4. Design of canal regulators, canal falls, cross drainage works
5. Classify canal outlets, design outlets.

UNIT-I (08 Hours)

Head Works: Types of head works, Functions and investigations of a diversion head work: component parts of a diversion head work and their design considerations.

Theories of Seepage: Seepage force and exit gradient, assumptions and salient features of Bligh's

Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness.

UNIT-II (07 Hours)

Design of Weirs: Weirs versus barrage, types of weirs, main components of weir, hydraulic jump and seepage flow. Design of barrage or weir.

Spillways: Components of spillways, types of gates for spillway crests, profiles neglecting velocity of approach, profile taking velocity of approach into account, upstream lip and approach ramp, advantages of gated spillways.

UNIT-III (08 Hours)

Canal Regulators: Off-take alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.

Canal Falls: Necessity and location, types of falls, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.

UNIT-IV (07 Hours)

Cross-Drainage works: Definitions, choice of type, Aqueducts, siphon aqueducts, super passages, canal siphons and level crossing.

Canal Outlets: Classifications, criteria for outlet behaviors, flexibility, proportionality, sensitivity, sensitiveness, etc. details and design of non-modular and modular outlets.

Recommended Text Books / Reference Books:

1. Irrigation Engg. & Hydraulic Structure by Santosh Kumar Garg, Khanna Publishers
2. Design of Irrigation Structures by R.K. Sharma, Oxford IBH Publications.
3. Irrigation Engg. & Hydraulics Structures by S.R. Sahasrabudhe, Katson Publishing
4. Irrigation Practice and Design Vol. I to VII by K.B. Khushlani. Oxford IBH Pub
5. P.N. Modi; Irrigation with Resources and with Power Engineering, Standard Book House
6. Irrigation Engg. Vol. I & II by Ivan E. Houk, John Wiley and sons.

AIR & NOISE POLLUTION AND CONTROL

Subject Code: BCIED1-712	L	T	P	C	Duration: 30 hrs.
	2	0	0	2	

Course Objectives:

The course should enable the students to:

1. Understanding of basic concepts of air pollution & noise pollution.
2. Study of air & noise pollution, identification of the parameters, conditions, mechanisms.
3. Study of sampling types and methods for ambient air and stack.
4. Study of macro and micro meteorology for understanding the dispersion of pollutants.
5. Study of pollution control methods, mechanism and devices.

Course Outcomes:

1. Explain basic principles on various aspects of atmospheric chemistry.
2. Identify the major sources, effects and monitoring of air and noise pollutants.

3. Understand the key transformations and meteorological influence on air and noise.
4. Relate and analyse the pollution regulation on its scientific basis.

UNIT-I (08 Hours)

Air Pollution: Composition and structure of atmosphere, global implications of air Pollution, Classification of air pollutants: Particulates, hydrocarbon, Carbon monoxide, Oxides of sulphur, Oxides of nitrogen and photo chemical oxidants. Indoor air pollution, Effects of air pollutants on humans, animals, property and plants.

Air Pollution Chemistry: Meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

UNIT-II (07 Hours)

Air Sampling & Measurement: Ambient air quality and standards, air sampling and measurements; ambient air sampling, Collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling, Control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

UNIT-III (07 Hours)

Control of Gaseous Contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydro carbons, automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT-IV (08 Hours)

Noise Pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices.

Recommended Text Books / Reference Books:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, Delhi
3. Martin Crawford: Air Pollution Control Theory.
4. Warkand Warner: Air Pollution: Its Origin and Control.
5. Rao and Rao: Air Pollution Control Engineering.
6. K Kant and R. Kant, “Air Pollution and Control Engineering”, Khanna Publishers House.
7. Environmental Pollution Control Engineering-CS Rao, Wiley Eastern Ltd., New Delhi,
8. Environmental Noise Pollution – PE Cunniff, McGraw Hill
9. Nevers: Air Pollution Control Engineering.
10. M. P. Poonia and S C Sharma,” Environmental Engineering, Khanna Publishing House.

GEOTECHNICAL DESIGN

Subject Code: BCIED1-713 **L T P C** **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

1. To understand the objectives, necessity and scope of different underground structures.
2. To learn about different types of forces acting on sub structures.
3. To know the behaviour of soil beneath and surrounding the underground structure
4. To learn the design and construction of sub structures

Course Outcomes:

1. Learn about types and purposes of different underground structures.
2. Have an exposure to the systematic methods for designing foundations.
3. Be able evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.
4. Have necessary theoretical background for design and construction of foundation systems.

UNIT-I (08 Hours)

Sheet Piles: Introduction, sheet pile structures, free cantilever sheet pile walls, cantilever sheet pile, depth of embedment of cantilever walls in sandy soils, depth of embedment of cantilever walls in cohesive soils, anchored bulkhead: free-earth support method, depth of embedment of anchored sheet piles in granular soils, design charts for anchored bulkheads in sand, moment reduction for anchored sheet pile walls, anchorage of bulkheads.

UNIT-II (07 Hours)

Braced Cuts and Coffer Dams: Lateral earth pressure distribution on braced-cuts, stability of braced cuts in saturated clay, Bjerrum and Eide method of analysis, piping failures in sand cuts, arching action of soil and its application, coffer dams.

UNIT-III (07 Hours)

Drilled Pier Foundations: Introduction, types of drilled piers, load transfer mechanism, vertical bearing capacity of drilled piers, the general bearing capacity equation for the base resistance, bearing capacity equations for cohesive soil and granular soil, ultimate skin resistance of cohesive cohesion-less soil and gravelly sands, ultimate side and total resistance in rock, estimation of settlements of drilled piers at working loads, uplift capacity of drilled piers, lateral bearing capacity of drilled piers.

UNIT-IV (08 Hours)

Well Foundations: Forces acting on wells, components of well foundation, bearing capacity, settlement and lateral resistance, tilts and shifts design and construction, types of caissons, advantages and disadvantages of each type of caisson, forces acting on the caissons and design of caissons.

Recommended Text Books / Reference Books:

1. J.E. Bowles – Foundation Design & Analysis, McGraw-Hill Edition1995.
2. Ground improvement techniques by P. Purushottam Raj, Laxmi Publication.
3. F. S. Fang Handbook of Foundation Engg. CBS Pub., 1985.

PRESTRESSED CONCRETE

Subject Code: BCIED1-721 | **L T P C** | **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

1. The intention of Prestressing is to permanently keep all (significant) parts of a concrete element in compression.
2. The benefit of that arises from the fact that concrete as a material is relatively poor when viewed as a tensile member. On the other hand, its compressive strength may be around ten times the tensile strength.
3. In simple terms it essentially clamps the concrete together in the area that will undergo the highest tensile forces.

Course Outcomes:

1. Students will understand the general mechanical behavior of prestressed concrete.
2. Students will be able to analyze and design prestressed concrete flexural members.
3. Students will be able to analyze and design for vertical and horizontal shear in prestressed concrete.

Note: IS 1343 Code of Practice is permitted in the examination.

UNIT-I (06 Hours)

Materials for Pre-stressed Concrete and Pre-stressing Systems: High strength concrete and high tensile steel, tensioning devices, pre-tensioning systems, post tensioning systems.

UNIT-II (09 Hours)

Analysis of Pre-stress and Bending Stresses: Analysis of pre-stress, resultant stresses at a sector, pressure line or thrust line and internal resisting couple, concept of load balancing, losses of pre-stress, deflection of beams.

UNIT-III (08 Hours)

Strength of Pre-Stressed Concrete Sections in Flexure, Shear and Torsion: Types of flexural failure, strain compatibility method, IS: 1343 code procedure, design for limit state of shear and torsion.

UNIT-IV (07 Hours)

Design of Pre-Stressed Concrete Beams and Slabs: Transfer of prestress in pre tensioned and post tensioned members, design of anchorage zone reinforcement, End zone, design of simple beams, cable profiles.

Recommended Text Books / Reference Books:

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill
2. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
3. P. Dayaratnam, Prestressed Concrete, Oxford & IBH
4. R. Rajagopalan, Prestressed Concrete.
5. Code of Practice for Prestressed Concrete (IS 1343 : 2012)

SOLID & HAZARDOUS WASTE MANAGEMENT

Subject Code: BCIED1-722 **L T P C** **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

The course should enable the students to:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, E-waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts of solid waste mismanagement
4. Understand engineering, financial and technical options for waste management.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Do sampling and characterization of solid waste.
2. Analysis of hazardous waste constituents including QA/QC issues
3. Apply steps in solid waste management like waste reduction at source, collection techniques, recycling, transport, optimization of solid waste.
4. Analyse treatment & disposal techniques and economics of the onsite vs. offsite waste management.

UNIT-I (09 Hours)

Sources and Composition of Municipal: Solid Waste Introduction, Sources of solid waste, types & classification of solid waste, Composition of solid waste and its determination, Types of materials recovered from MSW.

Properties of Municipal Solid Wastes: Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.

UNIT-II (06 Hours)

Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

UNIT-III (06 Hours)

Handling, Separation and Storage of Solid Waste: Handling and separation of solid waste At site, Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources.

UNIT-IV (09 Hours)

Processing of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying, compacting, Shredding, pulping, granulating etc., Processing of solid waste (Size & volume reduction)

Disposal & Treatment of Solid Waste: Combustion and energy recovery of municipal solid waste, effects of combustion, Sanitary landfill: Classification, planning, landfill processes, landfill design, landfill operation & bioreactors, Compositing, Incineration, Pyrolysis & gasification, Landfill leachate & gas management.

Recommended Text Books / Reference Books:

1. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, Delhi.
2. Vesilind P.A., Worrell W. and Reinhart D.R., "Solid Waste Engineering", Thomson Books.
3. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
4. Tchobanoglous G., Theisen H. and Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill International editions.
5. "Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India.
6. Management and Handling Rules for: municipal solid waste, biomedical waste, hazardous waste and radioactive wastes, Government of India Publications.

REPAIR & REHABILITATION OF STRUCTURES

Subject Code: BCIED1-723	L	T	P	C	Duration: 30 hrs.
	2	0	0	2	

Course Objectives:

To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

Course Outcomes:

Upon the completion of this course, the student will be able to:

1. Know the strategies of maintenance and repair.
3. Understand the properties of repair materials.
4. Understand the various properties of concrete.
5. Get an idea of repair techniques.
6. Understand the retrofitting strategies and techniques.

UNIT-I (06 Hours)

Maintenance and Repair Strategies: Definitions: Maintenance, Repair and Rehabilitation. Facets of Maintenance, Importance of Maintenance and Daily, Weekly, Monthly, Yearly Routine Maintenance, Various aspects of Inspection, stages of inspection, Assessment procedure for Evaluating a damaged Structure, Causes of deterioration.

UNIT-II (09 Hours)

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

Strength & Durability of Concrete: Quality assurance for Concrete: Strength, Durability and thermal properties, Cracks: Different types, Causes, Effects due to climate, Temperature, Sustained elevated temperature, Corrosion - Effects of cover thickness.

UNIT-III (09 Hours)

Techniques for Repair and Protection Methods: Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques: Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.
Demolition Techniques: Engineered demolition methods and Case studies.

UNIT-IV (06 Hours)

Repair, Rehabilitation and Retrofitting of Structures: Evaluation of root causes, Under pinning & shoring some simple systems of rehabilitation of structures; Guniting, shortcreting, Non-destructive testing system; Use of external plates, carbon fibre wrapping and carbon composites in repairs. Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake.

Recommended Books/References:

1. A.C. Panchdari, 'Maintenance of Buildings', New Age International (P) Limited Publishers.
2. Gambhir M.L., "Concrete Technology", McGraw Hill, 2013.
3. Ravishankar K., Krishnamoorthy T.S, "Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. R. Chudley, 'Building Finishes, Fittings and Domestic Services', Longman Technical Services.
5. G. Szechy, D. SC; 'Foundation Failures', Concrete Publications Limited, 14 Dartmouth Street, London.
6. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
7. W.H. Ransom, 'Building Failures: Diagnosis and Avoidance', New Age Publications (P) Ltd.

PROJECT-I

Subject Code: BCIES1-703

L	T	P	C
0	0	6	3

Duration: 90 hrs.

Course Objectives:

1. To make student synthesis and use knowledge of various disciplines gained during entire study in a civil project of his choice.
2. Demonstrate the personal abilities and skills required to produce and present an extended piece of work.
3. Engage in personal inquiry, action and reflection on specific topics and issues.
4. Focus on, and demonstrate an understanding of, the areas of interaction.
5. Reflect on learning and share knowledge, views and opinions.

Course Outcomes:

1. Describe and justify a focus on the chosen area(s) of interaction.
2. Describe the steps followed to achieve the stated goal.
3. Choose techniques relevant to the project's goal.
4. Respond thoughtfully to ideas and inspiration.

5. A fully worked-out design proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.
6. Where appropriate, suggest ways in which the project could have been tackled differently.
7. Assess the achieved results in terms of the initial goal and the focus on the chosen area(s) of interaction.

PROJECT WORK:

Students are required to work on practical projects in the field of Civil Engineering (Project work, seminar and internship in industry or at appropriate work place). The students have to work for 6 hrs per week with his / her supervisor(s).

SOFTWARE LAB

Subject Code: BCIES1-704	L	T	P	C	Duration: 30 hrs.
	0	0	2	1	

Course Objectives:

1. To obtain the knowledge of software's related to civil engineering.
2. To learn how to analyze and design complex Civil engineering problems with software.
3. To learn how to manage/optimize the project with time and resource with the help of software.

Course Outcomes:

On completion of this course the student will be able:

1. To design the whole project like roads, building etc. with the help of softwares.
2. To deal with project management in real time.

Student can choose anyone software according to their choice.

1. STAAD-PRO
2. E-TAB
3. ARC VIEW GIS
4. MX ROAD
5. PLAXIS
6. PRIMA VERA

ESSENCE OF INDIAN KNOWLEDGE TRADITION

Subject Code: BMNCC0-006	L	T	P	C	Duration: 30 Hrs.
	2	0	0	0	

COURSE OBJECTIVE:

The course is introduced

1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

COURSE OUTCOMES:

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

UNIT – II

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – III

Indian Fine Arts & Its Philosophy(Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – IV

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

RECOMMENDED BOOKS:

1. Kapil Kapoor, “Text and Interpretation: The India Tradition’’, ISBN: 81246033375, 2005
2. “Science in Samskrit”, Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007
3. NCERT, “Position paper on Arts, Music, Dance and Theatre’’, ISBN 81-7450-494-X, 2006
4. S. Narain, “Examination in Ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M.Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN-13: 978-8120810990,2014
7. Chatterjee. S & Dutta “An Introduction to Indian Philosophy”.

8th SEMESTER

TRANSPORTATION ENGINEERING-II					
Subject Code: BCIES1-801	**L**	**T**	**P**	**C**	**Duration: 45 hrs.**
	3	0	0	3	

Course Objectives:

1. The objective of this course is to familiarise the students about importance of railways and Air transportation systems in the social and economic development of the country.
2. To introduce engineering aspects of components of railway track and its geometric design, layouts of stations and yards, and railway signalling and interlocking systems
3. To acquaint the students about planning and design of runway and taxiway, airport configurations, and visual aids required for safe and efficient air transportation system.

Course Outcomes:

1. The students will learn about importance of railways and Air transportation systems in the social and economic development of the country.
2. The students will come to know about engineering aspects of components of railway track and its geometric design, layouts of stations and yards, and railway signalling and interlocking systems.
3. The students will learn about planning and design of runway and taxiway, airport configurations and visual aids required for safe and efficient air transportation system.

UNIT-I (12 Hours)

Railway Track: Rail gauge, alignment, engineering surveys, track stresses, rails, sleepers, ballast, formation, track fittings and fastenings, rail joints and welding of rails, creep of rails, track drainage, track maintenance, high speed tracks.

Geometric Design of Track: Curves and super-elevation, gradients, points and crossings, track junctions and simple track layouts, level crossing.

UNIT-II (11 Hours)

Railway Stations & Yards: Classification & layout of stations, Marshalling yard, Locomotive yard, equipment at railway stations & yards.

Signaling and Interlocking: Objectives, classification of signals, types of signals in stations and yards, principles of interlocking.

UNIT-III (11 Hours)

Airport Planning: Aircraft characteristics, airport site selection, airport classification, general layout of an airport, approach zones and turning zones.

Runway Orientation and Design: Head wind, cross wind, wind rose diagram, basic runway length, corrections, geometric design elements, runway configuration.

UNIT-IV (11 Hours)

Taxiway and Aircraft Parking: Aircraft parking system, main taxiway, exit taxiway, separation clearance, holding aprons.

Visual Aids: Marking and lighting of runway and taxiway, landing direction indicator, and wind direction indicator, IFR/VFR.

Recommended Text Books / Reference Books:

1. S. Chandra and M Aggarwal, 'Railway Engineering', Oxford University Press, New Delhi.
2. S.C. Saxena and S.P. Arora, 'A Textbook of Railway Engineering', Dhanpat Rai and Sons.
3. J.S. Mundrey, 'Railway Track Engineering', McGraw Hill Publishing Co, New Delhi
4. S.K. Khanna, M.G. Arora and S.S. Jain, 'Airport Planning and Design', Nem Chand & Bros.
5. R. Horenjeff, and F. McKelvey, 'Planning and Design of Airports', McGraw Hill Company.

DESIGN OF STEEL STRUCTURES-II

Subject Code: BCIED1-811	L	T	P	C	Duration: 45 hrs.
	3	0	0	3	

Course Objectives:

3. Learn the plastic behaviour of steel in flexure.
4. Learn the behaviour of different types of steel bridges during different type of loading and design of steel structures.
5. Ability to design industrial steel structures systems.
6. Familiarity with professional and contemporary issues.

Course Outcomes:

5. Identify and compute the design loads on a typical steel building.
6. Able to analyze and design with detailing of steel flexural members.
7. Ability to design and check for serviceability (crack and deflection) and ultimate limit state conditions.
8. Apply relevant Indian Standard provisions to ensure safety and serviceability of structural steel elements.

Note: IS 800:2007, General construction in Steel-Code of practice is permitted in examination.

UNIT-I (12 Hours)

Plastic Analysis: Introduction, flexural behavior, shape factor, plastic moment capacity of beams, Design of Beams.
Plate Girder: Elements of a plate girder, economical depth, IS recommendations, design of a plate girder, curtailment of flanges, various types of stiffeners using bolts and welds.

UNIT-II (11 Hours)

Foot Bridge: Elements of Foot Bridge, types, moving load behavior, Design of steel foot bridge with welded joints.

UNIT-III (11 Hours)

Industrial Buildings: Introduction, Terminology, types & uses, types of load, Design of elements of industrial buildings: Gantry girder, Column bracket using weld.

UNIT-IV (11 Hours)

Railway Bridge: Design of single track Railway Bridge with lattice girders having parallel chords (for B.G.)- Stringer, Cross girder, Main girders with welded joints, Portal sway bracings, rollers bearing.

Recommended Text Books / Reference Books:

1. S.K. Duggal, 'Limit State Design of Steel Structures'.
2. N. Subramanian, 'Design of Steel Structures'.
3. Ram Chandra, 'Design of Steel Structures', Vol. 2.
4. L.S. Negi, 'Design of Steel Structures'.
5. S.S. Bhavikatti, 'Design of Steel Structures (by limit state method as per IS: 800-2007).
6. IS 800: 2007 (General Construction in Steel-Code of Practice)
7. SP: 6(1) (Handbook for Structural Engineers-Structural Steel Sections).

PORT & HARBOUR ENGINEERING

Subject Code: BCIED1-812	L	T	P	C	Duration: 45 hrs.
	3	0	0	3	

Course Objectives:

1. The objective of this course is to acquaint the students about fourth major mode of transportation, i.e., waterways, after covering highways, railways, and airports in the previous semesters.
2. To understand the need for providing various civil engineering structures at the ports and harbours, construction, maintenance, and navigational aspects.
3. To learn about the functions of different components of harbours and ports for the purpose of safe and efficient water transportation.

Course Outcomes:

1. The students shall learn about the importance and application of fourth major mode of transportation, i.e., waterways, after covering highways, railways, and airports in the previous semesters.
2. They will understand the need for providing various civil engineering structures at the ports and harbours, and their construction, maintenance, and navigational aspects.
3. They will come to know about the functions of different components of harbours and ports for the purpose of safe and efficient water transportation.

UNIT-I (11 Hours)

General: History, Advantages and disadvantages of water transportation, Modern trends in water transportation, Elements of water transportation, Historical development in India.
Natural Phenomena: Tides, Wind, Water waves, Currents phenomena, Characteristics and effects on marine structures, Littoral drift.

UNIT-II (12 Hours)

Marine Structures: General design aspects, Breakwaters - function, types general design principles, Wharves, Quays, Jetties, Piers, Pier heads, Dolphin, Fenders, Mooring Accessories.
Harbours: Classification of harbours, Selection of site and planning of harbours, Ship characteristics, Characteristics of good harbour, Size of harbour.

UNIT-III (11 Hours)

Docks and Repair Facilities: Harbour docks, Wet docks, Repair docks, Lift docks, Floating

docks, Slipways.
Port Facilities: Port building facilities, Transit sheds, Warehouses, Cargo handling facility, Services for shipping terminals, Inland port facilities planning.

UNIT-IV (11 Hours)

Dredging: General, Classification of dredging works, Types of dredgers, Uses of dredged material, Execution of dredging work.
Navigation Aids: Necessity, Types of navigation aids, Requirement of signals, Fixed and floating navigation aids.

Recommended Text Books / Reference Books:

1. S. P. Bindra, 'A Course in Docks and Harbour Engineering', Dhanpat Rai & Sons, New Delhi.
2. R. Srinivasan and S. C. Rangwala, 'Harbour, Dock and Tunnel Engineering', Charotar Publishing House, Anand.
3. Alonzo Quinn, 'Design and Construction of Ports and Marine Structure', McGraw Hill Book Company, New York.

ENVIRONMENTAL IMPACT ASSESSMENT & LIFE CYCLE ANALYSES

Subject Code: BCIED1-813 **L T P C** **Duration: 45 hrs.**

3 0 0 3

Course Objectives:

1. To learn the concept and methodology of EIA and its documentation.
2. Characterize and reflect on requirements, standards as well as guidelines for LCA of products & service systems.
3. Reflect on influences of methodological choices on LCA results and be able to critically evaluate implications of LCA modelling decisions.
4. Analyse, interpret and validate LCA of a product or a service system by applying.appropriate me thods and tools to overcome modelling challenges.

Course Outcomes:

1. Knowledge about EIA tools & methodologies, auditing and documentation of EIA.
2. Students will gain competency and understanding of the significance of chemical and biological reactions in environmental problems and solutions.
3. Students will understand the theory behind the analytical techniques.
4. Students will learn the use of microbiological methods for treating water and waste water**.**

UNIT-I (12 Hours)

Evolution of EIA Concepts: Methodologies – Screening- Scoping- Base line studies- Mitigation – Matrices - Check List.

UNIT-II (11 Hours)

Elements of Life Cycle Assessment: Life Cycle Costing, Eco Labelling, Design for the Environment, Environmental Audit- Life cycle Assessment, International Environmental Standards

UNIT-III (11 Hours)

Assessment of Impacts: Air, Water, Soil, Noise, Biological, Green energy and green process management in Pharmaceutical, Construction, Textiles, Petroleum Refineries, Iron and Steel.

UNIT-IV (11 Hours)

Documentation of EIA: Environmental management Plan- Post Project monitoring- Environmental Management System EMS – case studies in EIA.

Recommended Text Books / Reference Books:

1. Integrated Environmental Modeling - Pollutant Transport, Fate and Risk in the Environment, Ramaswami A., Milford J.B., Small M. J., John Wiley & Sons.
2. Principles of Geographical Information Systems, Burrough P.A. and McDonnell, R.A., Oxford University Press 1998.
3. Dynamics of Environmental Bioprocesses Modeling and Simulation Snape J.B., Dunn I.J., Ingham J and Prenosil J.E., VCH, Weinheim 1995.
4. Activated Sludge Models ASM1, ASM2, ASM2d and ASM3, Henze M., IWA Publ. 2000
5. Surface Water Quality Modeling, Chapra S.C., McGraw-Hill Inc. 1997

ENGINEERING HYDROLOGY

Subject Code: BCIED1-821 **L T P C** **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

The course should enable the students to understand the:

1. Interaction among various processes in the hydrological cycle.
2. Average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, evapo-transpiration etc.
3. The various components of hydrographs and to estimate the run-off.
4. Estimation of peak flows by rational method, unit hydrograph theory, Gumbels's method.

Course Outcomes:

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

1. Understand the interaction among various processes in the hydrological cycle.
2. Calculate the average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, evapo-transpiration etc.
3. Understand the various components of hydrographs and to estimate the run-off.
4. Estimation of peak flows by rational method, unit hydrograph theory, Gumbels's method.

UNIT-I (09 Hours)

Introduction: Hydrologic cycle, History of hydrology, water budget equation, World Water balance, applications in engineering sources of data.

Precipitation: Forms of Precipitation, characteristics of precipitation in India, measurement of precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth-Area-Duration Relationships, Maximum Intensity / Depth-Duration-Frequency Relationship, Probable Maximum Precipitation (PMP), Rainfall Data in India.

UNIT-II (07 Hours)

Abstractions from precipitation: Evaporation process, Evaporimeters, Analytical methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapo-

transpiration, Interception, Depression storage.

Infiltration: Definition, Infiltration capacity, measurement of infiltration, Modelling infiltration capacity, Classification of Infiltration capacities, Infiltration Indices.

UNIT-III (09 Hours)

Runoff: Run-off volume, SCS-CN method of estimating runoff volume, flow-duration curve, flow-mass curve, hydrograph, factors affecting run-off hydrograph, components of hydrograph. (5)

Hydrographs: Base flow separation, effective rainfall, unit hydrograph, S-curve hydrograph, Snyder's synthetic unit hydrograph, surface water resources of India.

UNIT-IV (05 Hours)

Peak flows: Estimation of peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and it's hydrograph.

Recommended Text Books / Reference Books:

1. Engineering Hydrology - J.Nemec, Prentice Hall
2. Engineering Hydrology by Stanley Buttler, John. Wiley
3. Ground Water Hydrology by TODD, John. Wiley
4. Engineering for Dams Vol. II & III by Creager Justin & Hinds. John. Wiley
5. Hydrology by. S.K.Garg, Khanna Publications.
6. Hydrology Principles, Analysis and Design by. Raghunath, H M, New Age Int.

BRIDGE ENGINEERING

Subject Code: BCIED1-822 **L T P C** **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

1. The objective of this course is to apprise the students about the planning and construction of bridges, which is one of the most important components of the transportation infrastructure.
2. To learn about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. To learn about components of sub-structure and super-structure of the bridges along with construction and maintenance aspects of bridges.

Course Outcomes:

1. The students will learn about the planning and construction of bridges, which is one of the most important components of the transportation infrastructure.
2. They will learn about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. They will also learn about components of sub-structure and super-structure of the bridges along with construction and maintenance aspects of bridges.

UNIT-I (08 Hours)

Introduction: Definition and components of a bridge, Classification of bridges, Choice of a bridge type, Investigation for bridges, Selection of bridge site, design discharge for river bridge, linear

waterway, economical span, vertical clearance, scour depth, afflux.

Standard Specifications for Road Bridges: IRC Bridge Codes, Width of carriageway, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects, and Seismic forces.

UNIT-II (08 Hours)

Reinforced Concrete Bridges: Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Prestressed concrete bridges.

Steel Bridges: Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.

UNIT-III (07 Hours)

Sub-structure and Foundation: Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.

Bearings: Importance of Bearings, Different types of bearings, Expansion Bearings, Fixed Bearings, Elastomeric Bearings.

UNIT-IV (07 Hours)

Joints & Appurtenances: Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails.

Construction and Maintenance of Bridges: Methods of construction of concrete and steel bridges. Formwork and false work for concrete bridges, Causes of Bridge failures, Inspection and maintenance, Bridge Management System.

Recommended Text Books / Reference Books:

1. Johnson, Victor, 'Essentials of Bridge Engineering', Oxford University Press.
2. C.H. Khadilkar, 'A Text book of Bridge Construction', Allied Publishers.
3. S.C. Rangwala, 'Bridge Engineering', Charotar Publishing House Pvt. Ltd.
4. V.K. Raina, 'Concrete Bridges Handbook, Shroff Publishers and Distributors.
5. S. Ponnuswamy, 'Bridge Engineering', McGraw Hill Education.

SOIL REINFORCING TECHNIQUES

Subject Code: BCIED1-823	L	T	P	C	Duration: 30 hrs.
	2	0	0	2	

Course Objectives:

5. To understanding the necessity and scope of geo-synthetics in ground improvement.
6. To gain comprehensive understanding about different types of geo-synthetic products their functions, application and suitability.
7. To learn the analysis and design of reinforced soil walls.

Course Outcomes:

1. Competence in identification of ideal geo-synthetic function and ability to select the ideal

product to serve the function.
2. Ability to analyse and design the application of geo-synthetics.
3. Competence construction practices and evaluation of post construction improvement.

UNIT-I (07 Hours)

Reinforced Earth Retaining Wall: Principles, concepts and mechanism of reinforced earth – design consideration of reinforced earth retaining wall.

UNIT-II (08 Hours)

Geo-membrane: Physical, mechanical, chemical, biological, thermal and identification properties.
Designing with Geo-membranes: Liquid containment liners, covers for reservoirs, canal liners, landfill liners, caps & closures, underground storage tanks etc.

UNIT-III (08 Hours)

Geotextile: Physical, mechanical, hydraulic, endurance and degradation properties, designing with geotextiles, geotextile functions and mechanisms, designing for separation, designing for reinforcement, designing for stabilization, designing for filtration, designing for drainage, designing for multi functions.

UNIT-IV (07 Hours)

Geogrid: Physical, mechanical, endurance and environmental properties, designing for geogrid reinforcement
Geonets: Physical, mechanical, hydraulic, endurance and environmental properties, designing for geonet drainage
Geo-composites: Geo-composites for separation, reinforcement, filtration, drainage, liquid, vapour barriers.

Recommended Text Books / Reference Books:

1. Hausman, M. R. (1990). " Engineering Principles of Ground Modification" McGraw-Hills
2. Moseley, M.P. (1193), "Ground Improvement" Chapman and Hall.
3. Koener, R.M. (2012), "Designing with Geo-synthetics, Vol.1 & 2, Xlibriss Corporation.
4. Rao, G.V. and Raju, G.V.S.S. (1995) "Engineering with Geo-synthetics", TMH.
5. Purushothama Raj, P. (2014). "Ground Improvement Techniques". Laxmi Publishers.

INDUSTRIAL STRUCTURES

Subject Code: BCIED1-824 | **L T P C** | **Duration: 30 hrs.**

2 0 0 2

Course Objectives:

1. To learn various distress and damages to concrete and masonry structures.
2. To understand the importance of maintenance of structures.
3. To study the various types and properties of repair materials.
4. To assess the damage to structures using various tests.
5. To learn the importance and methods of substrate preparation.
6. To learn various repair techniques of damaged structures & corroded structures.

Course Outcomes:

By the end of this course students will have the capability/knowledge of

1. Various distress and damages to concrete and masonry structures, the importance of maintenance of structures, types and properties of repair materials etc.
2. Assessing damage to structures and various repair techniques.

UNIT-I (04 Hours)

Introduction: Role of Design Engineer, properties of structural steel, merits and demerits of structural steel over reinforced concrete structures.

UNIT-II (10 Hours)

Steel Structure Design: Design of tension members, compression members, and flexure members and beam-columns junctions, adopting Codal provisions of IS: 800 components & its terminology, load estimation, choice of sections, analysis and design for gantry girders.
Industrial structures with steel trusses and portal frames. Typical configuration with various elements, load assessment (deal load, live load, wind load and earthquake load).

UNIT-III (10 Hours)

Industrial Design: Different roofing and cladding alternatives and their design, types of purlins and their design, analysis and design of a trusses and portal frames, design of base plate, pedestal and footing considering both hinged and fixed support conditions, design of bracing and preparation of construction drawings.

UNIT-IV (06 Hours)

Welded Connections: Advantages of welding, fundamentals and methods of welding, types of joints, welding symbols and inspection of welding, Codal provisions, and design of typical welded connections. Bolted connections, Types of bolts, Codal provisions, design of typical bolted connections.

Recommended Text Books / Reference Books:

1. Design of Steel Structures - by Bresler & Lin.
2. Theory of Modern Steel Structures - by Linton Grinter.
3. Design of Steel Structures - by P. Dayaratnam.
4. Reinforced Concrete Structural Elements (behavior, analysis & design) by P. Purushothoman.
5. Practical Design of Reinforced Concrete by Russell S. Fling.
6. Design of Reinforced Concrete Structures by Ashok Kumar Gupta.
7. Structural Condition assessment by Robert T. Ratay.
8. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

ADVANCED INSPECTION & TESTING LAB

Subject Code: BCIES1-802	**L**	**T**	**P**	**C**	**Duration: 30 hrs.**
	0	0	2	1	

Course Objectives:

The course should enable the students to:

1. Gain experience with and understanding of the types, advantages and applications of various non-destructive testing (NDT) methods.
2. Equip the student with the ability of advance testing procedures.
3. Analyse recent techniques used by industry to evaluate the properties of a material, component, structure or system for characteristic differences or defects.
4. Assessment of existing structure for rehabilitation planning.
5. Monitoring of changes with passage of time.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Perform different NDTs on hardened concrete & highway.
2. Improve quality control during construction.
3. Improve product reliability.
4. Give information on repair criteria.
5. Predict accident prevention analysis and to reduce costs.

Laboratory Experiments:

1. Rebound Hammer Test
2. Ultrasonic Pulse Velocity Test
3. Reinforced Bar Locator Test
4. Cut and Pull Out (CAPO) Test
5. Fifth Wheel Bump Integrator Test
6. Benkelman Beam Deflection Test
7. Vehicular Speed Radar Test
8. Bitumen Extraction Test
9. Standard Penetration Test (SPT)

Recommended Books / Manuals:

1. M.L. Gambhir, 'Building and Construction Materials: Testing and Quality Control', TMH.
2. Concrete Lab Manual by NITTTR Chandigarh.
3. Concrete Technology, Theory and Practice by M.S. Shetty, S. Chand & Company.
4. Khanna S.K. and Justo, C.E.G. "Highway Material & Pavement Testing", Nem Chand.

PROJECT-II

Subject Code: BCIES1-803	L	T	P	C	Duration: 90 hrs.
	0	0	6	3	

Course Objectives:

6. To make student synthesis and use knowledge of various disciplines gained during entire study in a civil project of his choice.
7. Demonstrate the personal abilities and skills required to produce and present an extended piece of work.

8. Engage in personal inquiry, action and reflection on specific topics and issues.
9. Focus on, and demonstrate an understanding of, the areas of interaction.
10. Reflect on learning and share knowledge, views and opinions.

Course Outcomes:

8. Describe and justify a focus on the chosen area(s) of interaction.
9. Describe the steps followed to achieve the stated goal.
10. Choose techniques relevant to the project's goal.
11. Respond thoughtfully to ideas and inspiration.
12. A fully worked-out design proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.
13. Where appropriate, suggest ways in which the project could have been tackled differently.
14. Assess the achieved results in terms of the initial goal and the focus on the chosen area(s) of interaction.

PROJECT WORK:

Students are required to work on practical projects in the field of Civil Engineering (Project work, seminar and internship in industry or at appropriate work place) (May be continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place). The students have to work for 6 hrs per week with his / her supervisor(s).

Total Credits= 23

Semester-V (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BCIES1-521	Structural Analysis-II	3	0	0	40	60	100	3
BCIES1-522	Geotechnical Engineering	3	0	0	40	60	100	3
BCIES1-523	Environmental Engineering-II	3	0	0	40	60	100	3
BCIES1-524	Design of Steel Structures-I	3	0	0	40	60	100	3
Departmental Elective-II (Select any one)		3	0	0	40	60	100	3
BCIED1-551	Fluid Mechanics-II							
BCIED1-552	Maintenance of Building Structures							
BCIED1-553	Rural Water Supply and Onsite Sanitation Systems							
Departmental Elective-III (Select any one)		3	0	0	40	60	100	3
BCIED1-561	Construction Engineering & Management							
BCIED1-562	Repair & Rehabilitation of Structures							
BCIED1-563	River Engineering							
BCIES1-525	Geotechnical Engineering Lab	0	0	2	60	40	100	1
BCIES1-526	Engineering Geology Lab	0	0	2	60	40	100	1
BCIES1-527	Environmental Engineering Lab	0	0	2	60	40	100	1
BCIES1-528	Training-II*	0	0	0	60	40	100	2
Total		**-**	**-**	**-**	**480**	**520**	**1000**	**23**

*Internship will be imparted at the end of 4th semesteras per AICTE Internship Policy.

Total Credits= 22

Semester-VI (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BCIES1-621	Design of Concrete Structures-II	3	0	0	40	60	100	3
BCIES1-622	Foundation Engineering	3	0	0	40	60	100	3
BCIES1-623	Professional Practice & Law	3	1	0	40	60	100	4
BCIES1-624	Irrigation Engineering	3	0	0	40	60	100	3
XXXXX	Open Elective**	3	0	0	40	60	100	3
Departmental Elective-IV (Select any one)		3	0	0	40	60	100	3
BCIED1-651	Matrix Methods of Analysis							
BCIED1-652	Solid & Hazardous Waste Management							
BCIED1-653	Pavement Design							
BCIED1-654	Ground Improvement Techniques							
BCIES1-625	Soil Mechanics& Foundation Engineering Lab	0	0	2	60	40	100	1
BCIES1-626	Concrete Technology Lab-II	0	0	2	60	40	100	1
BCIES1-627	Computer-aided Civil Engineering Drawing-II	0	0	2	60	40	100	1
BMNCC0-001	Constitution of India (Mandatory Course)	2	0	0	100	---	100	0
Total		**-**	**-**	**-**	**520**	**480**	**1000**	**22**

*There will be 4-6 weeks Internship as per AICTE Internship Policy after 6thsemester.

**Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.

STRUCTURAL ANALYSIS-II					
Subject Code: BCIES1-521	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

1. To provide students with a solid background on principles of structural analysis by exposing them to the theories and concepts of analyzing the civil engineering structures.
2. To cover the analysis of statically indeterminate structures.

Course Outcomes:

1. The students will possess the skills to solve statically indeterminate problems of structural analysis dealing with different loads.
2. They will be able to apply their knowledge of structural analysis to address structural design problems.

UNIT-I (11 Hours)

1. Analysis of Statically Indeterminate Structures: Degree of static and kinematic indeterminacies, analysis of indeterminate beams, rigid frames and trusses by method of consistent deformation, law of reciprocal deflections, method of least work, induced reactions on statically indeterminate beams & rigid frames due to yielding of supports.

2. Fixed & Continuous Beams: Introduction, Analysis of fixed beams by moment-area theorem and strain energy method, fixed end moments due to different types of loadings, sinking and rotation of supports, bending moment and shear force diagrams for fixed beams, slope and deflection of fixed beams, analysis of continuous beams by the Three moment equation (Clapeyron's theorem) due to different types of loadings, effect of sinking of supports, BMDs.

UNIT-II (12 Hours)

3. Slope-Deflection Method: Introduction, slope-deflection equations, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements.

4. Moment-Distribution Method: Introduction, absolute and relative stiffness of members, stiffness and carry-over factors, distribution factors, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loads and uneven support settlements, symmetrical beams and frames with symmetrical, skew-symmetrical and general loading.

UNIT-III (11 Hours)

5. Rotation Contribution Method: Introduction, basic concept, analysis of statically indeterminate beams and rigid frames (sway and non-sway type) due to applied loadings and yielding of supports, symmetrical beams and frames, general case-storey columns unequal in height and bases fixed or hinged.

6. Approximate Methods of Structural Analysis: Introduction, Vertical and lateral load analysis of multistory frames, portal, cantilever and substitute-frame methods and their comparison.

UNIT-IV (11 Hours)

7. Two Hinged Arches: Introduction, Analysis of two hinged arches for Horizontal Thrust,

Bending Moment, Normal Thrust, and Radial Shear, Settlement (Foundation Yielding) and Temperature Effects, Rib Shortening and Shrinkage, Influence Lines for Two Hinged Arches.

8. Influence Lines for Statically Indeterminate Structures: Muller- Breslau principle for statically determinate and indeterminate beams, trusses and rigid frames, influence lines for reactions, shear force and bending moment for statically indeterminate beams, trusses and rigid frames.

Recommended Text Books / Reference Books:

1. C.S. Reddy, 'Basic Structural Analysis'.
2. C.K. Wang, 'Intermediate Structural Analysis'.
3. J. Sterling Kinney, 'Indeterminate Structural Analysis'.
4. B.C. Punmia, 'Theory of Structures'.

GEOTECHNICAL ENGINEERING

Subject Code: BCIES1-522 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To understand the various phase diagrams and derive various phase relationships of the soil.
2. To understand of index properties,
3. To understand the engineering properties of soil.
4. To understand of stability of slopes.

Course Outcomes:

1. The students will be able to apply their knowledge ofvarious phase diagrams and derive various phase relationships of the soil.
2. The students will be able to apply their knowledge of index properties,
3. The students will be able to apply their knowledge of the engineering properties of soil.
4. The students will be able to apply their knowledge of stability of slopes.

UNIT-I (12 Hours)

Types of Soils, Their Formation and Deposition, Definitions: soil mechanics, soil engineering, geotechnical engineering. Scope of soil engineering. Basic Definitions and Relationships-Soil as three-phase system in terms of weight, volume, voids ratio, and porosity. Definitions: moisture content, unit weights, degree of saturation, voids ratio, porosity, specific gravity and their relationships, Determination of various parameters such as: Moisture content, oven dry method, Specific gravity by density bottle method, Unit weight by core-cutter method, sand-replacement method.

Plasticity Characteristics of Soil: Introduction to definitions of: plasticity of soil, consistency limits-liquid limit, plastic limit, shrinkage limit, plasticity, liquidity and consistency indices, flow & toughness indices, definitions of activity and sensitivity. Determination of: liquid limit, plastic limit and shrinkage limit. Use of consistency limits. Particle size classification, textural classification, Indian standard soil classification system.

UNIT-II (11 Hours)

Compaction: Compaction, Concept of O.M.C. and zero Air Void Line, Standard and Modified proctor test, Factors affecting compaction, Effect of compaction on engineering soil properties, Field compaction methods their comparison of performance and relative suitability, Field control of compaction by proctor needle.

Permeability of Soil: Concept of effective stress principle, Critical hydraulic gradient and quick sand condition, Capillary phenomenon in soil, Darcy's law and its validity, Co-efficient of permeability and its determination by Constant Head Permeability test and Variable Head Permeability test, Average permeability of stratified soils, Factors affecting coefficient of permeability.

UNIT-III (10 Hours)

Consolidation: Consolidation, Difference between compaction and consolidation, Concept of various consolidation characteristics, Primary and secondary consolidation, Terzaghi's theory for one-dimensional consolidation, Consolidation test, Determination of coefficient of consolidation from curve fitting methods, Normally consolidated and over consolidated clays, Importance of consolidation settlement in the design of structures, e-logσ curve.

UNIT-IV (12 Hours)

Shear Strength: Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory, types of shear tests: direct shear test, merits of direct shear test, tri-axial compression tests, test behavior of UU, CU and CD tests, pore-pressure parameters, computation of effective shear strength parameters. Unconfined compression test, vane shear test.

Stability of Slopes: Introduction, types of slopes and their failure mechanisms, factor of safety, analysis of finite and infinite slopes, wedge failure Swedish circle method, friction circle method, stability numbers and charts.

Recommended Text Books / Reference Books:

1. K.R. Arora, 'Soil Mech. & Foundation Engg', Standard Publishers Distributors.
2. P. Purshotama Raj, 'Geotechnical Engineering', Tata McGraw Hill.
3. V.N.S. Murthy, 'Soil Mech. & Foundation Engg', CBS Publishers & Distributors.
4. B.M. Das, 'Principle of Geotechnical Engineering', Cengage Publisher.
5. Gopal Ranjan and A.S.R. Rao, 'Basic and Applied Soil Mechanics', New Age International.
6. Joseph E. Bowle 'Physical & Geotechnical Properties of Soil'.

ENVIRONMENTAL ENGINEERING-II

Subject Code: BCIES1-523	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

The course should enable the students to:

1. Extensive knowledge of sources, distribution & maintenance of sewerage system.

2. Emphasizes on design criteria, design equations, kinetics and hydraulic diagrams for the design of unit operations and processes for wastewater treatment systems.
3. Deals with biological sludge handling and treatment.
4. Analyse the importance of rural sanitation systems and natural and constructed wetlands.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Estimate sewage generation and design sewer system including Sewage pumping stations.
2. Required understanding on the characteristics and composition of sewage, self Purification of streams.
3. Perform basic design of the unit operations and processes for sewage treatment.
4. An ability to develop and conduct appropriate experimentation, analyze and interpret data for future sewage generation & handling.

UNIT-I (10 Hours)

Introduction: Terms & definitions, types of sewage, system of sewerage, choice of sewerage system and suitability to Indian conditions.

Sewerage Systems: Generation and estimation of community Sewage, flow variations, storm water flow, types of sewers. Design of sewers and storm water sewers, construction &maintenance of sewers, sewer appurtenances, sewage pumping and pumping stations.

UNIT-II (11 Hours)

House Drainage: Principles of house drainage, traps, sanitary fittings, systems of plumbing, drainage lay out for residences.

Characteristics of Sewage: Composition of domestic and industrial sewage, sampling, physical, chemical and microbiological analysis of sewage, biological decomposition of sewage, BOD and BOD kinetics, effluent disposal limits.

UNIT-III (14 Hours)

Treatment of Sewage: Introduction to unit operations and processes – Primary treatment: screening (theory), grit chamber (theory and design), floatation units, sedimentation tanks(theory and design), Secondary treatment units: ASP (theory and design), Sequencing batch reactors (theory and design), Trickling filters (theory and design) Anaerobic systems; Anaerobic filters (theory), UASB (theory), Anaerobic lagoons (theory), Sludge Handling and disposal; thickening, stabilization, dewatering, drying and disposal.

UNIT-IV (10 Hours)

Low Cost Sanitation Systems: Imhoff tanks (theory and design), septic tank (theory and design), soakage pit/soil absorption systems; stabilization ponds (theory and design); oxidation ponds (theory and design); and constructed wetland systems.

Wastewater Treatment Plants and Advanced Wastewater Treatment: Treatment Plants; site selection, operation and maintenance aspects, advanced wastewater treatment for nutrient removal, disinfection for sewage.

Recommended Text Books / Reference Books:

1. Waste Water Engg. (Environmental Engg.-II) by B.C. Punmia, Ashok Jain, Laxmi Publications.
2. Environmental Engg. – A design Approach by Arcadio P. Sincero and Gregoria P. Sincero, Prentice Hall of India, New Delhi
3. "Waste Water Engineering – Treatment and Reuse" by Metcalf & Eddy, TMH, New Delhi.
4. "Environmental Engg." By Howard S. Peavy, Donald R. Rowe & George Tchobanoglous, McGraw Hill, International Edition
5. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, Delhi.

DESIGN OF STEEL STRUCTURES-I

Subject Code: BCIES1-524 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Learn the behaviour of structural steel components Ability to perform analysis and design of steel members and connections.
2. Ability to design steel structural systems learns the behaviour of structural steel components.

Course Outcomes:

1. Identify the different failure modes of bolted and welded connections, and determine their design strengths.
2. Identify the different failure modes of steel tension and compression members and beams, and compute their design strengths.
3. Select the most suitable section shape and size for tension and compression members and beams according to specific design criteria.

Note: IS 800:2007, General construction in Steel-Code of practice is permitted in examination.

UNIT-I (11 Hours)

Introduction: Properties of structural steel, I.S. rolled sections, I.S. specifications.
Connections: Riveted, bolted and welded connections for axial and eccentric loads (Type-I & II).

UNIT-II (12 Hours)

Tension Members: Introduction, Mode of Failure, IS Specifications, Design of members subjected to axial tension using bolts and welds.
Compression Members: Introduction, buckling, effective length, slenderness, effects of end supports, Design of axially loaded members, built-up columns, laced and battened columns including the design of lacing and battens using bolts and welds.

UNIT-III (12 Hours)

Flexural Members: Plastic behavior, beam types, Shear in beam, bending, splices, Design of laterally restrained and un-restrained rolled and built-up sections using bolts and welds.
Foundation: Types, Anchor bolts, bearing plate, Design of slab base, gusseted base and grillage foundation using bolts and welds.

UNIT-IV (10 Hours)

Roof Truss: Introduction, Terminology, types & uses, types of load, purlins, Design of roof truss using bolts and welds.

Recommended Text Books / Reference Books:

1. S.K. Duggal, 'Limit State Design of Steel Structures', McGraw Hill.
2. N. Subramanian, 'Design of Steel Structures', Oxford Higher Education.
3. 'Design of Steel Structures', Vol. -1, Ram Chandra Standard Book House – Rajsons.
4. S S Bhavikatti, 'Design of Steel Structures' (by limit state method as per IS: 800-2007)', I.K. International Publishing House.
5. IS 800: 2007 (General construction in Steel-Code of practice).

FLUID MECHANICS-II

Subject Code: BCIED1-551 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The students should be able:

1. To have understanding of Laminar and turbulent flows.
2. To understand concepts of boundary layer theory.
3. To understand concepts of open channel flows, hydraulic jump, surges, Momentum principles, specific energy and GVF.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Understand laminar and turbulent flows.
2. Learn about concepts of boundary layer theory.
3. Design open channels for most economical sections.
4. Will be able to understand surges, momentum principles, specific energy and GVF profiles.

UNIT-I (11 Hours)

Laminar Flow: Navier-stokes equations in Cartesian coordinates (no derivation), meaning of terms, Flow through circular section pipe, flow between parallel plates, stokes law. Flow through porous media, Transition from laminar to turbulent flow, Critical velocity and critical Reynold number.

Turbulent Flow: Turbulent flows and flow losses in pipes, Darcy equation minor head losses in pipe fitting, Hydraulic and energy gradient lines. Definition of turbulence, scale and intensity, Effects of turbulent flow in pipes. Equation for velocity distribution in smooth and rough pipes (no derivation). Resistance diagram.

UNIT-II (13 Hours)

Boundary Layer Analysis: Assumption and concept of boundary layer theory. Boundary- layer thickness, displacement, momentum & energy thickness, laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, smooth and rough boundaries. Local and average friction

coefficients. Separation and Control.

Uniform Flow in Open Channels: Flow classifications, basic resistance Equation for open channel flow. Chezy, Manning, Bazin and Kutter formulae. Variation of roughness coefficient, conveyance and normal depth. Velocity Distribution. Most efficient flow sections; rectangular, trapezoidal and circular.

UNIT-III (13 Hours)

Energy and Momentum Principles and Critical Flow: Energy and specific Energy in an open channel; critical depth for rectangular and trapezoidal channels. Alternate depths, applications of specific energy to transitions and Broads crested weirs. Momentum and specific force in open channel flow, sequent depths.

Gradually Varied Flow: Different Equation of water surface profile; limitation, properties and classification of water and surface profiles with examples, computation of water surface profile by graphical, numerical and analytical approaches.

UNIT-IV (08 Hours)

Hydraulic Jump and Surges: Theory of Jump, Elements of jump in a rectangular Channel, length and height of jump, location of jump, Energy dissipation and other uses, surge as a moving hydraulic jump. Positive and negative surges.

Recommended Text Books / Reference Books:

1. Fluid Mechanics : Dr. R.K. Bansal
2. Fluid Mechanics: Dr. Modi & Dr. Seth.
3. Fluid Mechanics : Dr. Jagdish Lal
4. Flow in open channels by S. Subraminayam, Tata McGraw Hill.

MAINTENANCE OF BUILDING STRUCTURES

Subject Code: BCIED1-552 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Diversified skills needed to maintain and renovate commercial and residential properties.
2. To learn the skills of the maintenance management.
3. To learn the defects, Investigation & Inspection etc.
4. To learn various repair steps for different elements of building.

Course Outcomes:

Based on this course, the students will understand/evaluate/develop

1. Assess the health condition of structures.
2. Inspect and evaluate damage structures.
3. Implement the techniques for repairing of concrete structures.
4. Test to assess the conditions of properties of existing concrete structures.

UNIT-I (11 Hours)

Maintenance of Buildings: Introduction, Importance of maintenance, Types of Maintenance –

Daily, Weekly, Monthly, Annually, General importance – Painting and home electricity system.
Repair Strategies: Causes of distress in structures Construction and design failures, Condition assessment and distress-diagnostic techniques, Inspection and evaluating damaged structure.

UNIT-II (12 Hours)

Durability and Serviceability of Concrete: 1. Quality assurance for concrete construction based on concrete properties like: (a) strength (b) Permeability (c) Thermal properties (d) cracking
2. Effects due to: (a) climate (b) temperature (c) chemicals (d) corrosion
3. Design and construction errors 4. Effects of cover and cracks.

UNIT-III (11 Hours)

Materials for Repair: Special concretes and mortar, concrete chemicals, construction chemicals, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete, Rust eliminators and polymers coating for rebar, foamed concrete, dry pack, vacuum concrete, asphalt sheeting.
Techniques for Repairs: Guniting, grouting and Shotcrete, Epoxy injection, Jacketing, shoring and underpinning. Methods of corrosion protection: (a) corrosion inhibitors (b) corrosion resistant steels (c) coating and Cathodic protection.

UNIT-IV (11 Hours)

Repair: Repair of – stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation, etc.), Flooring, Roofs (sloping, flat, pitched, etc.), Concrete members due to Steel Corrosion, Lack of Bond & shear, tension, torsion, compression failure. Estimation of Repair.

Recommended Text Books / Reference Books:

1. A.C. Panchdari, 'Maintenance of Buildings', New Age International (P) Limited Publishers.
2. P. S. Gahlot, 'Building Repair and Maintenance Management', CBS Publishers and Distributors Pvt. Ltd.
3. B. L. Gupta, 'Maintenance & Repair of Civil Structures', Standard Publications.
4. W.H. Ransom, 'Building Failures: Diagnosis and Avoidance', New Age Publications (P) Ltd.
5. Housing Defects Reference Manual, 'The Building Research Establishment E. & F.N. Spon'.

RURAL WATER SUPPLY AND ONSITE SANITATION SYSTEMS

Subject Code: BCIED1-553 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:
The course should enable the students to:
1. Learn about water supply in rural areas
2. Learn about environmental sanitation methods in rural areas
3. Comprehend the global picture of water/sanitation/hygiene and health
4. Understanding the principles of operation of a range of appropriate water and sanitation technologies, and to be able to critically evaluate them with respect to multiple criteria

5. Investigate the concept of community participation and its role in enabling project success and sustainability.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Knowledge about water supply scheme in rural areas.
2. Knowledge about environmental sanitation methods and design in rural areas.

UNIT-I (11 Hours)

Sanitation in Rural Area: Concept of environmental and scope of sanitation in rural areas, Magnitude of problem of water supply and sanitation – population to be covered and difficulties National policy, Various approaches for planning of water supply systems in rural areas, Selection and development of preferred sources of water, springs, wells and infiltration galleries, collection of raw water from surface source.

UNIT-II (12 Hours)

Water Treatment for Rural Areas: Specific problem in rural water supply and treatment e.g. iron, manganese, fluorides etc., Low cost treatment, appropriate technology for water supply and sanitation, Compact system of treatment of surface and ground waters such as MB settlers, slow and sand filter, chlorine diffusion cartridge etc.

UNIT-III (11 Hours)

Waste Water Treatment & Distribution: Planning of distribution system in rural areas, Water supply during fairs, festivals and emergencies, Treatment and disposal of wastewater/sewage, various method of collection and disposal of night soil.

UNIT-IV (11 Hours)

Onsite Sanitation System for Rural Areas: On site sanitation system and Disposal of solids waste: Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, septic tanks, soakage pits, surface drains, onsite sanitation systems etc., composting, land filling, Biogas plants.

Recommended Text Books / Reference Books:

1. Low cost on site sanitation option, Hoffman & Heijno Occasional Nov.1981 paper No. 21, P.O. Box 5500 2280 HM Rijswijk, the Netherlands offices, J.C. Mokeniaan
2. Rijswijk (the Haque), Wagner, E.G. and Lanoik, J.N. water supply for rural areas and Small communities, Geneva: W.H.O.1959.
3. Manual of water supply and treatment, 3rd edition, CPHEEO, GOI, New Delhi.
4. Water Supply and Pollution Control by Warren Viessman Jr. And Mark J. Hammer, 7th Edition 2005, Pearson Education.
5. Wastewater Engineering; Treatment, Disposal, Reuse, by Metcalf & Eddy,Tata McGraw-Hill.

CONSTRUCTION ENGINEERING & MANAGEMENT					
Subject Code: BCIED1-561	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

To give an exposure of management skills and familiarization with various aspects of management related to various construction projects, to the students.

Course Outcomes:

1. Students will be able to develop basic ability to plan, control and monitor construction projects with respect to time and cost.
2. Students will be able to develop an idea of how to optimize construction projects based on costs.
3. Students will be able to develop an idea how construction projects are administered with respect to various contract systems and issues.
4. They will be able to develop an ability to put forward ideas and understandings to others with effective communication processes.

UNIT-I (10 Hours)

Basics of Construction: Unique features of construction, construction projects types and features, phases of a project, agencies involved and their methods of execution.

Brief Introduction of Construction Project Planning: Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules.

UNIT-II (12 Hours)

Introduction: Need for project planning & management, time, activity & event, bar chart, Milestone chart, uses & draw backs.

PERT Technology: Construction of PERT network, time estimates, network analysis, forward pass & backward pass, slack, critical path, data reduction, suitability of PERT for research project.

UNIT-III (12 Hours)

CPM Technology: Definitions, network construction, critical path, fundamental rules, determination of project schedule, activity time estimates, float types, their significance in project control.

Construction Methods Basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with block work walls; Modular construction methods for repetitive works.)

UNIT-IV (11 Hours)

Construction Equipment: Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment for Productivities.

Contracts Management Basics: Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to precede, rights and duties of various parties, notices to be given, Contract Duration and Price; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

Recommended Text Books / Reference Books:

1. Varghese, P.C., "Building Construction", Prentice Hall India, 2007.
2. National Building Code, Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., Construction Technology, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications.

REPAIR & REHABILITATION OF STRUCTURES

Subject Code: BCIED1-562 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

To make the students to gain the knowledge on quality of concrete, durability aspects, causes of deterioration, assessment of distressed structures, repairing of structures and demolition procedures.

Course Outcomes:

Upon the completion of this course, the student will be able to:

1. Know the strategies of maintenance and repair.
3. Understand the properties of repair materials.
4. Understand the various properties of concrete.
5. Get an idea of repair techniques.
6. Understand the retrofitting strategies and techniques.

UNIT-I (09 Hours)

Maintenance and Repair Strategies: Definitions: Maintenance, Repair and Rehabilitation. Facets of Maintenance, Importance of Maintenance and Daily, Weekly, Monthly, Yearly Routine Maintenance, Various aspects of Inspection, stages of inspection, Assessment procedure for Evaluating a damaged Structure, Causes of deterioration.

UNIT-II (13 Hours)

Materials for Repair: Special concretes and mortar, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.

Strength and Durability of Concrete: Quality assurance for Concrete: Strength, Durability and Thermal properties, Cracks: Different types, Causes, Effects due to climate, Temperature, Sustained elevated temperature, Corrosion – Effects of cover thickness.

UNIT-III (13 Hours)

Techniques for Repair and Protection Methods: Non-destructive Testing Techniques, Epoxy injection, Shoring, Underpinning, Corrosion protection techniques: Corrosion inhibitors, Corrosion resistant steels, Coatings to reinforcement, Cathodic protection.
Demolition Techniques: Engineered demolition methods and Case studies.

UNIT-IV (10 Hours)

Repair, Rehabilitation and Retrofitting of Structures: Evaluation of root causes, Under pinning & shoring some simple systems of rehabilitation of structures; Guniting, shortcreting, Non-destructive testing system; Use of external plates, carbon fibre wrapping and carbon composites in repairs. Strengthening of Structural elements, Repair of structures distressed due to corrosion, fire, Leakage, earthquake.

Recommended Text Books / Reference Books:

1. A.C. Panchdari, 'Maintenance of Buildings', New Age International (P) Limited Publishers.
2. Gambhir.M.L., "Concrete Technology", McGraw Hill, 2013.
3. Ravishankar.K., Krishnamoorthy.T.S, " Structural Health Monitoring, Repair and Rehabilitation of Concrete Structures", Allied Publishers, 2004.
4. R. Chudley, 'Building Finishes, Fittings and Domestic Services', Longman Technical Services.
5. G. Szechy, D. SC; 'Foundation Failures', Concrete Publications Limited, 14 Dartmouth Street, London.
6. CPWD and Indian Buildings Congress, Hand book on Seismic Retrofit of Buildings, Narosa Publishers, 2008.
7. W.H. Ransom, 'Building Failures: Diagnosis and Avoidance', New Age Publications (P) Ltd.

RIVER ENGINEERING

Subject Code: BCIED1-563 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. Mechanics of river flow, aggradations and degradation, measurements in rivers,
2. Physical river models,
3. River training works.
4. Design of river training and flood protection structures.

Course Outcomes:

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

1. Mechanics of river flow, aggradations and degradation, measurements in rivers.
2. Physical river models.
3. River training works.
4. Design of river training and flood protection structures.

UNIT-I (11 Hours)

River Morphology: Bars; Bends and Meanders, Thalweg; Braiding; Bifurcations etc.
Sediment Transport Mechanics: Incipient Motion of Sediment Particles, Critical tractive force, Ripple and dune regime, antidune regime, importance of regimes of flow, Bed forms, Bed Load transport, Transport of suspended sediment, Critical Shear stress, Sediment Transport Equations.

UNIT-II (11 Hours)

Aggradation and Degradation: Local Scour at Bridge Piers and other Hydraulic Structures.
Measurements in Rivers: Stage measurements, Channel geometry, Discharge, Sediment samplers and suspended and bed load measurement.

UNIT-III (13 Hours)

Physical River Models: fixed and movable bed models; sectional models, distorted Models, Mathematical models for aggradations, degradation and local scour.
River Protection and Training Works: Revetments, Dikes, Gabions, Spurs, Bank Protective measures and Bed control structures.

UNIT-IV (10 Hours)

Design of River Training and Flood Protection Structures: Diversion and Cofferdams; River regulations systems; Dredging and Disposal, River restoration.

Recommended Text Books / Reference Books:

1. Irrigation & Water Power Engg. B.C. Punmia, Pande B.B.Lal.
2. Mechanics of Sediment Transportation and Alluvial Stream Problems, R.J.Garde, K.G. Ranga Raju.

GEOTECHNICAL ENGINEERING LAB

Subject Code: BCIES1-525 | **L T P C** 0 0 2 1 | **Duration: 30 Hrs.**

Course Objectives:

1. To understand the laboratory tests used for determination of physical, index and Engineering properties of soil.
2. Expose the students to different types of soils.
3. Experience the concepts of soil mass, soil solids, and soil structure.
4. Make the students to relate theoretical concepts in doing lab tests.

Course Outcomes:

1. Have thorough knowledge about the procedures of laboratory tests used for determination of physical, index and engineering properties of soils.
2. Have the capability to classify soils based on test results and interpret engineering behaviour based on test results.
3. Be able to evaluate the permeability and shear strength of soils.
4. Be able to evaluate settlement characteristics of soils
5. Be able to evaluate compaction characteristics required for field application.

Laboratory Experiments:

1. Determination of natural moisture content by oven drying method.
2. Determination of field dry unit weight using core cutter method.
3. Determination of field dry unit weight using sand replacement method.
4. Determination of specific gravity of Soils.
5. Grain size distribution analysis by sieve analysis.
6. Grain size distribution by hydrometer analysis.
7. Determination of liquid limit by Casagrande apparatus.
8. Determination of plastic limit
9. Determination of shrinkage limit.
10. Determination of coefficient of permeability using Constant-head test method.
11. Determination of coefficient of permeability using Falling-head method.
12. Compaction of soil by standard proctor test.
13. Compaction of soil by modified proctor test.
14. Determination of relative density of soil.
15. Consolidation Test.
16. Unconfined Compression Strength Test.
17. Direct Shear Test
18. Triaxial Test (UU)

Recommended Books / Manuals:

1. Soil Mechanics by Craig R.F., Chapman & Hall.
2. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons.
3. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall.
4. Principles of Geotechnical Engineering, by Braja M. Das, Cengage.
5. Learning Principles of Foundation Engineering, by Braja M. Das, Cengage Learning.

ENGINEERING GEOLOGY LAB

Subject Code: BCIES1-526	**L**	**T**	**P**	**C**	**Duration: 30 Hrs.**
	0	0	2	1	

Course Objectives:

1. To understand the role of geology in the design and construction process of underground openings in rock
2. To apply geologic concepts and approaches on rock engineering projects.
3. To identify and classify rock using basic geologic classification systems.

Course Outcomes:

1. Ability to categorize rocks and minerals by their origin and engineering properties.
2. Ability to apply geological principles to rock masses and discontinuities for use in engineering design e.g. rock slopes, foundation.
3. Gain an understanding of the societal relevance of Geological system.
4. Life-long learning of students about the identification of minerals and rocks.

Laboratory Experiments:

1. Study of physical properties of minerals.
2. Study of different group of minerals.
3. Study of Crystal and Crystal system.
4. Identification of minerals: Silica group: Quartz, Amethyst, Opal; Feldspar group: Orthoclase, Plagioclase, Cryptocrystalline group: Jasper; Carbonate group: Calcite; Element group: Graphite; Pyroxene group: Talc; Mica group: Muscovite; Amphibole group: Asbestos, Olivine, Hornblende, Magnetite, Hematite, Corundum, Kyanite, Garnet, Galena, Gypsum.
5. Identification of rocks (Igneous Petrology): Acidic Igneous rock: Granite and its varieties, Syenite, Rhyolite, Pumice, Obsidian, Scoria, Pegmatite, Volcanic Tuff; Basic rock: Gabbro, Dolerite, Basalt and its varieties, Trachyte.
6. Identification of rocks (Sedimentary Petrology): Conglomerate, Breccia, Sandstone and its varieties, Laterite, Limestone and its varieties, Shale and its varieties.
7. Identification of rocks (Metamorphic Petrology): Marble, slate, Gneiss and its varieties, Schist and its varieties. Quartzite, Phyllite.
8. Study of topographical features from Geological maps, Identification of symbols in maps.

Recommended Books / Manuals:

1. Engineering and General Geology, Parbin Singh, 8th Edition (2010), S K Kataria & Sons.
2. Text Book of Engineering Geology, N. Chenna Kesavulu, 2nd Edition (2009), Macmillan Publishers India.
3. Geology for Geotechnical Engineers, J.C. Harvey, Cambridge University Press (1982).

ENVIRONMENTAL ENGINEERING LAB

Subject Code: BCIES1-527	L	T	P	C	Duration: 30 Hrs.
	0	0	2	1	

Course Objectives:

1. To make the students good aware about water and its importance to human survival.
2. Understand how to classify and analyse various quality parameters of raw water & waste water.

3. To make the students to prepare water quality & sewage quality assessment report.
4. To make the students as to suggest required type of treatment to purify raw water.
5. To make the students as to suggest required type of treatment for waste water.
6. To make the students as analysts to differ quality requirements for industrial waters and domestic waters.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Discuss about importance of water and its quality analysis.
2. Analyse various 18hysic-chemical and biological parameters of water in case of quality requirements.
3. Assess complete water quality assessment for EIA and domestic supplies.
4. Suggest various types of treatment methods required to purify raw water with different contaminants.
5. Assess complete waste water quality assessment for their disposal.

Laboratory Experiments:

1. To measure the Ph value of a water and waste water samples.
2. To determine optimum Alum dose for Coagulation.
3. To find MPN for the bacteriological examination of water.
4. To find the turbidity of a given waste water and water samples.
5. To find B.O.D. of a given waste water sample.
6. To measure D.O. of a given sample of water.
7. Determination of Hardness of a given water sample.
8. Determination of total solids, dissolved solids, suspended solids of a given water sample.
9. To find chlorides in given samples of water and waste water.
10. To find acidity and alkalinity of water samples.
11. To determine the COD of a wastewater sample.

Recommended Books / Manuals:

1. Chemistry for Environmental Engg. & Science by Sawyer & McCarty, TMH, New Delhi.
2. Water & Waste Water Testing by Mathur, Nem Chand & Bros.
3. Manual on Sewage and Sewerage treatment by Central Public Health and Environmental Engineering Organisation (CPHEEO), GOI.
4. IS 10500: 2012, Code for Drinking Water by Bureau of Indian Standards (BIS), GOI.

6th SEMESTER

DESIGN OF CONCRETE STRUCTURES-II

Subject Code: BCIES1-621 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Learn the plastic behaviour of concrete in flexure.
2. Learn the behaviour of different types of concrete structures.

Course Outcomes:

1. Identify and compute the design loads on RCC components.
2. Able to analyze and design with detailing RCC members.
3. Ability to design and check for serviceability (crack and deflection) and ultimate limit state conditions.
4. Apply relevant Indian Standard provisions to ensure safety and serviceability of RCC structural elements.

Note: Indian Standards-IS 456, IS 3370 and Design Aid SP-16 are permitted in examination.

UNIT-I (12 Hours)

Design of Foundations: Concept, Application, Types, Components of Footing, Design of Isolated Footing (Square, Rectangular), Combined Footing (Rectangular, Trapezoidal & Strap footing) and Raft Foundation.

Design of Stairs: Introduction, Elements of Stairs-Tread, Rise, Flight, Landing, Types of Stairs, Design and Reinforcement detail of Stairs.

UNIT-II (11 Hours)

Design of Compression Members: Classifications (According to Shape, Length and loading conditions), Assumptions, Guidelines as per Indian Standards, Behavior of Compression Members, Short Compression Members under Axial Load with Uni-axial and Bi-axial Bending, Design of Slender (Long) Columns.

UNIT-III (12 Hours)

Design of Beams (Continuous and Curved): Definition, Behavior, Design of Continuous beams and Curved beams, Reinforcement detailing.

Design of Retaining Walls: Classification, Elements-Stem, Base, Heel, Toe, Behavior and design of Cantilever and Counter fort type retaining wall.

UNIT-IV (10 Hours)

Design of Domes: Types, Components, Design of Spherical and Conical Dome.

Water Tanks: Introduction, Types & uses of Underground water tanks, ground water tanks, Design of Circular and Rectangular water tanks resting on ground.

Recommended Text Books / Reference Books:

1. N. Subramanian, 'Design of Reinforced Concrete Structures', Oxford University Press.
2. Pillai & Menon, 'Reinforced Concrete Design', Tata McGraw Hill Education.
3. P.C. Varghese, 'Limit State Design of Reinforced Concrete', Prentice Hall of India Pvt. Ltd.

4. Raju N. Krishna 'Reinforced Concrete Elements'.
5. Mallick and Rangasamy, 'Reinforced Concrete', Oxford-IBH.

FOUNDATION ENGINEERING

Subject Code: BCIES1-622 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. Analyse earth retaining structures to determine earth pressures.
2. Analyse bearing capacity of soils under shallow footings.
3. Design shallow footings based on dimensions, thickness, area and length.
4. Determine the bearing capacities of single pile in sand and clay using static method and the distribution of load in group piles as well as their efficiencies.
5. Conduct basic technical investigations, compile and analyse information, and produce a brief and concise report with an appropriate conclusion.

Course Outcomes:

After successful completion of this course, the students would:

1. Learn about types and purposes of different foundation systems and structures.
2. Have an exposure to the systematic methods for designing foundations.
3. Be able evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.
4. Have necessary theoretical background for design and construction of foundation systems.

UNIT-I (11 Hours)

Soil Investigation: Soil Investigation for new and existing structures. Depth of exploration for different structures, spacing of bore Holes, Methods of soil exploration and relative merits and demerits. Types of soil sample. Design features of sampler affecting sample disturbance, Essential features and application of various types of samplers, Geophysical exploration by seismic and electrical resistivity methods, Standard Penetration Test and Plate load test, Bore hole log.

Stresses in Soil: Boussinesq's equation for a point load, uniformly loaded circular and rectangular area, pressure distribution diagrams, Isobars, New mark's chart and its construction, Approximate method of load distribution, Comparison of Boussinesq's & Westergaard analysis for a point load.

UNIT-II (10 Hours)

Earth Pressure: Terms and symbols used for a retaining wall, Movement of wall and the lateral earth pressure, Earth pressure at rest, Rankine states of plastic equilibrium, Coefficient of active and passive earth pressures for horizontal backfills, Rankine's theory both for active and passive earth pressure for Cohesion-less and cohesive soil, Coulomb's method for cohesion less backfill, Merits and demerits of Ranking and Coulomb's theories, Culmann's graphical construction (without surcharge load).

UNIT-III (12 Hours)

Shallow Foundation: Type of shallow foundations, Factors affecting choice of foundation, Factors

affecting the depth of foundation. Definition of ultimate bearing capacity, safe bearing capacity and allowable bearing capacity, Terzaghi's analysis. Types of failures, Factors affecting bearing capacity, Skempton's equation, B.I.S. recommendations for shape, depth, inclination factors and water table corrections, Causes of settlement of structures, Immediate and consolidation settlement, calculation of settlement by plate load Test and Static Cone penetration test data, Allowable settlement of various structures according to I.S. Code, Introduction of rafts and floating foundation.

UNIT-IV (12 Hours)

Pile Foundations: Types, Necessity and uses of piles, Classification of piles, Types of pile driving hammers & their comparison, Determination of load carrying capacity of driven piles by dynamic formulae, Cyclic Pile Load Test, Determination of point resistance and frictional resistance of a single pile by Static formulas in sand and clay, Spacing of piles in a group, Group action of piles, Calculation of settlement of friction pile group in clay, Settlement of pile groups in sand, Negative skin friction.

Caissons and Wells: Major areas of use of caissons, advantages and disadvantages of open box and pneumatic caissons, Essential part of a pneumatic caisson, Components of a well foundation, Calculation of allowable bearing pressure, Conditions for stability of a well, Forces acting on a well foundation, Computation of scour depth.

Recommended Text Books / Reference Books:

1. K.R. Arora, 'Soil Mech. & Foundation Engg,' Standard Publishers Distributors.
2. V.N.S. Murthy, 'Soil Mech. & Foundation Engg.'
3. Gopal Ranjan and A.S.R. Rao, 'Basic and Applied Soil Mechanics', New Age International.
4. Muni Budhu, 'Soil Mech. & Foundations', Wiley, John Wiley & Sons.
5. Gulhati and Datta, 'Geotechnical Engineering', Tata McGraw Hill Education.

PROFESSIONAL PRACTICE & LAW

Subject Code: BCIES1-623 | **L T P C** | **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

The course should enable the students to:

1. Provide the ability to estimate the quantities of item of works involved in buildings, water supply & sanitary works, road works and irrigation works etc.
2. Equip the student with the ability to do rate analysis, valuation of properties and preparation of reports for estimation of various items.
3. Understand the technical specifications for various works to be performed for a project.
4. Impact the cost of a structure and also able to understand how competitive bidding works
5. How to submit a competitive bid proposal.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Understand the preparation of an abstract estimate for a residential building, roads,

irrigation projects, bridges, etc.

2. Analyse the units for various quantities of items of work & also evaluate the rates for various items of work
3. Design and prepare bar bending schedule for reinforcement works.
4. Evaluate the valuation of buildings & preparation of standard specifications for different items.

UNIT-I (16 Hours)

Estimating: Different types of estimates, methods of estimating and scheduling quantities for the following works: Building, culverts, bridges, irrigation works, steel structures, road works, canal works, sanitary and water supply works, roofs, R.C.C. work, cost sensitive index.

Analysis of Rates: Schedule of rates (As per CSR Punjab-2016), Analysis of rates: earth work, brick masonry, stone masonry, cement concrete, RCC work, iron work, plastering, flooring, white washing, painting, wood work, Road work.

UNIT-II (15 Hours)

Specifications: Detailed specifications of the following: earth work in foundation, lean concrete in foundation, cement concrete, RCC, brick work, plastering, painting, C.C. floor, mosaic floor, white washing, distempering, varnishing, painting, doors and windows, DPC, centering and shuttering, cement mortar, brick ballast and sand.

UNIT-III (15 Hours)

Valuation: Gross income, net income, outgoing, scrap value, salvage value, obsolescence, annuity, capitalized value, year's purchase, sinking fund, depreciation, book value, valuation of building, determination of depreciation, method of valuation, life of various items of works, different types of lease, fixation of rates, plinth area required for residential & commercial building, Arbitration, Introduction to Acts pertaining to-Minimum wages, Workman's compensation.

UNIT-IV (14 Hours)

Accounts Procedures: Regular and work charged establishment, pay bill, ACR, classifications of works, contract, tender, tender notice, earnest money, security money, arranging contract, power of accepting tender, daily labour, muster roll, classification of contracts, penalty, measurement book, account procedures of stores, stock accounting, Introduction to forms and bills, Advance payment, hand receipt, refund of security money, cash book, imprest, deposit works, temporary advances, treasury challan, inventory, administrative approval, competent authority, building bye laws.

Recommended Text Books / Reference Books:

1. Estimating & Costing in Civil Engineering: Theory & Practice by B.N. Dutta, UBS Publishers Distributors Ltd.
2. Estimation and Costing in Civil Engineering, by Birdie, G.S., Dhanpat Rai Publishing Co. Ltd, New Delhi, 2011.
5. Estimation, Costing, Specifications and Valuation in Civil Engineering, Chakraborti M, National Halftone Co. Calcutta
4. Estimating and Costing for Building & Civil Engineering Works by P.L. Bhasin.

5. Standard Schedule of rates and standard data book by Public Works Department.
6. National building code of India.
7. I.S. 1200 (Parts I to XXV – 1974/method of measurement of building and Civil Engineering works – B.I.S.

IRRIGATION ENGINEERING

Subject Code: BCIES1-624 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. The concepts, techniques and modernization of irrigation.
2. Design lined and un-lined canals for irrigations.
3. Different theories/ methods to design lined and un-lined canals.
4. Losses in canals and its control measures.
5. Construction of well and tube well.
6. River training works.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Recognize the concepts, techniques and modernization of irrigation.
2. Plan and design lined and un-lined canals for irrigations.
3. Apply different theories/ methods to design lined and un-lined canals.
4. Learn losses in canals and its control measures.
5. Design and construction of well and tube well.
6. Learn about river training works.

UNIT-I (10 Hours)

Introduction: Importance of irrigation engineering, purposes of irrigation, objectives of irrigation, benefits of irrigation, advantages of various techniques of irrigation: Furrow irrigation, boarder strip irrigation, basin irrigation, sprinkler irrigation, drip irrigation.

Methods of Irrigation: Advantages and disadvantages of irrigation, water requirements of crops, factors affecting water requirement, consumptive use of water, water depth or delta, Duty of water, relation between delta, duty and base period, Soil crop relation-ship and soil fertility.

UNIT-II (16 Hours)

Canal Irrigation: Classifications of canals, canal alignment, Inundation canals, Bandhara irrigation, advantages and disadvantages, Silt theories-Kennedy's theory, Lacey's theory, Drawbacks in Kennedy's & Lacey's theories, comparison of Lacey's and Kennedy's theories, Design of unlined canals based on Kennedy & Lacey's theories, suspended and bed loads.

Lined Canals: Types of lining, selection of type of lining, Economics of lining, maintenance of lined canals, silt removal, strengthening of channel banks, measurement of discharge in channels, design of lined canals, methods of providing drainage behind lining.

UNIT-III (10 Hours)

Losses in Canals, Water Logging and Drainage: Losses in canals-Evaporation and seepage, water logging, causes and ill effects of water logging- anti water logging measures. Drainage of land, classification of drains – surface and subsurface drains Design considerations for surface drains, Advantages and maintenance of tile drains.

River Training Works: Objectives, classification of river-training works, Design of Guide Banks. Groynes or spurs – Their design and classification ISI. Recommendations of Approach embankments and afflux embankments, pitched Islands, natural cut-offs and artificial cut-offs and design Considerations.

UNIT-IV (09 Hours)

Tube Well Irrigation: Types of tube – wells – strainer type, cavity type and slotted type. Type of strainers, Aquifer, porosity, uniformity coefficient, specific yield & specific retention, coefficients of permeability, transmissibility and storage. Yield or discharge of a tube well, Assumptions, Theim's & Dupuit's formulae. Interference of tube wells with canal or adjoining tube-wells, optimum capacity, causes of failure of tubewells. Duty and delta of a tube well. Rehabilitation of tube well.

Recommended Text Books / Reference Books:

1. Principles & practice of Irrigation Engg. S.K. Sharma.
2. Irrigation & Water Power Engg. B.C. Punmia, Pande B.B. Lal
3. Fundamentals of Irrigation Engg. Dr. Bharat Singh
4. Irrigation Engg. & Hydraulic Structure S.R. Sahasrabudhe.
5. Irrigation Engg. & Hydraulic Structure Varshney, Gupta & Gupta
6. Irrigation Engg. & Hydraulic Structure Santosh Kumar Garg

MATRIX METHODS OF ANALYSIS

Subject Code: BCIED1-651 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To provide a reasonably comprehensive treatment of matrix methods in structural analysis of skeletal i.e. framed structure in recent years.
2. To develop the elegant finite element method this is nothing but the extension of it.
3. To give engineering students and practicing professionals the fundamentals of the background theory necessary in commercial frame analysis program.

Course Outcomes:

1. Students will be able to analyze skeletal i.e. framed structures.
2. They will be able to differentiate between the flexibility and stiffness methods of structural analysis.
3. They will be able to access computers that permit the use of the stiffness method for analyzing traditional civil engineering structures, air frame, space structures etc.

UNIT-I (12 Hours)

Basic Concepts of Structural Analysis: Introduction, Types of Framed Structures, Deformations in Framed Structures, Equilibrium, Compatibility, Static and kinematic indeterminacies of beams, rigid-jointed plane and space frames, pin-jointed plane and space frames and hybrid structures, Structural Mobilities, Principle of Superposition, Equivalent Joint Loads, Energy Concepts and Virtual Work.

Flexibility & Stiffness Matrices: Actions and Displacements, Action and Displacement equations, Generalized System of Coordinates, Slope-Deflection equations in Generalized Coordinates, Axes and Coordinates, Flexibility and Stiffness Influence Coefficients, Flexibility Matrix, Stiffness Matrix, Relation between Flexibility and Stiffness Matrices, Basic definitions and types of matrices, matrix operations, matrix inversion, solution of linear simultaneous equations, matrix partitioning.

UNIT-II (11 Hours)

Flexibility Matrix (Physical Approach): Development of flexibility matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach.

Stiffness Matrix (Physical Approach): Development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using physical approach, reduced stiffness matrix, total stiffness matrix, translational or lateral stiffness matrix.

UNIT-III (11 Hours)

Flexibility Matrix (Element Approach): Transformation of system forces to element forces through force transformation matrix, Development of flexibility matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using Element Approach.

Stiffness Matrix (Element Approach): Transformation of system displacements to element displacements through displacement transformation matrix, Development of stiffness matrices for statically determinate and indeterminate beams, rigid-jointed plane frames and pin-jointed plane frames using Element Approach.

UNIT-IV (11 Hours)

Flexibility Method of Analysis: Analysis of continuous beams, rigid-jointed plane frames and pin-jointed plane frames using the physical and element approaches, effect of support settlements, temperature stresses and lack of fit.

Stiffness Method of Analysis: Analysis of continuous beams, rigid-jointed plane frames and pin-jointed plane frames using the physical and element approaches, effect of support settlements, temperature stresses and lack of fit, comparison of flexibility and stiffness methods of analysis.

Recommended Text Books / Reference Books:

1. G.S. Pandit and S.P. Gupta, 'Structural Analysis, A Matrix Approach'.
2. William Weaver, Jr. James M. Gere, 'Matrix Analysis of Framed Structures'.

3. C.S. Reddy, 'Basic Structural Analysis'.
4. C.S. Krishnamurthy, 'Finite Element Analysis'.
5. O.C. Zeincwicz, 'Finite Element Methods'.

SOLID & HAZARDOUS WASTE MANAGEMENT

Subject Code: BCIED1-652 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. Understanding of problems of municipal waste, biomedical waste, hazardous waste, E-waste, industrial waste etc.
2. Knowledge of legal, institutional and financial aspects of management of solid wastes.
3. Become aware of Environment and health impacts of solid waste mismanagement
4. Understand engineering, financial and technical options for waste management.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Do sampling and characterization of solid waste.
2. Analysis of hazardous waste constituents including QA/QC issues
3. Apply steps in solid waste management like waste reduction at source, collection techniques, recycling, transport, optimization of solid waste.
4. Analyse treatment & disposal techniques and economics of the onsite vs. Offsite waste management.

UNIT-I (12 Hours)

Sources and Composition of Solid Waste: Solid Waste Introduction, Sources of solid waste, types & classification of solid waste, Composition of solid waste & its determination, Types of materials recovered from MSW.

Properties of Municipal Solid Wastes: Physical properties of Municipal Solid Waste, Chemical properties of Municipal Solid Waste, Biological properties of Municipal Solid Waste, Transformation of Municipal Solid Waste.

UNIT-II (12 Hours)

Solid Waste Generation and Collection: Quantities of Solid Waste, Measurements and methods to measure solid waste quantities, Solid waste generation and collection, Factors affecting solid waste generation rate, Quantities of materials recovered from MSW.

Handling, Separation and Storage of Solid Waste: Handling and separation of solid waste At site, Material separation by pick in, screens, float and separator magnets and electromechanical separator and other latest devices for material separation, Waste handling and separation at Commercial and industrial facilities, Storage of solid waste at the sources.

UNIT-III (12 Hours)

Processing of Solid Waste: Processing of solid waste at residence e.g. Storage, conveying,

compacting, Shredding, pulping, granulating etc., Processing of solid waste (Size & volume reduction)

Disposal & Treatment of Solid Waste: Combustion and energy recovery of municipal solid waste, effects of combustion, Sanitary landfill: Classification, planning, landfill processes, landfill design, landfill operation & bioreactors, Compositing, Incineration, Pyrolysis & gasification, Landfill leachate & gas management.

UNIT-IV (09 Hours)

Solid Waste Management: Solid waste (management and handling) rules, hazardous waste (management and handling) rules, biomedical waste handling rules, Fly ash management & handling rules, recycled plastics usage rules, e-waste management rules, batteries (management and handling) rules, solid waste management in rural area, Recent advances in solid waste management.

Recommended Text Books / Reference Books:

1. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, New Delhi.
2. Vesilind P.A., Worrell W. And Reinhart D.R., "Solid Waste Engineering", Thomson Books.
3. Bhide A.D. and Sundaresan B.B., "Solid Waste Management, Collection, Processing and Disposal", Nagpur.
4. Tchobanoglous G., Theisen H. And Vigil S.A., "Integrated Solid Waste Management", McGraw-Hill International editions.
5."Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Urban Development, Government of India.
6. Management and Handling Rules for: municipal solid waste, biomedical waste, hazardous waste and radioactive wastes, Government of India Publications.

PAVEMENT DESIGN

Subject Code: BCIED1-653 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. The objective of this course is to train the students about how to design the crust thickness of highway and airfield pavements.
2. To introduce and practice the design principles and methods of flexible and rigid pavements being used worldwide.
3. To give special emphasis on design methods prescribed by the Indian Roads Congress for flexible and rigid pavements in India
4. To acquaint the students about strengthening of existing pavement structures and some modern pavement design concepts.

Course Outcomes:

1. The students will learn about how to design the crust thickness of highway and airfield pavements.

2. They will learn the design principles and methods of flexible and rigid pavements being used worldwide.
3. They will learn in detail the design methods prescribed by the Indian Roads Congress for flexible and rigid pavements in India.
4. The students will get exposure to methodology of strengthening of existing pavement structures and some modern pavement design concepts.

UNIT-I (10 Hours)

Introduction: Desirable characteristics of pavement, types and components, difference between highway and airfield pavement, functions of pavement components, comparison between rigid and flexible pavement.

Fundamentals of Design of Pavements: design life, traffic factors, climatic factors, subgrade strength and drainage, stresses and deflections; Burmister's two layered analysis.

UNIT-II (12 Hours)

Flexible Pavement Design Factors: Design wheel load, contact pressure, ESWL concept, determination of ESWL by equivalent deflection criteria, stress criteria, soil subgrade strength using CBR value.

Flexible Pavement Design Methods: Group Index method, McLeod method, Kansas method, California Resistance Value method, IRC: 37-2018 method.

UNIT-III (12 Hours)

Rigid Pavement Design: Principles, factors - wheel load and its repetition, properties of sub grade, properties of concrete. Westergaard's analysis – critical stresses, wheel load stresses, warping stress, frictional stress, and combined stresses.

Design Methods of Rigid Pavements: Design of cement concrete pavements by IRC:58-2015, PCA method, AASHTO method, reinforcement in slabs, requirements of joints, types of joints – expansion joint, contraction joint, warping joint, construction joint, longitudinal joint.

UNIT-IV (11 Hours)

Strengthening of Existing Pavements: Pavement overlays, types, design equations, flexible pavement overlay design as per IRC: 81-1997 using Benkelman beam.

Modern Pavement Design Concepts: Bituminous pavement with cemented base, interlocking concrete block pavement, roller compacted concrete pavement, full depth bituminous pavement, ultrathin white topping, perpetual pavement.

Recommended Text Books / Reference Books:

1. E.J. Yoder & M.W. Witczak, 'Principals of Pavement Design', Wiley Publication, New York.
2. S.K. Khanna and C.E.G. Justo, 'Highway Engineering', Nem Chand & Bros., Roorkee.
3. S.K. Sharma, 'Principles, Practice and Design of Highway Engineering', S. Chand & Co.
4. P. Chakraborty & A. Das, "Principles of Transportation Engg", Prentice Hall India, New Delhi.
5. Yang H. Huang, 'Pavement Analysis and Design', Pearson Publishers.

GROUND IMPROVEMENT TECHNIQUES

Subject Code: BCIED1-654 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To understand the objectives, necessity and scope of ground improvement techniques.
2. To learn different methods of in-situ densification of cohesive, cohesion-less soils.
3. To learn the classification, functions and applications of Geo-synthetics in ground improvement.
4. To learn the process of identification of necessity for ground improvement, finding alternative methods and recommendation of the ideal technique through case studies.

Course Outcomes:

1. Ability to understand the necessity of ground improvement and potential of a ground for improvement.
2. To gain comprehensive understanding about the improvement of in-situ cohesive soils as well as Cohesion less soils.
3. Competence to analyse an in-situ ground, identification of ground improvement techniques feasible, selection of the ideal method, its planning, design, implementation and evaluation of improvement level.

UNIT-I (12 Hours)

General : Formation of rock, soils and soil profiles, soil distribution in India and other countries - marine, black cotton soils (expansive)., lateritic, alluvial, desert soils peat etc., factors affecting the alteration of ground after formation – natural and man-made – reclaimed soils – methods of Geotechnical processes.

Compaction Methods: moisture density relations – compactive efforts – field methods – surface compaction, deep compactions- vibro compaction methods, vibro-probes, stone columns, sand compaction, stone column piles, selection of methods – quality control – specifications for compaction process for solving field problems.

UNIT-II (11 Hours)

Drainage Methods: seepage, ground water seepage control – filter requirements methods of dewatering – well point methods of discharge computations – design of steps for dewatering – design of well screens selection of pumps and accessories – deep bored wells. Pre-compression methods: compressibility and consolidation properties of soils estimation of rate of consolidation settlements – accelerating methods monitoring compressions – design of vertical drains – consolidation by electro osmosis and vacuum compression methods.

UNIT-III (11 Hours)

Grouting and Injection Methods: principles, design methods, selection of methods and requirements. Aspects of grouts, types of grouts and chemical applications, seepage control, solidification and stabilization – equipment and accessories used – quality control – specifications for achieving satisfactory results.

UNIT-IV (11 Hours)

Stabilization Methods: Mechanical, cement, lime, chemical methods of stabilization of soils – use of admixtures – polymers – geosynthesis –reinforcements thermal slurry trenches, void filling – prewetting –improving rock stability methods – exercise quality control to achieve desired results.

Recommended Text Books / Reference Books:

1. J.E. Bowles – Foundation Design & Analysis, McGraw-Hill Edition.
2. Ground improvement techniques by P. Purushottam Raj, Laxmi Publication.
3. F. S. Fang Handbook of Foundation Engg. CBS Publication, 1985.

SOIL MECHANICS & FOUNDATION ENGINEERING LAB

Subject Code: BCIES1-625 **L T P C** **Duration: 30 Hrs.**

0 0 2 1

Course Objectives:

1. To carry out all foundation engineering experiments according to standards.
2. Analyze and interpret experimental data.
3. To understand the techniques, skills and modern engineering tools necessary for engineering practice.
4. Knowledge of site specific field investigations including collection of soil samples for testing and observation of soil behaviour.

Course Outcomes:

1. Be able to perform and evaluate un-soaked and soaked California bearing ratio (CBR) tests used to estimate subgrade behaviour.
2. Be able to perform and evaluate load carrying capacities of piles.
3. Be able to perform and evaluate load carrying capacities of shallow foundation
4. Be able to perform and evaluate permeability of soil.

Laboratory Experiments:

1. Determination of soaked and un-soaked CBR value of soil in laboratory
2. Determination of soaked and un-soaked CBR value of soil in field
3. Determination of shear strength by vane shear test
4. Determination of coefficient of permeability in the field by pumping in method.
5. Determination of bearing capacity of soil by standard penetration test.
6. Determination of bearing capacity of soil by dynamic cone penetration test.
7. Determination of bearing capacity of soil by plate load test.
8. Determination of vertical load carrying capacity of a pile.
9. Determination of lateral load carrying capacity of a pile.
10. Determination of uplift capacity of a pile.

11. Determination of coefficient of sub grade reaction for the design of pavements.

12. Determination of load carrying capacity of soil by static cone penetration test.

Recommended Books / Manuals:

6. Soil Mechanics by Craig R.F., Chapman & Hall.
7. Fundamentals of Soil Engineering by Taylor, John Wiley & Sons.
8. An Introduction to Geotechnical Engineering, by Holtz R.D. and Kovacs, W.D., Prentice Hall,
9. Principles of Geotechnical Engineering, by Braja M. Das, Cengage.
10. Learning Principles of Foundation Engineering, by Braja M. Das, Cengage Learning.
11. Relevant IS Codes.

CONCRETE TECHNOLOGY LAB-II

Subject Code: BCIES1-626	L	T	P	C	Duration: 30 Hrs.
	0	0	2	1	

Course Objectives:

The course should enable the students to:

1. Give practical exposure of laboratory testing & mix design of different kinds of concrete.
2. Determine the engineering properties of concrete & tile in terms of strength, strain, fatigue, creep, elasticity, stiffness, durability and workability.
3. Use of different chemical admixtures with concrete to enhance its properties.
4. Exercise better quality control in a civil construction project.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Analyze & describe the properties of hardened concrete.
2. Knowledge of concrete mix design philosophy & analysis of these philosophies.
3. Design concrete mixes which fulfils the required properties for fresh and hardened concrete for sustainable development.
4. Test of different concrete property to specify quality of concrete.
5. Give practical exposure for laboratory testings and make their effective reports & presentations.

Laboratory Experiments:

1. To determine the workability of Concrete by Slump Cone & Vee-Bee Time Method.

2. To determine the workability of Concrete by Compaction Factor Method.

3. To test the different properties of Concrete Admixtures as per IS 9103.

4. Design Mixes of Concrete by IS methods.

5. Design Mixes of Concrete with admixture by IS methods.

6. To determine the Compressive Strength of Concrete by Cube test.

7. To determine the Compressive Strength of Concrete by Cylinder test.

8. To determine the Flexural strength of Concrete.
9. To determine the Split Tensile strength of Concrete.
10. To determine the Permeability of Concrete.
11. To determine the Compressive strength, Water Absorption & Specific Gravity of polished building stones (Granite).
12. Size & Load Test of Manhole Covers as per IS method.

Recommended Books / Manuals:

1. M.L. Gambhir, 'Building and Construction Materials: Testing and Quality Control', TMH.
2. Concrete Lab Manual by NITTTR Chandigarh.
3. Concrete Technology, Theory and Practice by M.S. Shetty, S. Chand & Company.

COMPUTER-AIDED CIVIL ENGINEERING DRAWING-II

Subject Code: BCIES1-627	**L**	**T**	**P**	**C**	**Duration: 30 Hrs.**
	0	0	2	1	

Course Objectives:

The students will be able to

1. Develop structural designs.
2. Understand design procedures and ways- The student learn to interpret drawings, and to produce designs using Civil Engineering software.

Course Outcomes:

1. Ability to use the software packers for drafting and modelling.
2. Design and draw working structural drawings of various concrete, steel, hydraulic, etc. structures and their components & members.
3. Understand and interoperate design aids and handbooks.
4. Use of relevant Indian Standard specifications applicable to reinforced concrete, steel, hydraulic and other structures.

Laboratory Experiments:

1. Advanced Structural Drawings of concrete elements.
2. Advanced Structural Drawings of steel elements.
3. Hydraulic Structures: Canal sections, Guide Bank, Weir/Barrage, Head/ Cross regulators, Canal falls, Cross Drainage works.
4. Structural drawings of R.C.C. building (Single & multi storey).

Recommended Books / Manuals:

1. Engineering graphics with Auto CAD- R.B. Choudary, Anuradha Publishes.
2. Computer Aided Drafting & Modeling Lab by K. Venugopal, Raja, Scitech Publications.
3. Computer Aided Design Laboratory by M.N. Shesha Prakash, G.S. Suresh, Laxmi Publications.

CONSTITUTION OF INDIA

Subject Code: BMNCC0-001	L	T	P	C	Duration: 30 Hrs.
	2	0	0	0	

Course Objectives:

The objective of this non-credit but mandatory course is:

1. To apprise the students about the Constitution of India which provides the framework for the structure, procedure, power and duties of the government, judiciary, institutions and agencies involved in all spheres of public life in India.
2. To enable the student to understand the importance of constitution.
3. To understand the structure of executive, legislature and judiciary.
4. To understand philosophy of fundamental rights and duties.
5. To understand the central and state relation, financial and administrative relations.

Course Outcomes:

1. Able to understand historical background of the constitutional making and its importance for building a democratic India, the structure of Indian government, the structure of state government, the local Administrations.
2. Able to apply the knowledge on directive principle of state policy, the knowledge in strengthening of the constitutional institutions like CAG, Election Commission and UPSC for sustaining democracy.
3. Able to analyze the History, features of Indian constitution, the role Governor and Chief Minister, role of state election commission, the decentralization of power between central, state and local self-government.
4. Able to evaluate Preamble, Fundamental Rights and Duties, Zilla Panchayat, block level organization, various commissions like SC/ST/OBC and women.

Course Contents:

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of 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 the 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.

Recommended Text Books / Reference Books:

1. Our Constitution by Subhash C. Kashyap.
2. An Introduction to the Constitution of India by M.V. Pylee.
3. An Introduction to the Constitution of India by Dr. Durga Das Basu.
4. The Indian Constitution: Cornerstone of a Nation by Granville Austin.

Total Credits= 21

Semester-VII (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BCIES1-721	Transportation Engineering-II	3	0	0	40	60	100	3
BCIES1-722	Earthquake Engineering	2	0	0	40	60	100	2
Departmental Elective-V (Select any one)		3	0	0	40	60	100	3
BCIED1-751	Water Recourses Engineering							
BCIED1-752	Air & Noise Pollution and Control							
BCIED1-753	Pipeline Engineering							
Departmental Elective-VI (Select any one)		3	0	0	40	60	100	3
BCIED1-761	Prestressed Concrete							
BCIED1-762	Pavement Construction and Management							
BCIED1-763	Soil Reinforcing Techniques							
XXXXX	Open Elective**	3	0	0	40	60	100	3
BCIES1-723	Software Lab	0	0	2	60	40	100	1
BCIES1-724	Project-I	0	0	6	60	40	100	3
BCIES1-725	Training-III*	0	0	0	60	40	100	3
Total		**-**	**-**	**-**	**380**	**420**	**800**	**21**

*Internship will be imparted at the end of 6thsemesteras per AICTE Internship Policy.

**Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.

Total Credits= 16

Semester-VIII (B. Tech Civil Engg.)		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BCIES1-821	Design of Steel Structures-II	3	0	0	40	60	100	3
Departmental Elective-VII (Select any one)		3	0	0	40	60	100	3
BCIED1-851	Bridge Engineering							
BCIED1-852	Design of Industrial Structures							
BCIED1-853	Disaster Management							
Departmental Elective-VIII (Select any one)		3	0	0	40	60	100	3
BCIED1-861	Engineering Hydrology							
BCIED1-862	Port and Harbour Engineering							
BCIED1-863	Geotechnical Design							
XXXXX	Open Elective**	3	0	0	60	40	100	3
BCIES1-822	Project-II	0	0	6	60	40	100	3
BCIES1-823	Advanced Testing Lab	0	0	2	60	40	100	1
BMNCC0-006	Essence of Indian Knowledge Tradition(Mandatory Course)	2	0	0	100	---	100	0
Total		**-**	**-**	**-**	**400**	**300**	**700**	**16**

**Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.

Overall Marks / Credits

Semester	Marks	Credits
1st	900	19
2nd	900	20
3rd	1100	24
4th	900	20
5th	1000	23
6th	1000	22
7th	800	21
8th	700	16
Total	**7300**	**165**

7th SEMESTER

TRANSPORTATION ENGINEERING-II					
Subject Code: BCIES1-721	**L**	**T**	**P**	**C**	**Duration: 45 Hrs.**
	3	0	0	3	

Course Objectives:

1. The objective of this course is to acquaint the students about highway planning and development in India.
2. The course will cover selection of highway alignment, design of geometric elements of highways, carry out traffic studies and implement traffic regulation and control measures and intersection design.
3. The characteristic properties of road construction materials and design of flexible and rigid pavements as per IRC guidelines shall also be covered in this course.

Course Outcomes:

1. The student will learn about essentials of highway planning and features of highway development in India.
2. The student will learn how to do selection of highway alignment and design the geometric elements of highways.
3. The student will learn how to carry out traffic studies and implement traffic regulation and control measures and intersection design.
4. The student will know about characteristic properties of road construction materials and design the flexible and rigid pavements as per IRC guidelines.

UNIT-I (12 Hours)

Highway Development and Planning: Classification of roads, road development in India, current road projects in India, highway alignment and project preparation.

Geometric Design of Highways: Highway cross section elements, sight distance, design of horizontal alignment, design of vertical alignment.

UNIT-II (11 Hours)

Traffic Characteristics & Studies: Road user characteristics, driver characteristics, vehicular characteristics. Volume studies, speed studies, O-D survey, parking study.

Traffic Safety and Control Measures: Traffic signs, markings, islands, signals, cause and type of accidents, use of intelligent transport system.

UNIT-III (11 Hours)

Pavement Materials: Materials used in highway construction- soils, stone aggregates, bituminous binders, desirable properties, tests, requirements for different types of pavements.

Paving Mixes: Marshall method of bituminous mix design, Superpave, Concrete mix design for rigid pavements.

UNIT-IV (11 Hours)

Design of Pavements: Pavement types, factors affecting design and performance of pavements, flexible pavements- components and functions, stresses in flexible pavements, design of flexible pavements as per IRC.

Rigid Pavements- components and functions, stresses in rigid pavements, design of cement concrete pavements as per IRC.

Recommended Text Books / Reference Books:

1. Khanna, S.K., Justo, C.E.G and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros., Roorkee.
2. Kadiyali, L.R., 'Traffic Engineering and Transport Planning', Khanna Publishers, Delhi.
3. Partha Chakraborty, ' Principles of Transportation Engineering, PHI Learning, New Delhi.
4. S.K. Sharma, 'Principles, Practice & Design of Highway Engineering', S. Chand & Company Ltd., New Delhi.
5. Fred L. Mannering, Scott S. Washburn, Walter P. Kilareski, 'Principles of Highway Engineering and Traffic Analysis', John Wiley& Sons, USA.
6. Paul H. Wright and Karen K. Dixon, 'Highway Engineering', Wiley Student Edition, USA.
7. C.A.O. Flaherty, 'Highway Engineering', Vol. 2, Edward Arnold, London.

EARTHQUAKE ENGINEERING

Subject Code: BCIES1-722 **L T P C** **Duration: 30 Hrs.**

2 0 0 2

Course Objectives:

1. The primary objective of earthquake resistant design is to prevent building collapse during earthquakes thus minimising the risk of death or injury to people in or around those buildings.
2. The potential consequences of strong earthquakes on urban areas and civil infrastructure.
3. Design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

Course Outcomes:

1. The students will gain an experience in the implementation of Earthquake Engineering on engineering concepts which are applied in field Structural Engineering.
2. The students will get a diverse knowledge of earthquake engineering practices applied to real life problems.
3. The students will learn to understand the theoretical and practical aspects of earthquake engineering along with the planning and design aspects.

UNIT-I (05 Hours)

Introduction to Earthquakes: Causes of earthquakes, basic Terminology, Magnitude, Intensity, Peak ground motion parameters, Seismic Zoning Map of India, Seismograms and Accelerogram. Past earthquakes and Lessons learnt.

UNIT-II (10 Hours)

Introduction to Dynamics: Theory of Vibrations, Sources of Vibrations, Types of Vibrations, Degree of Freedom, spring action and damping, Single Degree of Freedom (SDOF) Systems – Formulation of equations of motion –Undamped and damped free vibration –Damping –Response

to harmonic excitation –Concept of response spectrum. Multi-Degree of Freedom (MDOF) Systems: -Formulation of equations of motion –Free vibration –Determination of natural frequencies of vibration and mode shapes –Orthogonal properties of normal modes –Mode superposition method of obtaining response.

UNIT-III (08 Hours)

Lateral Force Analysis: Lateral Strength, stiffness, ductility and structural configuration, Floor Diaphragm action, Moment resisting frames, shear walls.
Codal Design Provisions: Review of the latest Indian seismic code IS:1893 (Part-I) provisions for buildings –Earthquake design philosophy.

UNIT-IV (07 Hours)

Codal Detailing Provisions: Review of the latest Indian Seismic codes IS: 4326 and IS: 13920 provisions for ductile detailing of R.C buildings –Beam, column and joints, Design of Shear walls as per IS: 13920 –Detailing of reinforcements.

Recommended Text Books / Reference Books:

1. Earthquake Resistant Design of Structures, Pankaj Aggrawal, Manish Shrikhande, PHI Learning
2. Dynamics of Structures: Theory and Applications to Earthquake Engineering, AK Chopra, Prentice Hall
3. Dynamics of Structures, R.W. Clough and Joseph Penzien, McGraw-Hill Education
4. Structural Dynamics by Mario & Paz, Springer.
5. Earthquake Resistant Design by David J. Dowrick, Wiley India Pvt. Ltd.
6. Elements of Earthquake Engg. by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra,
7. IS 1893-2016 Indian Standard Criteria for Earthquake Resistant Design of Structures
8. IS 4326-1993 Indian Standard for Earthquake Resistant Design and Construction of Buildings
9. IS 13920:2016- Ductile design and detailing of Reinforced Concrete Structures subjected to Seismic Forces

WATER RESOURCES ENGINEERING

Subject Code: BCIED1-751	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

Course Objectives:
The course should enable the students to:
1. Types of diversion headworks, seepage theories.
2. Design of weirs.
3. Spillways
4. Design of canal regulators, canal falls, cross drainage works.
5. Classification of canal outlets, design of types of outlets.

Course Outcomes:
Upon successful completion of this course, student will be able to:
1. To study types of diversion headworks, seepage theories

2. To design weirs
3. To learn about spillways
4. Design of canal regulators, canal falls, cross drainage works
5. Classify canal outlets, design outlets.

UNIT-I (12 Hours)

Head Works: Types of head works, Functions and investigations of a diversion head work: component parts of a diversion head work and their design considerations, silt control devices.
Theories of Seepage: Seepage force and exit gradient, assumptions and salient features of Bligh's Creep theory, Limitations of Bligh's Creep theory, salient features of Lane's weighted Creep theory and Khosla's theory, Comparison of Bligh's Creep theory and Khosla's theory, Determination of uplift pressures and floor thickness.

UNIT-II (13 Hours)

Design of Weirs: Weirs versus barrage, types of weirs, main components of weir, causes of failure of weir and design considerations with respect to surface flow, hydraulic jump and seepage flow. Design of barrage or weir.
Spillways: Components of spillways, types of gates for spillway crests, creagers profiles neglecting velocity of approach, profile taking velocity of approach into account, upstream lip and approach ramp, advantages of gated spillways, discharge characteristics of spillways.

UNIT-III (08 Hours)

Canal Regulators: Offtake alignment, cross-regulators – their functions and design, Distributory head regulators, their design, canal escape.
Canal Falls: Necessity and location, types of falls and their description, selection of type of falls, Principles of design, Design of Sarda type, straight glacis and Inglis or baffle wall falls.

UNIT-IV (12 Hours)

Cross-Drainage Works: Definitions, choice of type, Hydraulic design consideration, Aqueducts their types and design, siphon aqueducts – their types and design considerations, super passages, canal siphons and level crossing.
Canal Outlets: Essential requirements, classifications, criteria for outlet behaviors, flexibility, proportionality, sensitivity, sensitiveness, Details and design of non-modular, semi-modular and modular outlets.

Recommended Text Books / Reference Books:

1. Irrigation Engg. & Hydraulic Structures by Santosh Kumar Garg, Khanna Publishers.
2. Design of Irrigation Structures by R.K. Sharma, Oxford IBH Pub.
3. Irrigation Engg. & Hydraulics Structures by S.R. Sahasrabudhe, Katson Publishing.
4. Irrigation Practice and Design Vol. I to VII by K.B. Khushlani. Oxford IBH Pub.
5. P.N. Modi; Irrigation with Resources and with Power Engineering, Standard Book House.
6. Irrigation Engg. Vol. I & II by Ivan E. Houk, John Wiley and sons.

AIR & NOISE POLLUTION AND CONTROL

Subject Code: BCIED1-752 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. Understanding of basic concepts of air pollution & noise pollution.
2. Study of air & noise pollution, identification of the parameters, conditions, mechanisms.
3. Study of sampling types and methods for ambient air and stack.
4. Study of macro and micro meteorology for understanding the dispersion of pollutants.
5. Study of pollution control methods, mechanism and devices.

Course Outcomes:

1. Explain basic principles on various aspects of atmospheric chemistry.
2. Identify the major sources, effects and monitoring of air and noise pollutants.
3. Understand the key transformations and meteorological influence on air and noise.
4. Relate and analyse the pollution regulation on its scientific basis.

UNIT-I (12 Hours)

Air Pollution: Composition and structure of atmosphere, global implications of air Pollution, Classification of air pollutants: Particulates, hydrocarbon, Carbon monoxide, Oxides of sulphur, Oxides of nitrogen and photo chemical oxidants. Indoor air pollution, Effects of air pollutants on humans, animals, property and plants.

Air Pollution Chemistry: Meteorological aspects of air pollution dispersion; temperature lapse rate and stability, wind velocity and turbulence, plume behaviour, dispersion of air pollutants, the Gaussian Plume Model, stack height and dispersion.

UNIT-II (11 Hours)

Air Sampling & Measurement: Ambient air quality and standards, air sampling and measurements; ambient air sampling, Collection of gaseous air pollutants, collection of particulate air pollutants, stack sampling, Control devices for particulate contaminants: gravitational settling chambers, cyclone separators, wet collectors, fabric filters (Bag-house filter), electrostatic precipitators (ESP).

UNIT-III (10 Hours)

Control of Gaseous Contaminants: Absorption, Adsorption, Condensation and Combustion, Control of sulphur oxides, nitrogen oxides, carbon monoxide, and hydro carbons, automotive emission control, catalytic convertor, Euro-I, Euro-II and Euro-III specifications, Indian specifications.

UNIT-IV (12 Hours)

Noise Pollution: Basics of acoustics and specification of sound; sound power, sound intensity and sound pressure levels; plane, point and line sources, multiple sources; outdoor and indoor noise propagation; psycho-acoustics and noise criteria, effects of noise on health, annoyance rating schemes; special noise environments: Infra-sound, ultrasound, impulsive sound and sonic boom; noise standards and limit values; noise instrumentation and monitoring procedure, Noise indices.

Recommended Text Books / Reference Books:

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering.
2. Environmental Engineering (Vol. II) by S.K. Garg, Khanna Publishers, Delhi
3. Martin Crawford: Air Pollution Control Theory.
4. Warkand Warner: Air Pollution: Its Origin and Control.
5. Rao and Rao: Air Pollution Control Engineering.
6. K Kant and R. Kant, "Air Pollution and Control Engineering", Khanna Publishers House.
7. Environmental Pollution Control Engineering-CS Rao, Wiley Eastern Ltd., New Delhi,
8. Environmental Noise Pollution – PE Cunniff, McGraw Hill
9. Nevers: Air Pollution Control Engineering.
10. M. P. Poonia and S C Sharma," Environmental Engineering, Khanna Publishing House.

PIPELINE ENGINEERING

Subject Code: BCIED1-753	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

Course Objectives:

The course should enable the students to:

1. Transmission of water in pipelines.
2. Rehabilitation of pipeline systems.
3. Software for WDN analysis.
4. Pipe burst and leak control.
5. Appurtenances and pipe materials.

Course Outcomes:

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

1. Design and operation of pipeline.
2. Rehabilitation of pipeline systems.
3. Software for WDN analysis.
4. Pipe burst and leak control detection.
5. Appurtenances and pipe materials.

UNIT-I (11 Hours)

Designing and operating pipelines for transmission and distribution of water, Analysis of flow in water transmission and water distribution systems (pump & gravity), optimal design and operation of systems for achieving different goals (including latest tools available for optimization).

UNIT-II (12 Hours)

Extended period simulations, Software for WDN analysis and design, Rehabilitation of pipeline systems.

UNIT-III (11 Hours)

Water auditing, online monitoring and control, leak and burst detection, transient analysis and surge protection.

UNIT-IV (11 Hours)

Appurtenances (valves / flow meters etc.), Selection of pipe material, Jointing details, Pipe laying and testing, Structural design for buried and surface mounted pipes.

Recommended Text Books / Reference Books:

1. Fluid Mechanics & Hydraulic Machines: Dr. R.K. Bansal.
2. Fluid Mechanics and Machinery, C.S.P. Ojha, R. Berndtsson and P. N. Chadramouli, Oxford University Press, 2010.
3. Hydraulics and Fluid Mechanics, P. N. Modi and S. M. Seth, Standard Book House.
4. Theory and Applications of Fluid Mechanics, K. Subramanya, Tata McGraw Hill.
5. Fluid Mechanics with Engineering Applications, R.L. Daugherty, J.B. Franzini and E.J. Finnemore, International Student Edition, Mc Graw Hill.

PRESTRESSED CONCRETE

Subject Code: BCIED1-761 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The objectives of the course are:

1. The intention of Prestressing is to permanently keep all (significant) parts of a concrete element in compression.
2. The benefit of that arises from the fact that concrete as a material is relatively poor when viewed as a tensile member. On the other hand, its compressive strength may be around ten times the tensile strength.
3. In simple terms it essentially clamps the concrete together in the area that will undergo the highest tensile forces.

Course Outcomes:

1. Students will understand the general mechanical behaviour of prestressed concrete.
2. Students will be able to analyze and design prestressed concrete flexural members.
3. Students will be able to analyze and design for vertical and horizontal shear in prestressed concrete.

Note: IS 1343 Code of Practice is permitted in the examination.

UNIT-I (09 Hours)

Materials for Prestressed Concrete and Pre-stressing Systems: High strength concrete and high tensile steel, tensioning devices, pre-tensioning systems, post tensioning systems.

UNIT-II (13 Hours)

Analysis of Pre-stress and Bending Stresses:-Analysis of pre-stress, resultant stresses at a sector, pressure line or thrust line and internal resisting couple, concept of load balancing, losses of pre-stress, deflection of beams.

UNIT-III (12 Hours)

Strength of Pre-Stressed Concrete Sections in Flexure, Shear and Torsion:-Types of flexural

failure, strain compatibility method, IS: 1343 code procedure, design for limit state of shear and torsion.

UNIT-IV (11 Hours)

Design of Pre-Stressed Concrete Beams and Slabs: Transfer of prestress in pre tensioned and post tensioned members, design of anchorage zone reinforcement, End zone, design of simple beams, cable profiles.

Recommended Text Books / Reference Books:

1. N. Krishna Raju, Prestressed concrete, Tata McGraw Hill.
2. T.Y. Lin, Ned H. Burns, Design of Prestressed Concrete Structures, John Wiley & Sons.
3. P. Dayaratnam, Prestressed Concrete, Oxford & IBH.
4. R. Rajagopalan, Prestressed Concrete.
5. Code of Practice for Prestressed Concrete (IS 1343: 2012).

PAVEMENT CONSTRUCTION AND MANAGEMENT

Subject Code: BCIED1-762 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. The main objective of this course is to acquaint the students about various engineering methods used for construction and maintenance of different types of pavement structures.
2. To familiarize the students about the methods of evaluation of pavement structures to undertake various types of maintenance management strategies.
3. To introduce the concept of pavement management system and pavement performance prediction, this ensures timely maintenance of pavements with rational utilization of available budget.

Course Outcomes:

1. The students will learn about various engineering methods used for construction and maintenance of different types of pavement structures.
2. The student shall get familiar with the methods of evaluation of pavement structures to undertake various types of maintenance management strategies.
3. They will learn the concept of pavement management system and pavement performance prediction, which will not only help them in field applications but also in research at the postgraduate level after completion of their graduation.

UNIT-I (11 Hours)

Introduction: Types of highway construction, materials for construction, construction procedure of different highways: Earth roads, Gravel roads, WBM roads, Bituminous pavements, Cement Concrete pavements. Equipment used for highway construction.

Soil Stabilization for Pavements: Principles of proportioning of soil-aggregate mixes and compaction, mechanical, soil-cement, soil-bitumen and soil-lime stabilization methods; construction control and quality control checks.

UNIT-II (12 Hours)

Bituminous Pavement Construction: Earthwork, compaction and construction of embankments, specifications of materials, construction methods and field control checks for various types of flexible pavement materials in sub-base, base, binder and surface course layers.

Cement Concrete Pavement Construction: Specifications and method of cement concrete pavement construction; Quality control tests; Construction of various types of joints, Construction of interlocking block pavements.

UNIT-III (11 Hours)

Pavement Maintenance: Need for maintenance, Pavement failures, causes and remedial measures. Types of highway maintenance, Materials used for maintenance of different pavements, Maintenance and rehabilitation techniques.

Pavement Evaluation: Pavement distresses, functional condition evaluation of pavements- Roughness, Skid Resistance. Structural evaluation of pavements – non-destructive testing, Benkelman beam and Falling Weight Deflectometer.

UNIT-IV (11 Hours)

Pavement Management Systems: Concept, components, structure, data requirements, Project level and Network level needs.

Pavement Performance Prediction: Modeling techniques – AASTHO, CRRI and HDM models, Budget forecasting for maintenance and rehabilitation, Ranking and optimization methodologies, life cycle costing.

Recommended Text Books / Reference Books:

1. S.K. Khanna and C.E.G. Justo, 'Highway Engineering', Nem Chand & Bros., Roorkee.
2. S.K. Sharma, 'Principles, Practice and Design of Highway Engineering', S. Chand & Co.
3. Ralph C. G. Haas, W. Ronald Hudson, 'Pavement Management Systems', McGraw-Hill Book Company.
4. M. Y. Shahin, 'Pavement Management for Airports, Roads, and Parking Lots' Kluwer Academic Publishers.

SOIL REINFORCING TECHNIQUES

Subject Code: BCIED1-763 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

5. To understanding the necessity and scope of geo-synthetics in ground improvement.
6. To gain comprehensive understanding about different types of geo-synthetic products their functions, application and suitability.
7. To learn the analysis and design of reinforced soil walls.

Course Outcomes:

1. Competence in identification of ideal geo-synthetic function and ability to select the ideal product to serve the function.

2. Ability to analyse and design the application of geo-synthetics.
3. Competence construction practices and evaluation of post construction improvement.

UNIT-I (10 Hours)

Reinforced Earth Retaining Wall: Principles, concepts and mechanism of reinforced earth – design consideration of reinforced earth retaining wall.

UNIT-II (12 Hours)

Geo-membrane: Physical, mechanical, chemical, biological, thermal and identification properties.
Designing with Geo-membranes: Liquid containment liners, covers for reservoirs, canal liners, landfill liners, caps & closures, underground storage tanks etc.

UNIT-III (11 Hours)

Geotextile: Physical, mechanical, hydraulic, endurance and degradation properties, designing with geotextiles, geotextile functions and mechanisms, designing for separation, designing for reinforcement, designing for stabilization, designing for filtration, designing for drainage, designing for multi functions.

UNIT-IV (12 Hours)

Geogrid: Physical, mechanical, endurance and environmental properties, designing for geogrid reinforcement
Geonets: Physical, mechanical, hydraulic, endurance and environmental properties, designing for geonet drainage
Geo-composites: Geo-composites for separation, reinforcement, filtration, drainage, liquid, vapour barriers.

Recommended Text Books / Reference Books:

1. Hausman, M. R. (1990). " Engineering Principles of Ground Modification" McGraw-Hills
2. Moseley, M.P. (1193), "Ground Improvement" Chapman and Hall.
3. Koener, R.M. (2012), "Designing with Geo-synthetics, Vol.1 & 2, Xlibriss Corporation.
4. Rao, G.V. and Raju, G.V.S.S. (1995) "Engineering with Geo-synthetics", TMH.
5. Purushothama Raj, P. (2014). "Ground Improvement Techniques". Laxmi Publishers.

SOFTWARE LAB

Subject Code: BCIES1-723 | **L T P C** | **Duration: 30 hrs.**

0 0 2 1

Course Objectives:

1. To obtain the knowledge of software's related to civil engineering.
2. To learn how to analyze and design complex Civil engineering problems with software.
3. To learn how to manage/optimize the project with time and resource with the help of software.

Course Outcomes:

On completion of this course the student will be able:

1. To design the whole project like roads, building etc. with the help of softwares.
2. To deal with project management in real time.

Student can choose anyone software according to their choice:
1. STAAD-PRO
2. E-TAB
3. ARC VIEW GIS
4. MX ROAD
5. PLAXIS
6. PRIMA VERA

PROJECT-I					
Subject Code: BCIES1-724	**L**	**T**	**P**	**C**	**Duration: 90 hrs.**
	0	0	6	3	

Course Objectives:

1. To make student synthesis and use knowledge of various disciplines gained during entire study in a civil project of his choice.
2. Demonstrate the personal abilities and skills required to produce and present an extended piece of work.
3. Engage in personal inquiry, action and reflection on specific topics and issues.
4. Focus on, and demonstrate an understanding of, the areas of interaction.
5. Reflect on learning and share knowledge, views and opinions.

Course Outcomes:

1. Identify, describe & analyze the steps followed to achieve the chosen area(s) of interaction or stated goal.
2. Analyze & choose techniques relevant to the project's goal.
3. Respond thoughtfully to ideas and inspiration by using modern tools & techniques.
4. A fully worked-out design proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.
5. Assess the achieved results in terms of the initial goal and the focus on the chosen area(s) of interaction with future meets.

PROJECT WORK:

Students are required to work on practical projects in the field of Civil Engineering (Project work, seminar and internship in industry or at appropriate work place). The students have to work for 6 hrs per week with his / her supervisor(s).

8th SEMESTER

DESIGN OF STEEL STRUCTURES-II

Subject Code: BCIES1-821 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

3. Learn the plastic behaviour of steel in flexure.
4. Learn the behaviour of different types of steel bridges during different type of loading and design of steel structures.
5. Ability to design industrial steel structures systems.
6. Familiarity with professional and contemporary issues.

Course Outcomes:

5. Identify and compute the design loads on a typical steel building.
6. Able to analyze and design with detailing of steel flexural members.
7. Ability to design and check for serviceability (crack and deflection) and ultimate limit state conditions.
8. Apply relevant Indian Standard provisions to ensure safety and serviceability of structural steel elements.

Note: IS 800:2007, General Construction in Steel-Code of practice is permitted in examination.

UNIT-I (12 Hours)

Plastic Analysis: Introduction, flexural behavior, shape factor, plastic moment capacity of beams, Design of Beams.

Plate Girder: Elements of a plate girder, economical depth, IS recommendations, design of a plate girder, curtailment of flanges, various types of stiffeners using bolts and welds.

UNIT-II (11 Hours)

Foot Bridge: Elements of Foot Bridge, types, moving load behaviour, Design of steel foot bridge with welded joints.

UNIT-III (11 Hours)

Industrial Buildings: Introduction, Terminology, types & uses, types of load, Design of elements of industrial buildings: Gantry girder, Column bracket using weld.

UNIT-IV (11 Hours)

Railway Bridge: Design of single track Railway Bridge with lattice girders having parallel chords (for B.G.)- Stringer, Cross girder, Main girders with welded joints, Portal sway bracings, Rocker and rollers bearings.

Recommended Text Books / Reference Books:

1. S.K. Duggal, 'Limit State Design of Steel Structures'.
2. N. Subramanian, 'Design of Steel Structures'.
3. Ram Chandra, 'Design of Steel Structures', Vol. 2.
4. L.S. Negi, 'Design of Steel Structures'.
5. S.S. Bhavikatti, 'Design of Steel Structures (by limit state method as per IS: 800-2007).

6. IS 800: 2007 (General Construction in Steel-Code of Practice)
7. SP: 6(1) (Handbook for Structural Engineers-Structural Steel Sections)

BRIDGE ENGINEERING

Subject Code: BCIED1-851 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. The objective of this course is to apprise the students about the planning and construction of bridges, which is one of the most important components of the transportation infrastructure.
2. To learn about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. To learn about components of sub-structure and super-structure of the bridges along with construction and maintenance aspects of bridges.

Course Outcomes:

1. The students will learn about the planning and construction of bridges, which is one of the most important components of the transportation infrastructure.
2. They will learn about different types of bridges, their choice, site selection, loads, with special emphasis on RCC and steel bridges.
3. They will also learn about components of sub-structure and super-structure of the bridges along with construction and maintenance aspects of bridges.

UNIT-I (11 Hours)

Introduction: Definition and components of a bridge, Classification of bridges, Choice of a bridge type, Investigation for bridges, Selection of bridge site, design discharge for river bridge, linear waterway, economical span, vertical clearance, scour depth, afflux.

Standard Specifications for Road Bridges: IRC Bridge Codes, Width of carriageway, Dead load, I.R.C. standard live loads, Impact effect, Wind load, Longitudinal forces, Centrifugal forces, Horizontal forces due to water current, Buoyancy effect, Earth pressure, Deformation stresses, Erection stresses, Temperature effects and Seismic forces.

UNIT-II (12 Hours)

Reinforced Concrete Bridges: Types of RCC bridges; Culverts - Box Culvert, Pipe Culvert, Solid slab bridge, T-beam girder bridges, Hollow girder bridges, Balanced cantilever bridges, Continuous girder bridges, Rigid frame bridges, Arch bridges, Prestressed concrete bridges.

Steel Bridges: Types of Steel bridges; Beam bridges, Plate girder bridges, Box girder bridges, Truss bridges, Arch bridges, Cantilever bridges, Cable stayed bridges, Suspension bridges.

UNIT-III (12 Hours)

Sub-structure and Foundation: Piers and abutments, materials for piers and abutments, Types of foundations; Shallow, Pile, and Well foundations. Relative merits of piles and well foundations, Pneumatic Caissons, Box Caissons.

Bearings: Importance of Bearings, Different types of bearings, Expansion Bearings, Fixed Bearings, Elastomeric Bearings.

UNIT-IV (10 Hours)

Joints & Appurtenances: Expansion joints, Wearing Course, Approach Slab, Footpath, Handrails.

Construction and Maintenance of Bridges: Methods of construction of concrete and steel bridges. Formwork and false work for concrete bridges, Causes of Bridge failures, Inspection and maintenance, Bridge Management System.

Recommended Text Books / Reference Books:

1. Johnson, Victor, 'Essentials of Bridge Engineering', Oxford University Press.
2. C.H. Khadilkar, 'A Text book of Bridge Construction', Allied Publishers.
3. S.C. Rangwala, 'Bridge Engineering', Charotar Publishing House Pvt. Ltd.
4. V.K. Raina, 'Concrete Bridges Handbook, Shroff Publishers and Distributors.
5. S. Ponnuswamy, 'Bridge Engineering', McGraw Hill Education.

DESIGN OF INDUSTRIAL STRUCTURES

Subject Code: BCIED1-852 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To learn various distress and damages to concrete and masonry structures.
2. To understand the importance of maintenance of structures.
3. To study the various types and properties of repair materials.
4. To assess the damage to structures using various tests.
5. To learn the importance and methods of substrate preparation.
6. To learn various repair techniques of damaged structures & corroded structures.

Course Outcomes:

By the end of this course students will have the capability/knowledge of:

1. Various distress and damages to concrete and masonry structures, the importance of maintenance of structures, types and properties of repair materials etc.
2. Assessing damage to structures and various repair techniques.

UNIT-I (05 Hours)

Introduction: Role of Design Engineer, properties of structural steel, merits and demerits of structural steel over reinforced concrete structures.

UNIT-II (15 Hours)

Steel Structure Design: Design of tension members, compression members, and flexure members and beam-columns junctions, adopting Codal provisions of IS: 800 components & its terminology, load estimation, choice of sections, analysis and design for gantry girders.

Industrial structures with steel trusses and portal frames. Typical configuration with various elements, load assessment (deal load, live load, wind load and earthquake load).

UNIT-III (15 Hours)

Industrial Design: Different roofing and cladding alternatives and their design, types of purlins and their design, analysis and design of a trusses and portal frames, design of base plate, pedestal and footing considering both hinged and fixed support conditions, design of bracing and preparation of construction drawings.

UNIT-IV (10 Hours)

Welded Connections: Advantages of welding, fundamentals and methods of welding, types of joints, welding symbols and inspection of welding, Codal provisions, and design of typical welded connections. Bolted connections, Types of bolts, Codal provisions, design of typical bolted connections.

Recommended Text Books / Reference Books:

1. Design of Steel Structures by Bresler & Lin.
2. Theory of Modern Steel Structures by Linton Grinter.
3. Design of Steel Structures by P. Dayaratnam.
4. Reinforced Concrete Structural Elements (behavior, analysis & design) by P. Purushothoman.
5. Practical Design of Reinforced Concrete by Russell S. Fling.
6. Design of Reinforced Concrete Structures by Ashok Kumar Gupta.
7. Structural Condition assessment by Robert T. Ratay.
8. Repairs and rehabilitation of concrete structures by P. I. Modi & C. N. Patel, PHI Publication.

DISASTER MANAGEMENT

Subject Code: BCIED1-853 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. To understand basic concepts in Disaster Management.
2. To understand Definitions and Terminologies used in Disaster Management
3. To understand Types and Categories of Disasters
4. To understand the Challenges posed by Disasters
5. To understand Impacts of Disasters Key Skills.

Course Outcomes:

1. Understanding foundations of hazards, disasters and associated natural/social phenomena.
2. Familiarity with disaster management theory (cycle, phases).
3. Knowledge about existing global frameworks and existing agreements.
4. Humanitarian Assistance before and after disaster.
5. Technological innovations in Disaster Risk Reduction: Advantages and problems.
6. Experience on conducting independent DM study including data search, analysis and presentation of disaster case study.

UNIT-I (11 Hours)

Introduction: Concepts and definitions -disaster, hazard, vulnerability, risks-severity, frequency

and details, capacity, impact, prevention, mitigation, Disasters classification; natural disasters (floods, draught, cyclones, volcanoes, earthquakes, tsunami, landslides, coastal erosion, soil erosion, forest fires etc.); manmade disasters (industrial pollution, artificial flooding in urban areas, nuclear radiation, chemical spills, transportation accidents, terrorist strikes, etc.); hazard and vulnerability profile of India, mountain and coastal areas, ecological fragility.

UNIT-II (11 Hours)

Disaster Impacts: Disaster impacts (environmental, physical, social, ecological, economic, political, etc.); health, psycho-social issues; demographic aspects (gender, age, special needs); hazard locations; global and national disaster trends; climate change and urban disasters.

UNIT-III (12 Hours)

Disaster Risk Reduction (DRR): Disaster management cycle –its phases; prevention, mitigation, preparedness, relief and recovery; structural and non-structural measures; risk analysis, vulnerability and capacity assessment; early warning systems, Post-disaster environmental response (water, sanitation, food safety, waste management, disease control, security, communications); Roles and responsibilities of government, community, local institutions, NGOs and other stakeholders; Policies and legislation for disaster risk reduction, DRR programmes in India and the activities of National Disaster Management Authority.

UNIT-IV (11 Hours)

Disasters, Environment and Development: Factors affecting vulnerability such as impact of developmental projects and environmental modifications (including of dams, land-use changes, urbanization etc.),sustainable and environmental friendly recovery; reconstruction and development.

Recommended Text Books / Reference Books:

1. Natural Hazards in the Urban Habitat by Iyengar, C.B.R.I., Tata McGraw Hill Publisher.
2. Natural Disaster management, Jon Ingleton (Ed), Published by Tudor Rose, Leicester 92.
3. Singh B.K., Handbook of disaster management: Techniques & Guidelines, Rajat Publications.
4. Disaster Management, R.B. Singh (Ed), Rawat Publications.
5. ESCAP: Asian and the Pacific Report on Natural Hazards and Natural Disaster Reduction.

ENGINEERING HYDROLOGY

Subject Code: BCIED1-861 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

The course should enable the students to:

1. Interaction among various processes in the hydrological cycle.
2. Average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, evapo-transpiration etc.
3. The various components of hydrographs and to estimate the run-off.
4. Estimation of peak flows by rational method, unit hydrograph theory, Gumbels's method.

5. Flood routing.

Course Outcomes:

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

1. Understand the interaction among various processes in the hydrological cycle.
2. Calculate the average annual rainfall of any area using the rain gauge data and inter-relations of various parameters as infiltration, evapo-transpiration etc.
3. Understand the various components of hydrographs and to estimate the run-off.
4. Estimation of peak flows by rational method, unit hydrograph theory, Gumbels's method.
5. Understand flood routing.

UNIT-I (10 Hours)

Introduction: Hydrologic cycle, History of hydrology, water budget equation, World Water balance, applications in engineering sources of data.

Precipitation: Forms of Precipitation, characteristics of precipitation in India, measurement of precipitation, Rain Gauge Network, Mean Precipitation over an Area, Depth-Area-Duration Relationships, Maximum Intensity / Depth-Duration-Frequency Relationship, Probable Maximum Precipitation (PMP), Rainfall Data in India.

UNIT-II (11 Hours)

Abstractions from Precipitation: Evaporation process, Evaporimeters, Analytical methods of Evaporation Estimation, Reservoir Evaporation and Methods for its Reduction, Evapo-transpiration, Interception, Depression storage.

Infiltration: Definition, Infiltration capacity, measurement of infiltration, Modeling infiltration capacity, Classification of Infiltration capacities, Infiltration Indices.

UNIT-III (14 Hours)

Runoff: Run-off volume, SCS-CN method of estimating runoff volume, flow-duration curve, flow-mass curve, hydrograph, factors affecting run-off hydrograph, components of hydrograph.

Hydrographs: Base flow separation, effective rainfall, unit hydrograph, S-curve hydrograph, Snyder's synthetic unit hydrograph, surface water resources of India.

UNIT-IV (10 Hours)

Peak Flows: Estimation of peak flow-rational formula, use of unit hydrograph, frequency analysis, Gumbel's method, design flood and its hydrograph.

Flood Routing: Definition, Introduction to hydraulic and hydrologic routing- The Saint- Venant equations for open channel flow, flood wave propagation, kinematic diffusion wave approximations.

Recommended Text Books / Reference Books:

1. Engineering Hydrology - J. Nemec, Prentice Hall.
2. Engineering Hydrology by K Subramanya.
3. Engineering Hydrology by Stanley Buttler, John. Wiley.
4. Ground Water Hydrology by TODD, John Wiley.
5. Engineering for Dams Vol. II & III by Creager Justin & Hinds. John. Wiley

6. Hydrology by. S.K. Garg, Khanna Publications.
7. Hydrology Principles, Analysis and Design by. Raghunath, H M, New Age Int. Publications.

PORT AND HARBOUR ENGINEERING

Subject Code: BCIED1-862 | **L T P C** | **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. The objective of this course is to acquaint the students about fourth major mode of transportation, i.e., waterways, after covering highways, railways, and airports in the previous semesters.
2. To understand the need for providing various civil engineering structures at the ports and harbours, construction, maintenance, and navigational aspects.
3. To learn about the functions of different components of harbours and ports for the purpose of safe and efficient water transportation.

Course Outcomes:

1. The students shall learn about the importance and application of fourth major mode of transportation, i.e., waterways, after covering highways, railways, and airports in the previous semesters.
2. They will understand the need for providing various civil engineering structures at the ports and harbours, and their construction, maintenance, and navigational aspects.
3. They will come to know about the functions of different components of harbours and ports for the purpose of safe and efficient water transportation.

UNIT-I (09 Hours)

General: History, Advantages and disadvantages of water transportation, Modern trends in water transportation, Elements of water transportation, Historical development in India.
Natural Phenomena: Tides, Wind, Water waves, Currents phenomena, Characteristics and effects on marine structures, Littoral drift.

UNIT-II (12 Hours)

Marine Structures: General design aspects, Breakwaters - function, types general design principles, Wharves, Quays, Jetties, Piers, Pier heads, Dolphin, Fenders, Mooring Accessories.
Harbours: Classification of harbours, Selection of site and planning of harbours, Ship characteristics, Characteristics of good harbour, Size of harbour.

UNIT-III (12 Hours)

Docks and Repair Facilities: Harbour docks, Wet docks, Repair docks, Lift docks, Floating docks, Slipways
Port Facilities: Port building facilities, Transit sheds, Warehouses, Cargo handling facility, Services for shipping terminals, Inland port facilities planning.

UNIT-IV (12 Hours)

Dredging: General, Classification of dredging works, Types of dredgers, Uses of dredged

material, Execution of dredging work.

Navigation Aids: Necessity, Types of navigation aids, Requirement of signals, Fixed and floating navigation aids.

Recommended Text Books / Reference Books:

1. S. P. Bindra, 'A Course in Docks and Harbour Engineering', Dhanpat Rai & Sons, New Delhi.
2. R. Srinivasan and S. C. Rangwala, 'Harbour, Dock and Tunnel Engineering', Charotar Publishing House, Anand.
3. Alonzo Quinn, 'Design and Construction of Ports and Marine Structure', McGraw Hill Book Company, New York.

GEOTECHNICAL DESIGN

Subject Code: BCIED1-863	L	T	P	C	Duration: 45 Hrs.
	3	0	0	3	

Course Objectives:

1. To understand the objectives, necessity and scope of different underground structures.
2. To learn about different types of forces acting on sub structures.
3. To know the behaviour of soil beneath and surrounding the underground structure
4. To learn the design and construction of sub structures

Course Outcomes:

1. Learn about types and purposes of different underground structures.
2. Have an exposure to the systematic methods for designing foundations.
3. Be able evaluate the feasibility of foundation solutions to different types of soil conditions considering the time effect on soil behaviour.
4. Have necessary theoretical background for design and construction of foundation systems.

UNIT-I (12 Hours)

Sheet Piles: Introduction, sheet pile structures, free cantilever sheet pile walls, cantilever sheet pile, depth of embedment of cantilever walls in sandy soils, depth of embedment of cantilever walls in cohesive soils, anchored bulkhead: free-earth support method, depth of embedment of anchored sheet piles in granular soils, design charts for anchored bulkheads in sand, moment reduction for anchored sheet pile walls, anchorage of bulkheads.

UNIT-II (11 Hours)

Braced Cuts and Coffer Dams: Lateral earth pressure distribution on braced-cuts, stability of braced cuts in saturated clay, Bjerrum and Eide method of analysis, piping failures in sand cuts, arching action of soil and its application, coffer dams.

UNIT-III (11 Hours)

Drilled Pier Foundations: Introduction, types of drilled piers, load transfer mechanism, vertical bearing capacity of drilled piers, the general bearing capacity equation for the base resistance, bearing capacity equations for cohesive soil and granular soil, ultimate skin resistance of cohesive cohesion-less soil and gravelly sands, ultimate side and total resistance in rock, estimation of

settlements of drilled piers at working loads, uplift capacity of drilled piers, lateral bearing capacity of drilled piers.

UNIT-IV (11 Hours)

Well Foundations: Forces acting on wells, components of well foundation, bearing capacity, settlement and lateral resistance, tilts and shifts design and construction, types of caissons, advantages and disadvantages of each type of caisson, forces acting on the caissons and design of caissons.

Recommended Text Books / Reference Books:

1. J.E. Bowles – Foundation Design & Analysis, McGraw-Hill Edition 1995.
2. Ground improvement techniques by P. Purushottam Raj, Laxmi Publication.
3. F. S. Fang Handbook of Foundation Engg. CBS Publication, 1985.

PROJECT-II

Subject Code: BCIES1-822	**L**	**T**	**P**	**C**	**Duration: 90 hrs.**
	0	0	6	3	

Course Objectives:

1. To make student synthesis and use knowledge of various disciplines gained during entire study in a civil project of his choice.
2. Demonstrate the personal abilities and skills required to produce and present an extended piece of work.
3. Engage in personal inquiry, action and reflection on specific topics and issues.
4. Focus on, and demonstrate an understanding of, the areas of interaction.
5. Reflect on learning and share knowledge, views and opinions.

Course Outcomes:

1. Identify, describe & analyze the steps followed to achieve the chosen area(s) of interaction or stated goal.
2. Analyze & choose techniques relevant to the project's goal.
3. Respond thoughtfully to ideas and inspiration by using modern tools & techniques.
4. A fully worked-out design proposal-including consideration of site planning, structure, services, and any other aspect/specific to the project.
5. Assess the achieved results in terms of the initial goal and the focus on the chosen area(s) of interaction with future meets.

PROJECT WORK:

Students are required to work on practical projects in the field of Civil Engineering (Project work, seminar and internship in industry or at appropriate work place) (May be continued from VII Semester, Project work, seminar and internship in industry or at appropriate work place). The students have to work for 6 hrs per week with his / her supervisor(s).

ADVANCED TESTING LAB

Subject Code: BCIES1-823 | **L T P C** | **Duration: 30 hrs.**

0 0 2 1

Course Objectives:

The course should enable the students to:

1. Gain experience with and understanding of the types, advantages and applications of various non-destructive testing (NDT) methods.
2. Equip the student with the ability of advance testing procedures.
3. Analyse recent techniques used by industry to evaluate the properties of a material, component, structure or system for characteristic differences or defects.
4. Assessment of existing structure for rehabilitation planning.
5. Monitoring of changes with passage of time.

Course Outcomes:

Upon successful completion of this course, student will be able to:

1. Knowledge of different NDTs for concrete & highway works.
2. Improve quality of work during construction by identify & analyze the problems.
3. Improve product reliability, strength, etc. by conducting investigations.
4. Predict accident prevention analysis for safety and to reduce costs.
5. Solutions on repair criteria using modern techniques & tools for long term sustainability.

Laboratory Experiments:

1. Rebound Hammer Test
2. Ultrasonic Pulse Velocity Test
3. Reinforced Bar Locator Test
4. Cut and Pull Out (CAPO) Test
5. Fifth Wheel Bump Integrator Test
6. Benkelman Beam Deflection Test
7. Vehicular Speed Radar Test
8. Bitumen Extraction Test
9. Standard Penetration Test (SPT)

Recommended Books / Manuals:

1. M.L. Gambhir, 'Building and Construction Materials: Testing and Quality Control', TMH.
2. Concrete Lab Manual by NITTTR Chandigarh.
3. Concrete Technology, Theory and Practice by M.S. Shetty, S. Chand & Company.
4. Khanna S.K. and Justo, C.E.G. "Highway Material & Pavement Testing", Nem Chand.

ESSENCE OF INDIAN KNOWLEDGE TRADITION					
Subject Code: BMNCC0-006	**L**	**T**	**P**	**C**	**Duration: 30 Hrs.**
	2	0	0	0	

COURSE OBJECTIVE:

The course is introduced

1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

COURSE OUTCOMES:

After successful completion of the course the students will be able to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

COURSE CONTENTS:

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

UNIT – II

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – III

Indian Fine Arts & Its Philosophy(Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – IV

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

RECOMMENDED BOOKS:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition'', ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X, 2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M.Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978-8120810990,2014
7. Chatterjee. S & Dutta "An Introduction to Indian Philosophy".

Total Credits= 18

Semester 7th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BECED1-7XX	Departmental Elective-III	3	0	0	40	60	100	3
BECED1-7XX	Departmental Elective-IV	3	0	0	40	60	100	3
BECED1-7XX	Departmental Elective-V	3	0	0	40	60	100	3
XXXXX	Open Elective*	3	0	0	40	60	100	3
BECES1 -701	Project Stage-I	0	0	4	60	40	100	2
BMNCC0-002	Environmental Sciences (MC)	2	0	0	100	--	100	--
BECES1 -702	Training-III	--	--	--	60	40	100	4
Departmental Elective – III (Select any one)								
BECED1-711	Fiber Optic Communications							
BECED1-712	Mobile Communication and Networks							
Departmental Elective – IV (Select any one)								
BECED1-721	Parallel Processing							
BECED1-722	Scientific Computing							
BECED1-723	Neural Network & Fuzzy Logic							
Departmental Elective – V (Select any one)								
BECED1-731	VLSI Technology							
BECED1-732	CMOS Design							
BECED1-733	High Speed Electronics							
Total		**-**	**-**	**-**	**380**	**320**	**700**	**18**

***Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.**

Total Credits= 17

Semester 8th		Contact Hours			Max Marks		Total Marks	Credits
Subject Code	Subject Name	L	T	P	Int.	Ext.		
BECED1-8XX	Departmental Elective-VI	3	0	0	40	60	100	3
BECED1-8XX	Departmental Elective-VII	3	0	0	40	60	100	3
XXXXX	Open Elective*	3	0	0	40	60	100	3
BECES1 -801	Project Stage-II	0	0	10	120	80	200	5
BMNCC0-006	Essence of Indian KnowledgeTradition (MC)	2	0	0	100	--	100	--
BHSMC0-024	Project Management and Entrepreneurship**	3	0	0	40	60	100	3
Departmental Elective – VI (Select any one)								
BECED1-811	Wireless Sensor Networks							
BECED1-812	Satellite Communication							
BECED1-813	Error correcting codes							
Departmental Elective – VII (Select any one)								
BECED1-821	Machine Learning							
BECED1-822	Data Mining & Big Data							
BECED1-823	Artificial Intelligence							
BECED1-824	Internet of Things							
Total		**-**	**-**	**-**	**380**	**320**	**700**	**17**

Note *(Applicable for 2019 Batch onwards)*: As per AICTE Activity Point Programme, a candidate has to earn 100 activity points (for Lateral Entry – 75 activity points) in addition to the required Academic Grades before he/she appears in his/her final examinations.

***Open Elective Subjects may also be chosen from the list of Open Electives-I, II and III offered by other departments of university.**

****Detailed syllabus of Humanities/Management subjects may be seen on the UG Open Electives Page of University website by clicking on "MRSPTU List of Humanities, Social Science and Management Subjects_BHSMC0-XXX"**

FIBRE OPTIC COMMUNICATIONS

Subject Code: BECED1-711 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To provide knowledge about various types of optical sources and detectors.
2. To impart knowledge about optical fiber link design and multiplexing techniques.
3. To provide basic understanding of optical switches and amplifiers.
4. To make aware the students about non-linear effects of fiber optic communication.

Course Outcomes:

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

1. Understand the principles of fiber optic communication and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand the operation of lasers, LEDs, and detectors.
4. Design Fiber optic link and understand non-linear effects in optical fibers.

UNIT-I (11Hrs)

Introduction to light and optical Fiber: Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, ray model, wave model.
Different types of optical fibres, modal analysis of a step index fibre, Signal degradation on optical fibredue to dispersion and attenuation, fabrication of fibres and measurement techniques like OTDR

UNIT-II (12 Hrs)

Optical Sources, Detectors and Optical Link Design: LEDs and Lasers, photo-detectors-pin diodes, APDs, detector responsivity, noise, optical receivers, optical link design-BER calculation, quantum limit, power penalties.

UNIT-III (10Hrs)

Optical switches & Amplifiers: Optical switches – coupled mode analysis of directional couplers, electro-optic switches. Optical Amplifiers - EDFA, Raman amplifier.

UNIT-IV (12Hrs)

Optical Communication System: WDM and DWDM systems. Principles of WDM networks, Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and solition based communication.

Text/Reference Books:

1. John M Senior, 'Optical Fiber Communications', PHI.
2. Gerd Keiser, 'Optical Fiber Communications', TMH.
3. G. Aggarwal, Fiber Optic Communication systems, John wiley and sons, New York, 1997.
4. John Gowar, Optical Communication Systems, PHI Publications.

MOBILE COMMUNICATION AND NETWORKS

Subject Code- BECED1-712 **L T P C** **Duration:-45 hrs**
3 0 0 3

Course Objectives: - This course is meant to provide fundamental knowledge to students for understanding the basics of mobile communication and networks.

1. To make aware the students about the concept of mobile communication.
2. To provide the knowledge about the concepts of Signal Propagation.
3. To provide the knowledge about frequency selective channels and Access schemes.
4. To provide the knowledge of different receiver structures.

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

1. Understand the working principles of the mobile communication systems.
2. Understand the relation between the user features and underlying technology.
3. Analyze mobile communication systems for improves performance.

UNIT-I (10Hrs)

Introduction: - Cellular Concepts-Cell structure, frequency re-use, cell splitting, channel assignment, handoff, interference, capacity, power control, Wireless Standards: - Overview of 2G, 3G and 4G cellular standards.

UNIT-II (12Hrs)

Signal Propagation- Propagation mechanism- reflection, refraction, diffraction and scattering, large scale signal propagation and lognormal shadowing. Fading channels-Multipath and small scale fading- Doppler shift, statistical multipath channel models, narrowband and wideband fading models, power delay profile, average and rms delay spread, coherence bandwidth and coherence time, flat and frequency selective fading, slow and fast fading, average fade duration and level crossing rate.

UNIT-III (11Hrs)

Capacity of flat and frequency selective channels. Antennas- Antennas for mobile terminal-mono pole antennas, PIFA, base station antennas and arrays.

Multiple access schemes- FDMA, TDMA, CDMA and SDMA. Modulation schemes- BPSK, QPSK and variants, QAM, MSK and GMSK, multicarrier modulation, OFDM.

UNIT-IV (12Hrs)

Receiver structure- Diversity receivers- selection and MRC receivers, RAKE receiver, equalization; - Linear-ZFE and Adaptive, DFE. Transmit diversity- Altamonte scheme.

MIMO and Space time signal processing, spatial multiplexing, diversity/multiplexing tradeoff. Performance measures- Outage, average SNR, average symbol/bit error rate. System examples- GSM, EDGE, GPRS, IS-95, CDMA 2000 and WCDMA.

Text/Reference Books:-

1. WCY Lee, Mobile Cellular Telecommunications Systems, McGraw Hill, 1990.
2. WCY Lee, Mobile Communication Design Fundamentals, Prentice Hall, 1993.
3. Raymond Steele, mobile Radio Communication, IEEE Press, New York, 1992.
4. AJ Viterbi, CDMA: Principles of Spread Spectrum Communications, Addison Wesley, 1995.
5. VK Garg & JE Wilkes, Wireless and Personal Communication Systems, Prentice Hall, 1996.

PARALLEL PROCESSING

Subject Code: BECED1-721 **L T P C** **Duration: 45Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in parallel processing:

1. To familiarize students with the fundamental concepts of parallel processing.
2. Acquire knowledge about techniques and tools of parallel computing.
3. To understand the need of parallel processing.
4. To prepare students for advanced courses in more specific areas of parallel computing.

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

1. Understand the need and applications of parallel processing.
2. Explain terminologies used for parallel computation.
3. Describe software and hardware related issues and challenges ofparallel processing.
4. Differentiate among the popular parallel computing architectures.

UNIT-I (11Hrs)

Theory of Parallelism: *Parallel Computer Models:* The State of Computing, Multiprocessors and Multicomputers, Multivectors and SIMD Computers, PRAM and VLSI Models. *Program and Network Properties:* Conditions of Parallelism, Program Partitioning and Scheduling, Control Flow versus Data Flow, System Interconnect Architectures. *Principles of Scalable Performance:* Standard Performance Measures. Parallel Processing Applications – Massive Parallelism for Grand Challenges.

UNIT-II (11Hrs)

Speedup Performance Laws: Amdahl's Law for Fixed Workload, Gustafson's Law for Scaled Problems and Memory – Bounded Speedup Model. Scalability Metrics and Goals.

Processors and Memory Hierarchy: *Advanced Processor Technology:* Design Space of Processors, Instruction Set Architectures, CISC and RISC Scalar Processors.*Superscalar and Vector Processors:* Superscalar Processors, the VLIW Architecture. Memory Hierarchy Technology. *Virtual Memory Technology:* Virtual Memory Models, TLB, Paging and Segmentation, Memory Replacement Policies.

UNIT-III (11Hrs)

Bus, Cache and Shared Memory: *Cache Memory Organizations:* Cache Addressing Models, Direct Mapping and Associative Caches, Set-Associative and Sector Caches, Cache Performance Issues. *Shared-Memory Organizations*: Interleaved Memory Organization, Bandwidth and fault Tolerance, Memory Allocation Schemes. *Sequential*

and Weak Consistency Models: Atomicity and Event Ordering, Sequential Consistency Model, Weak Consistency models.

UNIT-IV (12 Hrs)

Pipelining and Superscalar Techniques: *Linear Pipeline Processors:* Asynchronous and Synchronous Models, Clocking and Timing Control, Speedup, Efficiency and Throughput. *Nonlinear Parallel Processors:* Reservation and Latency Analysis, Collision-Free Scheduling.

Multiprocessors and Multicomputers: *Multiprocessor System Interconnects:* Hierarchical Bus Systems, Crossbar Switch and Multiport Memory, Multistage and Combining Networks. *Cache Coherence and Synchronization Mechanisms:* The Cache Coherence Problem, Snoopy Bus Protocols, Directory-based Protocols and Hardware Synchronization Mechanisms.

Text/Reference Books:

1. Kai Hwang, "Advanced Computer Architecture", McGraw Hill International, 1993.
2. William Stallings, "Computer Organization and Architecture", Macmillan
3. Publishing Company, 1990.
4. M. J. Quinn, "Designing Efficient Algorithms for Parallel Computers", McGraw
5. Hill International, 1994.
6. John L. Hennessy and David A. Patterson, Computer Architecture A Quantitative approach, Morgan Kaufman Publishers. Inc., 1990.
7. D.P. Siewiorek, G.G. Bell, A. Newell, Computer Structures, Principle and Examples, McGraw Hill, 1982.
8. Related IEEE/IEE publications

SCIENTIFIC COMPUTING

Subject Code: BECED1-722 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To study the concepts of scientific computing.
2. To make students familiar with the concepts of programming and get them accustomed with high-level languages like Matlab.
3. To provide an overview of some of the issues and problems that arises in scientific computation, such as non-linear systems, numerical and symbolic integration, differential equations and simulation.

Course Outcomes:

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

1. Understand the basic concepts of scientific computing.
2. Demonstrate the knowledge of scientific applications of computer programs.
3. Understand simple mathematical models and scientific problems and implement a solution in an adequate scientific programming language.

UNIT-I (11Hrs)

Introduction: Introduction to scientific computing, representing numbers in a computer: scalar data types; Variables and constants: guidelines for variable names, Assignment statements: mathematical and logical operators; Keyboard input and screen output; Writing a simple, linear program, Conditional statements; arrays and subscripts; loops. Plotting; Functions and subroutines.

UNIT-II (11Hrs)

Foundation of Scientific Computing: Quantum computing, Wentzel-Kramer-Brillouin Method, Runge-Kutta method, Trapezoidal method, Quasi-linear, Laplace equation, wave packets. Scientific elements of a FEM, Lagrange and hermite interpolations, Elliptic equation with linear basis function, Pressure fluctuation.

UNIT-III (12Hrs)

Scientific applications of computer programs: Introduction to Matlab, Solving nonlinear equations; Numerical integration; Data analysis, plotting and smoothing; simulating simple physical, chemical and/or mathematical systems. Simulation: the simple programming approach to difference equations, Differential Equations.

UNIT-IV (11 Hrs)

Numerical Differentiation, Construction of finite difference schemes, Pade Approximants, Error analysis Non-uniform grids.

Numerical Integration: Rectangular, Trapezoidal and Simpsons rule, Romberg integration and Richardson extrapolation, Gaussian quadrature, Adaptive quadrature, Error analysis

.

Text/Reference Books:

1. Approximation Theory and Approximation Practice, by Lloyd N. Trefethen
2. Applied Numerical Methods Using MATLAB, by Won Y. Yang, Wenwu Cao, Tae-Sang Chung, John Morris, Wiley.
3. Interpolation and Approximation by polynomials, by George M. Phillips
4. Numerical Analysis (7th) by R. Burden and J. Faires
5. Numerical mathematics and computations, by W. Cheney, D. Kincaid, Thomson, Brooks/Cole.

NEURAL NETWORK & FUZZY LOGIC

Subject Code: BECED1-723 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To introduce the fundamentals of Artificial Neural Networks.
2. To Learn and apply ANN architectures, learning laws to different applications
3. To understand Fuzzy logic and design fuzzy inference systems.
4. To apply fuzzy logic and neural nets to real world problems.

Course Outcomes:

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

1. To design different types of ANNs for variety of applications.
2. To apply ANN to various real world applications.
3. To learn Fuzzy Algebra and design fuzzy inference systems.
4. To design and apply Neuro-fuzzy and genetic algorithms for different applications.

UNIT-I (10 Hrs)

Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential, Applications of ANN.

Types of Learning: Supervised, Unsupervised learning, Basic Learning laws, Hebb's rule, Delta rule, Widrow and Hoff LMS learning rule, Correlation learning rule instar and ouster learning rules, Competitive Learning, Reinforcement Learning.

UNIT-II (15 Hrs)

Multilayer Perceptron: Perceptron, Feed forward Neural Network, Multilayer Perceptron, Error Back propagation Learning Algorithm, MLP design issues and implementation in various applications.

Other ANNs: K-means clustering algorithm, Kohonen's feature maps. ART networks, Radial Basis Function Nets- recurrent networks, Hopfield Neural Nets, Associative and Hetro-associative memories, Applications of ANN in pattern recognition, optimization, control etc

UNIT-III (12 Hrs)

Fuzzy Algebra: Fuzzy algebra fundamental concepts, Classical sets, Fuzzy sets, Fuzzy relations, Fuzzification, Defuzzification,

Fuzzy Logic Systems: Membership functions, Fuzzy rules and Knowledge base, Fuzzy Inference System, applications of Fuzzy logic in real world problems, Fuzzy logic control and its comparison with PID control.

UNIT-IV (8 Hrs)

Neuro-fuzzy network, Genetic Algorithms, and their applications.

Text/Reference Books:

1. Berkin Riza C and Trubatch, "Fuzzy System design principles- Building Fuzzy IF-THEN rule bases", IEEE Press.
2. Yegna Narayanan, "Artificial Neural Networks". 8th Printing. PHI(2003)
3. Patterson Dan W, "Introduction to artificial Intelligence and Expert systems", 3rd Ed., PHI
4. Simon Haykin, "Neural Networks" Pearson Education.
5. Yen and Langari, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education.
6. Jacek M Zaurada, "Introduction to artificial neural Networks, Jaico Publishing Home, Fouth Impression.

VLSI TECHNOLOGY

Subject Code: BECED1-731 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various processes and techniques for semiconductor:

To provide knowledge of.

1. Understand the fundamentals of IC technology, components, scaling trends and limitations.
2. Various techniques and systems for IC fabrication.
3. NMOS and CMOS IC technology, bipolar IC fabrication.
4. Assembling and packaging of ICs.
5. Yield and reliability of VLSI technology

Course Outcomes:

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

1. Justify the significance of different processes involved in IC fabrication technology.
2. Organize the assembling& packaging of ICs and their respective significances.
3. Justify the procedural sequence of design of various processes for IC fabrication of CMOS and bipolar devices.
4. Designing of VLSI Subsystems

UNIT I (12 Hrs.)

Crystal Growth: Introduction, Electronic-Grade Silicon, Czochralski and Bridgman Growth, Crystal Evaluation, Silicon Shaping and Wafer Preparation.

Epitaxial Growth: Thermodynamics of vapour phase growth, selective growth, MOCVD, molecular beam epitaxy technology, gas source MBE and chemical beam epitaxy. Epitaxial evaluation.

Oxidation: Deal-Grove model, linear and parabolic rate coefficients, oxide characterization, types of oxidation and their kinematics, Thin oxide growth, Oxidation of polysilicon, oxidation induced stacking faults, oxidation techniques and systems.

UNIT II (12 Hrs.)

Etching: Wet etching, basic regimes of plasma etching, reactive ion etching and its damages, lift-off, and sputter etching.

Lithography: Optical, electron, X-ray and ion-beam, contact/proximity and projection printers, advanced mask concepts, alignment**.**

Dielectric and Polysilicon Film Deposition: Deposition Processes, Plasma-Assisted Depositions, silicon dioxide, silicon nitride and polysilicon depositions

UNIT III (11 Hrs.)

Diffusion and Ion-Implantation: Fick's diffusion law, atomistic model, diffusion coefficient of common dopants and diffusion systems. Scattering phenomenon, projected range, channeling and lateral projected range, implantation damage, problems and concerns in ion-implantation systems.

Metallization: Applications and choices, physical vapor deposition, patterning, problem areas, multilevel metallization.

UNIT IV (10 Hrs.)

VLSI Process Integration: NMOS and CMOS IC technology, MOS memory IC technology, bipolar IC fabrication.

Assembly Technique and Packaging: Package types, packaging design consideration, VLSI assembly technologies.

Yield and Reliability: Yield loss in VLSI, yield loss modeling, reliability requirements, accelerated testing, BIST.

Text/Reference Books:

1. Sze, S.M., "VLSI Technology", 4th Ed., Tata McGraw-Hill
2. Tyagi, M.S., "Introduction to Semiconductor Materials and Devices", John Wiley & Sons.
3. Chang, C.Y. and Sze, S.M., "ULSI Technology", McGraw-Hill.
4. Campbell, S.A., "The Science and Engineering of Microelectronic Fabrication", 4th Ed., Oxford University Press.
5. Plummer, J.D., Deal, M.D. and Griffin, P.B., "Silicon VLSI Technology: Fundamentals, Practice and Modeling", 3rd Ed., Prentice-Hall.
6. Chen W.K. (ed.), "VLSI Technology", CRC Press.

CMOS DESIGN

Subject Code: BECED1-732 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in CMOS design:

1. Understand the fundamentals of IC technology components, scaling trends and limitations.
2. Design VLSI circuits and systems utilizing modern IC design methodologies and design automation tools.
3. Analyze trade-offs to optimize power, delay and area.
4. Utilize modern CAD tools for IC design, simulation, verification and automated logic synthesis and layout.
5. Explore circuit and higher-level solutions for low-power and variation-aware designs.
6. Anticipate future challenges in IC technologies and think critically about solutions.

Course Outcomes:

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

1. Understand the operation of MOS devices.
2. Design different CMOS circuits using various logic families along with their circuit layout.
3. Design different CMOS combinational and sequential circuits.

UNIT I (12 Hrs.)

Review of MOS Devices: MOS structure, enhancement & depletion transistor, threshold voltage, MOS I-V and C-V characteristics, MOS device design equations, non-ideal behaviour of MOS, CMOS inverter and DC characteristics, beta ratio effects and noise margin.

UNIT II (12 Hrs.)

CMOS Fabrication Technology: CMOS fabrication process, CMOS layout design rules, CMOS process enhancements, fabrication issues, delay models: RC delay model, linear delay model, delay in a multistage logic network, power estimation, static and dynamic power, energy delay optimization, low power architectures, interconnects and their delay, energy and noise impacts, variability and reliability issues, transistor scaling.

UNIT III (11 Hrs.)

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic, circuit issues, combinational logic function, static complementary gate structure and layouts of different logic gates, delay and transmission times, speed power product.

UNIT IV (10 Hrs.)

Sequential Circuit Design: Static and dynamic latches and registers, pulsedlatches, resettable enabled latches and registers, differential flip-flops, choice of elements, sequencing dynamic circuits.

Text/Reference Books:

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C.Meadand, L.Conway, Introduction to VLSI Systems, Addison Wesley, 1979.
3. J.Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: Programming by Example, McGraw Hill, 2013.
5. L. Glaserand, D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

HIGH SPEED ELECTRONICS

Subject Code: BECED1-733 **L T P C** **Duration: 45 Hrs.**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in High-Speed Electronics:

1. To review basic EM concepts required for high-speed electronic design.
2. To impart knowledge about the signal transmission and related issues for high-speed electronic circuits.
3. To impart basic knowledge of properties of various components used in high-speed electronics
4. To create solution for real time design problems.

Course Outcomes:

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

1. Understandsignificanceandtheareasofapplicationofhigh-speedelectronicscircuits.
2. Understandthepropertiesofvariouscomponentsusedinhigh-speedelectronics
3. Design High-speed electronic system using appropriate components.

UNIT-I (10 Hrs.)

Introduction: Need of high speed electronic design and interconnect design, basics of transmission line theory, transmission line structures on PCB and MCM, transmission line parameters, wave propagation, reflections from transmission lines, effect of rise time, reflections from resistive, capacitive, inductive loads, reflection minimizations, crosstalk and associated noise, crosstalk induced, flight time and signal integrity issues, cross talk minimization, termination of transmission line pairs.

UNIT-II (10 Hrs.)

Non ideal Interconnect Issues: Transmission line losses, effect of dielectric constant and serpentine traces and bends on transmission behavior, inter-symbol interference, topological effects, impact of packages, vias, traces, connectors; non-ideal return current paths, high frequency power delivery, local decoupling requirements for high speed input-output, SSO/SSN, characteristics of passive devices: interconnects at RF frequencies, resistors, capacitors, inductors and transformers, interconnect options at high frequency.

UNIT-III (10 Hrs.)

Design Methodologies for High-Speed Buses: Basics of digital timing analysis, timing and signal quality metrics, test loads, design optimization and sensitivity analysis, radiated emissions and mechanism, chocking and decoupling at low as well as high frequencies, package/enclosure considerations, spread spectrum clocking, specifications, minimizing system noise.

UNIT-IV(15Hrs.)

RF Amplifier Design: Low noise amplifiers, LNA topologies, noise optimization, linearity and large signal performance, RF power amplifiers: class A, B, AB. C, D, E and F amplifiers, integrated circuit realizations, cross-over distortion, efficiency, RF power output stages.

Mixers: Mixer fundamentals, up-conversion, down-conversion, nonlinear system as linear mixer, multiplier based mixers, subsampling mixers, conversion gain and spurious response.

Oscillator: General considerations of oscillators, purely linear oscillators, issues, describing functions for bipolar and MOS based oscillators, tuned oscillators, resonators, quadrature signal generation.

Text/Reference Books:

1. Stephen H. Hall, Garrett W. Hall, James A. McCall "High-Speed Digital System Design: A Handbook of Interconnect Theory and Design Practices", August 2000, Wiley-IEEE Press.
2. Thomas H. Lee, "The Design of CMOSRadio-Frequency Integrated Circuits", Cambridge University Press, 2004, ISBN 0521835399.
3. Behzad Razavi, "RF Microelectronics", Prentice-Hall 1998, ISBN0-13-887571-5.
4. Guillermo Gonzalez, "Microwave Transistor Amplifiers", 2nd Edition, Prentice Hall.
5. Kai Chang, "RF and Microwave Wireless systems", Wiley.
6. R.G. Kaduskar and V.B.Baru, Electronic Product design, Wiley India,2011

ENVIRONMENTAL SCIENCES

Subject Code: BMNCC0-002 **L T P C** **Duration: 30 Hrs.**

2 0 0 0

Course Objectives:

1. To identify global environmental problems arising due to various engineering/industrial and technological activities and the science behind these problems
2. To realize the importance of ecosystem and biodiversity for maintaining ecological balance.
3. To identify the major pollutants and abatement devices for environmental management and sustainable development.
4. To estimate the current world population scenario and thus calculating the economic growth, energy requirement and demand.
5. To understand the conceptual process related with the various climatologically associated problems and their plausible solutions.

. UNIT-I

1. The Multidisciplinary Nature of Environmental Studies:

Definition, scope and importance, Need for public awareness.

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.

UNIT-II

Environmental Pollution: Definition

(a) Causes, effects and control measures of:

i) Air pollution

ii) Water pollution

iii) Soil pollution

iv) Marine pollution

v) Noise pollution

vi) Thermal pollution

vii) Nuclear pollution

(b) **Solid Waste Management**: Causes, effects and control measures of urban and industrial wastes.

(c) Role of an individual in prevention of pollution.

(d) Pollution Case Studies.

(e) Disaster management: floods, earthquake, cyclone and landslides.

UNIT-III

Social Issues and the Environment

(a) From unsustainable to sustainable development

(b) Urban problems and related to energy

(c) Water conservation, rain water harvesting, Watershed Management

(d) Resettlement and rehabilitation of people; its problems and concerns, Case studies.

(e) Environmental ethics: Issues and possible solutions

(f) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, Case studies.

(g) Issues involved in enforcement of environmental legislation

UNIT-IV

Human Population and the Environment

(a) Population growth, variation among nations

(b) Population explosion – Family Welfare Programmes

(c) Environment and human health

(d) Human Rights

(e) Value Education

(f) Women and Child Welfare

(g) Role of Information Technology in Environment and Human Health

(h) Case Studies.

Environmental Science related activities:

We as human being are not an entity separate from the environment around us rather we are a constituent seamlessly integrated and co-exist with the environment around US. We are not an entity so separate from the environment that we can think of mastering and controlling it rather we must understand that each and every action of ours reflects on the environment and vice versa. Ancient wisdom drawn from Vedas about environment and its sustenance reflects these ethoses. There is a direct application of this wisdom even in modern times. Idea of an activity based course on environment protection is to sensitize the students on the above issues through following two types of activities.

(a) Awareness Activities:

i) Small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste.

ii) Slogan making event

iii) Poster making event

iv) Cycle rally

v) Lectures from experts.

(b) Actual Activities:

i) Plantation

ii) Gifting a tree to see its full growth

iii) Cleanliness drive

iv) Drive for segregation of waste

v) To live some big environmentalist for a week or so to understand his work

vi) To work in kitchen garden for mess

vii) To know about the different varieties of plants

viii) Shutting down the fans and ACs of the campus for an hour or so

Recommended Books

1. Agarwal, K. C. 2001 Environment Biology, Nidi Publ. Ltd. Bikaner.
2. Jadhav, H & Bhosale, V.M. 1995. Environment Protection and Laws. Himalaya Pub House, Delhi 284p.
3. Rao M. N. & Datta A.K. 1987. Waste Water Treatment. Oxford & IBH Publ. Co. Pvt. Ltd. 345 p.
4. Principle of Environment Science by Cunninghan, W.P.
5. Essentials of Environment Science by Joseph.

8TH SEMESTER

WIRELESS SENSOR NETWORKS

Subject Code: BECED1-811 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding wireless sensor networks and its protocols.

1. To make aware the students about the concept wireless sensor networks.
2. To impart knowledge of different wireless sensor network protocols.
3. To provide the students detailed concepts of IEEE wireless standards.
4. To design basic wireless sensor network.

Course Outcomes:

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

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. UnderstandMACprotocolsusedfordifferentcommunicationstandardsusedinWSN
4. Explore new protocols for WSN

UNIT-I (13 Hrs)

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks. Mobile Ad-hoc Networks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

UNIT-II (11 Hrs)

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee, Dissemination protocol for large sensor network.

UNIT-III (11 Hrs)

Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols. Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

UNIT-IV (10 Hrs)

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments, introduction to TinyOS and nesC.

Text/Reference Books:

1. WaltenegusDargie , Christian Poellabauer, “Fundamentals Of Wireless Sensor Networks TheoryAndPractice”,ByJohnWiley&SonsPublications,2011
2. SabrieSoloman, “Sensors Handbook" by McGraw Hill publication.2009
3. FengZhao,LeonidasGuibas,“WirelessSensorNetworks”,ElsevierPublications,2004
4. Kazem Sohrby, Daniel Minoli, “Wireless Sensor Networks”: Technology, Protocols and Applications, Wiley-Interscience
5. PhilipLevis,AndDavidGay"TinyOSProgramming”byCambridgeUniversityPress2009

SATELLITE COMMUNICATION

Subject Code: BECED1-812 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To introduce various aspects in the design of systems for satellite communication.
2. To illustrate various aspects related to satellite systems such as orbital equations, sub-systems, link budget.
3. To impart knowledge about various phenomena in Satellite Communication.
4. To provide the knowledge of various multiple access techniques.

Course Outcomes:

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

1. Visualize the architecture of satellite systems as a means of high speed, high range communication system.
2. Understand link design for satellite communication.
3. Understand and utilize the basic approaches for multiple access techniques.
4. Solve numerical problems related to orbital motion and design of link budget for the given parameters and conditions.

UNIT-I (10Hrs)

Introduction to Satellite Communication: Principles and architecture of satellite communication, brief history of satellite systems, advantages, disadvantages, applications and frequency bands used for satellite communication.

UNIT-II (12Hrs)

Orbital Mechanics: Orbital equations, Kepler's laws, Apogee and Perigee for an elliptical orbit, evaluation of velocity, orbital period, angular velocity of a satellite, concept of Solar day and Sidereal day.
Satellite sub-systems: Study of Architecture, and roles of various sub-systems of a satellite system such as Telemetry, tracking, command and monitoring (TTC & M), Attitude and orbit control system (AOCS), communication sub-system, power sub-system.

UNIT-III (12Hrs)

Typical Phenomena in Satellite Communication: Solar Eclipse on satellite, its effect, remedies for eclipse, Sun Transit Outage phenomena, its effects and remedies, Doppler frequency shift phenomena and expression for Doppler shift.
Satellite Link Budget: Flux density and received signal power equations, calculation of system noise temperature for satellite receiver, noise power calculation, drafting of satellite link budget, C/N ratio calculations in clean air and rainy conditions

UNIT-IV (11Hrs)

Modulation and Multiple Access Schemes: Various modulation schemes used in satellite communication, multiple access schemes: TDMA, FDMA and CDMA.

Text/Reference Books:

1. Timothy Pratt, 'Satellite Communication', John Wiley & Sons.
2. D.C. Aggarwal, 'Satellite Communication', Khanna Publishers.
3. Tri. T. Ha, "Digital Satellite Comunications", Tata Mcgraw Hill, 2009.
4. Dennis Roddy, Satellite Communication, Tata Mcgraw Hill, 2009

ERROR CORRECTION CODING

Subject Code: BECED1-813 | **L T P C** 3 0 0 3 | **Duration: 45 Hrs.**

Course Objectives:

This course is meant to provide Fundamental knowledge about:

1. Types and sources of error in digital communication
2. Various error correcting and detecting techniques
3. How to use mathematical tools to design codes and sequences for data communication.
4. Issues in achieving data rates upto Shannon's limit

Course Outcomes:

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

1. Understand fundamentals of channel coding schemes and their application areas
2. Define the sources of error in digital communication
3. Explain the fundamental limits to achieve the Shannon's Channel Capacity
4. Describe the importance and principle of ECC in data communication and storage.
5. Demonstrate an ability to compare and contrast strengths and weaknesses of various ECC
6. Develop and model different ECC for appraise of reaching data rate to Shannon limit.
7. Apply the mathematical ideas to design well known ECC
8. Demonstrate competence in analyzing and evaluating different ECC

UNIT-I (9 Hrs.)

Channel capacity and coding: Introduction; Channel Models, Channel Capacity, Need of Channel Coding, Information Capacity Theorem, Shannon Limit; Random Selection of Codes, Hamming Distance, overview of Information Theory. Classification of error correcting codes (ECC), Linear and non-linear codes, memory-based and memory-less codes, Symmetric and asymmetric codes, perfect and quasi perfect codes, coding efficiency; **Applications of error control coding**

UNIT-II (12 Hrs.)

Block Codes: Digital Communication Channel, Introduction to Block Codes, Single Parity Check Codes, Product Codes, Repetition Codes, error detection and correction, Hamming Codes, Minimum Distance of Block Codes, bounds on the size of a block code; bounded and maximum-likelihood decoding of binary block codes, Soft - Decision Decoding, Automatic Repeat Request Schemes.

Linear Codes: Definition of Systematic Linear Codes, generator and parity check matrices, Standard Array decoding, Parity - Check Matrices, Syndrome decoding on symmetrical channels, Shortened and Extended Linear Codes.

UNIT-III (12 Hrs.)

Cyclic codes: Introduction of Cyclic Codes, Polynomials, Generator Polynomials, Encoding Cyclic Codes, Decoding Cyclic Codes, Factors of X^n +1, Parity-Check Polynomials, Dual Cyclic Codes, Generator and Parity-Check Matrices of Cyclic Codes.

BCH Codes: Linear Algebra, Galois Field, Definition and Construction of Binary BCH Codes, Error Syndromes in Finite Fields, Decoding Single error correction (SEC) and Double Error Correction (DEC) codes, Reed- Solomen Codes.

UNIT-IV (12 Hrs.)

Convolutional Codes: Introduction to Convolution codes, Encoding, Generator Matrices, Generator Polynomials, Graphical Representation of Convolutional Codes (code tree, state diagram, trellis diagram), Viterbi decoding algorithm. Concept of Interleaver and punctured coding
Concatenated codes: Introduction, Need and Purpose of concatenated codes, Overview of Turbo coders and decoders, LDPC coders and decoders, Recent trends in error correction coding.

Recommended Text Books / Reference Books:

1. Amitabha Bhattacharya, "Digital Communication", Tata McGraw Hill Publishing Company Limited, 2006.
2. Hwei P. Hsu, "Analog and Digital Communications", Schaum's Outline Series, McGraw Hill, 2nd Ed., 2003.
3. Shu Lin, Daniel J. Costello, Jr., "Error Control Coding", Second Edition, Pearson Education, 2011.
4. Martin Tomlinson, Cen Jung Tjhai, Marcel A. Ambroze, Mohammed Ahmed, Mubarak Jibril, "Error-Correcting Coding and Decoding: Bounds, Codes, Decoders, Analysis and Applications", Springer Nature, 2017.
5. Bose Ranjan, "Information Theory, Coding and Cryptography", Tata McGraw-Hill, 1st Ed., 2007.
6. Sklar Bernard, "Digital Communications - Fundamentals and Applications", Pearson Education-LPE, 2nd Ed., 2009.
7. F. J. McWilliams and N.J.A. Slone, "The Theory of Error Correcting Codes", 1977.
8. R.E. Balahut, "Theory and Practice of Error Control Codes", Addison Wesley, 1983.

MACHINE LEARNING

Subject Code: BECED1-821 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding machine learning and its applications.

1. To make aware the students about the concept machine learning.
2. To impart knowledge of different types of learning.
3. To provide the students concepts of clustering and classification in machine learning.
4. To implement basic classification algorithms in different domains.

Course Outcomes:

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

1. Understand the concept of data processing.
2. Understand the concepts of supervised and unsupervised learning.
3. Understand the concept of classification

UNIT-I (10 Hrs)

Basic concepts of data mining, including motivation and definition; different types of data repositories; data mining functionalities.
Data: Types of data and data quality; Data Preprocessing: data cleaning, data integration and transformation, data reduction, discretization and concept hierarchy generation; Exploring

Data: summary statistics, visualization, multidimensional data analysis

UNIT-II (12 Hrs)

Supervised learning- Perceptron learning, single l layer/multilayer perceptron, linear separability, hidden layers, Error backpropagation algorithm, Radial Basis Function network; Unsupervised learning - Kohonen, SOM, Counter-propagation, ART, Reinforcement learning, adaptive resonance architecture, applications of neural networks to pattern recognition systems such as character recognition, face recognition, application of neural networks in imageprocessing.

UNIT-III (10 Hrs)

Clustering- Concept of Clustering, clustering process, clustering algorithms, Clustering largedatasets*;* measures of similarity, Clustering algorithms: Partitioning methods - k-means and k-medoids.

UNIT-IV (13 Hrs)

Classification: Binary Classification - Basic concepts, Bayes theorem and Naive Bayes classifier, Association based classification, Rule based classifiers, Nearest neighbour classifiers, Decision Trees, Random Forest; Perceptron; Multi-category classification; Model overfitting, Evaluation of classifier performance - Cross validation, ROC curves.

Text/Reference Books:

1. Pang-Ning Tan, Michael Steinbach and Vipin Kumar, Introduction to Data Mining. Pearson (2005),India. ISBN978-8131714720
2. JiaweiHanandMichelineKamber,DataMining:ConceptsandTechniques,MorganKaufmann,3rdedition (July 2011). 744 pages. ISBN978-0123814791
3. IanH.WittenandEibeFrank,DataMining:PracticalMachineLearningToolsandTechniques,Morgan Kaufmann, 3rd edition (January 2011). 664 pages. ISBN978-0123748560.
4. David E. Goldberg, Genetic Algorithms in Search, Optimization & Machine Learning, AddisonWesley, 1997.

DATA MINING & BIG DATA

Subject Code: BECED1-822 **L T P C** **Duration: 45Hrs**
3 0 0 3

Course Objectives:

The course shall provide fundamental knowledge to students for understanding of the various concepts, techniques and applications of data mining & upcoming big data scenario:

1. To study fundamentals of data mining.
2. To know about basic algorithms including data preprocessing and classification.
3. To provide understanding of terminologies and the core concepts behind big data problems.
4. To develop skills to build various applications of Big Data for real life applications.

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

1. Develop algorithms for finding patterns in large data sets.
2. Apply novel cutting-edge techniques to applications of Big Data Computing in industry.
3. Analyze various frameworks and large-scale data storage technologies.
4. Apply Data Mining concepts to real life problems.

UNIT-I (11Hrs)

Introduction: Data Mining as the Evolution of Information Technology, Kinds of Data, Major Issues and Challenges involved in Data Mining, Data Objects and Attribute Types.

Data Preprocessing: Data Cleaning, Data Integration, Data Reduction, Data Transformation and Data Discretization. Association Rule Mining.

UNIT-II (11Hrs)

Data Warehousing: Basic Concepts, Modeling: Data Cube and OLAP, Design and Usage.

Classification: Basic Concepts, Decision Tree Induction, Bayes Classification Methods, Rule-Based Classification, K-Nearest Neighbor, Support Vector Machine, Model Evaluation and Selection, Techniques to Improve Accuracy.

UNIT-III (11Hrs)

Introduction to Big Data: Origin of Big Data, Big Data Analytics and Machine Learning; Big Data Analytics and Cloud Computing, Sources of Data Generation, Types: Structured, Unstructured, Semi-Structured Data. Issues, Challenges and Introduction to Enabling Technologies for Big Data.

UNIT-IV (12 Hrs)

Big Data Platforms and Applications: Introduction to Big Data Platforms, Big Data Storage Platforms for Large Scale Data Storage, Big Data Streaming Platforms for Fast Data, Big Data Applications and Machine Learning.

Text/Reference Books:

1. Jiawei Han, Micheline Kamber and Jian Pei. Data Mining Concepts and Techniques. Morgan Kaufmann Publishers.
2. Rajkumar Buyya, Rodrigo N. Calheiros and Amir Vahid Dastjerdi. Big Data Principles and Paradigms. Morgan Kaufmann Publishers.
3. Frank Ohlhorst. Big Data AnalyticsTurning Big Data into Big Money. Willey Publisher.
4. NPTEL Couse: Data Mining by PROF. PABITRA MITRA Department of Computer Science and Engineering IIT Kharagpur.*(https://nptel.ac.in/courses/106/105/106105174/)*
5. NPTEL Couse: Big Data Computing by Prof. Rajiv Misra, Department of Computer Science and Engineering, IIT Patna.*(https://nptel.ac.in/courses/106/104/106104189/)*

ARTIFICIAL INTELLIGENCE

Subject Code: BECED1-823 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To study the concepts of Artificial Intelligence.
2. To learn the methods of solving problems using Artificial Intelligence.
3. To introduce Image processing and NLP as application areas of AI.

Course Outcomes:

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

1. Apply the concepts of knowledge representation, planning and reasoning for real world applications.
2. Apply AI techniques to solve complex problems of Industry using machine learning.
3. Apply AI techniques to solve problems in Image Processing and NLP.
4. Learn to use AI with complete Ethics and Follow legal considerations.

UNIT-I (10 Hrs)

Introduction to AI

Introduction to artificial intelligence, History, AI applications, Problem spaces and search, Knowledge and rationality, Heuristic search strategies, Search and optimization (gradient descent),Adversarial search, Planning and scheduling,

UNIT-II (8 Hrs)

Knowledge Representation and Reasoning

Propositional logic, First-order logic, Knowledge representation, Quantifying uncertainty, Probabilistic reasoning

UNIT-III (15 Hrs)

Machine learning
Supervised methods: What is machine learning, Supervised vs. unsupervised learning, Regression -- linear, logistic, ridge, Classification – decision trees, SVM, random forests, Model performance evaluation – MSE, lift, AUC, Type 1 vs 2 errors

Deep Learning: Neural networks and back-propagation, Convolutional neural networks, Recurrent neural networks and Long Short-Term Memory (***LSTM***) networks

Machine Learning: Unsupervised Methods, Dimensionality reduction: PCA, Clustering – k-means, hierarchical clustering, Semi-supervised methods, Reinforcement learning, Choosing among machine learning techniques

UNIT-IV (12 Hrs)

AI and Machine learning in industry
Image Processing: Introduction to computer vision, Image segmentation, Object and motion detection, Object classification,

Natural Language Understanding: Intro to natural language understanding, Application of deep learning to NLP

Ethical and Legal Considerations in AI: Privacy, Bias, AI and the future of work, Appropriate uses of AI, Future of AI: Emerging developments,

Text/Reference Books:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence: A Modern Approach” , 3rd Edition, Prentice Hall, 2001
2. Goodfellow,I., Bengio, Y. and Courville A., “Deep Learning”, MIT Press, 2016
3. Elaine Rich and Kevin Knight, “Artificial Intelligence”, Tata McGraw Hill, 2008
4. Trivedi, M.C., “A Classical Approach to Artifical Intelligence”, Khanna Publishing House,Delhi.
5. Artificial Intelligence, George F. Luger, Pearson Education, 2001.

INTERNET OF THINGS

Subject Code: BECED1-824 **L T P C** **Duration: 45Hrs**
3 0 0 3

Course Objectives:

This course is meant to provide fundamental knowledge to students for understanding of the various concepts and techniques used in internet of things:

1. To learn the definition and significance of the Internet of Things.
2. To understand about SDN and data handling methods.
3. To explore the relationship between IoT and cloud computing.
4. To acquire knowledge about the different application-domain.

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

1. Explore the interconnection and integration of the physical world and the cyber space.
2. Develop skills to build machine to machine communication.
3. Design and develop of IoT Devices.
4. Identify how IoT differs from traditional data collection systems.

UNIT-I (11Hrs)

Introduction to Internet of Things (IoT): Definition, Characteristics, Evolution, Applications, IoT versus M2M (Machine to Machine) and IoT versus WoT (Web of Things). Sensing, Actuation, Sensors: Definition, Features, Classes. Sensor versus Transducers, Sensor Networks, UAV Networks, Actuator: Definition, Types (hydraulic, pneumatic, electrical, thermal, magnetic and mechanical).

Basics of IoT Networking: IoT Components, IoT Categories (Industrial and Consumer).Connectivity Technologies: LAN, WAN, Node, Gateway and Proxy, IPv4 versus IPv6. Communication Protocols.

UNIT-II (11Hrs)

Machine-to-Machine Communications: Introduction, Applications, Features. Interoperability in IoT: Current Challenges in IoT, Requirement, Types (User and Device).

Introduction to Arduino: Features, Types of Arduino Board. Programming, Integration of Sensors and Actuators with Arduino, Introduction to Python Programming, Introduction to Raspberry Pi, Implementation of IoT with Raspberry Pi.

UNIT-III (11Hrs)

Software-Defined Networking (SDN): Current Network and its limitations, Introduction toSDN, Current Network to SDN, SDN Architecture, Components of SDN, Rule Placement with OpenFlow, SDN for IoT, Benefits of Integrating SDN with IoT, Data Handling and Analytics, Cloud Computing-Service Models, Comparison of Different Service Models, Sensor-Cloud.

UNIT-IV (12 Hrs)

Fog Computing: Introduction, Architecture and working of Fog, Advantages and Applications of Fog, Smart Cities and Smart Homes, IoT Challenges in Smart Cities, Data Fusion and its Opportunity in IoT, Connected Vehicles, Smart Grid, Industrial IoT, Case Study: Agriculture, Healthcare and Activity Monitoring.

Text/Reference Books:

1. Raj Kamal, "Internet of Things - Architecture and Design Principles" McGrawHill
2. Mayur Ramgir, "Internet of Things - Architecture, Implementation, and Security", First Edition, Pearson Education.
3. Olivier Hersent, David Boswarthick andOmar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley.
4. ArsheepBahga and Vijay Madisetti "Internet of Things: A Hands-On Approach" Orient Blackswan Publishers.

MOOCs Course Mapping:

"Introduction to Internet of Things" by Prof. Sudip Misra, Department of Computer Science and Engineering, IIT Kharagpur***(https://nptel.ac.in/courses/106/105/106105166/)***

ESSENCE OF INDIAN KNOWLEDGE TRADITION

Subject Code- BMNCC0-006 **L T P C** **Duration: 30 Hrs.**
2 0 0 0

COURSE OBJECTIVE:
The course is introduced
1. To get a knowledge in Indian Philosophical Foundations.
2. To Know Indian Languages and Literature and the fine arts in India & Their Philosophy.
3. To explore the Science and Scientists of Medieval and Modern India

COURSE OUTCOMES:
After successful completion of the course the students will be able to
1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature among difference traditions.
3. Learn the philosophy of ancient, medieval and modern India.
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. The essence of Yogic Science for Inclusiveness of society.

COURSE CONTENTS:

UNIT – I

Introduction to Indian Philosophy: Basics of Indian Philosophy, culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian culture, Ancient Indian, Medieval India, Modern India.

Indian Philosophy & Literature: Vedas Upanishads, schools of Vedanta, and other religion Philosophical Literature. Philosophical Ideas the role of Sanskrit, significance of scriptures to current society, Indian Philosophies, literature of south India.

UNIT – II

Religion and Philosophy: Religion and Philosophy in ancient India, Religion and Philosophy in Medieval India, Religious Reform Movements in Modern India (selected movements only)

UNIT – III

Indian Fine Arts & Its Philosophy(Art, Technology & Engineering): Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in Indian, development of science in ancient, medieval and modern Indian.

UNIT – IV

Education System in India: Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Scientists of Medieval India, Scientists of Modern India. The role Gurukulas in Education System, Value based Education.

RECOMMENDED BOOKS:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition'', ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN-13:978-8187276333,2007
3. NCERT, "Position paper on Arts, Music, Dance and Theatre'', ISBN 81-7450-494-X, 2006
4. S. Narain, "Examination in Ancient India", Arya Book Depot, 1993
5. Satya Prakash, "Founders of Sciences in Ancient India", Vijay Kumar Publisher, 1989
6. M.Hiriyanna, "Essentials of Indian Philosophy", Motilal Banarsidass Publishers, ISBN-13: 978- 8120810990,2014
7. Chatterjee. S & Dutta "An Introduction to Indian Philosophy".

SEMESTER-VII

Subject Code	Course Title	Contact Hrs.			Max. Marks			Credits
		L	T	P	Int.	Ext.	Total	
BMECS1-701	Refrigeration & Air Conditioning	3	0	0	40	60	100	3
YYYYY	Department Elective -IV	3	0	0	40	60	100	3
XXXXX	Open Elective$	3	0	0	40	60	100	3
YYYYY	Department Elective -V	3	0	0	40	60	100	3
BMECS1-702	*Mechanical Engineering Lab-VII (DMS&IAR Lab) Lab)	0	0	2	60	40	100	1
BMECS1-703	** Mechanical Engineering Lab-VIII (RAC Lab)	0	0	2	60	40	100	1
BMECS1-704	***Industrial Training	0	0	--	60	40	100	3
Total		**-**	**-**	**-**	**340**	**360**	**700**	**17**

$ Open Electives (OE) can also be taken from existing lists of Open Elective-I, Open Elective-II and Open Elective-III subject lists.

***DMS- Design & Manufacturing Software**

IAR – Industrial Automation and Robotics

****RAC- Refrigeration & Air Conditioning**

*****The industrial Training to be imparted at the end of 6th semester for Six weeks.**

Department Elective-IV (Choose any one from the following)

1. Computer Aided Design– **BMECD1-711**
2. Finite Element Analysis– **BMECD1-712**
3. Additive Manufacturing– **BMECD1-713**
4. Heat Exchanger Design– **BMECD1-714**

Department Elective-V (Choose any one from the following)

1. Non-Destructive Testing– **BMECD1-721**
2. Composite Materials– **BMECD1-722**
3. Mechanical Vibrations – **BMECD1-723**
4. Advance Fluid Mechanics– **BMECD1-724**

SEMESTER-VIII

Subject Code	Course Title	Contact Hrs.			Max. Marks			Credits
		L	T	P	Int.	Ext.	Total	
YYYYY	Department Elective -VI	3	0	0	40	60	100	3
YYYYY	Department Elective -VII	3	0	0	40	60	100	3
XXXXX	Open Elective$	3	0	0	40	60	100	3
XXXXX	Open Elective$	3	0	0	40	60	100	3
BMECS1-801	Major Project	0	0	6	60	40	100	3
Total		**-**	**-**	**-**	**220**	**280**	**500**	**15**

$ Open Electives (OE) can also be taken from existing lists of Open Elective-I, Open Elective-II and Open Elective-III subject lists.

Department Elective-VI (Choose any one from the following)

1. Industrial Safety & Environment**– BMECD1-811**
2. Process Planning & Cost Estimation– **BMECD1-812**
3. Total Quality Management– **BMECD1-813**
4. Principles of Management– **BMECD1-814**
5. Energy Conservation and Management– **BMECD1-815**

Department Elective-VII (Choose any one from the following)

1. Operations Research**– BMECD1-821**
2. Operation Management– **BMECD1-822**
3. Sustainable Manufacturing– **BMECD1-823**
4. Work Study & Ergonomics– **BMECD1-824**

REFRIGERATION AND AIR CONDITIONING

Subject code: BMECS1-701 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the fundamental principles, various equipment's employed and different methods of refrigeration and air conditioning.
2. To understand various refrigeration cycles like Air refrigeration, vapour compression and vapour absorption refrigeration cycles and further to evaluate performance using Mollier charts and/ or refrigerant property tables.
3. To understand the concepts of different refrigerants with respect to properties, applications, environmental issues and their up gradation.
4. To understand the basic air conditioning processes, calculate cooling load for its applications in comfort and industrial air conditioning.

UNIT-I (10 Hrs)

Basic Concepts: Definition of Refrigeration and Air conditioning; Difference between Refrigeration, cooling and Air conditioning; EPR, COP of a refrigerator; and COP/EPR of a heat pump; Single Phase and two phase Reversed Carnot cycle and its limitations; and its Applications.

Aircraft Refrigeration & Air conditioning: Necessity, Applications and Classification of aircraft refrigeration and air conditioning systems, Bell Coleman/Reversed Brayton / Reversed Joule Cycle and its analysis; various types of air refrigeration systems; Air Refrigeration Cycle for aircraft with Ram compression; Performance of air-refrigeration systems; DART; Comparison of different aircraft refrigeration and air conditioning systems; Numerical.

UNIT-II (15 Hrs)

Simple Vapour Compression Refrigeration Cycle: Representation of Simple/Theoretical Vapour compression refrigeration cycle on h-s, T-s and P-h diagrams; C.O.P. ; Dry versus wet compression; expansion versus throttling of liquid refrigerant; Determination of properties of sub cooled, saturated and superheated refrigerant by using saturated properties & specific heat tables/saturated & superheated properties tables and P-h diagram; Compressor work and volumetric efficiency; Effect on performance and cooling capacity due to change in evaporator pressure, condenser pressure, sub cooling of liquid refrigerant, super heating of suction vapours, pressure drop in evaporator and condenser; Numericals, Actual vapour compression refrigeration cycle on T-s and P-h diagrams (No mathematical analysis);

Compound Vapour Compression Refrigeration Cycle: Introduction, its advantages, schematic representation of these systems with use of flash chamber, water intercooler, flash intercooler, liquid sub-cooler (independent and combination of these); Introduction and schematic representation of multiple evaporator systems with use of individual and multiple expansion valves arrangements, with single and multiple (individual and compound) compressor. Flash gas, its advantages and disadvantages, and its removal: flash chamber, liquid sub-cooler; Numericals.

Vapour Absorption Refrigeration Cycle (No Mathematical Analysis): Principle and advantages of vapour absorption refrigeration system over compression system; Simple-Ammonia Absorption system; Practical Aqua - ammonia vapour absorption refrigeration system; Lithium Bromide - water absorption system (Single and double effect); Electrolux refrigeration system.

UNIT-III (10 Hrs)

Refrigerants: Classification and nomenclature of refrigerants; Desirable thermodynamic, chemical and physical properties of refrigerants; Azeotropes; Zeotropes; environmental aspects of conventional refrigerants; Eco friendly refrigerants and action plan to reduce ecological hazards. Global Warming Potential (GWP) and Total Equivalent Warming Impact (TEWI).

Alternative Refrigeration Systems and Low Temperature Refrigeration: (No Mathematical Analysis) Principle, advantages, limitations and applications of Steam Jet Refrigeration; Mixed Refrigeration Systems; Vortex Tube Refrigeration, Thermoelectric refrigeration; Cascade Refrigeration System; Linde and Claude cycles, Liquefaction of gases, cryogenics and its engineering applications.

Refrigerant Control Devices: Purpose; Theory of operation; Description of different valves; capillary tubes; Basic functions, principles and application of piping, points to be considered in piping design, piping layout.

UNIT-IV (10 Hrs)

Air Conditioning Concepts and Applications: Classification of air-conditioning systems; Psychrometric properties of air, Adiabatic mixing of moist air streams without condensation and with condensation; Numerical. Human requirement of comforts; effective temperature and comfort charts; Industrial and comfort air conditioning.

Psychometric Processes: Basic psychrometric processes; Sensible heat; Latent heat and Total heat process; Sensible heat factor; Evaporative cooling; cooling with dehumidification; Heating with dehumidification; chemical dehumidification; By-pass factor; Contact factor; Psychrometric processes in air conditioning equipment: Cooling coils, Heating coils, cooling and

dehumidification coils, Evaporative coolers, Adiabatic dehumidifiers, Steam injection, mixing of air streams, Air washer ; Summer, winter and year round air conditioning systems; Numerical.

Calculations for Air Conditioning Load: Cooling and heating load estimation; Apparatus dew point temperature; Rate and state of supply air for air conditioning of different types of premises; Numerical, Package and central air conditioning plants. Room air conditioners; split units.

Refrigeration and Air Conditioning Equipment: Brief description of compressors, condensers, evaporators; Purpose and main components of Cooling towers; Defrosting methods; types of dampers, grills and air filters; types and comparison of various air-handling equipments, Air distribution and design of design of air conditioning ducts; Types and working of humidifiers.

Course Outcomes: Students successfully completing this module will be able to:

1. Understand the fundamental principles, operate and analyze the refrigeration and air conditioning systems.
2. Compute cooling capacity and coefficient of performance of various refrigeration systems.
3. Present the properties, applications, environmental issues of different refrigerants.
4. Calculate cooling load for air conditioning systems used for various applications.

Recommended Books

1. C.P. Arora, ‘Refrigeration and Conditioning’, Tata McGraw Hill.
2. Manohar Prasad, ‘Refrigeration and Conditioning’, Wiley Eastern Limited.
3. Jordan and Priester, ‘Refrigeration and Conditioning’, Prentice Hall of India.
4. W.F. Stoecker, ‘Refrigeration and Conditioning’, McGraw Hill.
5. Arora &Domkundwar, ‘Refrigeration and Air conditioning’, Dhanpat Rai.

COMPUTER AIDED DESIGN

Subject code: BMECD1-711 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To enable student to understand the basics of design software and hardware requirements for designing of mechanical component using computer.
2. To learn to represent various curves, surfaces and solids.
3. To understand the concepts of visual realism of models and assembly of components.
4. To describe CAD Standards and concepts of design of components using FEM.

UNIT-I (10 Hrs)

Fundamentals of Computer Graphics: Product cycle, sequential and concurrent engineering, Computer Aided Design system architecture, computer graphics, coordinate systems, 2D and 3D transformations

UNIT-II (10 Hrs)

Geometric Modeling: Representation of curves, Hermite curves, Bezier curves, B-spline curves, rational curves, Techniques of surface modeling, surface patches, Bezier and B-spline surfaces, Solid modeling techniques, CSG and B-rep.

UNIT-III

Visual Realism: Hidden line-surface-solid removal algorithms, shading, coloring, computer animation **10 Hrs**

Assembly of Parts: Assembly modeling, tolerance analysis, mass property calculations, mechanism simulation and interference checking **5 Hrs**

UNIT-IV

CAD Standards: Graphical Kernel System (GKS), standards for exchange images, Open Graphics Library (OpenGL), Data exchange standards- IGES, STEP, CALS etc., Communication standards **5 Hrs**

Finite Element Modeling: Overview of FEM, Advantages and applications, recent advancements in FEM, FEA software, Basic principles and general procedure of FEM. **5 Hrs**

Course Outcomes: Upon completion of the course, the student will be able to:

1. To apply the basics of design software and hardware requirements for designing of mechanical component using computer.
2. Make the representation of curves, surfaces and solids.

3. Understand the concepts of visual realism of models and assembly of components.
4. Describe CAD Standards and concepts of design of components using FEM.

Reference Books:

1. Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co.
2. C. McMohan and J. Browne, CAD/CAM Principles, II edition, Pearson Education
3. W. M. Neumann and R.F. Sproul, Principles of Computer Gra[hics, McGraw Hill
4. D. Hearn and M.P Baker, Computer Graphics, Prentice Hall Inc.

FINITE ELEMENT ANALYSIS

Subject code: BMECD1-712 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To introduce the basics and application of Finite Element Method for addressing Mechanical Engineering problems.
2. To apply finite element formulations to solve one dimensional problem.
3. To apply finite element formulations to solve two dimensional problems.
4. To apply finite element method to solve problems related to iso parametric element and dynamic problems.

UNIT-I (10 Hrs)

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discrete and continuous models, boundary and initial value problems, Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basic concept of Finite Element Method.

UNIT-II (11 Hrs)

One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, solution of problems from solid mechanics and heat transfer, longitudinal vibration and mode shapes, fourth order beam equation, transverse deflections and natural frequencies.

UNIT-III (12 Hrs)

Two dimensional equations, variational formulation, finite element formulation, triangular elements shape functions, elemental matrices and RHS vectors; application to thermal problems, torsion of non-circular shafts, quadrilateral and higher order elements. Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements.

UNIT-IV (12 Hrs)

Natural coordinate systems, isoperimetric elements and shape functions, numerical integration and application to plane stress problems, matrix solution techniques, solution of dynamic problems, introduction to FE software.

Course Outcomes: Upon completion of the course, the student will be able to

1. Understand and apply the basics of Finite Element Method for addressing Mechanical Engineering problems.
2. Apply finite element formulations to solve one dimensional problem.

3. Apply finite element formulations to solve two dimensional problems.
4. Apply finite element method to solve problems related to iso parametric element and dynamic problems.

Reference Books:

1. Reddy J.N., An Introduction to Finite Element Method, Tata McGraw Hill.
2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi.
3. Rao S.S., The Finite Element Method in Engineering, Butterworth Heinemann.
4. Chandraputla & Belegundu, Introduction to Finite Elements in Engineering, Prentice Hall.
5. Concepts and Applications of Finite Element Analysis, R D Cook, Wiley India.
6. C.S. Krishnamoorty, Finite Element Analysis, Tata McGraw-Hill

ADDITIVE MANUFACTURING

Subject Code: BMECD1-713 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course objectives:

1. To understand the concept and impact of Rapid Prototyping (RP) and its applications in various fields.
2. To learn various Product Prototyping strategies along with CAD modeling techniques.
3. To explore various RP techniques and manufacturing methods.
4. To understand various RP tooling, application area of RP and indirect methods of RP tooling production.

UNIT-I (10 Hrs)

Introduction to Rapid Prototyping: Classification of Manufacturing Processes, Introduction to Rapid Prototyping and Additive Manufacturing, History of development of RP, Engineering design process, Rapid Prototyping and its Impact, Product development, Product Prototyping and Product Development

Product Prototyping: Need of Product Prototyping, Prototype Planning and Management, Product and Prototype Cost Estimation, Prototype Design Methods and tools

UNIT-II(5 Hrs)

CAD Modeling: Geometrical Modeling Techniques, Wireframe Modeling, Surface Modeling and solid modeling, Slicing methods using design software

UNIT-III (15 Hrs)

Rapid Prototyping Processes: Rapid Prototyping Overview, Rapid Prototyping Procedure, Liquid-Based RP Processes, Solid-Based RP Processes, Powder-Based RP Processes, Prototyping Materials, Modeling of Material Properties, Modeling and Design of Materials and Structures.

Direct Digital Prototyping and Manufacturing: Solid Models and Prototype Representation, Reverse Engineering for Digital Representation, Prototyping and Manufacturing Using CNC Machining, Fully Automated Digital Prototyping and Manufacturing.

UNIT-IV (15 Hrs)

Direct Methods for Rapid Tool Production: Classification of Direct Rapid Tool Methods, Direct ACESTM Injection Moulds, Laminated Object Manufactured Tools, DTM Rapid Tool, Sand Form, EOS Direct Tool Process, Direct Metal Tooling using 3Dp.

Applications of Rapid Prototyping: Functional Models, Rapid Tooling, Rapid Manufacturing, Engineering Applications, Medical Model, and Art Models, Engineering Analysis Models.

Indirect Methods for Rapid Tool Production: Metal Deposition Tools, RTV Tools, Epoxy Tools, Ceramic Tools, Cast Metal Tools, Investment Casting, Fusible Metallic Core, Sand Casting, Keltool Process.

Course outcomes: After the completion of this course students will be able to:

1. Understand the importance of RP technology in view of product development and innovation in various fields.
2. Implement the knowledge, techniques, skills of Product Prototypingand modern tools like CAD.
3. Understand the various RP techniques and manufacturing methods that enable student to provide solution to Rapid prototyping problems.
4. Demonstrate comprehensive knowledge of the broad range of RP tooling, application area of RP and indirect methods of RP tooling production.

Reference Books:

1. Frank W. Liou, 'Rapid Prototyping and engineering Applications', CRC Press
2. D.T. Pham and S.S. Dimov, 'Rapid Manufacturing', Springer.
3. Kevin Otto, Kristin Wood, 'Product Design', Pearson.

HEAT EXCHANGER DESIGN

Subject Code: BMECD1-714 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course objectives:

Course Objectives:

1. To build up necessary background about the fundamentals of heat exchangers.
2. To predict the thermal performance and pressure drop characteristics of a given type of heat Exchanger due to fouling.
3. To provide the basic knowledge of various types of heat exchangers and their design calculations.
4. To analyze performance evaluation of the heat exchangers for various applications and heat transfer of phase change type heat exchangers.

UNIT I

Basic Design Methodologies: Classification of heat exchanger, selection of heat exchanger, Thermal-Hydraulic fundamentals, Overall heat transfer coefficient, LMTD method for heat exchanger analysis for parallel, counter, multipass and cross flow heat exchanger, e-NTU method for heat exchanger analysis, Fouling, Rating and sizing problems, heat exchanger design methodology **10Hrs**

UNIT II

Fouling of Heat Exchangers: Basic consideration, effect of fouling on heat transfer and pressure drop, cost of fouling, design of heat exchangers subject to fouling, fouling resistance, cleanliness factor, techniques to control fouling **06 Hrs**

UNIT III

Design of Double Pipe Heat Exchangers: Thermal and Hydraulic design of inner tube and annulus, hairpin heat exchanger with bare and finned inner tube, total pressure drop.

06Hrs

Design of Shell & Tube Heat Exchangers: Basic components, basic design procedure of heat exchanger, TEMA code, J-factors, conventional design methods, Bell-Delaware method

06 Hrs

Design of Compact Heat Exchangers: Heat transfer enhancement, plate fin heat exchanger, tube fin heat exchanger, heat transfer and pressure drop **05 Hrs**

UNIT IV

Condenser: Shell and tube condenser, plate condenser, air cooled condenser, direct contact condenser, condenser for refrigeration and air-conditioning, thermal design of shell and tube condenser **04 Hrs**

Evaporator: Evaporator for refrigeration and air-conditioning, thermal analysis of evaporator, standards for evaporators and condensers **04 Hrs**

Heat Transfer Enhancement and Performance Evaluation: Enhancement of heat transfer, Performance evaluation of Heat Transfer Enhancement technique. Introduction to pinch analysis. **04 Hrs**

Course Outcomes: Students successfully completing this module will be able to:

1. Understand the basic concept and design methodology of heat exchangers.
2. Predict the thermal performance important heat-exchanger design parameters due to fouling.
3. Determine general design requirements for different types of heat exchangers.
4. Analyze performance evaluation of different heat exchanger and phase change heat exchangers.

Reference Books:

1. Sadik, Kakac, 'Heat Exchanger Selection, Rating and Thermal Design', CRC Press.
2. Ramesh K. Shah, 'Fundamentals of Heat Exchanger Design', Wiley Publication.
3. V.A. Kays and A.L. London, 'Compact Heat Exchangers', McGraw Hill.
4. T. Kuppan, 'Heat Exchanger Design Handbook', Marcel Dekker, CRC Press.
5. E.U. Schunder, 'Heat Exchanger Design Hand Book', Hemisphere Pub.
6. Donald Q. Kern, 'Process Heat Transfer', McGraw Hill.

NON-DESTRUCTIVE TESTING

Subject code: BMECD1-721 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives

1. To understand the Need and Significance of Non-Destructive Testing methods and fundamental concepts of Non-Destructive Testing**.**
2. To understand techniques of various magnetizing methods that may be used practically to magnetize any steel part using these methods.
3. To understand distinguishing features of ultrasonic inspection method for metal parts.
4. To understand the concept and applications of radiography i.e, X-ray and Gamma –ray along with effect of variables on radiographs.

UNIT-I

Introduction: Scope and Classification of techniques of material testing, NDT Versus Mechanical testing, Need for NDT in Industry and Significance of Non Destructive Testing methods, Overview of the Non Destructive Testing Methods for the detection of manufacturing defects as well as material characterization, type of Non Destructive testing methods. Liquid Penetrant Testing – Principles, types and properties of liquid penetrants, developers, advantages and limitations of various methods, Equipment and procedure, Characteristics of Developers. Testing Procedure, Interpretation of results. **12 Hrs**

UNIT-II

Magnetic Particle Testing- Theory of magnetism, inspection materials Magnetization methods: Basic principles, scope and applications, magnetic analysis, magnetization methods, equipment, inspection medium, Principles and methods of demagnetization, advantages and disadvantages of Magnetic particle testing. Interpretation and evaluation of test indications, Residual magnetism.

11 Hrs

UNIT-III

Ultrasonic Testing: Basics of Ultrasonic Testing: Principles, Techniques, Applications, Limitations, Codes, standards and Specifications related to Ultrasonic Testing flaw detection in rails and tubes (Sperry Detector), Ultrasonic testing, Detection of defects in ferrous and non-ferrous metals, plastics, ceramics, measurement of thickness, hardness, stiffness, sonic material analyzer, concrete test hammer. **11 Hrs**

UNIT-IV

Radiographic Examination: Basics of Radiographic Testing: Principles, Techniques, Applications, Limitations, Codes, standards and Specifications related to Radiography, Radiant energy and radiography, practical applications, X-ray and Gamma–ray equipment, effect of variables on radiographs, requirement of a good radiograph, interpretation of radiograph, Xeroradiography, Fundamentals of radiation safety and safety precautions.

11 Hrs

Course Outcomes: Upon completion of the course, the student will be able to:

1. Explore Basic principles, scope and applications of Non-Destructive Testing technique.
2. Apply fundamental concepts of Non-Destructive Testing to select the appropriate technique for a given application.
3. Detect any defects in ferrous and nonferrous metals, plastics by utilizing underling principle of Ultrasonic testing.
4. Distinguish various nondestructive techniques, advantages and disadvantages of individual technique. Even more, will be able to interpret the concept of radiography.

Reference Books:

1. H.E. Davies, G.E. Troxell and G.F.W. Hauck, 'The Testing of Engineering Materials', McGraw Hill.

2. W.H. Armstrong, Mechanical Inspection, McGraw Hill.

3. P.J. Shull, 'Nondestructive Evaluation - Theory, Techniques, and Applications', Marcel Decker Inc.
4. D.E. Bray and R.K. Stanley, 'Non-destructive Evaluation - A Tool in Design, Manufacturing and Service', CRC Press.
5. 'NDT Hand Books', ASNT Press, OH, USA.
6. Baldev Raj, T. Jaya Kumar, 'Practical Non-destructive Testing', Woodhead Publishing Ltd.
7. Paul E. Mix, 'Introduction to NDT: A Training Guide', John Wiley.

COMPOSITE MATERIALS

Subject code: BMECD1-722 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course objectives:

1. To understand composite materials and its applications.
2. To understand PMC and their processes.
3. To understand Metal matrix Composites and their processes.
4. To understand Ceramic Matrix Composites.

UNIT-I

Introduction to Composites: Fundamentals of composites - need for composites – Glass Fibers, Graphite Fibers, Aramid, Metallic and Other Fibers. Matrix materials and Polymers Metals and Fillers Enhancement of properties. Laminated Composites.

Classification of composites – Matrix-Polymer matrix composites (PMC), Metal matrix composites (MMC), Ceramic matrix composites (CMC) – Reinforcement – Particle reinforced composites, Fibre reinforced composites. Applications of various types of composites materials and rule of mixture, Manufacturing of thermoset composites and other Composite Fabrication Methods. Advances in Composites. **13 Hrs**

UNIT-II

Polymer Matrix Composites: Polymer matrix resins – Thermosetting resins, thermoplastic resins – Reinforcement fibre – Rovings – Woven fabrics – Non woven random mats – various types of fibre. PMC processes - Hand lay-up processes – Spray up processes – Compression moulding – Reinforced reaction injection moulding - Resin transfer moulding – Pultrusion – Filament welding – Injection moulding. Fibre reinforced plastics (FRP), Glass fibre reinforced plastics. Behavior of unidirectional composites, Short-fiber composites **10 Hrs**

UNIT-III

Metal Matrix Composites: Characteristics of MMC, Various types of Metal matrix composites Alloy vs. MMC, Advantages of MMC, Limitations of MMC, Metal Matrix, Reinforcements – particles – fibre. Effect of reinforcement - Volume fraction – Rule of mixtures for MMC. Processing of MMC – Powder metallurgy process - diffusion bonding – stir casting – squeeze casting. **10 Hrs**

UNIT-IV

Ceramic Matrix Composites: Engineering ceramic materials – properties – advantages – limitations – Monolithic ceramics - Need for CMC – Ceramic matrix - Various types of Ceramic Matrix composites- oxide ceramics – non oxide ceramics – aluminum oxide – silicon nitride – reinforcements – particles- fibres- whiskers. Sintering - Hot pressing – Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Failure of Composites. **12 Hrs**

Course Outcomes:

Upon completion of this course, the students will be able to

1. Learn various composite materials and their applications.
2. Understand PMC and their processes.
3. Learn about Metal matrix Composites and their processes.
4. Understand to develop Ceramic Matrix Composites.

Reference Books:

1. Gibson R.F. Principles of Composite Material Mechanics, second edition, McGraw Hill.
2. Hyer M.W., Stress Analysis of Fiber- Reinforced Composite Materials, McGraw Hill.
3. Mallick, P. K. , “Fibre-Reinforced Composites”, CRC press, New York.
4. Jones, R.M., “Mechanics of Composite Materials”, McGraw Hill, New Delhi.
5. K.K. Chawla, ‘Composite Materials, Springer – Verlag’.
6. S.C. Sharma, ‘Composite Materials, Narosa Publications.
7. Broutman and Agarwal, “Analysis and Performance of Composite materials”, John Willey and Sons, New York.

MECHANICAL VIBRATIONS

Subject Code: BMECD1-723 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the fundamental principles and applications of mechanical vibrations, vibration systems and damping. Also, Various vibration measuring instruments.
2. To gain the knowledge of various two degrees of freedom systems and principle, working and applications of various dampers.
3. To understand multi degrees of freedom systems and various methods to solve the numerical problems.
4. To understand continuous systems like strings, bars, beams and torsion in circular shafts.

UNIT-I

Introduction: Basic concepts, Types of vibration, Periodic & Harmonic vibrations, Methods of vibration analysis. Undamped free vibrations damped free vibrations and damped forced vibration system, Modelling of stiffness and damping (both viscous and coulomb), estimation of damping by decay plots, vibration isolation transmissibility, vibration measuring instruments.

13 Hrs

UNIT-II

Two degrees of Freedom systems: Principal modes of vibrations, natural frequencies, amplitude ratio, undamped free, damped free, forced harmonic vibration, semi-definite systems, combined rectilinear & angular modes; Lagrange'sequation.

Application to un-damped and damped absorbers: Vibration absorber – principle; centrifugal pendulum vibration absorber, torsional vibration damper, untuned dry friction and viscous vibration damper, torsional vibration absorber. **14 Hrs**

UNIT-III

Multi-degree of freedom: Undamped free vibrations, influence coefficients, Generalized coordinates, orthogonality principal, matrix iteration method, Rayleigh and Dunkerley, Holzer's, Stodola method,Eigen values and eigenvectors. **08 Hrs**

UNIT-IV

Continuous systems: Lateral vibrations of a string, longitudinal vibrations of bars, transverse vibrations of beams, Euler's equation of motion for beam vibration, natural frequencies for various end conditions, torsional vibration of circular shafts. **10 Hrs**

Course Outcomes: Upon completion of the course, the student will be able to:

1. Illustrate the types, fundamental principles and applications of mechanical vibrations and their measuring instruments.
2. Understand two degrees of freedom systems and various types of vibration dampers and absorbers.
3. Solve the problems related to multi degree of freedom systems and various methods to solve the problems related.
4. Understand and solve problems related to continuous systems such as string, bars, beams and circular shafts.

Reference Books:

1. G.K. Grover, Mechanical Vibrations Hem Chand andBros
2. K.K. Pujara, Mechanical Vibrations, Dhanpat Rai and Sons, Delhi
3. V.P.Singh, Mechanical Vibrations Dhanpat Rai and Sons, Delhi
4. Debabrata Nag, Mechanical Vibration, John WileyIndia
5. Thomson, Mechanical Vibration, PrenticeHall

ADVANCED FLUID MECHANICS

Subject Code: BMECD1-724 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives

1. To enable the students to analyze the fluid flow and their causes and effects.
2. To enable the students to understand the basic governing equations of flow and to understand the analytical approximate solutions.
3. To enable the students to solve the flow problems related to near wall flows.
4. To enable the students to learn about the mathematical modeling techniques for fluid mechanics problems.

UNIT-I

Potential Flow: Stream function and velocity potential functions for standard flow patterns uniforms flow, source/sink, doublet and free vortex; combination of certain flows to obtain flow patterns of various shapes, circulation, Kutta Joukowski Theorem-lift on a cylinder. **10 Hrs**

UNIT-II

Viscous Flow: Navier Stokes equation of motion; Fluctuation velocity components; intensity and scale of turbulence; Reynolds equations Relationship between shear stress and pressure gradient; two dimensional laminar flow between two fixed parallel planes; Plain Couette flow and its application to hydro-dynamic theory of lubrication. **13 Hrs**

UNIT-III

Boundary Layer: Salient features of flow pattern in a boundary layer; Velocity and shear stress distribution along the boundary; Von-Karman momentum integral equation, Quantitative correlation for boundary layer thickness, local skin friction coefficient and drag coefficient in laminar, flow over a curved surface, boundary layer separation and its control. **12 Hrs**

UNIT-IV

CFD: Comparison of the three basic approaches in engineering problem solving – Analytical, Experimental and Computational Methods. The standard procedure for formulating a problem Physical and Mathematical classification of problems; Types of governing Differential equations and Boundary conditions. Methods of Discretization: Techniques for solution of PDEs in fluid mechanics – finite difference method, finite element method and finite volume method, Finite volume (FV) method in one dimension. **10 Hrs**

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

1. To develop the solutions of ideal fluid flows
2. To apply the knowledge of fluid mechanics governing equation
3. To develop solutions for near wall flows
4. Apply the mathematical modeling techniques for fluid mechanics problems

Reference Books:

1. Frank M. White ,Viscous Fluid Flow, McGraw-Hill international edition.
2. Yunus Cengel, John Cimbala, Fluid Mechanics, McGraw-Hill international edition.
3. Dr. D.S. Kumar, Fluid Mechanics, S K Kataria and Sons.
4. S K Som, G Biswas, S Chakraborty, Introduction to Fluid Mechanics and Fluid Machines, Laxmi Publications.
5. Suhas V. Patankar, Numerical Heat Transfer and Fluid Flow, Hemisphere Publishing Corporation.
6. John D. Anderson, Jr. Computational Fluid Dynamics the Basics with Applications, McGraw Hill Education.

MECHANICAL ENGINEERING LABORATORY-VII
(DMS & IAR LAB)

Subject code: BMECS1-702 **L T P C**
0 0 2 1

Course Objectives:

1. To model machine parts, its assembly and design analysis using software.
2. To learn the modeling of geometrical transformations, curves, surfaces and solids.
3. To understand the part programming for CNC Machines.
4. To understand the working of robotic arm, its configurations

EXPERIMENTS

1. Modeling of machine parts and components using any 3D modeling software.
2. Assembling of any two machine parts with proper mating conditions and checking of tolerances and fits using CAD software.
3. Design analysis of any two machine parts using analysis software.
4. Practice the modeling of various types of curves, surfaces and solids.
5. Introduction of Part programming for CNC Machines (e.g. G and M codes).
6. Manual part programming on CNC machine (for any 02 different profiles).
7. Assembly of hydraulic / pneumatic circuit.
8. Demonstration and working of power steering mechanism.
9. Study of different types of hydraulic and pneumatic valves.
10. Study of reciprocating movement of double acting cylinder using pneumatic direction control valves.
11. Use of direction control valve and pressure control valves clamping devices for jig and fixture.
12. Study of robotic arm and its configuration.

Course Outcomes: Upon completion of the course, the student will be able to

1. Model machine parts, its assembly and design analysis using software.
2. Use geometrical transformations, curves, surfaces and solids for modelling the various mechanical components.
3. Understand the part programming for CNC Machines.
4. Understand the basic robotic arm configurations.

MECHANICAL ENGINEERING LABORATORY-VIII
REFRIGERATION AND AIRCONDITIONING LAB

Subject code: BMECS1-703 **L T P C**
0 0 2 1

Course Objectives:

1. To understand the fundamental principles of refrigeration and air conditioning system.
2. To enable the students to compute the cooling capacity and coefficient of performance of vapour compression and vapour absorption refrigeration systems.
3. To enable the students to calculate cooling load for air conditioning systems used in large buildings.
4. To enrich students to apply the psychometric concepts in real applications.

EXPERIMENTS

1. Study of various elements of a vapour compression refrigeration system through cut section models / actual apparatus.
2. Study and performance testing of domestic refrigerator.
3. Study the performance testing of Electrolux refrigerator.
4. Study and performance testing of an Ice plant.
5. Calculation/ Estimation of cooling load for a large building.
6. Visit to a central Air conditioning plant for study of processes for winter and summer air conditioning.
7. Visit to a cold storage for understand its working.
8. Study and performance testing of window type room air conditioner.
9. Study and performance testing of water cooler.
10. To find the performance parameter of cooling tower.

Course Outcomes: Upon completion of the course, the student will be able to:

1. Apply the fundamental principles of refrigeration and air conditioning system.
2. Compute the cooling capacity and coefficient of performance by conducting test on vapour compression and vapour absorption refrigeration systems.
3. Calculate cooling load for air conditioning systems used in large buildings.
4. Students will explore the psychometric concept during visit to a central Air conditioning plant and further apply this concept in performance testing of window type room air conditioner.

INDUSTRIAL SAFETY AND ENVIRONMENT

Subject code: BMECD1-811 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To realize the need of safety in industry.
2. To learn the safety planning and standards for safety.
3. To understand effect of environment changes on the safety.
4. To understand the concept of ventilation, heat and lightning for safety.

UNIT-I

Meaning & Need for Safety: Relationship of safety with plant design, equipment design and work environment. Industrial accidents, their nature, types and causes. Assessment of accident costs; prevention of accidents. Industrial hazards, Hazard identification techniques, Accident investigation, reporting and analysis. **10 Hrs**

UNIT-II

Planning for Safety & its Measures: Definition, purpose, nature, scope and procedure. Range of planning, variety of plans. Policy formulation and implementation of safety policies. Safety measures in a manufacturing organization, safety and economics, safety and productivity. Employees participation in safety. Safety standards and legislation.

10 Hrs

UNIT-III

Meaning of Environment and Need for Environmental Control: Environmental factors in industry. Effect of temperature, Illumination, humidity noise and vibrations on human body and mind. Measurement and mitigation of physical and mental "fatigue" Basics of environment design for improved efficiency and accuracy at work. Environment Standards: Introduction to ISO 14000; Environment standards for representative industries. **10 Hrs**

UNIT-IV

Ventilation and Heat Control Purpose of ventilation, Lighting, Noise & Vibrations: Physiology of heat regulation. Thermal environment and its measurement. Thermal comfort. Indices of heat stress. Thermal limits for comfort, efficiency and freedom from health risk. Natural ventilation. Mechanical ventilation. Air conditioning Process ventilation. Control of heat exposures: control at source, insulation, and local exhaust ventilation. Control of radiant heat, dilution ventilation. Local relief. Industrial Lighting: Purpose of lighting, benefits of good illumination. Phenomenon of lighting and safety. Lighting and the work. Sources and types of

artificial lighting. Principles of good illumination. Recommended optimum standards of illumination. Design of lighting installation. Maintenance standards relating to lighting and colour. Noise & Vibrations, Continuous and impulse noise. The effect of noise on man. Noise measurement and evaluation of noise. Noise absorption techniques. **15 Hrs**

Course Outcomes: Upon completion of the course, the student will be able to:

1. Understand importance of safety at work.
2. Understand various safety measures and importance of standards for safety.
3. Understand basics of environmental design.
4. Understand the control of Ventilation and heat etc.

Reference Books:

1. H.W. Heinrich, 'Industrial Accident Prevention', McGraw Hill.
2. Beranek, 'Noise Reduction', McGraw Hill.
3. D.C. Reamer, 'Modern Safety and Health Technology', R. Wiley.

PROCESS PLANNING AND COST ESTIMATION

Subject code: BMECD1-812 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives

1. To understand the various factors influencing processes planning.
2. To estimate various factors contributing in total cost.
3. To compute total machining time.
4. To learn to estimate production cost.

UNIT-I

Introduction of Process Planning- methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection.
Process planning activities- process parameter calculation for various production processes, selection of jigs and fixtures, selection of quality assurance methods, documents for process planning, economics of process planning, case studies. **13 Hrs**

UNIT-II

Introduction to cost estimation- importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates, estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost. **11Hrs**

UNIT-III

Machining time estimation- importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planning and Grinding. **11 Hrs**

UNIT-IV

Production costs- different production processes for different jobs, estimation of forging, welding, foundry cost and machining cost **10 Hrs**

Course Outcomes: On completion of this course, the students will be able to

1. Understand various contributing factors in process planning.
2. Estimate various cost elements.
3. Estimate machining time.
4. Estimate the production cost.

Reference Books:

1. Peter Scalon, Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech..
2. Ostwaal P.F. and Munez J., Manufacturing Processes and Systems, John Wiley.
3. Chitale A.V. and Gupta R.C., Product Design and Manufacturing, Prentice Hall.

TOTAL QUALITY MANAGEMENT

Subject code: BMECD1-813 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the concept of Quality and the implication of Quality on Business.
2. To understand Total Quality Management principles and processes.
3. To understand TQM tools and techniques and performance measures.
4. To introduce new developments in ISO 9000 and overview of other sector specific quality standards.

UNIT-I

Introduction, need for quality, evolution of quality; Definitions of quality, product quality and service quality; Basic concepts of TQM, TQM framework, contributions of Deming, Juran and Crosby. Barriers to TQM; Quality statements, customer focus, customer orientation & satisfaction, customer complaints, customer retention; costs to quality. **11 Hrs**

UNIT-II

TQM principles; leadership, strategic quality planning; Quality councils- employee involvement, motivation; Empowerment; Team and Teamwork; Quality circles, recognition and reward, performance appraisal; Continuous process improvement; Plan-do-check-act (PDCA) cycle, 5S, Kaizen; Supplier partnership, Partnering, Supplier rating & selection.

The seven traditional tools of quality; New management tools; Six sigma- concepts, methodology, applications to manufacturing, service sector including IT, Bench marking process; Failure Modes and Effects Analysis (FMEA), its stages and types. **13 Hrs**

UNIT-III

TQM tools and techniques, control charts, process capability, concepts of six sigma, **Quality function deployment** (**QFD**), Taguchi quality loss function; TPM- concepts, improvement needs, performance measures. **10 Hrs**

UNIT-IV

Quality systems need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, QS 9000, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors. **11 Hrs**

Course Outcomes: Upon completion of this course, the students will be able to

1. Understand the concept of Quality and the implication of Quality on Business.
2. Apply total quality management principles and processes.

3. Apply TQM tools and techniques and performance measures.

4. Get the knowledge of new developments in ISO 9000 and overview of other sector specific quality standards.

Reference Books:

1. Bester field D.H. et al., Total quality Management, Pearson Education Asia.
2. Evans J.R. and Lindsay W.M., The management and Control of Quality, first Indian edition, Cengage Learning.
3. Janakiraman B. and Gopal R.K., Total Quality Management, Prentice Hall India.
4. Suganthi L. and Samuel A., Total Quality Management, Prentice Hall India.

PRINCIPLES OF MANAGEMENT

Subject code: BMECD1-814 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives

1. To understand the functions and responsibilities of managers.
2. To understand types of planning and strategic decision making.
3. To understand nature and purpose of the organization.
4. To understand control and performance measure.

UNIT-I

Definition of management, science or art, manager vs entrepreneur; Types of managers- managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management. **11 Hrs**

UNIT-II

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.

9 Hrs

UNIT-III

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication. **14 Hrs**

UNIT-IV

Controlling system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting. **11 Hrs**

Course Outcomes: On completion of this course, the students will be able to

1. Understand the principles of management.
2. Understand the process of planning and strategic decision making.
3. Understand the nature and purpose of the organization.
4. Apply the control and performance measure in management.

Reference Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India.
2. Stoner JAF, Freeman RE and Gilbert DR, Management, Pearson Education.
3. Tripathy PC & Reddy PN, Principles of Management, Tata McGraw Hill.

ENERGY CONSERVATION AND MANAGEMENT

Subject code: BMECD1-815 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the energy and power scenario of the world.
2. To understand the concept of HT & LT supply and the concept of lighting.
3. To understand power consumption pattern of thermal systems.
4. To understand the power consumption pattern in major utilities.

UNIT-I

Introduction to energy & power scenario of world, National Energy consumption data, environmental aspects associated with energy utilization; Energy Auditing- need, types, methodology and barriers, role of energy managers, instruments of energy auditing. **09 Hrs**

UNIT-II

Components of Electricity Billing. High Tension (HT) and Low Tension (LT) supply, transformers, cable sizing; Concept of capacitors, power factor improvement, harmonics; Electric motors- motor efficiency computation, energy efficient motors; Illumination- Lux, Lumens, types of lighting, efficacy, LED lighting and scope of energy conservation in lighting.

11 Hrs

UNIT-III

Thermal systems, Boilers, Furnaces and Thermic Fluid heaters- efficiency computation and energy conservation measures; Steam distribution and usage, steam traps, condensate recovery, flash steam utilization; Insulation & Refractories. **12 Hrs**

UNIT-IV

Energy conservation in major utilities; pumps, fans, blowers, compressed air systems, Refrigeration& Air Conditioning systems, Cooling Towers, DG sets. Energy Economics- discount period, payback period, internal rate of return, net present value; Life Cycle costing- ESCO concept. **13 Hrs**

Course Outcomes: At the end of the course, the student should be able to

1. Analyse the energy and power scenario prevalent to the world.
2. Understand the concept of HT & LT supply and the concept of lighting.
3. Learn the consumption pattern of power in thermal systems.
4. Understand the power consumption pattern in major utilities.

Reference Books:

1. Witte L.C., Schmidt P.S. and Brown D.R., Industrial Energy Management and Utilization, Hemisphere Publ., Washington
2. Callaghn P.W., Design and Management for Energy Conservation, Pergamon Press, Oxford
3. Murphy W.R. and McKay G., Energy Management, Butterworths, London
4. Energy Manager Training Manual, Bureau of Energy Efficiency (BEE) under Ministry of Power, GOI (available at www.energymanager training.com).

OPERATIONS RESEARCH

Subject Code: BMECD1-821 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the application of Operations Research (OR) in industrial environment and formulation of linear programming problems.
2. To formulate and understand the concepts of transportation and assignment modeling.
3. To formulate and understand the concepts Queuing and Network Models.
4. To understand the basics of non-linear programming model, inventory model and game theory.

UNIT-I

Introduction: Origin of OR and its role in solving industrial problems: General approach for solving OR problems. Classification of mathematical models: various decision-making environments.

Linear Programming: Formulation of linear mathematical models: Graphical and simplex techniques for solution of linear programming problems, Big M method and two-phase method, Introduction to duality theory and sensitivity analysis. **15 Hrs**

UNIT-II

Transportation and Assignment Models: Various initial basic feasible solutions methods, Optimization of transportation and assignment using different methods considering the concept of time and cost function.

Dynamic Programming: Introduction to deterministic and probabilistic dynamic programming.

10 Hrs

UNIT-III

Queuing Theory: Types of queuing situation: Queuing models with Poisson's input and exponential service, their application to simple situations.

Network models: Shortest route and traveling sales - man problems, PERT &CPM introduction, analysis of time bound project situations, construction of networks, identification of critical path, slack and float, crashing of network for cost reduction. **10 Hrs**

UNIT-IV

Non-linear Programming Models: Introduction to non-linear programming models. Problems related to the topic.

Inventory Models: Introduction to inventory costs. Models with deterministic demand – model (a) demand rate uniform and production rate infinite, model (b) demand rate non-uniform and production rate infinite.

Game Theory: Competitive games, rectangular games, saddle point, minimax (maximin) method of optimal strategies, value of the game. Solution of games with saddle points, dominance principle. Rectangular games without saddle point – mixed strategy for 2 X 2 games. **10 Hrs**

Course Outcomes: At the end of the course, the student should be able to:

1. Apply the concept of linear programming.
2. Solve Transportation and Assignment Problems.
3. Apply the concept of queuing and network modeling.
4. Employ non-linear programming model, inventory model and game theory.

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI
2. Hira and Gupta, Operations Research, S. Chand
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi
4. H.M. Wagner, Principles of Operations Research, PHI, Delhi
5. Hitler Libermann Operations Research: McGraw Hill Pub.
6. Pannerselvam, Operations Research: Prentice Hall of India

OPERATION MANAGEMENT

Subject Code: BMECD1-822 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To understand the fundamental theory of operation management and various stages of product design and development.
2. To forecasts in the manufacturing and service sectors using selected quantitative and qualitative techniques.
3. To apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources.
4. To Understand the role of information system in quality control.

UNIT-I

Need and Scope of Operation Management: Types of production system and their characteristics, productivity definition, types and measurements.

Product Design and Development: Steps involved in product design and development, considerations of technical, ergonomic, aesthetic, economic and time factors. Use of concurrent engineering in product design and development. **09 Hrs**

UNIT-II

Planning and Forecasting: Role of market survey and market research in pre-planning, long medium and short range forecasting, objective and techniques of forecasting, smoothening and revision of forecast, Production planning: Production planning objective and functions, Bill of material, Capacity and man power requirement planning, operation analysis and process planning, long range planning, aggregate planning; Objective, Strategies, graphical and mathematical techniques of aggregate planning, master production scheduling, MRP-I and MRP II Systems. **14 Hrs**

UNIT-III

Production Control: Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up. Techniques of production control in job shop production, batch production and mass production systems,

Material Management: Objectives, scope and functions of material management, planning, procurement, storing, ending and inventory control. Purpose of inventory, inventory cost, inventory control systems, Selective inventory control systems, Determination of EOQ, Lead time and reorder point. Methods of physical stock control. **13 Hrs**

UNIT-IV

Quality Control: Meaning of quality and quality control, quality of design, quality of conformance and quality of performance, functions of quality control. Introduction to statistical quality control-control charts and sampling plans, QC tools.

Management Information Systems: Introduction to MIS, steps in designing MIS, Role of Computers in MIS. **09 Hrs**

Course outcomes: After completion of this course the students will be able to:

1. Understand the fundamental theory of operation management and various stages of product design and development.
2. Make forecasts in the manufacturing and service sectors using selected quantitative and Qualitative techniques.
3. Apply the principles and techniques for planning and control of the production and service systems to optimize/make best use of resources.
4. Understand the role of information system in quality control.

Reference Books:

1. Charry, 'Production and Operation Management', Tata-McGraw Hill.
2. J.G. Monks, 'Production/Operation Management', Tata-McGraw Hill.
3. R.N. Nauhria and Rajnish Prakash, 'Management of Systems', Wheeler Publishing, New Delhi.
4. E.L. Grant and R.S. Leaven Worth, 'Statistical Quality Control', McGraw Hill.

SUSTAINABLE MANUFACTURING

Subject Code: BMECD1-823 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course Objectives:

1. To impart knowledge on sustainable manufacturing.
2. To impart knowledge on Green manufacturing and environmental impact assessment.
3. To impart knowledge on Lean Management and its implementation.
4. To impart the knowledge of product recovery management.

UNIT-I

Introduction to Sustainability - Sustainability, need and concept of sustainability, Concept of triple bottom line, Environmental, economic and social dimensions of sustainability, Sustainable development, challenges for sustainable development, Environmental legislations in India, Corporate Social Responsibility (CSR). **10 Hrs**

UNIT-II

Green Manufacturing: Why Green Manufacturing, Motivations and Barriers to Green Manufacturing, Environmental Impact of Manufacturing, Life cycle assessment, Strategies for Green Manufacturing, Introduction to green energy concepts - Environmental Impact parameters - Environmental degradation- Environmental pollution – Pollution due to manufacturing industries – Remedies **10 Hrs**

UNIT-III

Lean Manufacturing (LM): Introduction and need of LM, Lean manufacturing tools; Comparison of conventional manufacturing and lean Manufacturing; Introduction to seven waste and their narration; Value flow and Muda, Muri and Mura; Advantages and Limitations of lean Manufacturing.

Various tool of LM, Need for Total Productivity Management (TPM), Pillars of TPM, Implementation of TPM, Pull Method, Kanban; Just In Time; value stream mapping. **15 Hrs**

UNIT-IV

Product Recovery Management: Introduction to product recovery management, types of product recovery methods, end-of-use, end-of-life products, reverse logistics, closed loop supply chain management, zero waste management, concept of circular economy. **10 Hrs**

Course Outcomes: Upon completion of the course, the student will be able to

1. Understand concept of sustainability and sustainable manufacturing.
2. Learn the concept of Green Manufacturing and Environmental impact assessment.
3. Apply the concept of lean principles and implementation.
4. Understand the concept of product recovery management.

Reference Books:

1. Davim, J.P., Sustainable Manufacturing, John Wiley and Sons.
2. Davim.J.Pauls, Green Manufacturing Processes and Systems, Springer
3. Gopalakrishnan N, Simplified Lean Manufacture: Elements, Rules, Tools and Implementation; PHI Publications

WORK STUDY AND ERGONOMICS

Subject code: BMECD1-824 **L T P C** **Duration: 45 Hrs**
3 0 0 3

Course objective:

1. To learn the concept of productivity and realize the role of Work Study.
2. To learn the concept of Method Study and factors effecting productivity of any manufacturing or service industry.
3. To learn about Work Measurement its benefits and steps involved in Time Study.
4. To enrich the students in terms of ergonomics principles so that he/she can design safe workplace.

UNIT-I

Productivity: Definition of productivity and its measurement, factors affecting the productivity, productivity improvement programs.

Work Study: Definition, objective and scope of work study, Human factor in work study Work study and management, work study and supervision, work study and worker.

09 Hrs

UNIT-II

Introduction to Method Study : Definition, objective and scope of method study, basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, SIMO, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study. **13 Hrs**

UNIT-III

Introduction to Work Measurement: Definition, objective and benefit of work measurement, Work measurement techniques, work sampling, need of confidence levels, sample size determination, random observation with simple problems.

Time Study: Definition, time study equipments, selection of jobs, steps in time study, breaking jobs into elements, recording information, rating, standard performance, scales of rating, factors affecting rate of working, allowances, standard time determination. **13 Hrs**

UNIT-IV

Ergonomics: Introduction, areas of study under ergonomics, man-machine system, Components of man-machine system and their functions, study of development of stress in human body and their consequences, computer-based ergonomics.

Display systems and anthropometric data: Display- types of visual display, visual indicators and warning signals, factorial and graphic display types of control, layouts of panels and machines, Design of workplaces, Introduction to anthropometry, Task analysis to reduce Musclo-Skeletal disorders, influence of climate on human efficiency, Influence of noise, vibration and light on human efficiency. **10 Hrs**

Course Outcomes: Upon completion of the course, the student will be able to

1. Identify various factors that effects productivity of any organization.
2. Independently conduct a method study to improve process, material movement etc.
3. Develop time standards for operations; identify production bottlenecks to minimize time wastage.
4. Improve design of a safe workplace by applying the concept of the ergonomic.

Reference Books:

1. ILO -Introduction to work study, Publisher: India Book House Pvt. Ltd
2. Niebel, B.W., Motion & Time Study, 9th Edition McGraw Hill Higher education
3. Kanawaty, G., Work Study, ILO, Geneva
4. Barnes, R. M., Motion & Time Study, John Wiley & Sons
5. Bridger, R.S., Introduction to Ergonomics, McGraw Hill
6. Halender, M., A guide to Human Factors and Ergonomics. Taylor & Francis

MAJOR PROJECT

Subject code: BMECS1-801 **L T P C**
0 0 6 3

Course Objectives:

1. To apply the acquired theoretical knowledge to practical applications.
2. To understand the design process for fabrication of any machine component.
3. To understand the various mechanism involved in movement of components.
4. To understand the working of different manufacturing process.

Course Details:

The problem formulated during minor project is to be extended and executed in major project by the same group of students. Thus, complete project may consist of the following steps-

1. Modelling and Simulation (if required)
2. Design of components.
3. Fabrication of Individual components.
4. Assembly of the components.
5. Demonstration of working of assembled device.
6. Discussions about the utility and practical applications.
7. Cost calculations.
8. Report writing.

Course outcomes: Upon completion of the course, the student will be able to

1. Relate between theory and practical application.
2. Understand the steps involved in design of any component and the product.
3. Understand the different motion mechanism and the stresses involved in entire design.
4. Learn the practical application of different manufacturing processes.

UNIVERSAL HUMAN VALUES 2: UNDERSTANDING HARMONY

Subject Code: HSMC (H-102) **L T P C** **Duration: 45 Hours**
2 1 0 3

Course Objectives:

This course is intended to provide a much needed orientational input in value education to the young enquiring minds.

Course Outcomes:

a) To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
b) To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
c) To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

UNIT-I (09 Hrs)

Introduction to Value Education Lecture: Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Right Understanding, Relationship and Physical Facility, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations

UNIT-II (12 Hrs)

Harmony in the Human Being: Understanding Human being as the Co-existence of the Self and the Body Lecture 8: Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health

UNIT-III (09 Hrs)

Harmony in the Family and Society: Harmony in the Family – the Basic Unit of Human Interaction, Values in Human-to-Human Relationship, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Exploring the Feeling of Respect, Understanding Harmony in the Society, Vision for the Universal Human Order

UNIT-IV (15 Hrs)

Harmony in the Nature/Existence: Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

Implications of the Holistic Understanding – a Look at Professional Ethics: Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for

Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

Suggested Readings

Text Book and Teachers Manual

a) The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-47-1
b) The Teacher's Manual Teachers' Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978- 93-87034-53-2 3.2

Reference Books

1. Jeevan Vidya: EkParichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
2. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
3. The Story of Stuff (Book).
4. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
5. Small is Beautiful - E. F Schumacher.
6. Slow is Beautiful - Cecile Andrews
7. Economy of Permanence - J C Kumarappa
8. Bharat Mein Angreji Raj - PanditSunderlal
9. Rediscovering India - by Dharampal
10. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
11. India Wins Freedom - Maulana Abdul Kalam Azad
12. Vivekananda - Romain Rolland (English)
13. Gandhi - Romain Rolland (English)

24/02/2021