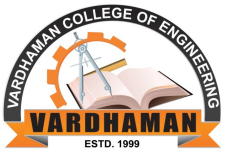

VARDHAMAN COLLEGE OF ENGINEERING

(AUTONOMOUS)

Affiliated to **JNTUH,** Approved by **AICTE,** Accredited by **NAAC** with **A++** Grade, **ISO 9001:2015** Certified

Kacharam, Shamshabad, Hyderabad - 501218, Telangana, India

www.vardhaman.org

CURRICULUM

For

Master of Technology

Engineering Design

Under

Choice Based Credit System (CBCS)

M. Tech. - Regular Two Year PG Program

(For batches admitted from the Academic Year 2022-2023)

October 2022

M. Tech – Engineering Design

Regulations: VCE-R22

College Vision:

- **To be a pioneer institute and leader in engineering education to address societal needs through education and practice.**

College Mission:

- **To adopt innovative student centric learning methods.**
- **To enhance professional and entrepreneurial skills through industry institute interaction.**
- **To train the students to meet dynamic needs of the society.**
- **To promote research and continuing education.**

Department Vision:

- To be a premier center for producing competent mechanical engineers to cater the ever changing industrial demands and societal needs.

Department Mission:

- To impart knowledge and skills in basic and applied areas of Mechanical Engineering through innovative learner-centric approach.
- To associate with industries and research organizations for gaining real time practical knowledge.
- To facilitate continuous learning based on dynamic needs of the society.

Program Educational Objectives(PEOs):

- **PEO1: To produce graduate engineers to participate in innovative and integrative activities desired for modern design engineering by developing their competencies and contemporary technical skills.**

- **PEO2: To make graduate engineers proficient of contributing at a level of research and development in the fields of advanced engineering design of mechanical engineering systems.**

- **PEO3: To make graduate engineers develop life skills to become professional design engineers, administrators or academicians and engage in lifelong learning by adopting techno-social developments of the nation.**

Program Outcomes(POs):

- **PO1: An ability to independently carry out research/investigation and development work to solve practical problems.**
- **PO2: An ability to write and present a substantial technical report/document.**
- **PO3: An ability to demonstrate a degree of mastery over the area as per the Engineering Design program. The mastery should be at a level higher than the requirements in the appropriate bachelor program**
- **PO4:An ability to apply knowledge of experimental skills and mathematical techniques of engineering design for the solutions of latest manufacturing and industrial problems.**
- **PO5: An ability to contribute in the areas of interdisciplinary engineering problems through continual learning.**

Programme Curriculum Structure
M. Tech – Engineering Design

Regulations: VCE-R22

I Year I Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6701	Advanced Mechanics of Solids	3	0	3	40	60	100
2	B6702	Analysis and Synthesis of Mechanisms	3	0	3	40	60	100
3		Professional Elective - I	3	0	3	40	60	100
4		Professional Elective - II	3	0	3	40	60	100
5	B6703	Geometric Modelling Laboratory	0	4	2	40	60	100
6	B6704	Machine Dynamics and Analysis Laboratory	0	4	2	40	60	100
7	B6001	Research Methodology and IPR	2	0	2	40	60	100
8		Audit Course - I	2	0	0	-	100	100
Total			16	8	18	280	520	800

I Year II Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6705	Advanced Finite Element Analysis	3	0	3	40	60	100
2	B6706	Mechanical Vibrations	3	0	3	40	60	100
3		Professional Elective - III	3	0	3	40	60	100
4		Professional Elective - IV	3	0	3	40	60	100
5	B6707	Finite Element Analysis Laboratory	0	4	2	40	60	100
6	B6708	Advanced Design Laboratory	0	4	2	40	60	100
7	B6741	Mini-Project/Seminar	0	4	2	100	-	100
8	B6742	Dissertation Work Review - I	-	-	-	-	-	-
9		Audit Course - II	2	0	0	-	100	100
Total			14	12	18	340	460	800

Programme Curriculum Structure
M. Tech – Engineering Design

Regulations: VCE-R22

II Year I Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1		Professional Elective-V	3	0	3	40	60	100
2		Open Elective	3	0	3	40	60	100
3	B6743	Dissertation Work Review - II	0	12	6	100	-	100
Total			6	12	12	180	120	300

II Year II Semester								
#	Course Code	Title of the Course	Hours per Week and Credit			Assessment Marks		
			L	P	C	CIE	SEE	Total
1	B6744	Dissertation Work Review - III	0	12	6	100	-	100
2	B6745	Dissertation Work Viva - Voce	0	28	14	-	100	100
Total			0	40	20	100	100	200

Programme Curriculum Structure
M. Tech – Engineering Design

Regulations: VCE-R22

List of Professional Electives

Professional Elective - I	
Course Code	**Title of the Course**
B6751	Numerical Methods in Engineering
B6752	Robotics
B6753	Mechanics of Composite Materials

Professional Elective - II	
Course Code	**Title of the Course**
B6754	Applied Elasticity and Plasticity
B6755	Tribology
B6756	Fatigue Fracture and Creep

Professional Elective - III	
Course Code	**Title of the Course**
B6757	Design Automation with Internet of Things
B6758	Advanced Stress Analysis
B6759	Multibody Dynamics

Professional Elective - IV	
Course Code	**Title of the Course**
B6760	Condition Based Monitoring
B6761	Optimization Techniques in design
B6762	Nano Technology

Professional Elective - V	
Course Code	**Title of the Course**
B6763	Manufacturing Systems Engineering
B6764	Computer Aided Vehicle Design
B6765	Material Management

Programme Curriculum Structure
M. Tech – Digital Electronics and Communication Systems

Regulations: VCE-R22

Audit Courses		
#	Course Code	Title of the Course
1	B6091	Disaster Management
2	B6092	Value Education
3	B6093	Constitution of India
4	B6094	Stress Management by Yoga
5	B6095	Personality Development through Life Enlightenment Skills
6	B6096	Professional Ethics

Open Electives		
#	Course Code	Title of the Course
1	B6081	Business Analytics
2	B6082	Waste to Energy
3	B6083	Operations Research
4	B6084	IoT and Applications
5	B6085	Cyber Security
6	B6086	Mobile Cloud Computing

I YEAR I SEMESTER

Course Structure

A6701 - Advanced Mechanics of Solids

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course covers the analysis of stress, strain and material properties, problems in elasticity, failure criteria, bending of beams, torsion of prismatic bars, explanation to solving mechanical problems, by presenting the theory of stress and strain. These basics will be used to derive generalized elastic constitutive relations in materials with anisotropic and time-dependent properties.

Course Pre/co-requisites

Mechanics of solids Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6701.1 Determine the position of the shear centre for axis-symmetric and Unsymmetrical sections
A6701.2 Analyze the bending stresses in a beam subjected to unsymmetrical bending.
A6701.3 Examine the torsion problems with linear elastic solution of non-circular cross section and explain with different analogies.
A6701.4 Evaluate the beam on elastic foundation at different loading conditions
A6701.5 Analyze the influences of contact stress induced in structures.

3. Course Syllabus

Shear Center: Bending Axis and Shear Center- Shear Center for Axis-Symmetric and Unsymmetrical Sections. **Unsymmetrical Bending:** Bending Stresses in Beams Subjected to unsymmetrical Bending; Deflection of Straight Beams due to unsymmetrical Bending.

Curved Beam Theory: Winkler Bach Formula for Circumferential Stress, Limitations, Correction Factors, Radial Stress in Curved Beams, Closed Ring Subjected to Concentrated and Uniform Loads Stresses in Chain Links.Torsion: Linear Elastic Solution; Prandtl Elastic Membrane (Soap-Film) Analogy; Narrow Rectangular Cross-section ; Hollow Thin wall Torsion Members, Multiply connected Cross Section.

Beams on Elastic Foundation: General theory - Infinite Beam Subjected to Concentrated Load: Boundary conditions - Infinite Beam Subjected to a Distributed Load Segment - Semi-infinite Beam Subjected to loads of its End - Semi-infinite Beam with Concentrated load near its End - Short Beams .

Contact Stresses: Introduction; Problem of Determining contact stresses; Assumptions on which a solution for contact stresses is based; Expressions for principal stresses; Method of computing contact stresses; Deflection of bodies in point contact; Stresses for two bodies in contact over narrow rectangular area (Line contact), Loads normal to area; Stresses for two bodies in line contact, Normal and Tangent to contact area.

Theory of Elasticity: Analysis of stress, analysis of stain, Elasticity Problems in two dimensions and three dimensions, Mohr's circle for three dimensional stresses. Stress tensor, Airy's stress function in rectangular and polar coordinate.

4. Books and Materials

Text Books:

1. Arthur P. Boresi, Richard J. Schmidt, Advanced Mechanics of Materials, 6thEdition, Wiley India Ltd, New Delhi, India,2009.
2. Stephan Timoshenko, J. N. Goodier , Theory of elasticity, 3rd Edition, Tata McGraw Hill Education Private Limited, New Delhi, India,2010.

Reference Books:

1. Jacob Pieter Den Hartog, Advanced strength of materials, New Edition, Dover Publications, New York,1987.
2. Stephan Timoshenko, Theory of Plates & Shells, 2nd Edition, Tata McGraw-Hill Education Private Limited, New Delhi, India,2010.
3. Henry Taylor Bovey, Theory of Structures and Strength of Materials, Photo Copy Edition, Nabu Press, USA,2010.
4. Sadhu Singh, Strength of Materials, 10th Edition, Khanna Publishers, New Delhi, India,2009.

Course Structure

A6702 - Analysis and Synthesis of Mechanisms

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course deals with basic concepts and mean techniques for synthesis and analysis of mechanisms. When students finished, they will be able to create and analyse a great number of types of mechanisms. Course is focused on mean properties of synthesis and analysis of mechanisms, without large and tedious calculations. Then analysis techniques will allows to students to simulate and see the motion of mechanisms, (velocities, accelerations, forces, etc.), and also to verify that they are useful.

Course Pre/co-requisites

Kinematics of Machinery Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6702.1 Discuss the theory and methodologies employed for design of mechanisms.
A6702.2 Solve problems of analysis and synthesis of mechanisms.
A6702.3 Develop Burmester curve of various mechanisms by graphical method.
A6702.4 Apply the graphical and analytical techniques commonly used in the synthesis of mechanisms.
A6702.5 Illustrate the basic concepts of robotics including kinematics.

3. Course Syllabus

Module 1: Basic Concepts, Definitions and assumptions; planar and spatial mechanisms; Mobility Criterion for Planar Mechanisms, kinematic pairs; degree of freedom; equivalent mechanisms; Kinematic Analysis of Planar Mechanisms. Review of graphical and analytical methods of velocity and acceleration analysis of kinematically simple mechanisms.

Module 2: Fixed and moving centrodes, inflection circle, Euler-Savary equation, Bobillier constructions, cubic of stationary curvature, Applications in dwell mechanisms.

Module 3: Kinematic Synthesis of planar mechanisms, accuracy (precision) points, Chebesychev spacing, types of errors, Graphical synthesis for function generation and rigid body guidance with two, three and four accuracy points using pole method, Analytical synthesis

of four-bar and slider-crank mechanisms .

Module 4: Freudenstein's equation, synthesis for four and five accuracy points, synthesis of four-bar for prescribed angular velocities and accelerations using complex numbers, three accuracy point synthesis using complex numbers.

Module 5: Coupler Curves: Equation of coupler curve, Robert-Chebychev theorem, double points and symmetry.Kinematic Analysis of Spatial Mechanisms, Denavit-Hartenberg parameters, matrix method of analysis of spatial mechanisms.

4. Books and Materials

Text Books:

1. R.S. Hartenberg and J. Denavit, "Kinematic Synthesis of Linkages", 1st Edition,McGraw-Hill, New York, 1980.
2. Robert L.Nortan ,Design of Machinery,3rd Edition Tata McGraw Hill Edition,2004.

Reference Books:

1. Hamilton H.Mabie,"Mechanisms and Dynamics of Machinery", 4th Edition,John Wiley and sons New York,1991.
2. S.B.Tuttle, Mechanisms for Engineering Design"3rdEdition, John Wiley and sons New York,1996.
3. Ghosh and A.K. Mallik, "Theory of Machines and Mechanisms", 1st Edition,Affiliated East-West Press, New Delhi, 1988.
4. A.G. Erdman and G.N. Sandor, "Mechanism Design - Analysis and Synthesis", (Vol. 1 and 2),3rdEdition, Prentice Hall India, 1988.
5. 5. J.E. Shigley and J.J. Uicker, "Theory of Machines and Mechanisms", 2nd Edition, McGraw-Hill, 1995.

Course Structure

B6703 - Geometric Modelling Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

The focus of the course is to investigate various representations of shape and how different representations can be used for analysis and comparison of 3D objects, Discuss the Overview of CAD Systems and Graphics Standards, Representation of curves and Surfaces.

Course Pre/co-requisites

CAD Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6703.1 Illustrate the methods representation of wireframe, surface, and solid modeling systems
A6703.2 Acquire fundamental knowledge of MATLAB.
A6703.3 Apply the gained knowledge to design a system, component, or process to meet desired needs and solve engineering problems
A6703.4 Develop various types of curves commonly used in engineering practice.
A6703.5 Make use MATLAB programming to develop analytic and synthetic curves.

3. Course Syllabus

1. Introduction and Installation of CAD/CAE Software's.
2. Introduction to Solid Modeling
3. Introduction to MATLAB Programming.
4. Working with advanced modeling tools (Sweep, Blend & Swept Blend).
5. Generating, editing and modifying drawings.
6. Generating solids using Boolean operations.
7. Creating an assembly, moving components, wire frame and surface geometry.
8. Generating detailed drawings and bill of material.
9. Generating of Ferguson's cubic surface patches, Bezier surface patches and coons patches.
10. Exercises on Analytic Curves (Lines, Circles, Ellipses, Parabolas, Hyperbolas, Conics) using MATLAB Programming.
11. Exercises on Synthetic Curves (Cubic Spines, Bezier Cures, B-Spine Curves) using MATLAB Programming.

12. Working with CAD Data Exchange formats: IGES, ACIS, DXF and STL.

Note: Note: Minimum 10 of the above experiments are to be conducted

4. Laboratory Equipment/Software/Tools Required

1. SOFTWARE USED : CATIA V5/CREO/MATLAB

Course Structure

B6704 - Machine Dynamics and Analysis Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

This laboratory is to understand the kinematics and dynamics of mechanical elements such as linkages, gears, cams and learn to design such elements to accomplish desired motions or tasks and also discuss the Mechanical Vibrations.

Course Pre/co-requisites

Dynamics of Machinery Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6704.1 Analyze the characteristics curves of different types of governors.
B6704.2 Examine the balancing conditions of rotating and reciprocating systems.
B6704.3 Determine the active and reactive gyroscope couples.
B6704.4 Evaluate the natural frequency of single rotor system with viscous damping and amplitude of a vibrating system.
A6704.5 Analyze the direct and inverse mechanism of robot.

3. Course Syllabus

1. Static balancing using steel balls.
2. Determination of damped natural frequency of vibration of the vibrating system with different viscous oils.
3. Field balancing of the thin rotors using vibration pickups.
4. Determination of steady state amplitude of forced vibratory system.
5. To determine the active and reactive gyroscopic couples and compare them.
6. To determine the characteristic curves of the watt and porter governors.
7. To determine the characteristic curves of the Proel and spring loaded governor governors.
8. To determine the characteristics journal bearing.
9. To study frictional behavior of different combinations of Materials.
10. To study wear of different materials under various loads and sliding speed conditions.
11. Direct Kinematic analysis of a robot.
12. Palletizing operation using Robot programming.

Note: Minimum 10 of the above experiments are to be conducted.

4. Laboratory Equipment/Software/Tools Required

1. Universal Governor Apparatus
2. Motorised Gyroscope
3. Single Rotor System With Viscous Damping Setup
4. Static And Dynamic Balancing Of Rotating Masses
5. Equivalent Spring Mass System
6. Journal Bearing Apparatus
7. Friction & Wear Test Rig
8. Field Balancing Of Thin Rotors Using Vibration Pickup
9. Robot Arm
10. Forced Vibratory Systems Apparatus With Recording Unit

Course Structure

B6001 - Research Methodology and IPR

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
2	0	28	0	2	40	60	100

1. Course Description

Course Overview

Research is an art of scientific investigation. Research is an original contribution to the existing stock of knowledge making for its advancement. It is the pursuit of truth with the help of study, observation, comparison and experiment. This course will help students to understand about the research process, tools, importance of ethics. Students can learn about the law of patent and copyrights and knowledge on IPR (Intellectual Property rights)

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6001.1. Identify an appropriate research problem in their suitable domain.
B6001.2. Construct a well-structured research paper and scientific presentations.
B6001.3. Express the importance of research ethics in scientific community.
B6001.4. Explore on various component of IPR and process of filing.
B6001.5. Gain knowledge on patents and copyrights.

3. Course Syllabus

Research Problem: Scope and objectives, Selection criteria, Research Problems, Research Approaches, Data collection, Data analysis, Ethics, Instrumentation, Interpretation.

Literature Studies: Effective literature studies, Types of literature review, Process and Purpose, Survey, Critical analysis, classification and comparison, case study, identifying the knowledge gap and propose a action plan.

Technical Writing: Effective Report/Article/Thesis writing, tools required, documentation using suitable application (Word, LaTeX, Pages), data representation using graphs, bar diagrams, pi-charts, preparation of manuscript, plagiarism, presentation of research work, Abstract and Conclusion.

Research proposal: Problem defining, national and international Scenario of proposed research, key factors, cost and contingencies, preparing timeline for research plan, funding agencies, collaboration, product and patent development.

Patent Rights and IPR: Process of Patenting and Development, Copyright, Trademark, Licensing and transfer of technology, Patent information and databases, New Developments in IPR, Administration of Patent System, Trade Secret, Copyright Infringement.

4. Books and Materials

Text Books:

1. C.R. Kothari, Gaurav Garg, Research Methodology : Methods And Techniques, New Age International Publishers; 4th edition, 2019
2. P Suganda Devi, Research Methodology: A Handbook for Beginners, Notion Press; 1st edition, 2017
3. Brad Sherman and Lionel Bently, Intellectual Property Law, Oxford University Press, 4th edition, 2014

I YEAR II SEMESTER

Course Structure

B6705 - Advanced Finite Element Analysis

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course is aimed at providing exposure to and understanding of advanced, specialist areas of Finite Element Analysis and their underlying Solid/Structural Mechanics concepts. It then concentrates on using this knowledge for solving discipline-specific engineering problems employing commercial Finite Element Analysis software.

Course Pre/co-requisites

Mechanics of solids concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6705.1 Apply the numerical methods to solve engineering problems and outline the requirements for convergence.
B6705.2 Analyze the linear one dimensional, Two dimensional structural problems.
B6705.3 Formulate shape functions for different elements to solve the problems.
B6705.4 Examine plain stress, plain strain, axi-symmetric and heat transfer problems.
B6705.5 Evaluate the Eigen values and Eigen vectors for structural elements.

3. Course Syllabus

Module 1: Introduction, Classification of problems – Dimensionality, time dependence, Boundary Value problems, Initial value problems, Linear/Non-linear problems.

Module 2: Differential equation as the starting point for FEM, steps in finite element method, discretization, types of elements used, Shape functions, Linear Elements, Local and Global coordinates, Coordinate transformation and Gauss-Legendre scheme of numerical integration, Nodal degrees of freedom.

Module 3: Finite element formulation, variational, weighted residual and virtual work methods.

Module 4: 1-D and 2-D problems from Structural Mechanics – Bar, Beam, Plane stress and

plane strain problems, Axi-symmetric problems – Axi-symmetric forces and geometry.

Module 5: Computer implementation, higher order elements, Iso-parametric formulation. Eigen-value problems, Natural vibration of bars and beams, Methods to find Eigen-values and Eigen-vectors.

4. Books and Materials

Text Books:

1. Chandrupatla and Belegundu "Introduction to Finite Elements in Engineering", 4th Edition, Prentice Hall of India Pvt. Ltd. New Delhi, 2011.
2. Logan Deryl L., "A First Course in Finite Element Method", Thomson Brook/Cole,5th Edition. 2012.

Reference Books:

1. Cook R.D. "Concepts and applications of finite element analysis" 4th Edition,Wiley, New York, 2002.
2. Reddy J N, "Finite element Method", 3rd Edition,Tata McGraw Hill publishing Co Ltd, New Delhi, ., 2005.
3. Bathe K.J., Cliffs, N.J. "Finite Element Procedures in Engineering Analysis", PHI Learning, Eastern Economy Editions, 2009.

Course Structure

B6706 - Mechanical Vibrations

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The objective of this course is to make students to gain basic knowledge and overview of Vibrations of the systems. The knowledge of Mechanical vibrations enables them to design, analysis various mechanical systems. Vibration response of the systems can be evaluated by applying numerical methods to various physical systems.

Course Pre/co-requisites

Numerical Methods concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6706.1 Formulate mathematical models and develop the equations of motion for vibrating systems by different principles
B6706.2 Analyze the causes and effects of vibration in mechanical systems.
B6706.3 Determine the dynamic response of system using different computational approaches.
B6706.4 Implement the approximate and iterative techniques to obtain the response of continuous vibratory systems.
B6706.5 Analyze the mechanism of rotating components and measure the responses of different vibrating structures.

3. Course Syllabus

Module 1: Introduction: study of vibration, basic concepts of vibration, classification of vibration systems, simple harmonic motion, equivalent systems, mathematical modeling-inertia element, stiffness element, dissipation element, model construction.

Module 2: Single Degree of Freedom Systems - I,Undamped and Damped free vibrations: forced vibrations; coulomb damping; Response to harmonic excitation; rotating unbalance and support excitation; Vibration isolation and transmissibility. **Two Degree of Freedom Systems:** Principal modes, Undamped and damped free and forced vibrations, coordinate coupling and principal coordinate, Undamped vibration absorbers.

Module 3: Multi Degree of Freedom Systems:Matrix formulation, stiffness and flexibility influence coefficients; Eigen value problem; normal modes and their properties; Free and forced vibration by Modal analysis; Method of matrix inversion.

Module 4: Numerical Methods:Rayleigh's, Stodola's, Rayleigh-Ritz Method, Matrix iteration and Holzer's methods. **Continuous Systems:** Free vibration of strings – longitudinal oscillations of bars-traverse vibrations of beams-Torsional vibrations of shafts.

Module 5: Rotor Unbalanced:Introduction, Torsional vibrations of single and multi – rotor systems, geared systems and critical speed without and with damping, secondary critical speed. **Vibration Measurement:** Introduction, frequency response function measurement, force input, capacitive probe, laser vibrometers, velocity meters and accelerometers.

4. Books and Materials

Text Books:

1. Meirovitch, Elements of Vibration Analysis, 2nd Edition (SIE), Tata McGraw Hill, New Delhi, India,2006
2. G. K. Grover, Mechanical Vibrations, 8th Edition, Nem Chand & Bros, Roorkee, India,2009.

Reference Books:

1. S S. Rao, Mechanical Vibrations, 4th Edition, Pearson Publications,2009.
2. Amy L. Galloway, Mechanical Vibrations: Types, Testing, and Analysis, 1st Edition, Nova Science Publishers, New York, USA,2011.
3. Stephen Timoshenko, Vibration problems in Engineering, 2nd Edition, Oxford City Press, New York, USA,2011.

Course Structure

B6707 - Finite Element Analysis Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

Finite element methods course is one of the important courses in mechanical engineering. This course introduces student's finite element methods for analysis of solid, structural, fluid and heat transfer problems. It deals analysis of one dimensional, two dimensional problems like truss, beams and plane stress and plane strain problems, steady state Heat Transfer and dynamic analysis problems.

Course Pre/co-requisites

Mechanics of Solids Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6707.1 Develop the MATLAB code for the different numerical techniques
B6707.2 Analyze stress and deformation of part models, axi-symmetric components and beams.
B6707.3 Develop the mode shapes and frequency resonance for the components and beams.
B6707.4 Assess the harmonic resonance for the given component
A6707.5 Analyze the components in heat transfer analysis and thermal stress analysis.

3. Course Syllabus

1. Bisection method and Fixed-point iteration method
2. Newton-Raphson and Secant method
3. Numerical solution of ODE (Euler's Method)
4. Numerical solution of ODE (Runge-Kutta Method)
5. Stress analysis of a plate with a circular hole.
6. Stress analysis of rectangular L bracket
7. Stress analysis of an axi-symmetric component.
8. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
9. Mode frequency analysis of a 2 D component.
10. Mode frequency analysis of beams (Cantilever, Simply supported, Fixed ends)
11. Harmonic analysis of a 2D component

12. Thermal stress analysis of a 2D component
13. Conductive heat transfer analysis of a 2D component
14. Convective heat transfer analysis of a 2D component

Note: Minimum 12 of the above experiments are to be conducted.

4. Laboratory Equipment/Software/Tools Required

1. Software: ANSYS/MATLAB

Course Structure

B6708 - Advanced Design Laboratory

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
0	4	0	56	2	40	60	100

1. Course Description

Course Overview

Advanced Design Laboratory course is one of the important courses in mechanical engineering. This course introduces FFT analyzer,Advanced Spectrum Analysis,3D Printing and Components and Vibration Equipment's.

Course Pre/co-requisites

Mechanics of Solids and dynamics Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6708.1 Determine the deflection, shear centre, whirling speed and stress of different structures.
B6708.2 Analyze the transverse vibration of different beam set up.
B6708.3 Evaluate the compressive, tensile and buckling of 3-D printed structures. .
B6708.4 Estimate the natural frequency of dynamic system using FFT analyzer.
A6708.5 Calculate the natural frequencies and amplitudes of mechanical components using spectrum analysis concepts.

3. Course Syllabus

1. Determination of natural frequency of given structure using FFT analyzer.
2. Diagnosis of a machine using FFT analyzer.
3. Advanced Spectrum Analysis.
4. Compressive/Tensile strength of 3D printed components Using different layer height.
5. Compressive/Tensile strength of 3D printed components Using different infill.
6. Buckling analysis of 3D printed components
7. Estimation of damping using logarithmic decrement curve.
8. Determine the whirling speed of Shaft.
9. Transverse vibration of beam Apparatus.
10. To determine the deflection of a structural member using Pin jointed setup.
11. Calculation of shear centre of different cross sections using Shear centre setup.
12. Buckling Analysis of column using column buckling setup.
13. To determine the deflection of a frame using Portal frame set up.

14. Analyze the stress distribution of structural member using curved beam apparatus.

Note: Minimum 12 of the above experiments are to be conducted.

4. Laboratory Equipment/Software/Tools Required

1. FFT Analyzer
2. NI Accelerometer & DAS.
3. 3D Printer
4. Mini Tensile and Compressive Equipment.
5. Column Buckling Setup.
6. Whirling of shafts Apparatus
7. Transverse vibrations of Beam Apparatus.
8. Pin Jointed Truss Setup.
9. Shear Center Setup.
10. Portal Frame Setup.
11. Curved Beam Apparatus.

Professional Electives

Course Structure

A6751 - Numerical Methods in Engineering

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course will cover a range of numerical analysis techniques related to solving systems of linear algebraic equations, matrix eigenvalue problems, nonlinear equations, polynomial approximation and interpolation, numerical integration and differentiation, ordinary and partial differential equations.

Course Pre/co-requisites

Engineering Mathematics Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A6751.1 Apply numerical methods to find our solution of algebraic equations using different methods under different conditions.
A6751.2 Apply various interpolation methods and finite difference concepts
A6751.3 Make use of numerical differentiation and integration to solve the problem,wherever routine methods are not applicable.
A6751.4 Select and use appropriate methods for finding roots of equations as well as interpolation and approximation methods.
A6751.5 Use numerical methods for differentiation and integration with engineering applications.

3. Course Syllabus

Module 1: Numerical Methods in Linear Algebra:Direct and iterative solution techniques for simultaneous linear algebraic equations – Gauss elimination, Gauss-Jordon, LU Decomposition, QR Method, Jacobi and Gauss-Seidel Methods.

Module 2: Eigenvalues and Eigenvectors:Power and inverse power method, householder transformation, physical interpretation of eigen values and eigenvectors, Eigen value problems in engineering.

Module 3: Solution of Nonlinear Algebraic Equations:Bisection method, fixed-point iteration method, Newton-Raphson, Secant method, solution of system of nonlinear algebraic

equations. Interpolation: Polynomial interpolation, Lagrange interpolating polynomial, Hermite interpolation, interpolation in 2 and 3 dimensions.

Module 4: Numerical Differentiation and Integration:Finite difference formula using Taylor series, Differentiation of Lagrange polynomials, Simpson's rule, Gauss-quadrature rule, Romberg method, multiple integrals.

Module 5: Numerical Solution of Differential Equations:Ordinary Differential Equations – Euler, Heun's method and Stability criterion, second order and fourth order Runge-Kutta methods, Adams-Bashforth-Moulton method, system of ODEs and nonlinear ODEs

4. Books and Materials

Text Books:

1. S. P. Venkateshan, Prasanna Swaminathan, Computational Methods in Engineering, 1st Edition Ane Books,2012.
2. Steven C. Chapra, Numerical Methods for Engineering, 8th Edition, Mc-Graw Hill Education, 2021.

Reference Books:

1. Joe D Hoffman, Numerical Methods for Engineers and Scientists, 2nd Edition, Marcel Dekker,2001.
2. Gilbert Strang, Computational Science and Engineering, 1st Edition, Wellesley-Cambridge Press,2007.

Course Structure

B6752 - Robotics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course explores the robotics foundations for motion planning and control of robot manipulators. The course gives an insight on determining the position and orientation of robot manipulator applying homogeneous transformation technique, path planning and trajectory planning concepts for robot motion and obstacle avoidance. The course finally explores Components and modeling concept of robot.

Course Pre/co-requisites

Engineering Mathematics Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6752.1 Illustrate the basic concepts and components of a robotic system.
B6752.2 Identify suitable actuators and sensors for designing robot mobility systems.
B6752.3 Apply the key concepts of trajectory planning and control in robot motion.
B6752.4 Calculate the position, forward and inverse kinematics of a robot arm.
B6752.5 Calculate the velocity, kinematics and dynamics of a robot arm.

3. Course Syllabus

Module 1: Introduction and Mathematical Representation of Robots:History of Robots, Types of Robots, Notation, Position and Orientation of a Rigid Body, Some Properties of Rotation Matrices, Successive Rotations, Representation by X-Y-Z, Z-Y-Z Euler Angles, Transformation between coordinate system, Homogeneous transformation, Representation of links using D-H parameters, Transformation matrices, Transformation matrices for 2R, 3R manipulators and planar four bar mechanisms. **Kinematics of Manipulators:** Degrees of freedom of a manipulator, Loop constraint equations. Direct kinematics of 2R and 3R manipulator, Planar four bar mechanism. Inverse kinematics of 2R and 3R manipulator, Inverse kinematics of planar four bar mechanisms.

Module 2: Velocity and Statics of Manipulators:Introduction, Linear and angular velocity of links, Jacobian matrix, Singularities in Velocity domain, Statics equilibrium, Force and Torque analysis, Singularity in force domain. **Dynamics of Manipulators:** Introduction,

Lagrangian formulation, Mass and Inertia of a link, Equation of motion of 2R and 3R manipulators using Lagrangian, Newton-Euler formulation, Recursive formulation of Dynamics using Newton Euler equation.

Module 3: Trajectory Planning:Joint space schemes, Cubic trajectory, Joint space schemes with via points, Cubic trajectory with a via point, Third order polynomial trajectory planning, Cartesian space schemes, Cartesian straight line and circular motion planning.CONTROL: Feedback control of a single link manipulator, First order and Second order systems, PID control, PD control of multi link manipulator, Cartesian control of manipulators, Force control of manipulators-Force control of single mass.

Module 4: Actuators:Types, Characteristics of actuating system, Hydraulic and Pneumatic actuators, Electric Motors: DC motors, Reversible AC motors, Brushless DC motors, Stepper motors- structure and principle of operation, Stepper motor speed-torque characteristics.

Module 5: Sensors:Sensor desirable features, Position sensors, Velocity sensor, Acceleration sensors, Force and Pressure sensors, Torque sensors, Touch and tactile sensor, Proximity sensors and Range sensors. **Robot Grippers:** Types of Grippers, Design aspect for gripper, Force analysis for various basic gripper systems.

4. Books and Materials

Text Books:

1. Ashitava Ghosal , Robotics: Fundamental Concepts and Analysis, 1st Edition, Oxford University Press, New Delhi, India,2009.
2. Saeed B. Niku, Introduction to Robotics: Analysis, Control, Applications, 2nd Edition, Wiley India Pvt Ltd, New Delhi, India,2011.

Reference Books:

1. John J. Craig, Introduction to Robotics: Mechanics and Control, 3rd Edition, Pearson Education, New Delhi, India,2010.
2. Schilling J. Robert, Fundamentals of Robotics, Analysis and Control, 1st Edition, Prentice Hall of India, New Delhi, India,2009.
3. M. P. Groover, Industrial Robotics, 3rd Edition, Pearson Education, New Delhi,2009.

Course Structure

B6753 - Mechanics of Composite Materials

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Composite materials are materials comprising two or more material phases with different physical properties. Because they usually exhibit remarkable physical properties, in general superior to the properties of their individual components, they appear pervasively in engineering applications (e.g., reinforced concrete in construction, fiber-reinforced materials for aircraft structures, reinforced rubber in car tires, ...). Despite being comprised multiple material phases with different physical properties, these materials may be considered for practical purposes as homogeneous materials with physical material-like effective properties. The course will focus primarily on the elastic properties of a wide range of composites (laminated materials, particulate/fiber-reinforced composites, multidirectional laminates) and will cover a number of engineering methods for the computation of the effective properties of these materials based on the properties and spatial arrangement (volume fraction, shape, orientation, ...) of their underlying constituents.

Course Pre/co-requisites

Engineering Mathematics Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6753.1 Describe what are composite materials and their differences with respect to conventional materials such as metals.
B6753.2 Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
B6753.3 Determine stresses and strains in composites.
B6753.4 Predict strength and failure of lamina and laminates under mechanical loads.
B6753.5 Analyze failure criteria and critically evaluate the results.

3. Course Syllabus

Module 1: Introduction:Definition and characteristics, Overview of advantage and limitations of composite materials, Significance and objectives of composite materials, Science and technology, current status and future prospectus.

Module 2: Basic Concepts and Characteristics:Structural performance of conventional material, Geometric and physical definition, Material response, Classification of composite materials, Scale of analysis; Micromechanics, Basic lamina properties, Constituent materials and properties, Properties of typical composite materials.

Module 3: Elastic Behavior of Unidirectional Lamina:Stress-strain relations, Relation between mathematical and engineering constants, transformation of stress, strain and elastic parameters.

Module 4: Strength of Unidirectional Lamina:Micromechanics of failure; failure mechanisms, Macro-mechanical strength parameters, Macro-mechanical failure theories, Applicability of various failure theories.

Module 5: Elastic Behavior of Laminate:Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, general load–deformation relations, Analysis of different types of laminates.**Stress and Failure Analysis of Laminates:** Types of failures, Stress analysis and safety factors for first ply failure of symmetric laminates, Micromechanics of progressive failure; Progressive and ultimate laminate failure, Design methodology for structural composite materials.

4. Books and Materials

Text Books:

1. Isaac M. Daniels, Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press, 1994.
2. Bhagwan D. Agarwal, Lawrence J. Broutman, "Analysis and Performance of fiber composites", John Wiley and Sons, Inc. 1990.

Reference Books:

1. Mathews, F. L. and Rawlings, R. D., "Composite Materials: Engineering and Science", CRC Press, Boca Raton, 2003.
2. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004.
3. Mazumdar S. K., "Composite Manufacturing – Materials, Product and Processing Engineering", CRC Press, Boca Raton, 2002.
4. Robert M. Jones, "Mechanics of Composite Materials", Taylor and Francis, Inc., 1999.

Course Structure

B6754 - Theory of Elasticity and Plasticity

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

In this course, introduce the relationship between stress and strain in an elastic body, the two-dimensional theory of elasticity, applications to problems of rod-torsion and plate-bending, handling of anisotropic materials, approaches to elastic-plastic problems, the bending and torsion of elastic-plastic materials.

Course Pre/co-requisites

Mechanics of solids Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6754.1 Illustrate strength and deformation of machines and structures.
B6754.2 Apply constitutive equations of composite materials and understand mechanical behavior at micro, macro and meso level.
B6754.3 Determine stresses and strains in composites.
B6754.4 Predict strength and failure of lamina and laminates under mechanical loads.
B6754.5 Analyze failure criteria and critically evaluate the results.

3. Course Syllabus

Module 1: Introduction:Definition and characteristics, Overview of advantage and limitations of composite materials, Significance and objectives of composite materials, Science and technology, current status and future prospectus.

Module 2: Basic Concepts and Characteristics:Structural performance of conventional material, Geometric and physical definition, Material response, Classification of composite materials, Scale of analysis; Micromechanics, Basic lamina properties, Constituent materials and properties, Properties of typical composite materials.

Module 3: Elastic Behavior of Unidirectional Lamina:Stress-strain relations, Relation between mathematical and engineering constants, transformation of stress, strain and elastic parameters.

Module 4: Strength of Unidirectional Lamina: Micromechanics of failure; failure mechanisms, Macro-mechanical strength parameters, Macro-mechanical failure theories, Applicability of various failure theories.

Module 5: Elastic Behavior of Laminate:Basic assumptions, Strain-displacement relations, Stress-strain relation of layer within a laminate, Force and moment resultant, general load–deformation relations, Analysis of different types of laminates. **Stress and Failure Analysis of Laminates:** Types of failures, Stress analysis and safety factors for first ply failure of symmetric laminates, Micromechanics of progressive failure; Progressive and ultimate laminate failure, Design methodology for structural composite materials.

4. Books and Materials

Text Books:

1. Isaac M. Daniels, Ori Ishai, "Engineering Mechanics of Composite Materials", Oxford University Press, 1994.
2. Bhagwan D. Agarwal, Lawrence J. Broutman, "Analysis and Performance of fiber composites", John Wiley and Sons, Inc. 1990.

Reference Books:

1. Mathews, F. L. and Rawlings, R. D., "Composite Materials: Engineering and Science", CRC Press, Boca Raton, 2003.
2. Madhujit Mukhopadhyay, "Mechanics of Composite Materials and Structures", University Press, 2004.
3. Mazumdar S. K., "Composite Manufacturing – Materials, Product and Processing Engineering", CRC Press, Boca Raton, 2002.
4. Robert M. Jones, "Mechanics of Composite Materials", Taylor and Francis, Inc., 1999.

Course Structure

B6755 - Tribology

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Tribology is the science and technology of interacting surfaces in relative motion. This includes study of friction, lubrication, contact mechanics, surface damage processes and surface optimization. It is highly multidisciplinary and spans many applications including physics, chemistry, materials science, biology and engineering.

Course Pre/co-requisites

Environmental Science Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6755.1 Illustrate the basic concepts of friction, wear and lubrication
B6755.2 Select the appreciate lubrication mechanism for requirements.
B6755.3 Apply the basic theories of friction, wear and lubrication to predict the frictional behavior of commonly encountered sliding interfaces.
B6755.4 Solve the Tribo-logical problems by using laws of friction, wear and lubrication
B6755.5 Analyze the behavior of tribological components subjected to different working conditions

3. Course Syllabus

Module 1: Friction, theories of friction, Friction control, Surface texture and measurement, genesis of friction, instabilities and stick-slip motion.

Module 2: Wear, types of wear, theories of wear, wear prevention. Tribological properties of bearing materials and lubricants.

Module 3: Lubrication, Reynolds's equation and its limitations, idealized bearings, infinitely long plane pivoted and fixed show sliders, infinitely long and infinitely short (narrow) journal bearings, lightly loaded infinitely long journal bearing (Petroff's solution), Finite Bearings, Design of hydrodynamic journal bearings.

Module 4: Hydrostatic, squeeze film Circular and rectangular flat plates, variable and alternating loads, piston pin lubrications, application to journal bearings.

Module 5: Elasto-hydrodynamic lubrication – pressure viscosity term in Reynolds's equation, Hertz' theory, Ertel-Grubin equation, lubrication of spheres, gear teeth and rolling element bearings, Air lubricated bearings, Tilting pad bearings.

4. Books and Materials

Text Books:

1. Cameron, "Basic Lubrication Theory",3rd Edition, Ellis Horwood Ltd, 1981.
2. J. Halling,Principles in Tribology,illustrated Edition,Macmillan,the University of California,1975

Reference Books:

1. B. J. Hamrock,Fundamentals of Fluid Film Lubrication, 2rdEdition,McGraw Hill International,1994
2. T.A. Stolarski, "Tribology in Machine Design". Kindle Edition, Newnes publisher,2013
3. B. C. Majumdar,Introduction to Tribology of Bearings, 2ndEdition,A. H. Wheeler & co. pvt. ltd 1999.
4. D.D. Fuller, "Theory and Practice of Lubrication for Engineers",2rdEdition, John Wiley and Sons, 1984.

Course Structure

B6756 - Fatigue, Fracture and Creep

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course will introduce the theory and application of fracture mechanics. The perspectives of multiple disciplines including mechanics, materials, manufacturing, statistics, and nondestructive evaluation will be integrated to develop a holistic view of design and sustainment of fatigue-limited structures. The course will provide a solid foundation of classic approaches to solving fatigue and fracture problems while simultaneously discussing the underlying physical mechanisms that drive material behavior.

Course Pre/co-requisites

Mechanics of solids Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6756.1 Develop skills in Fracture Signature Identification
B6756.2 Illustrate crack resistance and energy release rate of crack criticality.
B6756.3 Apply linear elastic fracture mechanics on materials.
B6756.4 Analyze for strength of cracked bodies by using various methods.
B6756.5 Discuss materials properties at elevated temperatures and introduce creep

3. Course Syllabus

Module 1: Introduction:Types of fracture, cohesive strength, Elliptical crack model, Modes of fracture, Dislocation theory for brittle fracture, Prediction of mechanical failure, Macroscopic failure modes; brittle and ductile behavior, Fracture in brittle and ductile materials – characteristics of fracture surfaces; intergranular and intragranular failure, cleavage and micro-ductility, growth of fatigue cracks, the ductile/brittle fracture transition temperature for notched and un notched components. Fracture at elevated temperature. Griffith's analysis, Concept of energy release rate (G), fracture energy, crack resistance(R), Modification for ductile materials, loading conditions. Critical energy release rate.

Module 2: Linear Elastic Fracture Mechanics (LEFM):Three loading modes and the state of stress ahead of the crack tip, stress concentration factor, stress intensity factor and the material parameter the critical stress intensity factor. Crack tip plasticity, The Irwin ap-

proach, Shape and size of plastic zone, definition of plane stress and Plane strain and the effect of component thickness, Crack tip triaxiality.

Module 3: Elastic-Plastic Fracture Mechanics (EPFM):The definition of alternative failure prediction parameters, Crack Tip Opening Displacement (CTOD), The J integral, J as path-independent line integral and stress intensity parameter, Relation between J and CTOD. The effect of Microstructure on fracture mechanism and path, crack growth resistance curve, cleavage and ductile failure, factors improving toughness.

Module 4: Definition of terms used to describe fatigue cycles, High Cycle Fatigue, Low Cycle Fatigue, mean stress, R-ratio, strain and load control. S-N curves. Goodman's rule and Miners rule. Micro mechanisms of fatigue damage, Fatigue crack propagation, leading to a consideration of factors enhancing fatigue resistance, Strain life equation, effect of stress concentration on fatigue, Fatigue under combined stress Total life and damage tolerant approaches to life prediction, Damage tolerance methodology.

Module 5: Creep Deformation:The evolution of creep damage, the creep curve, Structural changes during creep, Mechanism of creep deformation, Activation energy for steady state creep, Fracture at elevated temperature, Prediction of long time properties (Larson-Miller parameters), Damage accumulation rule, Creep-fatigue interactions, Stress dependence of creep - power law dependence. Comparison of creep performance under different conditions.

4. Books and Materials

Text Books:

1. T. L. Anderson, Fracture Mechanics: Fundamentals and Applications, 3rd Edition, Taylor & Francis CRC Press, Boca Raton, USA,2005.
2. Brian Lawn, Fracture of Brittle Solids, 2nd Edition, Cambridge University Press, New York, USA,1998.

Reference Books:

1. M. Janssen, J. Zuidema, R. J. H. Wanhill, Fracture mechanics, 2nd Edition, Spon Press, New York, USA,2004.
2. J. F. Knott , Fundamentals of Fracture Mechanics, 2nd Edition, Butterworths, London, UK,1981.
3. George E Dieter, Mechanical Metallurgy, 3rd Edition, McGraw-Hill Book Company,2017.

Course Structure

B6757 - Design Automation with Internet of Things

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This Course discuss the An overview of IoTs, design of smart objects that provide collaboration and ubiquitous services will be explored. Design for longevity/energy efficiency will be highlighted. Step by step system design will be introduced. At the end of the course, the student is expected to make the right choice of hardware, software and protocols for the proposed application

Course Pre/co-requisites

IoT Concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6757.1 Identify the Components that forms part of IoT Architecture.
B6757.2 Determine the most appropriate IoT Devices and Sensors based on Case Studies.
B6757.3 Develop the connections between the Devices and Sensors.
B6757.4 Evaluate the appropriate protocol for communication between IoT.
B6757.5 Apply IoT technologies and solutions to Robotics and Autonomous Vehicles .

3. Course Syllabus

Module 1: Introduction: to IoT & Cyber-Physical Systems, IoT Enabling Technologies – Physical End points, Network Services, Cloud. Different Levels of IoT Applications.

Module 2: Communication and networking technologies in IoT: Communication models, adhoc.Industrial & Automotive Networks, Vehicular networks

Module 3: Sensors and Actuators:Categorization based on complexity, Introduction with applications, IR/Ultrasonic proximity & distance measurement, Accelerometers, Gyroscope, magnetometer, Acoustic Sensors, Multi 37 sensor fusion. Motion control, motor control, relays , solenoid valve, IP based control. Control of Actuators via Internet, Cloud based control.

Module 4: IoT implementation in Transportation and logistics, Energy and utilities, Automotive Connected supply chain, Plant floor control automation, remote monitoring, Management of critical assets, and proactive maintenance.

Module 5: Applications:Applications HCI and IoT world -Multilingual interactions Robotics and Autonomous Vehicles Sensing and data processing-Simultaneous mapping and localization-Levels of autonomy, Smart factories, Future research challenges

4. Books and Materials

Text Books:

1. Adrian McEwan and Hakim Cassimally, "Designing the internet of things",1st Edition, Wiley, 2013
2. Vijay Madisetti and ArshdeepBahga,"Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014 .

Reference Books:

1. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, StamatisKarnouskos, Stefan Avesand, David Boyle, "From Machine-to-Machine to the Internet of Things -Introduction to a New Age of Intelligence" Elsevier,2015.
2. Francis daCosta,"Rethinking the Internet of Things: A Scalable Approach to Connecting Everything",1st Edition, Apress Publications, 2013.

Course Structure

B6758 - Advanced Stress Analysis

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course covers the Concept of three-dimensional stress and strain at a point as well stress-strain relationships for isotropic materials. Stresses in components of noncircular cross section subjected to unsymmetrical bending and torsional loading. Shear centre, calculation of stresses and strains associated with thick wall cylindrical pressure vessels and rotating disks.

Course Pre/co-requisites

Mechanics of Solids concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6758.1 Analyze the theories of stress and strain for the analysis of mechanical system.
B6758.2 Obtain the solution to elastic problem and deflection of structure using energy methods.
B6758.3 Explore the general methods to aid the differential equation for linear elastic torsion problem.
B6758.4 Determine the shear centre and bending moment of unsymmetrical sections.
B6758.5 Compute the stress and deflection of pressurized cylinder and rotating disk.

3. Course Syllabus

Module 1: Theory of Elasticity: Analysis of stress, Analysis of stain, Elasticity problems in two dimension and three dimensions, Mohr's circle for three dimensional stresses. Stress tensor, Aire's stress function in rectangular and polar coordinates.

Module 2: Energy Methods:Energy method for analysis of stress, strain and deflection The three theorem's - theorem of virtual work, theorem of least work, Castiglione's theorem, Rayleigh Ritz method, Galekin's method, Elastic behavior of anisotropic materials like fiber reinforced composites.

Module 3: Theory of Torsion:Torsion of prismatic bars of solid section and thin walled section. Analogies for torsion, membrane analogy, fluid flow analogy and electrical analogy.

Torsion of conical shaft, bar of variable diameter, thin walled members of open cross section in which some sections are prevented from warping, Torsion of noncircular shaft.

Module 4: Unsymmetrical Bending and Shear Centre: Concept of shear center in symmetrical and unsymmetrical bending, stress and deflections in beams subjected to unsymmetrical bending, shear center for thin wall beam cross section, open section with one axis of symmetry, general open section, and closed section.

Module 5: Pressurized Cylinders and Rotating Disks:Governing equations, stress in thick walled cylinder under internal and external pressure, shrink fit compound cylinders, stresses in rotating flat solid disk, flat disk with central hole, disk with variable thickness, disk of uniform strength, Plastic action in thick walled cylinders and rotating disc.

4. Books and Materials

Text Books:

1. Sadd, Martin H., Elasticity: Theory, applications and Numeric, 2nd Edition,Academic Press, 2005.
2. Boresi, A.P. and K. P. Chong, Elasticity in Engineering Mechanics, 3rd Edition, John Wiley & Sons,2010.

Reference Books:

1. Budynas, R. G. Advance strength and Applied Stress Analysis, 2nd Edition, WCB/ McGraw Hill 1999.
2. Dally, J. W. and W.F. Riley, Experimental Stress Analysis, 3rd Edition, McGraw Hill International, 1991.
3. Theory of Elasticity – Timoshenko and Goodier, 3rd Edition,Mc Graw Hill,2017.

Course Structure

B6759 - Multibody Dynamics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

A Multi Body Dynamics Course (MBD) system is one that consists of solid bodies, or links, that are connected to each other by joints that restrict their relative motion. The study of Multi Body Dynamics Course is the analysis of how mechanism systems move under the influence of forces, also known as forward dynamics.

Course Pre/co-requisites

Theory of Machines concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6759.1 Analyze the theories of stress and strain for the analysis of mechanical system.
B6759.2 Derive the equation of motion for interconnected bodies in multibody system
B6759.3 analyse interconnected bodies in a multi-body system
B6759.4 Compute the kinematics of any point in a given multi-body system
B6759.5 Use numerical methods for the analysis of multi body system

3. Course Syllabus

Module 1: Introduction:The method of constraints for planar kinematic analysis. Revolute, prismatic, gear and cam pairs are considered together with other 2 degrees – of - freedom types of constraints. Basic principles for analysis of multi-body systems: The automatic assembly of the systems of equations for position, velocity and acceleration analysis. Iterative solution of systems of non linear equations. Geometry of masses. The principle of virtual work and Lagrange's equations.

Module 2: Dynamics of Planar Systems: Dynamics of planar systems. Systematic computation and assembly of mass matrix. Computation of planar generalized forces for external forces and for actuator – spring - damper element. Simple applications of inverse and forward dynamic analysis. Numerical integration of first-order initial value problems. The method of Baumgarte for the solution of mixed differential – algebraic equations of motion. The use of coordinates partitioning, QR and SVD decomposition for the orthogonalization of constraints.

Module 3: Kinematics of Rigid Bodies in Space: Reference frames for the location of a body in space. Euler angles and Euler parameters, The formula of Rodrigues, Screw motion in space. Velocity, acceleration and angular velocity. Relationship between the angular velocity vector and the time derivatives of Euler parameters.

Module 4: Kinematic Analysis of Spatial Systems: Basic kinematic constraints. Joint definition frames. The constraints required for the description in space of common kinematic pairs (revolute, prismatic, cylindrical, spherical).Equations of motion of constrained spatial systems.

Module 5: Computation of Forces: Computation of spatial generalized forces for external forces and for actuator – spring – damper element. Computation of reaction forces from Lagrange's multipliers.

4. Books and Materials

Text Books:

1. Rajiv Rampalli, Why Do Multi-Body System Simulation, Gabriele Ferrarotti and Michael Hoffmann, 1st Edition, NAFEMS Publications,2012.
2. Donald T. Greenwood ,"Principles of Dynamics" , 2nd Edition, Prentice Hall,2017.

Reference Books:

1. Wittenburg, J., Dynamics of Systems of Rigid Bodies, B.G. Teubner, Stuttgart, 1977.
2. Kane, T.R, Levinson, D.A., Dynamics: Theory and Applications, McGraw-Hill Book Co., 1985.
3. Nikravesh, P.E., Computer Aided Analysis of Mechanical Systems, Prentice-Hall Inc., Englewood Cliffs, NJ, 1988.
4. Roberson, R.E., Schwertassek, R., Dynamics of Multibody Systems, Springer-Verlag, Berlin, 1988.

Course Structure

B6760 - Condition Based Monitoring

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course is intended to provide the necessary tools and basic knowledge in the field of monitoring the health of rotating and reciprocating machines, primarily through vibration analysis.

Course Pre/co-requisites

Signal Processing and Vibration concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6760.1 Illustrate Vibration Based Condition Monitoring in various sectors and fields
B6760.2 Apply condition monitoring techniques to machineries and industries
B6760.3 Implement data acquisition and signal processing techniques to all mechanical components
B6760.4 Develop the health monitoring Techniques by using condition monitoring.
B6760.5 Design the architecture of an appropriate condition monitoring system for typical machines,

3. Course Syllabus

Module 1: The basic idea of health monitoring and condition monitoring of structures and machines. Some basic techniques.

Module 2: Basics of signal processing: Study of periodic and random signals, probability distribution, statistical properties, auto and cross correlation and power spectral density functions of commonly found systems, spectral analysis.

Module 3: Fourier transform:The basic ideas of Fourier transform interpretation and application to real signals. Response of linear systems to stationary random signals: FRFs, resonant frequencies, modes of vibration.

Module 4: Introduction to vibration-based monitoring, Machinery condition monitoring by vibration analysis: Use and selection of measurements, analysis procedures and instruments.

Module 5: Typical applications of condition monitoring using vibration analysis to rotating machines. Some other health monitoring techniques, acoustic emission, oil debris and temperature analysis, Applications.

4. Books and Materials

Text Books:

1. M. Adams, Rotating machinery analysis - from analysis to troubleshooting, Marcel Dekker, New York, 2001, ISBN 0-8247-0258-1.
2. 2. Cornelius Scheffer Paresh Girdhar, Practical Machinery Vibration Analysis and Predictive Maintenance, Newnes, 1st Edition, 2004, Paperback ISBN: 9780750662758.

Reference Books:

1. Isermann R., Fault Diagnosis Applications, Springer-Verlag, Berlin, 2011.
2. Rao, J S., Vibration Condition Monitoring, Narosa Publishing House, 2nd Edition, 2000.
3. Allan Davies, Handbook of Condition Monitoring,2nd Edition, Chapman and Hall, 2000.

Course Structure

B6761 - Optimization Techniques in Design

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The purpose of this course is to develop a knowledge in the field of optimization techniques their basic concepts, principles. linear programming and Geometric programming.

Course Pre/co-requisites

Operation Research concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6761.1 Illustrate the fundamental knowledge of Linear Programming and Dynamic Programming.
B6761.2 Use classical optimization techniques and numerical methods of optimization.
B6761.3 Develop Optimum design of mechanical elements like beams, columns, gears, shafts
B6761.4 Formulate simplex methods variable with upper bounds
B6761.5 Solve optimization problems by using concepts of Genetic algorithms

3. Course Syllabus

Module 1: Introduction to optimization, classification of optimisation problems, classical optimization techniques.

Module 2: Linear programming, simplex method and Duality in linear programming, sensitivity or post-optimality analysis, Karmarkar's methods.

Module 3: Non-Linear Programming:- One dimensional minimization, unconstrained and constrained minimization, direct and indirect methods.

Module 4: Geometric programming, Optimum design of mechanical elements like beams, columns, gears, shafts, etc.,

Module 5: Introduction to Genetic Algorithms, Operators, applications to engineering optimization problems.

4. Books and Materials

Text Books:

1. S. S. Stricker, "Optimising performance of energy systems" 1st Edition,Battelle Press, New York,1985.
2. R.C. Johnson, "Optimum Design of Mechanical Elements", 1st Edition, Willey, New York, 1980.

Reference Books:

1. J. S. Arora, "Introduction to Optimum Design",1st Edition, McGraw Hill, New York, 1989.
2. Kalyanmoy Deb, "Optimization for Engineering Design", 1st Edition,Prentice Hall of India, New Delhi, 05
3. R.J. Duffin, E.L. Peterson and C.Zener "Geometric Programming-Theory and Applications", 1st Edition, Willey, New York, 1967.

Course Structure

B6762 - Nano Technology

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course cover introduction to nanotechnology. Description of various nanomaterials,their applications and synthesis methods.

Course Pre/co-requisites

Engineering Physics concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6762.1 Illustrate various top-down and bottom-up approaches for nanomaterial synthesis.
B6762.2 Apply different techniques for characterization of nano materials .
B6762.3 Synthesise and deposit nanomaterials by various methods.
B6762.4 Apply various deposition techniques at the atomic and molecular level
B6762.5 the advanced concepts in various vapour deposition techniques

3. Course Syllabus

Module 1: Introduction, Importance of Nano-technology, Emergence of Nano-Technology, Bottom-up and Top-down approaches, challenges in Nano Technology.

Module 2: Zero Dimensional Nano-structures, Nano particles through homogenous nucleation; Growth of nuclei, synthesis of metallic Nano particles, Nano particles through heterogeneous nucleation; Fundamentals of heterogeneous nucleation and synthesis of nano particles using micro emulsions and Aerosol.

Module 3: One Dimensional Nano-structures, Nano wires and nano rods, Spontaneous growth: Evaporation and condensation growth, vapor-liquid-solid growth, stress induced recrystallization. Template based synthesis: Electrochemical deposition, Electro-phoretic deposition. Electrospinning and Lithography.

Module 4: Two dimensional nano-structures, Fundamentals of film growth. Physical vapour Depostion(PVD): Ebvaporation molecular beam epitaxy (MBE), Sputtering, Comparison of

Evaporation and sputtering. Chemical Vapour Deposition (CVD): Typical chemical reactions, Reaction kinetics, transportant phenomena, CVD methods, diamond films by CVD.

Module 5: Thin films, Atomic layer deposition (ALD), Electrochemical deposition (ECD), Sol-Gel films. Special Nano Materials, Carbon fullerence and nano tubes: carbon fullerness ,formation, properties and applications. Carbon nano tubes: formation and applications.

4. Books and Materials

Text Books:

1. Guozhong Cao ,"Nano structures and Nano materials: Synthesis, properties and applications", 2nd Edition, Imperial College press,2004.
2. M.S. Ramachandra Rao, Nanoscience and Nanotechnology: Fundamentals of Frontiers,Softcover Edition, Wiley, 2013.

Reference Books:

1. M.A. Shah, Nanotechnology: The Science of Small, 2nd Edition,Wiley,2013
2. Charles P. Poole Jr. & Frank J. Owens, Introduction to Nanotechnology,2nd Edition, Wiley, 2003

Course Structure

B6763 - Manufacturing Systems Engineering

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course provides ways to analyze manufacturing systems in terms of material flow and storage, information flow, capacities, and times,Factory models and durations of events. Fundamental topics include probability, inventory and queuing models, optimization, and linear and dynamic systems. Factory planning and scheduling topics include flow planning.Manual Assembly lines, Automated Production lines.

Course Pre/co-requisites

Production Operations and management concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6763.1 Apply Queuing theory and probability theory for manufacturing systems applications.
B6763.2 Estimate the processing time for the given production requirements .
B6763.3 Organize workplaces and methods to increase the utilization of limited resources.
B6763.4 Select appropriate assembly lines for better production output.
B6763.5 Investigate optimization methods for Material requirement planning systems.

3. Course Syllabus

Module 1: Overview of Manufacturing systems, Probability: introduction, discrete random variable, continuous random variable. Queuing: single-server queues, queuing networks.

Module 2: Introduction to Factory models, single workstation factory models, processing time variability, Single-Part-Type Systems, Multi-stage single product and multi-product systems.

Module 3: Models of various forms of batching, WIP limiting control strategies, serial limited buffer models.

Module 4: Manual Assembly lines, Automated Production lines, Automated Assembly systems, Group technology and cellular manufacturing, Flexible manufacturing cells and systems, Toyota Production System.

Module 5: Material Requirements Planning, Multi-Stage Control and Reactive Scheduling, Simulation Techniques.

4. Books and Materials

Text Books:

1. M. P. Groover, Automation, Production Systems and Computer-Integrated Manufacturing, 4th Edition, Pearson Education, 2016, ISBN: 9789332572492.
2. Guy L. Curry and R. M. Feldman, Manufacturing Systems Modeling and Analysis, 1st Edition, Butterworth - Heinemann, 2009, ISBN: 978-3-540-88762-1.

Reference Books:

1. S. B. Gershwin, Manufacturing Systems Engineering, 1st Edition, Prentice Hall PTR, 1993, ISBN: 9780135606087.
2. W. J. Hopp and M. L. Factory Physics, 3st Edition, Waveland Press, 2011, ISBN: 978-1577667391.

Course Structure

B6764 - Computer Aided Vehicle Design

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course discuss the computer aided vehicle design and apply the same for the optimum designing of the vehicle components like Vehicle Frame and Suspension,Front Axle Steering Systems,Drive Line and Real Axle,Clutch and Gearbox.

Course Pre/co-requisites

Automobile Engineering concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6764.1 Design the Vehicle components based on loads and deformations.
B6764.2 Develop vehicle components with industry standards .
B6764.3 Determine the Optimum Dimensions and properties for Steering Linkages .
B6764.4 Design vehicle components by using modelling software tools
B6764.5 Apply the Changes in design instantly from the initial stage.

3. Course Syllabus

Module 1: Vehicle Frame and Suspension:Study of Loads-Moments and Stresses on Frame Members. Computer Aided Design of Frame for Passenger and Commercial Vehicles. Computer Aided Design of Leaf Spring, Coil Springs and Torsion Bar Springs.

Module 2: Front Axle Steering Systems:Analysis of Loads- Moments and Stresses at different sections of Front Axle. Determination of Bearing Loads at Kingpin Bearings. Wheel Spindle Bearings. Choice of Bearings. Determination of Optimum Dimension and properties for Steering Linkages ensuring minimum error in Steering.

Module 3: Drive Line and Rear Axle:Computer Aided Design of Propeller Shaft. Design of Final Drive Gearing. Design of full-Floating., Semi-Floating and Three Quarter-Floating, Rear Axle Shafts and Rear Axle Housings.

Module 4: Clutch: Torque capacity of Clutch. Computer Aided Design of Clutch Components. Design details of Roller and Spring type of Clutches.

Module 5: Gear Box:Computer Aided Design of Three Speed and Four Speed Gear Boxes.

4. Books and Materials

Text Books:

1. Dean Averns, Automobile Chasses Design, Ist Edition, Iliffe & Sons, London, 1948
2. Heldt, P.M., Automotive Chasses,3rdEdition, Chilton Co., New York,1982.

Reference Books:

1. Kirpal Singh, "Automobile Engineering",7thEdition ,Standard publishers, Distributors, Delhi, 1997.
2. Giles, J.G. Steering, Suspension and Tyres,Ist Edition, llliffe Books Ltd., London,1975.
3. Steeds. W., Mechanics of Load Vehicles, 3rd Edition,llliffe Books Ltd., London,1992.

Course Structure

B6765 - Material Management

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Materials Management deals with the planning, organizing,purchasing,cost reduction and controlling of materials in flow,storage and use, from raw material to finished goods.

Course Pre/co-requisites

Industrial Management concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6765.1 Identifying the scope for integrating materials management function over the logistics and supply chain operations.
B6765.2 Estimate the Material requirement for productivity .
B6765.3 Apply various purchasing method and inventory controlling techniques into practice.
B6765.4 Illustrate the Cost analysis for Productivity
B6765.5 Analyze Material storage and Various Inventory models for Optimum utilization of material.

3. Course Syllabus

Module 1: Introduction: Introduction to material management and productivity, functions of material management, organization structures in material management, role of material management techniques in improved material productivity.

Module 2: Material planning:Objectives, material requirement planning, manufacturing resource planning, JIT production planning, strategic material planning, material control: acceptance, sampling, inspection, make or buy decision, simple cost analysis, economic analysis, break even analysis, break even point theory, whether to add or drop a product line store management and warehousing, product explosion.

Module 3: Purchasing: Importance of good purchasing system, organization of purchasing functions, purchase policy and procedures, responsibility and limitations, purchasing decisions, purchasing role in new product development, role of purchasing role cost reduction, negotiations and purchase, purchasing research: identification of right sources of supply,

vendor rating, standardization, vendor certification plans, vendor and supply reliability, developing new source of supply.

Module 4: Cost reduction:cost control vs cost reduction, price analysis, material cost reduction techniques, variety reduction, cost reduction and value improvement, techniques of cost control, standard costing, cost effectiveness, cost analysis for material management, material flow cost control.

Module 5: Inventory management, inventory vs stores, types of inventory, inventory control, inventory build-up, EOQ, various inventory models, inventory models with quantity discount, exchange curve concept, coverage analysis, optimal stocking and issuing policies, inventory management of perishable commodities, ABC - VED analysis, design of inventory distribution systems, surplus management, information system for inventory management, case studies.

4. Books and Materials

Text Books:

1. WR Stelzer Jr, Material management, 1st Edition, Prentice Hall,1970.
2. AK Dutta, Material management, 2nd Edition, Prentice Hall,1998.

Reference Books:

1. Ajay K Garg, Production and Operations Management, 1st Edition, Tata McGraw Hill , 2012.
2. Ronald H. Ballou and Samir K. Srivastava, Business Logistics and Supply Chain Management, 5th Edition, Pearson education, 2013.
3. DS Ammer & Richard Irwin , Material management, 1st Edition. Homewood, R. D. Irwin, Inc. 1962.

Audit Courses

Course Structure

B6091 – Disaster Management

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course has been framed with an intention to provide a general concept in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6091.1 Identify concepts, hazards and vulnerabilities of different types of disasters.
B6091.2 Examine the components of disaster management mechanism.
B6091.3 Select suitable capacity building framework for disaster management.
B6091.4 Interpret various disaster coping strategies.
B6091.5 Develop Strategies for disaster management planning.

3. Course Syllabus

Introduction: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude. **Disaster Prone Areas in India:** Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics.

Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Disaster Preparedness and Management: Preparedness: Monitoring of Phenomena Triggering A Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Risk Assessment Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival.

Disaster Mitigation: Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

4. Books and Materials

Text Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et. Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall of India, New Delhi.
3. Goel S. L., Disaster Administration and Management Text and Case Studies", Deep &Deep Publication Pvt. Ltd., New Delhi

Course Structure

B6092 – Value Education

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The present education system does not prepare students well for dealing with life. Primarily, it prepares them for profession or jobs. It concentrates on providing "How to do" rather than "What to do" or "Why to do?". This course will be helpful for students to develop critical ability, commitment and courage in real life problems. Students will learn about happiness, character development, self control, honesty, time management.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6092.1 Identify the importance of value based living for character development.
B6092.2 Emerge as responsible citizens with clear conviction to practice values and ethics in life.
B6092.3 Interpret their role in nation building for a better tomorrow .
B6092.4 Develop a sense of commitment and decision making capability.

3. Course Syllabus

Values and Self - Development: Social values and individual attitudes. Work ethics, Indian vision of humanism. Moral and non-moral valuation. Standards and principles. Value judgments.

Importance of Cultivation of Values: Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truth fullness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature Discipline.

Personality and Behavior Development: Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness.

Achieving Happiness: Avoid fault Thinking. Free from anger, Dignity of labour. Universal brotherhood and religious tolerance. True friendship. Happiness Vs suffering, love for

truth. Aware of self-destructive habits. Association and Cooperation. Doing best for saving nature.

Character and Competence: Holy Books vs Blind faith. Self-Management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, and Studying effectively.

4. Books and Materials

Text Books:

1. Chakroborty, S.K. "Values and Ethics for organizations Theory and practice", Oxford University Press, New Delhi.
2. David N. Aspin, Judith D. Chapman, "Values Education and Lifelong Learning: Principles, Policies, Programmes" Springer, 2007

Course Structure

B6093 – Constitution of India

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6093.1 Identify the important components of Indian Constitution.
B6093.2 Explore the basics of Constitutional right in various domains .
B6093.3 Illustrate the evolution of Indian Constitution.
B6093.4 Analyze the Administrative process in India from grass-root level.
B6093.5 Relate the basic concepts of democracy, liberty, equality, secular and justice.

3. Course Syllabus

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), **Philosophy of the Indian Constitution:** Preamble, Salient Features.

Contours of Constitutional Rights & Duties: Fundamental Rights Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualification, Powers and Functions.

Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Election Commission: Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

4. Books and Materials

Text Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015

Reference Books:

1. M. P. Jain, Indian Constitution Law, 7th Edition., Lexis Nexis, 2014
2. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015

Course Structure

B6094 - Stress Management by Yoga

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Stress has been determined to be a key factor of illness and disease. Prolonged stress in any person can lead to negative thinking, depression and worse. The course is based on managing stress by practice of yogic principles that are proven to be highly effective and easy to learn. In this course the students will learn about different types of yoga practices, Meditation, Yoga asanas, Pranayama for stress, anger and fear management.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6094.1 Make use of yoga for stress management in educational environments.
B6094.2 Improve emotional intelligence to better deal with stress.
B6094.3 Develop flexibility through participation in yoga.
B6094.4 Learn methods of performing asanas, pranayama, mudras and bandhas.
B6094.5 Practice meditation for holistic living.

3. Course Syllabus

Meaning and Definition of Stress: Eutress, Distress, Anticipatory Anxiety, Intense Anxiety and Depression. Necessity of Stress Management, Concept of Stress according to Yoga.

Introduction to Yoga: Definition and Meaning of Yoga, Historical Perceptive on yoga – yoga before the time of Patanjali (Indus valley civilization, Vedas, Brahmnas, Upanishads, Epics, Puranas).

Schools of Yoga: Eight Limbs of Yoga: Yama, Niyama, Asana, Pranayama, Pratyahara, Dharana, Dhyana & Samathi. General principles of practicing Asana, Pranay- ama, Meditation, Kriyas Bandhas and Mudra.

Essentials of yoga practices: Prayer, Disciplines in Yogic Practices, Place & Timing, Diet & Schedule for Yoga Practitioner. Obstacles in the Path of Yoga Practice, Sequence for yogic

practices, Different between yogic & non yogic system of exercise. Do's and donts during Yoga

Personality development by yoga: Yoga and development of Social qualities of personality, Co-operation, Simplicity, Tolerance, Social adjustments, Yoga and personal efficiency. Improvement of personal efficiency through yoga.

4. Books and Materials

Text Books:

1. Wasmer Linda Andrews, Stress Control For Peace of Mind, Barnes & Noble Publisher, 2005
2. H.R. Nagendra, and R. Nagarathana, Yoga practices for anxiety & depression. Bangalore: Swami Sukhabodhanandha Yoga Prakashana 2004.

Reference Books:

1. BKS Iyengar, The Art of Yoga. New Delhi: Harper Collins Publishers, 2003.

Course Structure

B6095 - Personality Development through Life Enlightenment Skills

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course aims to provide a basic awareness about the significance of Life Enlightenment skills in all-round development of personality. Personality development boosts confidence level in students and help them achieve high esteem. In this course the holistic development of personality in students will be done by practicing some basic Veres of Srimad Bhagavath Geetha by explaiing the true meaning of Wisdom, Pride, Virtue, Happiness, Pain.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6095.1 Create Holistic development of personality.
B6095.2 Exercise the role model in the Bhagavath Geetha by practicing it.
B6095.3 Develop a sense of spirituality and heart fullness in mind and body.
B6095.4 Demonstrate knowledge of beliefs and values to continuing personal reflection and reassessment.

3. Course Syllabus

Neetisatakam - Holistic Development of Personality:

Verses- 19, 20, 21,22 (Wisdom)

Verses- 29, 31, 32 (Pride & Heroism)

Verses- 26, 28, 63, 65 (Virtue)

Do's and Dont's

Verses- 52, 53, 59 (Dont's)

Verses- 71, 73, 75, 78 (Do's)

Approach to Day to Day Work and Duties:

Chapter 2: Verses 41, 47,48

Chapter 3: Verses 13, 21, 27, 35

Chapter 6: Verses 5,13,17, 23, 35

Chapter 18: Verses 45, 46, 48.

Statements of basic knowledge :

Chapter 2: Verses 56, 62, 68

Chapter 12: Verses 13, 14, 15, 16,17, 18

Personality of Role Model

Chapter 2: Verses 17

Chapter 3: Verses 36,37,42

Chapter 4: Verses 18, 38,39

Chapter 18: Verses 37,38,63

4. Books and Materials

Text Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata.

Reference Books:

1. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Samskrit Sansthanam, New Delhi.

Course Structure

B6096 - Pedagogy Studies

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

Pedagogy is the relationship between learning techniques and culture. It requires meaningful classroom interactions between educators and learners. The objective of this course is to help students build on prior learning and develop skills and attitudes. Furthermore it can improve the quality of your teaching and the way students learn, helping them gain a deeper grasp of fundamental material.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6096.1 Develop a positive attitude towards life and teaching profession
B6096.2 Critically analyze the classroom teaching, learning and behavior.
B6096.3 Compare the teaching and learning practices in educational institutes in the past decade.
B6096.4 Summarize the aspects of effective teaching process.

3. Course Syllabus

Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology. Theories of learning, Curriculum, Teacher education, Conceptual framework, Research questions, Overview of methodology and Searching.

Thematic Overview: Pedagogical practices in formal and informal classrooms in developing countries, Curriculum development, Teacher education.

Evidence on the Effectiveness of Pedagogical Practices : Quality assessment of included studies, How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?. Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Professional Development: Alignment with classroom practices and followup support. Peer support, Support from the head teacher and the community. Curriculum and assessment. Barriers to learning: limited resources and large class sizes.

Research Gaps and Future Directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment. Dissemination and research impact.

4. Books and Materials

Text Books:

1. Ackers J, Hardman F (2001) Classroom Interaction in Kenyan Primary Schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular Reform in Schools: The Importance of Evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher Training in Ghana - does it count? Multi-site Teacher Education Research Project (MUSTER) Country Report 1. London: DFID.

Reference Books:

1. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving Teaching and Learning of Basic Maths and Reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
2. Alexander RJ (2001) Culture and Pedagogy: International Comparisons in Primary Education. Oxford and Boston: Blackwell.
3. Chavan M (2003) Read India: A mass scale, rapid, 'Learning to Read' campaign.

Open Electives

Course Structure

B6081 - Business Analytics

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course addresses the scope of business analytics, process and tools used to get competitive advantages of business analytics. It covers the forecasting techniques to predict the given data for various decision making. Apart from prediction it also establishes the relationship between the given data to formulate the strategies for business decisions.

Course Pre/co-requisites

This course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6081.1	Demonstrate knowledge of data analytics.
B6081.2	Demonstrate the ability of think critically in making decisions based on data and deep analytics.
B6081.3	Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making,
B6081.4	Demonstrate the ability to translate data into clear, actionable insights.

3. Course Syllabus

Theory

Business analytics and Statistical Tools: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

Forecasting Techniques and Monte Carlo Simulation and Risk Analysis: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model,Overbooking Model, Cash Budget Model.

Decision Analysis and recent trends: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

4. Books and Materials

Text Books:

1. Varshney & Maheswari , Business analytics Principles, Concepts, and Applications, Marc J. Schniederjans, Dara G.Schniederjans, Christopher M. Starkey, 1st Ed., Pearson FT Press, 2014
2. Jamesh R Evans, Business Analytics, Global Edtion, Pearson Higher Education & Professional Group, 2020

Course Structure

B6082 - Waste to Energy

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course deals with the production of energy from different types of wastes through thermal, biological and chemical routes. This course provides insights into waste management options by reducing the waste destined for disposal and encouraging the use of waste as a resource for alternate energy production. This course is explores Biomass Pyrolysis, Biomass gasification, Biomass combustions and Bio energy systems.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6082.1 Classify different waste material produces from all sources.
B6082.2 Analyze Bio energy systems resources, process and application.
B6082.3 Apply emerging methods for Bio mass Pyrolysis, gasification and combustion to improve the efficiency.
B6082.4 Analyze different case studies for understanding success and failure of waste to energy technologies.

3. Course Syllabus

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors.

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers - Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs,

fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

4. Books and Materials

Text Books:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.

Reference Books:

1. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
2. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Structure

B6083 - Operations Research

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The courses in Operational Research offer a unique blend of traditional coursework, practical skills, and real-world problem-solving experience designed to position students for success in today's competitive world. This course covers Linear Programming, Non-Linear Programming Problem, Mathematical Models and problems.

Course Pre/co-requisites

Industrial Management concepts

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6083.1 Gain knowledge in concepts and techniques of Operations Research.
B6083.2 Determine the optimal solution for Linear Programming problems.
B6083.3 Formulate and obtain the optimal solution for non- Linear Programming problems.
B6083.4 Solve to get optimal solution using queuing and inventory models .
B6083.5 Determine solution for non- Linear Programming problems using dynamic programming

3. Course Syllabus

Linear Programming Problem & Its Application I: Introduction, Formulation of LPP. Slack Variable, Surplus Variable and Artificial Variables. Standard Form and Matrix Form. Concept of Duality. Graphical Method. Simplex Method. Big - M method & Two - Phase Method. Problems of Degeneracy.

Linear Programming Problem & Its Application II: Parametric Programming introduction . Types of Linear Variations. Graphical and Analytical Sensitivity Analysis.

Non-Linear Programming Problem I: Introduction, Formulation and Graphical Method, Kuhn-Tucker Conditions, Quadratic Programming Problems by Wolfe's and Beale's Method.

Non-Linear Programming Problem II: Geometric programming introduction and analytical methods , Fractional programming introduction and analytical methods, Dynamic

programming introduction and analytical methods.

General Mathematical Models: Sequencing - n Jobs and m Machines, Inventory Control - introduction and its analytical methods. Single server queuing model.

4. Books and Materials

Text Books:

1. S.D. Sharma, Operations Research Theory, Methods and Applications, 18th Edition, Kedarnath Ramnath Publishers, Delhi 2017
2. H.A. Taha, Operations Research- An Introduction,8th Edition PHI, 2008.
3. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.

Reference Books:

1. J.C. Pant, Introduction to Optimization: Operations Research, 7th Edition,Jain Brothers, Delhi, 2008.
2. Hitler Libermann, Operations Research: McGraw Hill Pub. 2009.
3. Pannerselvam, Operations Research:2nd Edition, Prentice Hall of India 2010.
4. Harvey M Wagner, Principles of Operations Research:2nd Edition, Prentice Hall of India 2010.

Course Structure

B6084 - IoT and Applications

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

The course introduces you to advance concepts and design methodologies to design IoT systems and developing IoT applications programming languages and tools optimized for IoT domain. The course covers python languages in great detail with set of packages which makes it obvious choice as a leading IoT language. It also exposes participants to communication technologies and legacy protocols as well as newly developed IoT specific application and physical layer protocols. The course covers Cloud based service in great detail with set of packages which makes it obvious choice as a leading IoT Technology.

Course Pre/co-requisites

The course has no specific prerequisite and co-requisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6084.1 Identify the basic Architecture of IoT and its characteristics
B6084.2 Determine the most appropriate IoT Devices and communication system management
B6084.3 Utilize Python standard libraries for implementing various IoT Applications
B6084.4 Analyze the appropriate protocol for establishing communication between various IoT Devices
B6084.5 Analyze cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms

3. Course Syllabus

Introduction to Internet Of Things : Introduction, Definition & Characteristics of IoT,Physical Design of IoT, Logical Design of IoT, IoT Enabling Technologies, IoT Levels & Deployment Templates DOMAIN SPECIFIC IOTS - Introduction, Home Automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle.

IoT , M2M and IoT System Management with NETCONF-YANG : Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT IoT System Management with NETCONF-YANG - Need for IoT Systems Management, Simple Network Management

Protocol (SNMP), Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG.

IoT Platforms Design Methodology : IoT Platforms Design Methodology - Introduction, IoT Design Methodology, Case Study on IoT System for Weather Monitoring, Motivation for Using Python IoT SYSTEMS - LOGICAL DESIGN USING PYTHON - Introduction, Installing Python, Python Data Types & Data Structures, Control Flow, Functions, Modules, Packages, File Handling, Date/Time Operations, Classes,Python Packages of Interest for IoT.

IoT Physical Devices & Endpoints : What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interface, Programming Raspberry Pi with Python, Other IoT Devices IoT PHYSICAL SERVERS & CLOUD OFFERINGS - Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework,Designing a RESTful Web API, Amazon Web Services for IoT, SkyNet IoT Messaging Platform.

Case Studies Illustrating IoT Design : What is an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interface, Programming Raspberry Pi with Python, Other IoT Devices IoT PHYSICAL SERVERS & CLOUD OFFERINGS - Introduction to Cloud Storage Models & Communication APIs, WAMP - AutoBahn for IoT, Xively Cloud for IoT, Python Web Application Framework,Designing a RESTful Web API, Amazon Web Services for IoT, SkyNet IoT Messaging Platform.

4. Books and Materials

Text Books:

1. Arshdeep Bahga,Vijay Madisetti(2015), "Internet of Things A Hands-On Approach", University Press, India.
2. Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, 3rd Edition, Narosa Publishing House, 2011

Course Structure

B6085 - Cyber Security

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This course drawing upon a wealth of experience from academia, industry, and government service, Cyber Security details and dissects, in current organizational cyber security policy issues on a global scale—taking great care to educate students on the history and current approaches to the security of cyberspace. It includes thorough descriptions of Cyber Offences, Cyber Crime, tools and methods used in Cyber Crime. It also delves into organizational implementation issues, and equips students with descriptions of the positive and negative impact of specific policy choices.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6085.1 Demonstrate the basics of cybercrime in computer, networked device or a network.
B6085.2 Identify various cyber offences in real time.
B6085.3 Identify the different attacks in cybercrime.
B6085.4 Use various methods and tools to control cybercrimes and cyber offences.
B6085.5 Examine how to protect organizations from intruders, attackers and cyber criminals.

3. Course Syllabus

Introduction to Cybercrime: Introduction, Cybercrime, and Information Security, who are Cybercriminals, Classifications of Cybercrimes. The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes. Botnets: The Fuel for Cybercrime, Attack Vector, and Cloud Computing.

Cybercrime: Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing

Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Tools and Methods: Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Cyber Security: Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications. Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

4. Books and Materials

Text Books:

1. Nina Godbole and Sunil Belapure., Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, 1st Edition, Wiley INDIA. 2011.

Reference Books:

1. James Graham, Richard Howard and Ryan Otson., Cyber Security Essentials, 1st Edition, CRC Press, 2011.
2. Chwan-Hwa(John) Wu,J.David Irwin., Introduction to Cyber Security, , 1st Edition, CRC Press T&F Group, 2013.
3. Richard A. Clarke, Robert Knake., Cyberwar: The Next Threat to National Security & What to Do About It, Ecco, 2010.

Course Structure

B6086 - Mobile Cloud Computing

Hours Per Week		Hours Per Semester		Credits	Assessment Marks		
L	P	L	P	C	CIE	SEE	Total
3	0	42	0	3	40	60	100

1. Course Description

Course Overview

This Course provides a comprehensive overview of how to integrate cloud and mobile technology. It is an emerging field and this course explores how distributed resources can be shared by mobile users in different ways and issues arising there from. This course also provides understanding of Architecture, Applications of Mobile Cloud Computing along with Offloading concept and Resource allocation techniques. This also introduces concept called Green Mobile Computing and also discusses about the security issues in Mobile Cloud Computing. This course enables the student to choose as research area of interest.

Course Pre/co-requisites

The course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

B6086.1 Identify the architecture, issues and applications in mobile cloud computing.
B6086.2 Make use of remote cloud and offloading techniques for storage and computation.
B6086.3 Choose a resource allocation method in mobile cloud computing.
B6086.4 Use green mobile computing for an energy efficient mobile network.
B6086.5 Identify the trust and privacy requirements in a mobile cloud computing environment.

3. Course Syllabus

Mobile Cloud Computing: : Introduction to cloud computing, Basic cloud architecture, Motivation to MCC, Architecture, Platform and Technologies, Mobile Augmentation approaches, Issues of Mobile Cloud Computing, Advantages and Applications of Mobile Cloud Computing.

Offloading in Mobile Cloud Computing: Introduction, Offloading Decision, Types of Offloading, offloading in CC and MCC: Similarities and Differences, Adaptive Computation offloading from Mobile Devices, Cloud Path selection for Offloading, Mobile Data Offloading Using Opportunistic Communication, Three-Tier Architecture of Mobile Cloud Computing,

Requirements of Data Offloading, Performance Analysis of Offloading Techniques, Multi-Cloud Offloading in Mobile Cloud Computing Environment.

Resource Allocation in MCC: Introduction, Significance of Resource Allocation, Resource-Allocation Strategies- Semi-Markov Decision Process (SMDP), Task Scheduling Using Activity-Based Costing Algorithm, Resource Allocation Using Middleware, Energy-Aware Resource Allocation, Resource Allocation in MCC Using Entropy-Based FIFO Method, Auction Mechanism for Resource Allocation in MCC.

Green Mobile Computing: Introduction, Green Mobile Computing, Green Mobile Network, Green Cloud Computing, Green Mobile Cloud Computing, Green Mobile Devices Using Mobile Cloud Computing, Green Femtocell Using MCC.

Privacy and Security in MCC: Introduction, Security Levels, Security Issues. Trust in MCC: Introduction, Properties, Components, types of Trust, Trust Issues, and Trust Establishment.

4. Books and Materials

Text Books:

1. Debashis De., Mobile Cloud Computing-Architectures, Algorithms and Applications, CRC Press, Taylor and Fransis group, 2016.

Reference Books:

1. Frank H.P. Fitzek and Marcos D. Katz., Mobile Clouds: Exploiting Distributed Resources in Wireless, Mobile and Social Networks, 1st Edition, WILEY publications, 2014.
2. Valentino Lee, Heather Schneider, and Robbie Schell., Mobile Applications: Architecture, Design, and Development, Prentice Hall, 2004.