Dr. Babasaheb Ambedkar Technological University (Established a University of Technology in the State of Maharashtra)
(Under Maharashtra Act No. XXIX of 2014)
P.O. Lonere, Dist. Raigad, Pin 402 103,
Maharashtra Telephone and Fax. 02140 - 275142 www.dbatu.ac.in
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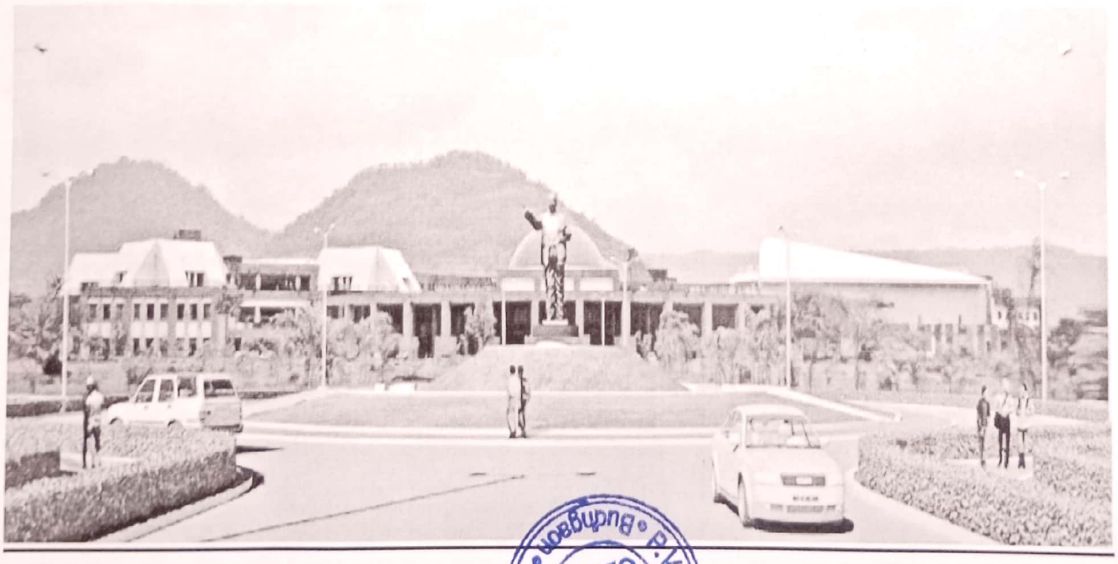
# CURRICULUM UNDER GRADUATE PROGRAMME FOR B. TECH

## ARTIFICIAL INTELLIGENCE & DATA SCIENCE

WITH EFFECT FROM THE ACADEMIC YEAR
SY: 2021-2022
TY: 2022-2023
B.Tech:2023-24



# Course Structure for Second Year

**B. Tech in Artificial Intelligence & Data Science / B. Tech. in Artificial Intelligence & Data Science**

| Semester IV ( Term 4) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC3 | BTAIC401 | Data Analysis | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC4 | BTAIC402 | Database Management System | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC3 | BTHM403 | Basic Human Rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| BSC8 | BTBS404 | Probability Theory and Random Processes | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC-1 | BTAIPE405 | Professional Elective Courses –I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTAIPE405A | 1. Numerical Methods and Computer Programming | | | | | | | | |
| | BTAIPE405B | 2. Image Processing & Computer Vision | | | | | | | | |
| | BTAIPE405C | 3. Internet of Things & Embedded System | | | | | | | | |
| | BTAIPE405D | 4. Programming in JAVA | | | | | | | | |
| LC2 | BTAIL406 | Data Analysis Lab and Database Management System Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Seminar | BTAIS407 | Seminar - II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTAIP408 | Internship -II | - | - | - | - | - | - | - | Audit |
| | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

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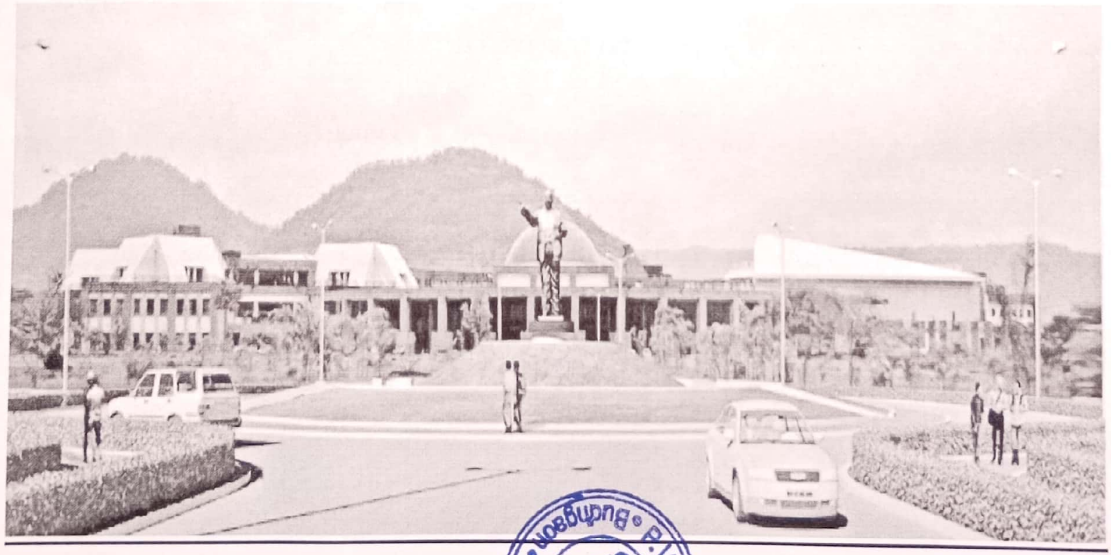
# CURRICULUM UNDER GRADUATE PROGRAMME FOR B. TECH

## ARTIFICIAL INTELLIGENCE & DATA SCIENCE

WITH EFFECT FROM THE ACADEMIC YEAR
SY: 2021-2022
TY: 2022-2023
B.Tech:2023-24



# Course Structure for Third Year

**B. Tech in Artificial Intelligence & Data Science / B. Tech. in Artificial Intelligence & Data Science**

| Semester VI ( Term 6) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC7 | BTAIC601 | Deep Learning | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC8 | BTAIC602 | Advanced Machine Learning | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC-3 | BTAIPE603 | Professional Elective Course (PEC) -III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTAIPE603A | 1. Geographical Information Systems | | | | | | | | |
| | BTAIPE603B | 2. Recommender System | | | | | | | | |
| | BTAIPE603C | 3. Industry 4.0 & Automation | | | | | | | | |
| | BTAIPE603D | 4. Web Development | | | | | | | | |
| OEC-2 | BTAIOE604 | Open Elective Course (OEC) - I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTAIOE604A | 1. Big Data Analytics | | | | | | | | |
| | BTAIOE604B | 2. Cryptography & Network Security | | | | | | | | |
| | BTAIOE604C | 3. Agile Methodology | | | | | | | | |
| | BTAIOE604D | 4. Augmented Reality | | | | | | | | |
| HSSMEC-5 | BTAIHM605 | Humanities and Social Sciences including Management Elective Course (HSSMEC) – II | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTAIHM605A | 1. Development Engineering | | | | | | | | |
| | BTAIHM605B | 2. Employability and Skills Development | | | | | | | | |
| | BTAIHM605C | 3. Consumer Behavior | | | | | | | | |
| LC4 | BTAIL606 | Deep Learning Lab and Advanced Machine Learning Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ | BTAIM607 | Mini Project II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTAIP608 | Internship –III | - | - | - | - | - | - | - | Audit |
| | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

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# Course Structure for Third Year

**B. Tech in Artificial Intelligence & Data Science / B. Tech. in Artificial Intelligence & Data Science**

| Semester V ( Term 5) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC5 | BTAIC501 | Computer Network and Cloud Computing | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC6 | BTAIC502 | Machine Learning | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC4 | BTAIHM503 | Humanities and Social Sciences including Management Elective Course (HSSMEC) – II | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTAIHM503A | 1. Economics and Management | | | | | | | | |
| | BTAIHM503B | 2. Business Communication | | | | | | | | |
| | BTAIHM503C | 3. Knowledge Reasoning and AI Ethics. | | | | | | | | |
| PEC-2 | BTAIPE504 | Professional Elective Course (PEC) -II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTAIPE504A | 1. Advanced Database System | | | | | | | | |
| | BTAIPE504B | 2. Soft Computing | | | | | | | | |
| | BTAIPE504C | 3. Sensors & Robotics Technology | | | | | | | | |
| | BTAIPE504D | 4. Advanced Java | | | | | | | | |
| OEC-1 | BTAIOE505 | Open Elective Course (OEC) - I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTAIOE505A | 1. Data Mining and Warehousing | | | | | | | | |
| | BTAIOE505B | 2. Digital Communication & Information Theory | | | | | | | | |
| | BTAIOE505C | 3. Software Engineering and Testing | | | | | | | | |
| | BTAIOE505D | 4. Virtual Reality | | | | | | | | |
| LC3 | BTAIL506 | Machine Learning Lab and Competitive Programming Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ | BTAIM507 | Mini Project I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTAIP508 | Internship –II (Evaluation) | - | - | - | - | - | - | - | Audit |
| | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

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**Dr. Babasaheb Ambedkar Technological University, Lonere**

**Curriculum for Second year Undergraduate Degree Programme**

**B. Tech. in Chemical Engineering**

**With effect from AY 2021-22**

| | **Semester III** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| BSC | BTBS301 | Engineering Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC302 | Fluid Flow Operations | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC303 | Process Calculations | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC304 | Mechanical Operations | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC | BTCHE305 | Professional Elective I | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| LC | BTCHL306 | Fluid Flow Operations + Mechanical Operations Lab | - | - | 3 | 60 | - | 40 | 100 | 2 |
| Seminar | BTCHS307 | Seminar I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTCHI308 | Internship – 1 (Evaluation) | - | - | - | - | - | - | - | Audit |
| | | Total | **15** | **3** | **7** | **220** | **100** | **380** | **700** | **22** |
| | **Semester IV** | | | | | | | | | |
| PCC | BTCHC401 | Chemical Engineering Thermodynamics | 4 | 1 | - | 20 | 20 | 60 | 100 | 5 |
| PCC | BTCHC402 | Heat Transfer Operations | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC | BTHM403 | Basic human rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC | BTCHO404 | Open Elective I | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC | BTCHE405 | Professional Elective – II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| LC | BTCHL406 | Heat Transfer Operations Lab | - | - | 3 | 60 | - | 40 | 100 | 2 |
| Seminar | BTCHS407 | Seminar II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | | Field Training / Internship 2/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time). | - | - | - | - | - | - | - | Credits To be evaluate d in V Sem. |
| | | Total | **16** | **3** | **7** | **220** | **100** | **380** | **700** | **23** |

**List of Electives**

1) Professional Elective I

A. Green Technology

B. Nanotechnology

C. Energy Technology and Conversion

D. Reliable Energy Sources

E. Materials for Engineering applications

2) Professional Elective II

**A. Numerical methods**

B. Introduction to Bioprocess Engineering

C. Strength of Materials

**D. Introduction to Polymer Science and Engineering**

E. Advanced Engineering Chemistry

3) Open Elective I

A. **NSS I**

B. Development Engineering

**Curriculum for Third Year Undergraduate Degree Programme**

**B. Tech. in Chemical Engineering**

**With effect from AY 2022-23**

| | **Semester V** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC | BTCHC501 | Mass Transfer Operations - I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC502 | Chemical Reaction Engineering - I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC503 | Chemical Technology | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC | BTCHO504 | Open Elective - II | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC | BTCHE505 | Professional Elective – III | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| LC | BTCHL506 | Chemical Reaction Engineering Lab | - | - | 3 | 60 | - | 40 | 100 | 2 |
| Project | BTCHM507 | Mini Project - 1 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTCHI508 | Internship – 2 (Evaluation) | - | - | - | - | - | - | - | Audit |
| | | Total | **15** | **2** | **7** | **220** | **100** | **380** | **700** | **21** |
| | **Semester VI** | | | | | | | | | |
| PCC | BTCHC601 | Chemical Reaction Engineering - II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC602 | Mass Transfer Operations - II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC | BTCHC603 | Process Instrumentation and Control | 4 | 1 | - | 20 | 20 | 60 | 100 | 5 |
| HSSMC | BTHM604 | Engineering Economics and Project management | 4 | - | - | 20 | 20 | 60 | 100 | 4 |
| OEC | BTCHO605 | Open Elective - III | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| LC | BTCHL606 | Mass Transfer Operations Lab | - | - | 3 | 60 | - | 40 | 100 | 2 |
| Project | BTCHM607 | Mini Project - 2 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | | Field Training / Internship3/Industrial Training (minimum of 4 weeks which can be completed partially in fifth semester and sixth semester or in at one time). | - | - | - | - | - | - | - | Credits To be evalua-ted in VII Sem. |
| | | Total | **17** | **3** | **7** | **220** | **100** | **380** | **700** | **24** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Course

**List of Electives**

1) Professional Elective III
   A. Industrial Safety and Hazard Mitigation
   B. Optimization Techniques
   C. Petroleum refining and Petrochemicals
   D. Food technology
   E. Disaster Management in Chemical Industries
2) Open Elective II
   A. NSS II
   B. Pollution Control in Process Industries
3) Open Elective III
   A. Pharmaceuticals and fine Chemicals
   B. Heat Transfer Equipment Design

**Curriculum for Final year B. Tech. in Chemical Engineering**

**With effect from AY 2023-24**

| | Semester VII | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC | BTCHC701 | Transport Phenomena | 4 | 1 | - | 20 | 20 | 60 | 100 | 5 |
| PCC | BTCHC702 | Process Equipment Design and Drawing | 4 | - | - | 20 | 20 | 60 | 100 | 4 |
| PEC | BTCHE703 | Professional Elective - IV | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC | BTCHO704 | Open Elective - IV | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| LC | BTCHL705 | Process Instrumentation and Control Laboratory | - | - | 3 | 60 | - | 40 | 100 | 2 |
| LC | BTCHL706 | Process Equipment Design, Drawing and Simulation Laboratory | - | - | 3 | 60 | - | 40 | 100 | 2 |
| Project | BTCHM707 | Mini-Project - III | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTCHI708 | Internship – 3 Evaluation | - | - | - | - | - | - | - | Audit |
| | | Total | **14** | **1** | **10** | **260** | **80** | **360** | **700** | **21** |
| | **Semester VIII** | | | | | | | | | |
| Project/ Internship | BTCHP/ BTCHI - 801 | Project work/ Internship | - | - | 24 | 60 | -- | 40 | 100 | 12 |
| | | Total | **-** | **-** | **24** | **60** | | **40** | **100** | **12** |

ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course

**List of Electives**

4) Professional Elective IV
   A. Mathematical methods in Chemical Engineering
   B. Membrane Technology
   C. Advanced Petroleum Refining
   D. Modeling and Simulation in Chemical Engineering
   E. Entrepreneurship Development
5) Open Elective IV
   A. Plant Utilities and Safety
B. Corporate Communication

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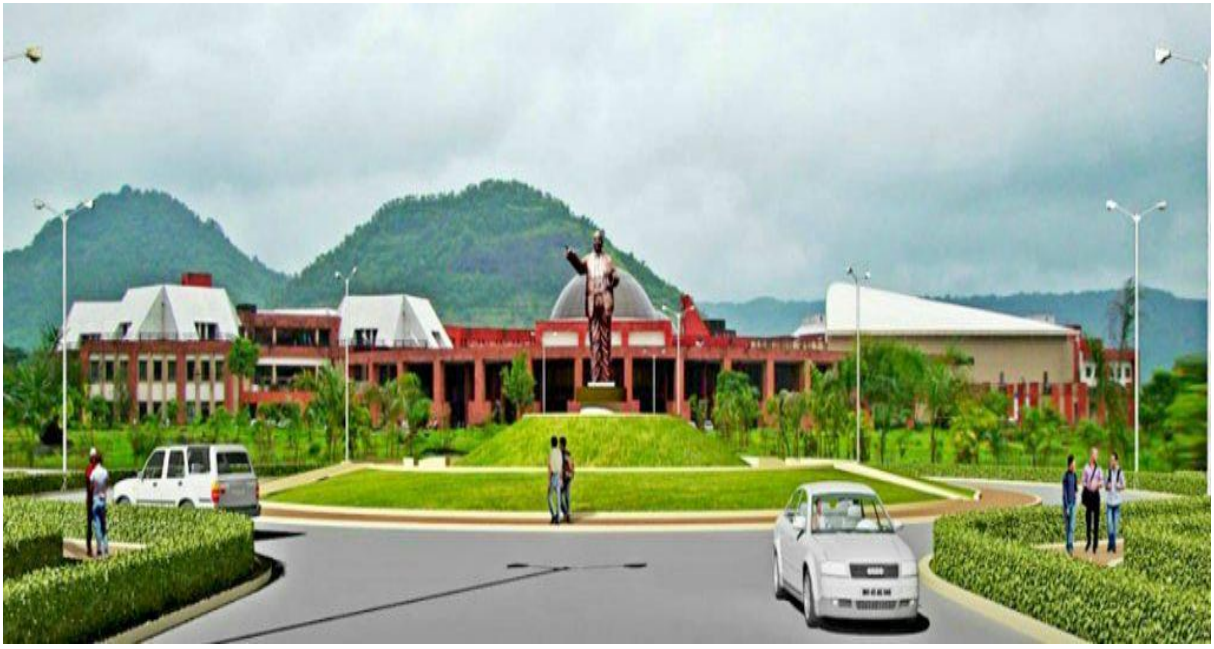
## Curriculum for Undergraduate Degree Programme

## S.Y. B. Tech. in Civil Engineering

### With effect from AY 2021-22



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## Teaching & Evaluation Scheme for Second Year B. Tech. Civil Engg.

| Semester- III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| BSC 5 | BTBS301 | Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| ESC 8 | BTCVES302 | Mechanics of Solids | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 1 | BTCVC303 | Building Construction & Drawing | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 2 | BTCVC304 | Hydraulics -I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 3 | BTCVC305 | Surveying | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC2 | BTHM306 | Soft Skill Development | 2 | - | - | 50 | - | - | 50 | Audit |
| LC 1 | BTCVL 307 | Solid Mechanics Laboratory | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 2 | BTCVL 308 | Hydraulics-I Laboratory | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 3 | BTCVL 309 | Surveying Laboratory | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | BTES210P | Internship –I Evaluation (From Sem II) | - | - | - | - | - | 50 | 50 | Audit |
| | | **Total** | **15** | **05** | **06** | **210** | **100** | **440** | **750** | **21** |

| Semester- IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 4 | BTCVC401 | Building Planning and Drawing | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| PCC 5 | BTCVC402 | Environmental Engineering | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| PCC 6 | BTCVC403 | Structural Mechanics - I | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 7 | BTCVC404 | Water Resources Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC 8 | BTCVC405 | Hydraulics - II | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 9 | BTCVC406 | Engineering Geology | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| LC 4 | BTCVL407 | Building Planning and CAD Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 5 | BTCVL408 | Environmental Engg. Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 6 | BTCVL409 | HE-II Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | BTCVP410 | Field Training / Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester IV and appear at examination in Semester V) | - | - | - | - | - | - | - | To be evaluated in V Sem. |
| | | **Total** | **13** | **03** | **06** | **180** | **120** | **450** | **750** | **19** |

# Detailed Syllabus

## BTBS301 Mathematics – III

**Teaching Scheme:** (3 Lectures +1 Tutorial) hours/week

### Course Contents

**Module 1: Laplace Transform** **(Lectures 09)**

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by tn, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

**Module 2: Inverse Laplace Transform** **(Lectures 09)**

Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

**Module 3: Fourier Transform** **(Lectures 09)**

Definitions – integral transforms; Fourier integral theorem (without proof); Fourier sine and cosine integrals; Complex form of Fourier integrals; Fourier sine and cosine transforms; Properties of Fourier transforms; Parseval's identity for Fourier Transforms.

**Module 4: Partial Differential Equations and Their Applications** **(Lectures 09)**

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one-dimensional heat flow equation $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$, and two-dimensional heat flow equation

**Module5: Functions of Complex Variables** **(Lectures 09)**

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping. Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

**Text Books**


1) Grewal B. S., "Higher Engineering Mathematics" Khanna Publishers, New Delhi.

2) Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & Sons, New York.

3) Das H. K. and Er. Verma Rajnish, "Higher Engineering Mathematics", S. Chand & Co. Pvt. Ltd., New Delhi.

4) Dr. Singh B. B., "A course in Engineering Mathematics (Vol III)", Synergy Knowledgeware, Mumbai.

5) Wartikar J.N. and Wartikar P.N., "Engineering Mathematics Vol. I & II", PVG Prakashan, Pune, 1992

6) Ramana B. V., "Higher Engineering Mathematics", Tata McGraw-Hill Publications, New Delhi.


**Reference Books**


1) Peter O' Neil, "A Text Book of Engineering Mathematics" Thomson Asia Pte Ltd., Singapore.

2) Wylie C. R. & Barrett L. C., "Advanced Engineering Mathematics", TMH Publishing Co. Ltd., N. Delhi.

3) Dr. Singh B. B., "Integral Transforms and their Engineering Applications", Synergy Knowledgeware, Mumbai.

4) Sneddon I. N., "Integral Transforms", Tata McGraw-Hill , New York.


**Course Outcomes:** On completion of the course, student will be able to formulate and solve mathematical model of civilengineering phenomena in field of structures, survey, fluid mechanics and soil mechanics.

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# BTCVES302 Mechanics of Solids

**Teaching Scheme:**(3 Lectures +1 Tutorial) hours/week

**Course Contents**

## Module 1: Stress and Strain (Lectures 10)

**Simple stress** -Analysis of internal forces, simple stress, shearing stress, bearing stress, diaphragm or skin stresses in thin walled vessels, statically indeterminate members and thermal stresses

**Simple strains** -Stress strain diagram for different engineering materials and its importance for elastic and plastic analysis, Hooke's law: axial and shearing deformations, Poisson's ratio: biaxial and tri-axial deformations, variation of stress with inclination of element, relationship between modulus of rigidity and modulus of elasticity, variation of stress at a point: analytical derivation, introduction to strain measurement devices, Sensors: working principle

## Module 2: Axial Force, Shear Force and Moment in Beam (Lectures 10)

Axial force, shear force and moment in beams – concept of unbalanced forces at a transverse section, axial forces, shear forces and moment – interaction of these, relations among load shear and moment, introduction to moving loads

## Module 3: Stresses in beams (Lectures 10)

Theory of cylindrical bending, Relationship between intensity of loading, shear force and bending moment over elemental length, Derivation of flexural formula, economic sections, analysis of flexural action, derivation of formula for shearing stress, concept of shear flow, shear lag and shear center

**Torsion** -Assumptions, derivation of torsion formulae, torsion of circular shafts, power transmission, stresses and deformation in determinate solid/hollow homogeneous shafts

## Module 4: Columns and Struts (Lectures 10)

Concept of short and long columns, formulae by Euler and Rankin, Euler's Crippling load for different end conditions, limitation of Euler's formula, equivalent length, eccentrically loaded short compression members, Kern of a section; load applied off the axes of symmetry, introduction to combined axial and flexural loads,

## Module 5: Combined Stresses (Lectures 8)

State of simple shear, Analytical and graphical representation of state of combined stress at a point, absolute maximum shearing stress, application of Mohr's circle to combined loading, principal stresses and strains

**Theories of Failure-** maximum principal stress theory, maximum principal strain theory, maximum strain energy theory, maximum shear stress theory, maximum shear strain theory.

## Text Books:


- Singer F.L. and Pytle, 2011, "Strength of Materials", Harper Collins Publishers, Fourth Edition
- Junnarkar S.B. (2014), "Mechanics of Structures", Charotor Publishers, Anand, 31st edition,
- Khurmi R.S., 2018, "Strength of Material", S. Chand and Co., Edition revised 1968, New Delhi
- Sadhu Singh, 1978, "Strength of Materials", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-048-7
- Prasad I.B, 1988, "A text book of Strength of Materials", Khanna Publishers, N. Dehli, ISBN NO:978-81-7409-069-X
- Timoshenko S.P. and Young D.H., 2002, "Elements of Strength of Materials", East West Press, 4th edition 1962, New Delhi
- Prasad I.B, 1988, "A text book of Strength of Materials", ISBN: 978-81-7409-069-X
- Dr. Sadhu Singh, 1978, "Strength of Materials", ISBN: 978-81-7409-048-7
- Ramamrutham S., 2011, "Strength of Materials", Dhanpat rai and Sons, Delhi


## Reference Books:


- Beer F P., Jhonston E. R., John. T. D E wolf, 2017, "Mechanics of Materials" TMH, 7th edition
- Popov E.P.,2015, "Introduction to Mechanics of Solids", Prentice-Hall, Second Edition 2005
- Crandall S.H., Dahl N.C., & Lardner T.J., 1955, "An Introduction to Mechanics of Solids", Tata McGraw Hill, 2nd Edi, 1978
- Nash W., 2005, "Strength of Materials Schaum's outline series", McGraw Hill, fourth edition
- Punmia B. C., 2018, "Mechanics of Materials" Laxmi Publications, revised edition, 2016
- Subramanian R., 2016, "Strength of Materials" Oxford University Press, 2nd edition, New Delhi
- Dr. Sadhu Singh, 1978, "Theory and Solved Problems in Adv. Strength of Materials", ISBN: 978-81-7409-212-7


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Perform the stress-strain analysis.
CO2: Draw force distribution diagrams for members and determinate beams.
CO3: Visualize force deformation behavior of bodies.
CO4: Perform failure analysis

☑☑☑☑☑☑☑☑☑☑☑☑

# BTCVC 303 Building Construction & Drawing

**Teaching Scheme:** (2 Lectures + 1 Tutorials) hours/week

## Course Contents

**Module 1: Masonry Construction (Lectures06)**

Stone masonry: Random rubble, un-coursed rubble, coursed rubble & ashlar brickwork & brick bonds - english, flemish, principles to be observed during construction composite masonry, various partition walls, brick, aluminum & timber, solid concrete blocks, hollow concrete blocks and light weight blocks (aerated autoclaved), soil stabilized blocks, fly ash blocks, cement concrete walls

**Module 2: Concrete for Construction (Lectures 06)**

Introduction and properties of ingredients, importance of admixture materials such as pozzolona, fly ash, specific purpose chemical admixtures, Properties of fresh and hardened concrete

**Module 3: Arches and Lintels (Lectures 06)**

Arches and their stability, technical terms in arches, types of arches, methods of construction; Lintel: Necessity, materials: wood, stone, brick, steel, R.C.C. and reinforced brick lintels, beams: types according to material, layout such as primary and secondary, continuous beams, formwork for RCC elements: function, requirements

**Module 4: Means of Lateral Communication (Lectures 10)**

**Doors and windows**-Doors - classification based on parameters such as material, geometry, fixtures and fastening
Windows - classification based on parameters such as material, geometry, fixtures and fastening
Use of composite materials for doors and window frames and shutters, laying out of passages
**Stairs:** Terminology, requirements of a good stair, functional aspects, various types, uses and limitations
**Ramps:** Requirements and types, planning aspects for physically handicapped person
**Elevators:** Types and their Use

**Module 5: Flooring Roofs and Types (Lectures 08)**

**Flooring:** Types, factors for selections of floorings, flooring in ground and upper floors, various types of tiled flooring: natural, composite, synthetic, and special purpose flooring, concrete flooring for industrial purpose: tremix flooring
**Roof coverings:** Terms used, roof and their selection, pitched roofs and their types, roof coverings and their selection. Natural, composite, synthetic, and special purpose roof coverings, timber trusses (King Post and Queen Post), steel trusses types and their suitability

Precast and Pre-engineered Building Advantages and disadvantages.

### List of Drawing Assignments

1) Sketch Book consisting of free hand proportional scale sketches for items to be drawn on drawing sheets as mentioned below under (2)
2) Drawing to scale on a half imperial drawing sheet covering following aspects.
   a) Lettering, Symbols, Types of lines and dimensioning as per IS 962.
   b) Foundations: - Isolated, Combined Footings, Under Reamed Piles, Rafts.
   c) Types of Stone Masonry: Elevation and Sectional Drawings.
   d) Types of Brick masonry: Elevation and Sectional Drawings.
   e) Types of Doors: Elevation and Sectional Drawings.
   f) Types of Windows: Elevation and Sectional Drawings, Standard Aluminum Sections.
   g) Types of Stairs: Plan and Sectional Drawings.
   h) Trusses: Various types, various roof covering materials, sketches for sectional profiles
   i) Typical plan for a single room and sectional views.
3) Site visit: To understand various building materials and their use.

### Text Books


- Punmia B.C., Jain A. K., 2008, “Building Construction", Laxmi Pub. Pvt. Ltd., 10th Edi, N. Delhi
- Arora S. P. and Bindra S. P., 2010, “Text Book of Building Construction”, Dhanpat Rai Publications
- Kumar Sushil, 2010, “Building Construction” Standard Publishers, 20th Edition,.
- P. Purushothama Raj, 2016, “Building Construction Materials and Techniques”, Pearson Education
- Jain V.K., 2015, “Automation Systems in Smart and Green Buildings” ISBN NO: 978-81-7409-237-3


### Reference Books


- NBC 2005, National Building Code of India, Parts III, IV, VII and IX, B.I.S. New Delhi
- Chudley R., 1973, "Construction Technology", Vol.1, 2, 3 and 4 ELBS Publisher
- SP 7- National Building Code Group 1 to 5, B.I.S. New Delhi
- I.S. 962 - 1989 Code for Practice for Architectural and Building Drawings, B.I.S. New Delhi
- Sikka V. B., 2015, “A Course in Civil Engineering Drawing”, S. K. Kataria and Sons

- Catalogues. Information Brochures, Trade Literature by material or product manufacturers
- Mehta, Scarborough, Armpriest, 2007, "Building Construction", Pearson Education
- Macay W.B, 2004, "Building Construction", Vol. I, II, III, IV, Pearson Education
- Jain V.K., 2015, "Handbook of Designing and Installation of Services in High Rise Building Complexes" ISBN : 978-81-7409-245-8


**Course Outcomes:** On completion of the course, students will be able to:

CO1: Understand types of masonry structures.
CO2: Comprehend components of building and there purposes.
CO3: Draw plan, elevation and section of various structures.
CO4: Apply the principles of planning and by laws used for building planning.
CO5: Prepare detailed working drawing for doors and windows.

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## BTCVC304 Hydraulics - I

**Teaching Scheme:** (3 Lectures +1 Tutorial) hours/week

### Course Contents

**Module 1: Fluid Statics** **(Lectures 10)**

Definition of fluids, fluid properties-density, specific weight, specific volume, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, types of fluids - Newtonian and non-Newtonian fluid, continuum, fluid pressure
Forces on fluid elements, fundamental equation, manometers, hydrostatic thrust on submerged surfaces, buoyancy, stability of unconstrained bodies, fluids in rigid body motion

**Module 2: Fluid Dynamics** **(Lectures 10)**

Types of flow, continuity equation, derivation and applications of momentum equation, flow measuring devices, Euler's equation, Bernoulli's equation, velocity potential and stream function, concept of flow net

**Module 3: Laminar & Turbulent Flow** **(Lectures 10)**

Fully developed laminar flow between infinite parallel plates, both plates stationary, upper plate moving with constant speed, fully developed laminar flow in pipe.
**Turbulent flow:** Shear stress distribution and turbulent velocity profiles in fully developed pipe flow, velocity distribution and shear stresses in turbulent flow, Prandtl mixing length theory, Nikuradse's experiment, Introduction to Boundary Layer Theory

**Module4: Dimensional Analysis and Similitude** **(Lectures 10)**

Nature of dimensional analysis, Rayleigh's Method, Buckingham pi theorem, dimensionless groups and their physical significance, flow similarity and model studies, Scale Effects, Distorted and Undistorted Models

**Module5: Flow through Pipes** **(Lectures 08)**

Loss of energy in pipes, pipe discharging from a reservoir, pipe connecting two reservoirs in series and parallel, siphon, transmission of power through nozzle, water hammer in pipes- rigid and elastic water column theory, surge tanks - function, calculation of head loss, introduction to Moody's chart, nomograms and other pipe diagrams

### Text Books


- Fox. R. W. And Mc-Donald. A. T., 2011, "Introduction to Fluid Mechanics", John Wiley and Sons, Fifth Edition
- Modi and Seth, 2017, "Fluid Mechanics and Hydraulic Machinery", Standard Book House, Tenth Edition , 1991
- Kumar K. L., 2010, "Fluid Mechanics", S. Chand publication
- Bansal R. K., 1989, "Fluid Mechanics", Laxmi publication Delhi
- Jain A.K, 1998, "Fluid Mechanics including Hydraulic Machines" ISBN: 978-81-7409-194-7


### Reference Books


- Streeter V. L., Bedford K. W. and Wylie E. B., 1998, "Fluid Dynamics", New York, McGraw-Hill, Ninth Edition.
- Som S. K. & Biswas G., 2017, "Introduction to Fluid Mechanics & Fluid Machines", Tata McGraw-Hill.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Calibrate the various flow measuring devices.
CO2: Determine the properties of fluid and pressure and their measurement.
CO3: Understand fundamentals of pipe flow, losses in pipe and analysis of pipe network.
CO4: Visualize fluid flow phenomena observed in Civil Engineering systems.

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# BTCVC305 Surveying

**Teaching Scheme :** (2 Lectures +1 Tutorial) hours/week

**Course objectives:**

1) To determine the relative position of any objects or points of the earth.
2) To determine the distance and angle between different objects.
3) To prepare a map or plan to represent an area on a horizontal plan.

## Course Contents

**Module 1: Chain Surveying** **(Lectures 08)**

Definition, principles, classification, fields and office work, scales, conventional signs, survey instruments, their care and adjustment, ranging and chaining, reciprocal ranging, setting perpendiculars, well-conditioned triangles, traversing, plotting , enlarging and reducing figures

**Module 2: Compass & Plane Table Surveying** **(Lectures06)**

Prismatic compass, surveyor's compass, bearing systems and conversions, local attraction, magnetic declination, dip traversing, adjustment of errors.

Plane table instruments and accessories, merits and demerits, methods: radiation, intersection, resection, traversing

**Module 3: Leveling and Applications** **(Lectures08)**

Level line - Horizontal line - Levels and Staves, Sprit level – Sensitiveness, Bench marks - Temporary and permanent adjustments, Fly and Check leveling, Booking, reduction, Curvature and Refraction – reciprocal leveling - Longitudinal and cross sections - Plotting - Contouring - Methods - Characteristics and uses of contours - Plotting - Earth work volume - Capacity of reservoirs. Planimeter-Types, Theory, concept of zero circle, Study of Digital Planimeter, Computation of Areas and Volumes

**Module 4: Theodolite Surveying** **(Lectures 08)**

Theodolite - Vernier and micro-optic - Description and uses - temporary and permanent adjustments of vernier transit –Angles: Horizontal - Vertical - Heights and Distances - Traversing - Closing error and distribution - Gales's table - Omitted measurements

**Module 5: Engineering Surveys** **(Lectures 08)**

Reconnaissance, Preliminary and location surveys for engineering projects, Layout, Setting out works, Route Surveys for highways, railways and waterways, introduction to curve ranging, Mine Surveying - Instruments – Tunnels: correlation of underground and surface surveys, shafts

### Text Books


- Kanetkar T.P. and Kulkarni S. V., 2014, "Surveying and Leveling", Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
- Punmia B.C., 1967, "Surveying", Vols. I, II and III, Laxmi Publications, 16th edition, 2016


### Reference Books


- Clark D., 1944, "Plane and Geodetic Surveying", Vol. I & II, C.B.S. Pub. & Distri., N. Delhi, 6th edi.
- Anderson J. M. and Mikhail E. M., 1986, "Introduction to Surveying", McGraw Hill Book Company
- Bannister A. and Raymond S., 1959, "Surveying", ELBS, Sixth Edition, 1992
- Kahmen Heribert and Faig Wolfgang, 2017, "Surveying", Walter de Gruyter, 1995


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Perform measurements in linear/angular methods.
CO2: Perform plane table surveying in general terrain.
CO3: Know the basics of leveling and Theodolite survey in elevation and angular measurements.

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# BTHM306 Soft Skill Development

**Teaching Scheme:** (2 Lectures) hours/week

**Program Educational Objectives:**

1) To build the skills like team building so that they can work efficiently in groups.

2) To provide knowledge of conflict management while working in large organizations.

3) To develop management skills required in routine work environment.

4) To polish the personality of the learners in order to make them good leaders and employees.

5) To imbibe qualities like manners & etiquettes co-ordination, mutual understanding while working in a group.

**Module 1: Development of Proficiency in English** **(Lectures 05)**

Speaking skills, Feedback & questioning technique, Objectivity in argument (Both one on one and in groups), 5 Ws& 1 H & 7 Cs for effective Communication, Imbibing Etiquettes and manners, Study of different pictorial expressions of non-verbal communication and their analysis

**Module 2:Self-Management** **(Lectures 05)**

Self-Evaluation, Self-discipline, Self-criticism, Recognition of one's own limits and deficiencies, dependency, etc., Self-Awareness, Self-Management, Identifying one's strengths and weaknesses, Planning & Goal setting, Managing self-emotions, ego, pride, Leadership & Team Dynamics

**Module 3: Time Management Techniques** **(Lectures 04)**

Practice by game playing and other learning strategies to achieve the set targets Time Management Concept, Attendance, Discipline & Punctuality, Acting in time, Quality /Productive time

**Module 4: Motivation/ Inspiration** **(Lectures 04)**

Ability to shape and direct working methods according to self-defined criteria, Ability to think for oneself, Apply oneself to a task independently with self-motivation

**Motivation techniques**: Motivation techniques based on needs and field situations

**Module 5: Interpersonal & Computing Skills** **(Lectures 06)**

Positive Relationship, Positive Attitudesand Empathies: comprehending others' opinions, points of views, and face them with understanding Mutuality, Trust, Emotional Bonding, Handling Situations (Interview), Importance of interpersonal skills

Designing an effective Presentation, Contents, appearance, themes in a presentation, -Tone and Language in a presentation, Role and Importance of different tools for effective presentation

**Reference Books**

1) Mitra, Barun, "Personality Development and Soft Skills", Oxford University Press, 2016
2) Ramesh, Gopalswamy, "The Ace of Soft Skills: Attitude, Communication & Etiquette for Success", Pearson Education, 2013
3) Covey, Stephen R., "Seven Habits of Highly Effective People: Powerful Lessons in Personal Change"
4) Rosenberg Marshall B., "Nonviolent Communication: A Language of Life"

***Program* Educational Outcomes**

1) Learners will acquire interpersonal communication skills.
2) Learners will develop the ability to work independently.
3) Learners will develop the qualities like self-discipline, self-criticism and self-management.
4) Learners will have the qualities of time management and discipline.
5) Learners would be able to present themselves as an inspiration for others.

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## BTCVL307 Solid Mechanics Laboratory

**Practical:** 2 hours / week

Practical Work consists of performance of at least seven experiments from the list below (excluding the eleventh study)experiment: Detailed report is expected.

**List of Experiments**

1. Tension test on ferrous and non-ferrous alloys (mild steel / cast iron /aluminum etc.)
2. Compression test on mild steel, aluminum, concrete, and wood.
3. Shear test on mild steel and aluminum (single and double shear tests).
4. Torsion test on mild steel and cast iron solid bars and pipes.
5. Flexure test on timber and cast iron beams.
6. Deflection test on mild steel and wooden beam specimens.
7. Graphical solution method for principal stress problems.
8. Impact test on mild steel, brass, Aluminum, and cast iron specimens.
9. Experimental on thermal stresses.
10. Strain measurement involving strain gauges / rosettes.

Assignment involving computer programming for simple problems of stress, strain computations.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Evaluate Young Modulus, torsional strength, hardness and tensile strength of given specimens.

CO2: Determine the strength of coarse aggregates.
CO3: Find the compressive strength of concrete cubes and bricks.

CO4: Determine physical properties of given coarse aggregates, fine aggregates and cement samples.

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## BTCVL308 Hydraulics- I Laboratory

**Practical:** 2 hours / week

Practical Work consists of at least eight performances from list below and detailed reporting in form of journal. Practical examination shall be based on above.

1) Measurement of Viscosity of various fluids
2) Demonstration of working of different types of valves and pipe fittings
3) Measurement of pressure Piezometer, manometers, Pressure gauges
4) Measurement of discharge - Calibration of measuring tank, Use of hook or point gauge.
5) Verification of Bernoulli's Theorem
6) Determination of metacentric height.
7) Calibration of an orifice / mouthpiece / venturimeter / orifice meter
8) Study of factors affecting coefficient of friction for pipe flow (for two different materials and two differentdiameters)
9) Determination of loss of head due to Pipe Fittings

Use of computer programs such as MS Excel is desirable for post-processing of results.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Analyze the properties of fluids and their verification.
CO2: Predict empirical behavior of fluids.
CO3: Apply principles of hydraulics while working in field.

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## BTCVL309 Surveying Laboratory

**Practical:** 2 hours / week

Practical Work consists of performances among the list below and detailed reporting in form of field book, journal and drawing sheets.

Perform each of the following practical work

1) Use of Dumpy Level, Auto Level and Tilting Level.
2) Sensitivity of Bubble Tube using Dumpy Level.
3) Evaluation of constant of Planimeter, and use of Digital Planimeter for measurement of areas.
4) Study of Theodolite.
5) Methods of Plane Table Survey
6) Study and use of Total Station

Among following any two shall be performed

1) Reciprocal Levelling.
2) Illustration of Permanent adjustment of Dumpy Level
3) Measurement of Horizontal Angle by Various Methods
4) Measurement of Magnetic Bearing and Vertical Angle by Theodolite
5) Two Point and Three Point Problems

Among following two shall be performed

1) Road survey, 2) Radial Contouring, 3) Block Contouring, 4) Theodolite Traversing

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Use the theodolite along with chain/tape, compass on the field.
CO2: Apply geometric and trigonometric principles of basic surveying calculations.
CO3: Plan a survey, taking accurate measurements, field booking, and adjustment of errors.
CO4: Apply field procedures in basic types of surveys, as part of a surveying team.
CO5: Employ drawing techniques in the development of a topographic map.

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## BTES210P Internship Evaluation I (from semester II)

Student shall undergo field training / industrial training / internship during summer vacation after Semester II. This training is at elementary level expecting exposure to field practices. A brief report shall be submitted. Evaluation shall be based on reportand power point presentation.

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| Semester- IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 4 | BTCVC401 | Building Planning and Drawing | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| PCC 5 | BTCVC402 | Environmental Engineering | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| PCC 6 | BTCVC403 | Structural Mechanics - I | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 7 | BTCVC404 | Water Resources Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC 8 | BTCVC405 | Hydraulics - II | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 9 | BTCVC406 | Engineering Geology | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| LC 4 | BTCVL407 | Building Planning and CAD Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 5 | BTCVL408 | Environmental Engg. Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 6 | BTCVL409 | HE-II Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | BTCVP410 | Field Training / Internship/Industrial Training (minimum of 4 weeks training in Summer Vacation after Semester IV and appear at examination in Semester V) | - | - | - | - | - | - | - | To be evaluated in V Sem. |
| | | **Total** | **13** | **03** | **06** | **180** | **120** | **450** | **750** | **19** |

# BTCVC 401 Building Planning and Drawing

**Teaching Scheme: (**2 Lectures) hours/week

**Course Contents**

**Module 1: Principles of building planning** **(6 Lectures)**

Principles of building planning, significance sun diagram, wind diagram, orientation, factors affecting, and criteria under Indian condition, concept of green building: aspect at planning level, construction stage and operational level.

**Module 2: Building Services** **(8 Lectures)**

Building planning byelaws & regulations as per SP-7, National Building Code of India group 1 to 5, planning of residential building: bungalows, row bungalows, apartments and twin bungalows, procedure of building permission, significance of commencement, plinth completion or occupancy certificate

Anthropometry: Study of Human dimensions, Concept of percentile in Indian standards, space required for various simple activities, Circulation spaces.

**Module 3: Plumbing Systems** **(8 Lectures)**

Various materials for system like stoneware, GI, AC, CI, PVC, HDPE and various types of traps, fittings, chambers, need of septic tank, concept of plumbing & drainage plan, introduction to rainwater harvesting, concept of rainwater gutters, rainwater outlet & down tank systems

**Electrification:** wiring types, requirements & location of various points, and concept of earthing

**Fire resistance in building:** Fire protection precautions, confining of fire, fire hazards, characteristics of fire resisting materials, building materials and their resistance to fire

**Module4: Ventilation** **(8 Lectures)**

Definition, necessity of ventilation, functional requirements, various system & selection criteria.

**Air conditioning:** Purpose, classification, principles, various systems

**Thermal Insulation:** General concept, Principles, Materials, Methods, Computation of Heat loss & heat gain in Buildings

**Module 5: Introduction to Acoustics & Green Building** **(6 Lectures)**

Absorption of sound, various materials, Sabine's formula, optimum reverberation time, conditions for good acoustics Sound insulation: Acceptable noise levels, noise prevention at its source, transmission of noise, Noise control-general considerations

**Green Building:** Concept, Principles, Materials, Characteristics, Applications

**Reference Books**


- Shah, Kale, Pataki, "Building Drawing", Tata McGraw- Hill
- Sane Y. S.,"Building Design and Drawing", Allied Book Stall, Pune
- Jain V.K., "Automation Systems in Smart and Green Buildings", Khanna Publishers, N. Dehli ISBN No 978-81-7409-237-3
- Jain V.K., "Handbook of Designing and Installation of Services in High Rise Building Complexes", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-245-8
- Deodhar S.V., "Building Science and Planning", Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-199-8
- Jain A.K., "The Idea of Green Building"Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4
- SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi
- I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings


**Course Outcomes:** On completion of the course, the students will be;

CO1: To plan buildings considering various principles of planning and byelaw of governing body.
CO2: Comprehend various utility requirements in buildings
CO3 : Understand various techniques for good acoustics.

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## BTCVC402 Environmental Engineering

**Teaching Scheme:** (2 Lectures+1 Tutorial) hours/week

### Course Contents

**Module 1: Introduction** **(6 Lectures)**

Environment and its components, importance of water, role of environmental engineer, sources of water, water demand: Design flow, design period, design population, factors affecting water consumption, variation in demand, and design capacity for water supply components, quality of water: Physical, chemical, biological characteristics, Indian standard for quality of potable water

**Module 2: Treatment of Water** **(10 Lectures)**

Conveyance of raw water: Canals and pipelines, hydraulics of conduits, laying and jointing of pipelines, testing of pipe lines, designing of rising main, type of valves, types of pumps, intake structure, types of intake structures, necessity of water treatment processes

Types of Treatments:

**Aeration**: Necessity, methods, removal of taste and odour, design of aeration fountain

**Sedimentation:** Suspended Solids, settling velocity, types of sedimentation tanks, surface loading, detention time, inlet and outlet arrangements

**Coagulation:** Necessity, coagulant dosage, choice of coagulants, optimum pH

**Rapid Mixing**: Necessity, gravitational, mechanical, pneumatic devices

**Slow Mixing and Flocculation:** Design of flocculation chamber, mean velocity gradient, design of clari-flocculator, plate settler and tube settler

**Filtration:** Theory of filtration, filter materials, types of filters, components, working and cleaning of filters

**Disinfection**: Theory of disinfection, factors affecting, efficiency of disinfection, types of disinfectants, break point chlorination, bleaching powder estimation

**Water softening methods**: Lime-soda, ion exchange method, demineralization

**Module 3: System of Water Supply** **(6 Lectures)**

Continuous and intermittent system, type of distribution systems, layouts, methods of supply: gravity, pumping and combination, hydraulic analysis of distribution system

**Module 4: Treatment** **(10 Lectures)**

**Treatment of Waste Water**

Sources of wastewater flows, components of wastewater flows, wastewater constituents, characteristic of municipal waste water, necessity of treatment of waste water, sewerage systems, concept of sewage, sullage, storm water, introduction of preliminary treatment, primary treatment, secondary treatment, introduction to tertiary or advanced treatment fundamentals of anaerobic treatment, sewage and industrial waste of common origin, types

**Treatment of Solid Waste**

Types, sources, characteristics, ill-effects of improper solid waste management, collection, processing techniques, methods of treatment of solid waste-composting, incineration, pyrolysis and sanitary land filling. biodegradable, non-degradable segregation of solid waste, concept of hazardous waste management, e-waste disposal

**Module 5: Air Pollution** **(4 Lectures)**

Definition, sources of air pollution, types air pollutants, atmospheric stability, mixing heights, plume types and meteorological parameters, effects of air pollution, control measures of air pollution

**Text Books**

- Rao and Rao,"Air Pollution ", Tata McGraw Hill Publications, New Delhi, 1990
- Garg S. K., "Water Supply Engineering", Khanna Publishers, New Delhi
- Birdi J. S. and Birdi G. S., "Water Supply & Sanitary Engineering", DhanpatRai Pub. Company, 8th edition, New Delhi

**Reference Books**

- Peavy and Rowe, "Environmental Engineering", McGraw Hill Publications
- Stern, "Environmental Engineering", Vol. I to IV, McGraw Hill Publications
- Sharma and Kaur, "Environmental Chemistry", Goyal Publisher
- Government Of India Publication, "Water Supply and Treatment Manual"
- Fair and Geyr, "Environmental Engineering", McGraw Hill Publications
- Steel and McGhee, "Environmental Engineering", McGraw Hill Publications
- Viessman& Hammer, "Water Supply & Pollution Control", Harper Collins Collage Publishers
- Publications by reouted organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.

**Course Outcomes**: On completion of the course, the students will be able to:

CO1: Apply the water treatment concept and methods.
CO2: Prepare basic process designs of water and wastewater treatment plants.
CO3: Apply the wastewater treatment concept and methods.
CO4: Apply the solid waste management concepts.

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## BTCVC 403 Structural Mechanics– I

**Teaching Scheme:** (2 Lectures +1 Tutorial) hours/week

**Course Contents**

**Module 1: Beam Deflections** **(Lectures 06)**

Calculations of deflection for determinate beams by double integration, Macaulay's method, moment area method, conjugate beam method, deflection by method of superposition

**Module 2: Energy Principles** **(Lectures 06)**

Strain energy and strain energy density, strain energy in traction, shear, flexure and torsion - Castiglano's and Engessor's energy theorems, principle of virtual work, application of energy theorems for computing deflections in beams, Maxwell's reciprocal theorem, Williot Mohr diagrams

**Module 3: Method of Consistent Deformation** **(Lectures 08)**

Different structural systems, concept of analysis, basic assumptions, indeterminacy, choice of unknowns, Castiglano's theorem **Indeterminate Beams:** Analysis of indeterminate beams: Propped cantilever and fixed beams - fixed end moments and reactions for standard cases of loading – slopes and deflections in fixed beams

**Module 4: Moment Distribution Method** **(Lectures 08)**

Analysis of continuous beams propped cantilevers, continuous beams - theorem of three moments - analysis of continuous beams settlement effects, thermal effect, Shear Force and Bending Moment diagrams for continuous beams, portal frames with and without sway

**Module 5: Slope Deflection Method** **(Lectures 08)**

Analysis of continuous beams, analysis of rigid frames, frames without sway and with sway, settlement effects, introduction to difficulties in frames with sloping legs and gabled frames

**Text Books**

- Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill,3rd edition 2010
- Wang C.K., "Statically Indeterminate Structures", McGraw Hill
- Vazirani V.N., Ratwani M.M and Duggal S.K., "Analysis of Structures - Vol. I", ISBN NO:978-81-7409-140-8
- Khurmi R.S., "Theory of Structures", S Chand, Delhi
- Punmia B.C., "Structural Analysis", Laxmi Publications


**Reference Books**


- Timoshenko and Young, "Theory of structures", McGraw Hill
- Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
- Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
- Hibbler R. C., "Structural Analysis", Pearson Publications, 9th Edition
- Schodek, "Structures", Pearson Education, 7th edition
- Ramamrutham S. and Narayanan R., "Theory of Structures" Dhanpat Rai Publishers, Delhi


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Describe the concept of structural analysis, degree of indeterminacy.
CO2: Calculate slopes and deflection at various locations for different types of beams.
CO3: Identify determinate and indeterminate trusses and calculate forces in the members of trusses
Perform the distribution of the moments the in continuous beam and frame

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## BTCVC404 Water Resources Engineering

**Teaching Scheme:** (3 Lectures) hours/week

### Course Contents

**Module 1: Introduction** **(6 Lectures)**

Introduction, definition, scope, necessity, ill-effects of irrigation, advantages, types of irrigation systems, methods of distribution of water, development of irrigation in India

**Water Requirement of Crops**

Water requirement of crops, base, delta and duty, methods of improving duty, types of soil, types of soil water, soil moisture, consumptive use, irrigation frequency, irrigation methods, crops season, crop pattern

**Module 2: Reservoirs** **(6 Lecturers)**

Planning of Reservoirs: Classification of Reservoir, Selection of site for Reservoir, Investigation works for Reservoir, Yield and Capacity of Reservoir, Mass Curve and Demand Curve, Storage Calculations, Control Levels, Useful Life of Reservoir, Silting of Reservoirs, Losses in Reservoirs

**Module 3 Dams and Hydraulic structures** **(8 Lectures)**

Difference between weir, barrage and dam, Gravity Dams – Estimation of Loading, Design Criteria, Causes of Failure of Gravity Dam, Precaution against Failure, Theoretical and Practical Profile, Stability Calculations, Galleries, Joints, and Earth Dams: Components and their Functions, Design Criterion, Inverted Filters, Downstream Drainage, Causes of Failure of Earthen Dam. Arch Dams – Types, Forces on Arch Dam, Introduction and types of Spillway.

**Module 3: Weirs and Canals** **(8 Lectures)**

Weirs on Permeable Foundations: Theories of Seepage, Bligh's Creep Theory, Limitations of Bligh's Creep Theory, Khosla's Theory, Piping and Undercutting Canals: Types, Alignment, Kennedy's and Lacey's Silt Theories, Canal Losses, Typical Canal Sections, Canal Lining: Necessity and Types, Canal Structures: Cross Drainage Works and Canal Regulatory Works

**Module 4: Hydrology** **(6 Lectures)**

Introduction to hydrology: hydrologic cycle, rain, surface and ground water
measurement of rainfall, peak flow, base flow, precipitation and its measurement, average depth of precipitation, water losses, flood frequency, catchment area formulae, flood hydrograph, rainfall analysis, infiltration, run off, estimation of runoff, unit hydrograph and its determination, s- hydrograph

**Module 5:**

**Lift Irrigation** **(8 Lectures)**

Lift irrigation, wells and tube wells, introduction, classification of well, specific yield, deep and shallow wells, comparative advantage of well and canal irrigation, duty of well water, types of tube wells, types of strainers, boring methods. Darcy's law, permeability, safe yield of basin. Lift irrigation schemes: Various components and their design principles (Only concepts).

**Water logging and drainage**

Causes of water logging, preventive and curative measures, drainage of irrigation of lands, reclamation of water logged, alkaline and saline lands, Preventive and Curative Measures Water Conservation: Rain water Harvesting, Ground Water Recharge, small scale techniques of surface water detention such as: Soil embankments, field ponds, concrete bandhara.

**Text Books**


1. Varshney R. S., Gupta & Gupta, 1987, “Theory and Design of Irrigation Structures”, Vol. I & II
2. Punamia B. C. Pandey B. B. and Lal, 1992, “Irrigation and Water Power Engineering”, Standard Publishers, New Delhi
3. Garg S. K., 1976, “Irrigation Engineering & Hydraulic Structures”,Khanna Publishers, N. Delhi,
4. Priyani, 1982, “Irrigation and Water Power”, Charotar Publishing House, Anand
5. Bharat Singh,1979, “Irrigation”, Nemchand Brothers, Roorkee
6. Subramanya K., 1984, “Engineering Hydrology”, Tata Mc-Graw Hill Company Limited, N. Delhi


**References Books**


1. USBR, “Design of Small Dam", OXFORD & IBH, Publishing Company
2. Justinn, 1961, “Engineering for Dam” Vol. I, II, III, Creager and Hinds
3. Leliavsky, “Design of Hydraulic Structures” Vol. I & II,
4. C B I & P “River Behaviour, Management and Training”
5. Circular of Government of Maharashtra, 18 February 1995, “Design of Canals”


**Course Outcomes**: On completion of the course, the students will be able to:

CO1: Understand need of Irrigation in India and water requirement as per farming practice in India.
CO2: Understand various irrigation structures and schemes. CO3: Develop basis for design of irrigation schemes.

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## BTCVC405 Hydraulics-II

**Teaching Scheme:** (2 Lectures +1 Tutorial) hours/week

### Course Contents

**Module 1: Uniform Flow in Open Channel** **(Lectures 06)**

Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter) weir & spillway: sharp, broad & round crested weirs, calibration of weir, time of emptying tank with weir, profile of ogee spillway, flow below gates

**Module 2: Steady & Uniform Flow** **(Lecture 06)**

Chezy's& Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section- considerations for rectangular, triangular, trapezoidal, circular sections

Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow, specific force, specific discharge derivation of relationships and numerical computations

**Module 3: Varied Flow & Impact of Jet** **(Lectures 10)**

**Gradually (G.V.F.):** Definition, classification of channel Slopes, dynamic equation of G.V.F. (Assumption and derivation), classification of G.V.F. profiles-examples, direct step method of computation of G.V.F. profiles

**Rapidly varied flow (R.V.F.):** Definition, examples, hydraulic jump- phenomenon, relation of conjugate depths, parameters, uses, types of hydraulic jump

**Impact of Jet:** Impulse momentum principle, impact of jet on Vanes-flat, curved (stationary and moving), inlet & outlet velocity triangles under various conditions, Series of flat, curved vanes mounted on wheel

**Module 4: Turbines** **(Lectures 08)**

**Turbines:** Importance of hydro-power, classification of turbines, description, typical dimensions and working principle of Pelton, Francis & Kaplan turbine (detailed design need not to be dealt with), Module quantities, specific speed, performance characteristics, selection of type of turbine, description & function of draft tube, Thomas's cavitation number

**Module 5: Pumps** **(Lectures 06)**

**Pumps:** Classification, component parts, working of centrifugal pump, performance characteristics, pump selection, common troubles & remedies, introduction to different types of pumps: reciprocating, multi-stage, jet, air lift, submersible pump

**Text Books**


- Modi, Seth, “Fluid Mechanics – Hydraulic & Hydraulic Mechanics” Standard Book House
- Bansal R.K., “Fluid Mechanics”, Laxmi Publications, 9th edition 2017
- Garde R. J., “Fluid Mechanics through Problems”, New Age Publications, 3rd edition 2011
- Jain A. K., “Fluid Mechanics”, Khanna Publications, 8th edition, 2003, Delhi
- Kumar K. L., “Fluid Mechanics”, Eurasia Publication House, 11th edition, Delhi
- Rangaraju, “Open Channel flow”, Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K., “Fluid Mechanics through Problems” Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K., “Flow in Open Channel”, Edition V, Tata McGraw-Hill Pub. Co., Delhi

**Reference Books**

- Streeter, "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Shames, "Mechanics of Fluids", McGraw Hill, 4th edition
- Chaw V. T., "Flow in Open Channel", McGraw-Hill International Book Co., Auckland
- Hughes & Brighton, "Fluid Mechanics", Tata McGraw Hill

**Course Outcomes:** On completion of the course, the students will

CO1: Design open channel sections in a most economical way.
CO2: Know about the non-uniform flows in open channel and the characteristics of hydraulic jump.
CO3: Understand application of momentum principle of impact of jets on plane

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## BTCVC406 Engineering Geology

**Teaching Scheme:** 3 hours/week

### Course Contents

**Module 1: Introduction and Physical Geology** **(Lectures 06)**

Definition, Scope and subdivisions, applications of Geology in Civil Engineering, Major features of the Earth's structure, internal structure of earth, and Geological work of river: features of erosion, deposition and transportation, Civil Engineering Significance, Geological work of wind: Processes and features of erosion, deposition and transportation, Civil Engineering Significance. Volcano: Central and Fissure types, Products of volcano, Mountain: Origin and formation, types, examples.

**Module 2: Mineralogy and Petrology** **(Lectures 06)**

Mineralogy: Physical properties of mineral, Classification of minerals, Petrology: Definition, rock cycle, Igneous rocks: origin, textures and structures, classification, concordant and dis-concordant intrusions, civil engineering significance, Secondary rocks: formation, classification, residual deposits: soil, laterite and bauxite and their importance, Sedimentary deposits: formation, textures, classification and structures, civil engineering significance, chemical and organic deposits, Metamorphic rocks: agents and types of metamorphism, stress and anti-stress minerals, structures, products of metamorphism.

**Module 3: Structural Geology, Building Stones and Ground Water** **(Lectures 08)**

Outcrop, Strike and Dip, Unconformity-Types, Outliers and Inliers, Overlap Fold and Fault: Parameters, Classification, Causes, Civil Engineering significance Joint: Types, Civil engineering considerations.
**Building Stones -** Properties of rocks, Requirement of good building stone, various building stones in India.
**Groundwater:** Sources of groundwater, water table, zones of groundwater, porosity and permeability.

**Module 4: Preliminary Geological Investigations** **(Lectures 08)**

Preliminary geological survey, steps in geological investigations, consideration of structural features. Exploratory drilling: observations, preservation of cores, core logging, core recovery, graphical representation of core log, limitation of exploratory drilling method.

**Module 5: Geology of Dams, Reservoirs, Tunnels and Bridges** **(Lectures 08)**

Dam, types of dams, Influence of geological conditions on location, alignment, design and types of a dam, geological considerations in site selection for dams, Site improvement techniques, dams on carbonate rocks, sedimentary rocks, folded strata and Deccan traps, favorable and unfavorable geological conditions for a reservoir site**.** Tunneling:- Types of tunnels, influence of geological conditions on tunneling, difficulties during tunneling, tunnel lining, tunneling in folded strata, sedimentary rocks and Deccan traps. Bridges:- Types of bridges, dependence of types of bridges on geological conditions.

**Text Books**

- Singh Prabin, 2009, "Engineering and General Geology", S. K. Katariya and sons, Delhi
- Mukerjee P. K., 2013, "A Text Book of Geology", World Press Pvt. Ltd., Calcutta
- Gokhale K.V.G.K. and Rao D. M., 1982, "Experiments in Engineering Geology", TMN, New-Delhi
- Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune
- Subinoy Gangopadhyay, 2013, "Engineering Geology ",oxford university

**Reference Books**

- G. W. Tyrrell, 1926, "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi
- A. Holmes, 1944, "Principles of Physical Geology", ELBS Chapman & Hall, London
- Billings M. P., 1942, "Structural Geology", Prentice Hall of India Private Ltd., New Delhi
- Legget R. F., 1983"Geology Hand book in Civil Engineering", McGraw-Hill, New York
- Krynine D. P. & Judd W. R., 2005, "Principles of Engineering Geology & Geo-technics", CBS Publishers &Distri., New Delhi
- Reddy Dr. D. V., 2017, "Engineering Geology for Civil Engineering", Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi
- Read H. H., 1962, "Rultey's Elements of Mineralogy", CBS Publishers & Distributors, Delhi

**List of Assignments**

It consists of study of relevant rock and mineral samples. Detailed report is expected.

- Megascopic study of Rock forming minerals
- Megascopic study of Ore forming minerals
- Megascopic study of Igneous rocks
- Megascopic study of Secondary rocks

- Megascopic study of Metamorphic rocks
- Cross-section Preparation and interpretation of geological maps
- Study of Structural Geological models
- Preparation of bore log /lithologs
- Interpretation of bore- hole data

Study Visit to the places of Engineering Geological importance.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Recognize the different land forms which are formed by various geological agents.
CO2: Identify the origin, texture and structure of various rocks and physical properties of mineral.
CO3: Emphasize distinct geological structures which have influence on the civil engineering structure.
CO4: Understand how the various geological conditions affect the design parameters of structures.

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## BTCVL407 Building Planning and CAD Lab

**Practical:** 2 hours / week

Term work shall consist of detailed report of in form of set of drawings mentioned below. In practice sessions, free-hand sketching in drawing book shall be insisted.

1) Imperial size sheets based on actual measurement of existing residential building consisting of plan, elevation, section passing through staircase, Site plan. Area statement & brief specifications.
2) Planning & design of a building (Minimum G+1): Full set of drawings for:
    1) Municipal Submission drawing as per local statutory body bye-laws such as Town Planning, Municipal Council or Corporation Authorities.
    2) Foundation / Center Line Drawing.
    3) Furniture layout plan.
    4) Electrification plan.
    5) Water supply & drainage plan.
    6) Project report giving details of Drainage System, Water Supply System, Water Tank, Septic Tank Design of terrace Drainage System.
    7) Rain water harvesting systems
3) Setting out of planned building actually on ground using conventional or modern surveying instruments

It is desirable to use drawings produced in this submission for carrying out structural design under BTCVL708 and / orBTCVL806 in next semesters. If this is implemented, student shall get extra 10% weightage limited to maximum limit.

**Course Outcomes:** On completion of the course, the students will be able to:

Draw plan, elevation and section of load bearing and framed structures.
Draw plan, elevation and section of public structures.

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## BTCVL 408 Environmental Engineering Laboratory

**Practical:** 2 hours / Week

Practical Work consists of performance of at least six experiments from the List (A) below:

**(A) Determination of:**

1) pH and Alkalinity
2) Hardness
3) Chlorides
4) Chlorine demand and residual chlorine
5) Turbidity and optimum dose of alum
6) MPN
7) Sulphates
8) Fluorides and Iron
9) Total Solids, Dissolved Solids & Suspended Solids
10) Sludge Volume Index (SVI)
11) Dissolved Oxygen
12) BOD and COD

**B) Site Visit to Water Treatment Plant:**

A report based on the visit to water treatment plant shall be submitted.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Quantify the pollutant concentration in water, wastewater and ambient air.
CO2: Recommend the degree of treatment required for the water and wastewater.
CO3: Analyze the survival conditions for the microorganism and its growth rate.

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## BTCVL 409 Hydraulic Engineering Laboratory - II

**Practical:** 2 hours / week

Practical Work consists of at least three performances from groups listed below and detailed reporting in form of journal. Practical examination shall be based on above.

**Group (A)**

1) Calibration of V notch / Rectangular notch.
2) Calibration of Ogee Weir.
3) Study of hydraulic jump
    a) Verification of sequent depths,
    b) Determination of loss in jump.
    c) Study of parameters with respect to Fraud Number: i) Y2/Y1; ii) Length; iii) Energy loss
4) Study of flow below gates – Discharge v/s head relation, Equation of flow, Determination of contraction in fluid in downstream of gate.
5) Velocity distribution in open channel in transverse direction of flow.

**Group (B)**

1) Impact of jet.
2) Study of Turbines (Demonstration).
3) Tests on Centrifugal Pump.
4) Study of Charts for Selection of Pumps

Use of computer programs such as MS Excel is desirable for post-processing of results.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand various properties of fluids and measurement techniques.
CO2: Carry out calibrations of various flow measuring devices.
CO3: Understand mechanism of hydraulic jump, various jets and pumps.

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## BTCVP410 Field Training/Internship/Industrial Training

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester IV and appear at examination in Semester V.

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# Dr. Babasaheb Ambedkar Technological University, Lonere

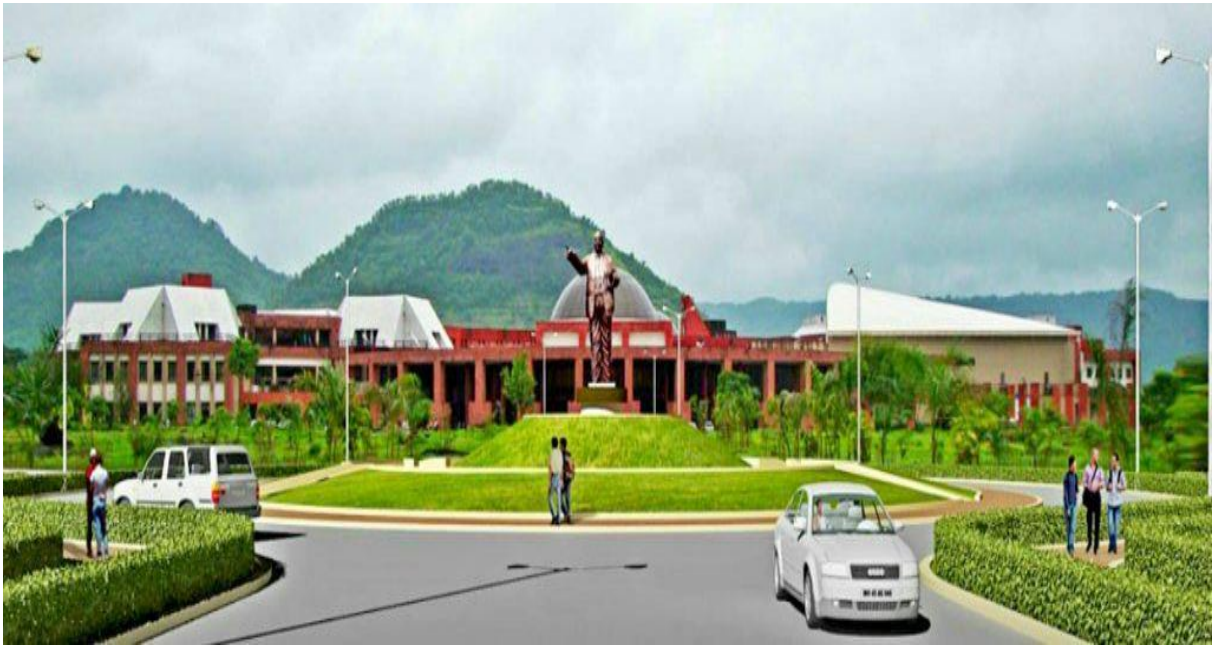
**(Established as a University of Technology in the State of Maharashtra)**
**(Under Maharashtra Act No. XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra**
**Telephone and Fax. : 02140 - 275142**
**www.dbatu.ac.in**

## Draft Copy of Curriculum for Undergraduate Degree Programme

## B. Tech. in Civil Engineering

### Third Year

### With effect from AY 2022-2023



## Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

| Semester- V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 10 | BTCVC501 | Design of Steel Structures | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 11 | BTCVC502 | Geotechnical Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 12 | BTCVC503 | Structural Mechanics –II | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 13 | BTCVC504 | Concrete Technology | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| HSSMC3 | BTHM505 | Project Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC 1 | BTCVPE506 | A. Advanced Environmental Engg.<br>B. Applied Geology<br>C. Hydraulic Engineering Design<br>D. Advanced Water Resources<br>E. Geomatics<br>F. Town and Urban Planning<br>G. Material, Testing and Evaluation<br>H. Construction Economics & Finance | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| ESC10 | BTCVES507 | Software applications in Civil Engineering | 2 | - | - | 50 | - | - | 50 | Audit |
| LC 7 | BTCVL508 | SDD of Steel Structures Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 8 | BTCVL509 | Geotechnical Engineering Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 9 | BTCVL510 | Concrete Technology Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | BTCVP410 | Internship – 2 Evaluation | - | - | - | - | - | - | - | Audit |
| | | **Total** | **17** | **3** | **6** | **230** | **120** | **450** | **800** | **21** |

| Semester- VI | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 14 | BTCVC601 | Design of RC Structures | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 15 | BTCVC602 | Foundation Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 16 | BTCVC603 | Transportation Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC 2 | BTCVPE604 | A. Industrial Waste Treatment<br>B. Managerial Techniques<br>C. Open Channel Flow<br>D. Water Power Engineering<br>E. Ground Improvement Techniques<br>F. Structural Audit<br>G. Intelligent Transportation Systems<br>H. Plastic Analysis of Structures<br>I. Numerical Methods in Civil Engg.<br>J. Engineering Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC 1 | BTCVOE605 | A. Environmental Impact Assessment<br>B. Basic Human Rights<br>C. Business Communication and Presentation Skills<br>D. Composite Materials<br>E. Experimental Stress Analysis<br>F. Python Programming<br>G. Operation Research<br>H. Applications of Remote Sensing and Geographic Information Systems<br>I. Civionics: Instrumentation & Sensor Technologies for Civil Engineering<br>J. Planning for Sustainable Development<br>K. Development Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC4 | BTHM606 | Indian Constitution | 2 | - | - | 50 | - | - | 50 | Audit |
| LC 10 | BTCVL607 | SDD of RC Structures Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 11 | BTCVL608 | Transportation Engineering Lab | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Project | BTCVM609 | Mini Project | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | | **Mandatory (BTCVP610)**<br>Field Training/ Internship/Industrial Training<br>(minimum of 4 weeks training in Summer Vacation after Semester VI and appear at examination in Semester VII.) | - | - | - | - | - | - | - | Credits to be evaluated in VII Sem |
| **Total** | | | **17** | **2** | **6** | **210** | **100** | **390** | **700** | **20** |

# Detailed Syllabus

## *Dr. Babasaheb Ambedkar Technological University, Lonere*

## Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

| Semester- V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 10 | BTCVC 501 | Design of Steel Structures | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 11 | BTCVC 502 | Geotechnical Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 12 | BTCVC 503 | Structural Mechanics –II | 2 | 1 | - | 20 | 20 | 60 | 100 | 3 |
| PCC 13 | BTCVC 504 | Concrete Technology | 2 | - | - | 20 | 20 | 60 | 100 | 2 |
| HSSMC3 | BTHM505 | Project Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC 1 | BTCVPE506 | A. Advanced Environmental Engg.<br>B. Applied Geology<br>C. Hydraulic Engineering Design<br>D. Advanced Water Resources<br>E. Geomatics<br>F. Town and Urban Planning<br>G. Material, Testing and Evaluation<br>H. Construction Economics & Finance | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| ESC9 | BTCVES507 | Software applications in Civil Engineering | 2 | - | - | 50 | - | - | 50 | Audit |
| LC 7 | BTCVL508 | SDD of Steel Structures Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 8 | BTCVL509 | Geotechnical Engineering Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 9 | BTCVL510 | Concrete Technology Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | BTCVP410 | Internship – 2 Evaluation | - | - | - | - | - | - | - | Audit |
| | | **Total** | **17** | **3** | **6** | **230** | **120** | **450** | **800** | **21** |

## BTCVC 501 Design of Steel Structures

**Teaching Scheme:** (2 Lectures + 1 Tutorial) hours/week

**Course Contents**

**Module 1: Introduction and Connections** **(6 Lectures)**

Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations
Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints

**Module 2: Axially Loaded Members, and Flexure Members** **(8 Lectures)**

Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt

Beams: Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections.

**Module 3: Industrial Roofing** **(8 Lectures)**

Gantry girder: Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details
Roof trusses: Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports

**Module 4: Columns and Column Bases** **(6 Lectures)**

Simple and built up section, lacing, battening, column subjected to axial force and bending moment, column splices.

Column bases: Analysis and design of: Slab base, gusseted base and moment resisting bases, grillage foundation, design of anchor bolt

**Module 5: Introduction to Plastic Analysis and Limit State method** **(8 Lectures)**

Introduction to: Plastic Analysis, Hinge Formation, Collapse Mechanism, Recent approaches in Steel Structure design based on Plastic Analysis Method and Limit State Approach, Introduction to Provisions in IS 800-2007

**Note:** Contents in Module 1 to part of 4 shall be taught with help of relevant text or reference books based on elastic design concept and IS 800: 1984. Module 5 shall be taught with reference to IS 800 2007
Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

**Text Books**


- Duggal S. K., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Gambhir, "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Negi L. S., "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Chandra Ram, "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi
- Dayaratnam P., "Design of Steel Structures", Wheeler Publishing, New Delhi
- Subramanian N., "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi
- Vazirani V.N. and Ratwani M.M., "Design and Analysis of Steel Structures", ISBN NO: 978-81-7409-295-3
- Sai Ram K. S., "Design of Steel Structures", Pearson Education, 2nd Edition


**Reference Books**


- Arya A. S. and Ajamani J.L., "Design of Steel Structures", Nemchand and Brothers, Roorkee
- Vazirani&Ratwani, "Design of Steel Structures", Standard Book House, New Delhi
- Duggal S. K., "Limit State Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi
- Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V)
- Gaylord E.H. and Gaylord C.N., "Design of Steel Structures" McGraw Hill, New York
- Lothers J.E., "Design in Structural Steel" Vol.-I, Prentice Hall New Jersy
- Salmon and Johnson, "Steel Structures: Design and Behaviour", Harper and Row, New York
- Steel Designers Manual.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Identify and compute the design loads and the stresses developed in the steel member.

CO2: Analyze and design the various connections and identify the potential failure modes.

CO3: Analyze and design various tension, compression and flexural members.
CO4: Understand provisions in relevant BIS Codes.

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# BTCVC502 Geotechnical Engineering

**Teaching Scheme:** (3 Lectures + 1 Tutorial) hours/week

**Course Contents**

**Module 1: Introduction** **(8 Lectures)**

Definition of soil and soil engineering, Application areas of soil mechanics, Three Phase system, Soil moisture, Soil minerals Soil structure, Terzaghi's effective stress concept, Effective and neutral pressure

**Module 2: Soil Consistency** **(10 Lectures)**

Index properties of soil: Different unit weights of soil, and their determination, unit weight of solids, unit weights of soil mass, method for determination of field density viz. sand replacement and core cutter, Specific Gravity determination methods void ratio and porosity, degree of saturation, Inter relation between weight volume state, density indexes, Atterberg's limits and their significance,Soil Classification: Soil classification based on particle size and consistency, I.S. classification system

**Module 3: Flow of Water Through Soil: Permeability** **(10 Lectures)**

Head, gradient and potential, Darcy's law, Factors affecting permeability, Field and Laboratory methods of determining permeability, Seepage pressure, quick sand condition, Derivation of Laplace equation, Flow net: characteristics& application, construction of flow net, piping phenomenon, Permeability through stratified soil, Discharge and seepage velocity.

**Module 4: Shear Strength** **(10 Lectures)**

Concept of shear, Coulomb's theory and failure envelope, Principle stress, stress analysis (Total stress approach and effective stress approach), representation of stresses on Mohr's circle for different types of soil such as cohesive and cohesionless, saturated and partly saturated soil etc, Application of shear stress parameters in the field, Different types of shear tests: Unconsolidated undrained, Consolidated undrained and consolidated drained choice of the type of test, box shear test, triaxial compression test with pore pressure and volume change measurement, Unconfined compression test, vane shear test

**Module 5: Compressibility of Soils** **(10 Lectures)**

CompactionTheory of compaction, factors influencing compaction, compacted density, Laboratory Standard and modified compaction test, Method and measurement of field compaction, Field compaction control Consolidation Compressibility: Definition, compressibility of laterally confined soil, compression of sand and clay, e-p and e-log p curve, compression index. Consolidation: Terzaghi's theory of one dimensional consolidation, consolidation test, determination of coefficient of consolidation, degree of consolidation, relevance of one dimensional consolidation to field condition, time factor

Earth Pressure Theories: Earth pressure at rest, active and passive conditions, Elementary idea about Rankin's and Coulomb's earth pressure. Graphical methods for active earth pressure.

**Text Books:**


- Kasamalkar B. J., "Geotechnical Engineering", Pune Vidyarthi Griha Prakashan Pune
- Murthy V.N.S., "Soil Mechanics & Foundation Engineering", U.B.S. Publishers and Distributors N. Delhi
- Punmia B.S., "Soil Mechanics & Foundation Engineering", Laxmi Publications
- Arora K. R., "Soil Mechanics" Standard Publishers, N. Delhi
- Gopal R Rao "Basic Soil Mechanics "


**Reference Books:**


- Alam Singh, "Text book of soil mechanics in theory and practice", Asian Pub. House, Mumbai
- Taylor D.W., "Fundamentals of Soil mechanics"
- Terzaghi and Peak "Soil mechanics" John Willey and Sons, New-York
- Scott R. F., "Principal of soil mechanics"
- Lambe T.W, "Soil Testing" by Willey Eastern Ltd., New Delhi


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand different soil properties and behavior

CO2: Understand stresses in soil and permeability and seepage aspects.

CO3: Develop ability to take up soil design of various foundations

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# BTCVC503 Structural Mechanics -II

**Teaching Scheme:** (2 Lectures + 1 Tutorial) hours/week

**Course Contents**

Application of all methods shall be restricted to beams, Frames and /or pin jointed frames or trusses of Degree of Indeterminacy up to three.

**Module 1: Analysis of trusses** **(6 Lectures)**

Analysis of determinate and indeterminate pin jointed trusses by energy method, effects of settlement and pre-strains

.

**Moving Loads and Influence Lines**

Introduction to moving loads, concept of equivalent UDL, absolute maximum bending moment and shear force, concept of influence lines, influence lines for reaction, shear force, bending and deflection of determinate beams, influence line diagram (ILD) for forces in determinate frames and trusses, analysis for different types of moving loads, single concentrated load, several concentrated loads, uniformly distributed load shorter and longer than span, application of Muller Breslau principle for determinate structures to construct ILD.

**Module 2: Cables, Suspension Bridges and Arches** **(8 Lectures)**

Analysis of forces in cables, suspension bridges with three hinged and two hinged stiffening girders, theory of arches, Eddy's theorem, circular , parabolic and geometric arches, concept of radial shear force and axial thrust, analysis of three hinged and two hinged arches, effect of yielding of supports, rib shortening and temperature changes. ILD for 3 hinged arches and suspension bridges

**Module 3: Analysis of Indeterminate Structures by direct Flexibility Method** **(8 Lectures)**

Fundamental concepts of flexibility method of analysis, flexibility coefficients and their use in formulation of compatibility equations, application of above methods to propped cantilevers, fixed beams, continuous beams,simple pin jointed frames including effect of lack of members, rigid jointed frames.

**Module 4: Analysis of Indeterminate Structures by direct Stiffness Method** **(8 Lectures)**

Fundamental concepts of stiffness method of analysis, stiffness coefficients for prismatic members and their use for formulation of equilibrium equation, applications of the above methods to indeterminate beams and simple rigid jointed frames, rigid jointed frames with inclined member but having only one translational DoF in addition to rotational DoF's, including the effect of settlement of supports, pin jointed frames.

**Module 5: Finite Element Method** (Contents to conceptual level) **(6 Lectures)**
Introduction to analysis by discretization such as finite difference method, Finite element method: types of elements-1D, 2D, 3D, Plane Strain and Plane Stress Problem, isoperimetric and axisymmetric, convergence criteria, Pascal's triangle, direct stiffness method, principle of minimum potential energy. Shape functions, concept of local and global stiffness matrix

**Text Books**


- Reddy C. S., "Basic Structural Analysis", Tata McGraw Hill
- Pandit G. S. and Gupta S. P., "Structural Analysis - a Matrix Approach", Tata McGraw Hill, N.Delhi, 1986
- Chandrupatla T. R., Belegundu A. D., "Introduction to Finite Elements in Engineering, PrenticeHall, N. Delhi, 1996
- Thadani B. N. and Desai J. P., "Structural Analysis"
- Punmia B.C., "Structural Analysis", Laxmi Publications
- Vazirani V.N., Ratwani M.M and Duggal S.K., "Analysis of Structures - Vol. II" Khanna Publishers, N. Dehli, Sadhu Singh, "Theory and Solved Problems in Adv. Strength of Materials", Khanna Publishers, N. Dehli,
- Ramamrutham S. and Narayanan R., "Theory of Structures" DhanpatRai Publishers, Delhi


**Reference Books**


- Norris C. H. and Wilbur J. B., "Elementary Structural Analysis", McGraw Hill
- Beaufait, F. W., "Basic Concepts of Structural Analysis", Prentice Hall, N.J. Kinney J. S., "Indeterminate Structural Analysis", Oxford and IBH
- Krishnamurthy, C.S., "Finite Element Analysis – Theory and Programing", Tata McGraw Hill, N. Delhi 1994
- Hibbler R. C., "Structural Analysis", Pearson Publications
- Kanchi M. B., "Matrix Methods of Structural Analysis", Wiley Eastern Ltd., N. Delhi
- Wang C. K., "Matrix Methods of Structural Analysis", International Text-book, Scranton, Pennsylvania, 1970
- Gere J.M., Weaver W., "Analysis of Framed Structures", D. Van Nostrand Company, Inc., Princeton, N. Jersey


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Have a basic understanding of matrix method of analysis and will be able to analyze the determinant structure.

CO2: Have a basic understanding of the principles and concepts related to finite difference and finite element methods

CO3: Have a basic understanding of concept of influence line

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# BTCVC504 Concrete Technology

**Teaching Scheme**: (2 Lectures) hours/week

## Course Contents

**Module 1** **(4 Lectures)**

Materials for Concrete: Cement, Manufacturing Process, Physical Properties, Hydration of Cement, hydration products, Chemical Compounds in Cement, Types of Cement, Aggregates: Classification of aggregates, Physical Properties, Bulking of Sand, Mechanical Properties, Water: Specifications of Water to be used For Concrete

**Module 2** **(4 Lectures)**

Properties of Fresh Concrete -Types of Batching, Mixing, Transportation, Placing Including Pumping and Compaction Techniques for Good Quality Concrete, Workability, Factors affecting workability, Methods of Measuring Workability, Segregation and Bleeding, setting time, Curing of Concrete, Types of curing, Temperature Effects on Fresh Concrete

**Module 3** **(4 Lectures)**

Admixtures In Concrete: Types, Plasticizers and Super-plasticizers and their Effects On Workability, Air Entraining Agents, Accelerators, Retarders, Pozzolanic Admixtures, Green concrete, Bonding Admixtures, Damp-Proofing Admixtures, Construction Chemicals

**Module 4** **(8 Lectures)**

Desired Properties of Concrete, Strength, Durability &Im-permeability, Characteristic Strength, Compressive, Tensile and Flexure of Concrete, Bond Strength, Tests on Concrete, Modulus of Elasticity, Effect of W/C Ratio and admixtures on Strength, Types of concrete, High Strength and High Performance Concrete Creep and Shrinkage of Concrete, Significance, Types of Shrinkage and Their Control,
Factors Affecting Creep. Durability of Concrete: Minimum & Maximum Cement Content, Strength & Durability Relationship, Exposure to Different Conditions, Factors Contributing to Cracks in Concrete, Sulphate Attack, Alkali Aggregate Reaction (AAR), factors affecting on AAR, Deteriorating effects of AAR, Chloride Attack, Corrosion of Steel (Chloride Induced)

**Module 5** **(4 Lectures)**

Concrete Mix Design, Nominal Mix Concrete, Factors Governing Mix Design, Methods of Expressing Proportions, Trial Mixes, Acceptance Criteria, Factors Causing Variations, Field Control, Statistical Quality Control, Quality Measurement in
Concrete Construction, Non-destructive Testing of Concrete

**Text Books**

- Gambhir M. L. “Concrete Technology”, Tata Mc-Graw Hill 2015 15th edition
- Shetty M. S. “Concrete Technology”, S. Chand 2005.
- Krishnaswamy, “Concrete Technology”, DhanapatRai and Sons

**Reference Books**

- Orchard, “Concrete Technology”, Applied Science Publishers
- Neville A. M., “Concrete Technology”, Pearson Education
- Neville A. M., “Properties of Concrete”, Pearson Education
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS:10262(2009), IS:456 (2009), IS 4926 (2003)

**Course Outcomes**: On completion of the course, the students will be able to:

CO1: Understand the various types and properties of ingredients of concrete.
CO2: Understand effect of admixtures on the behavior of the fresh and hardened concrete.
CO3: Formulate concrete design mix for various grades of concrete.

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# BTHM505 Project Management

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(8 Lectures)**

Introduction, Steps in Project Management, fundamentals of material, machinery and manpower management in Project, Bar Chart, Mile stone chart, Development of network, Fulkerson's Rule, Introduction to CPM, Time estimates, floats, critical path

**Module 2:** **(6 Lectures)**

Network Compression, Least Cost and Optimum Duration, Resource Allocation, Updating Calculations for Updated Network

**Module 3:** **(8 Lectures)**

Introduction to PERT, concept of probability, normal and beta distribution, central limit theorem, time estimates, critical path, slack, probability of project completion

**Module 4:** **(8 Lectures)**

Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation, cash – flow diagram, economic comparisons – discontinuing methods, non-discontinuing criteria

**Module 5:** **(6 Lectures)**

Linear break even analysis – problems, quality control – concept, statistical methods – control charts
Total quality management– philosophy of Juran, Deming, importance, Quality Circle implementation, introduction to ISO 9000 series and 14000 series, Introduction to Computer Aided Project Management

**Text Books**

- Roy Pilcher, "Project Cost Control in Construction",Sheridon House Inc.(Feb1988)
- Gupta R.C. "Statistical Quality Control", khanna publishers 9th edition
- Layland Blank and Torquin, "Engineering Economics",Mc-Graw-Hill Edition
- Naik B. M. "Project Management",Stosius Inc./Advent Book division
- Khanna O.P., "Work Study",Dhanpatrai publication
- Srinath L. S. "CPM PERT", Affiliated East-West Press (Pvt) ltd

**Reference Books**

- Antill and Woodhead, "C.P.M. in Construction Practice", Wiley-Interscience 4th edition 1990
- Taylor. G.A., "Management and Engineering Economics", Mc-Graw Hill 4th edition
- Roy Pilcher, "Principles of Construction Management" Mc-Graw Hill Higher Education 2rd revision

**Course Outcomes:** On completion of the course, the students will be able to: Understand various steps in project Management, different types of charts.Construct network by using CPM and PERT method.
Determine the optimum duration of project with the help of various time estimates.
Know the concept of engineering economics, economic comparisons, and linear break even analysis problems.
Understand the concept of total quality Management including Juran and Deming's philosophy.

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# BTCVPE506 A. Advanced Environmental Engineering

**Teaching Scheme :**(3 Lectures) hours/week

**Course Contents**

**Module 1: Low cost wastewater treatment methods** **(8 Lectures)**

Principles of waste stabilization pond, Design and operation of oxidation pond, aerobic & anaerobic Lagoons, Aerated Lagoon, Oxidation ditch, Septic tank. Concept of recycling of sewage Disposal of waste water-stream pollution, Self Purification, DO sag curve, Streeter Phelp's Equation, Stream classification, disposal on land, effluents standards for stream and land disposals

**Module 2: Industrial Waste Water Treatment Management** **(8 Lectures)**

**Sources of Pollution:** Physical, Chemical, Organic and Biological properties of Industrial Wastes – Differences between industrial and municipal waste waters –Effects of industrial effluents on sewers and treatment plants, Prevention vs Control of Industrial Pollution
**Pre and Primary Treatment:** Equalization, Proportioning, Neutralization, Oil Separation by Floatation, Prevention v/s Control of Industrial Pollution

**Module 3: Waste Water Treatment Methods** **(8 Lectures)**

Nitrification and De-nitrification – Phosphorous removal – Heavy metal removal – Membrane Separation Process–Reverse osmosis– Chemical Oxidation–Ion Exchange – Air Stripping and Absorption Processes – Special Treatment Methods – Disposal of Treated Waste
**Common Effluent Treatment Plants (CETPs):** Need, Planning, Design, Operation & Maintenance Problems

**Module 4: Environmental Sanitation** **(6 Lectures)**

Communicable diseases, Methods of communication, Diseases communicated by discharges of intestines, nose and throat, other communicable diseases and their control

**Module 4: Insects and Rodent Control** **(6 Lectures)**

Mosquitoes, life cycles, factors of diseases control methods - natural &chemical, Fly control methods and fly breeding prevention, Rodents and public health, plague control methods, engineering and bio-control methods in Rural areas, Population habits and environmental conditions, problems of water supply and sanitation aspects, low cost excreta disposal systems, Rural sanitation improvement schemes.

**Text Books**


- Masters G.M. (2008) "Introduction to Environmental Engineering and Science"Prentice-Hall of India Pvt. Ltd., N. Delhi
- Metcalf & Eddy (1982) "Waste Water Engineering Treatment & Disposal", Tata McGraw Hill, New Delhi
- Garg S. K. (1979) "Sewage Disposal and Air Pollution Engineering", Khanna Publishers,New Delhi
- Rao M.N.& Datta A. K. (2018)"Waste water treatment", Oxford & Ibh Publishing Co Pvt Ltd, New Delhi


**Reference Books**


- Peavey H. S., Rowe D.R. (2017) "Environmental Engineering", McGraw-Hill Book Co., New Delhi
- Viessman W. and Hammer M. J. (2008) "Water Supply and Pollution Control",Pearson Publications, N. Delhi
- Hammer M. J. (2012) "Water and Waste water Technology", Prentice-Hall of India Private Limited,New Delhi
- Canter L. W. (1995) "Environmental Impact Assessment", Tata McGraw Hill Publication,New Delhi


**Course Outcomes:**On completion of the course, the students will be able to:

1. Determine the sewage characteristics and design various sewage treatment plants.
2. Understand municipal water and wastewater treatment system design and operation.
3. Apply environmental treatment technologies and design processes for treatment of industrial waste water.
4. Understand the rural sanitation schemes.

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# BTCVPE 506B Applied Geology

**Teaching Scheme:** (3Lectures) hours/week

**Course Contents**

**Module 1: Stratigraphy and Indian geology** **(6 Lectures)**

geological time scale, physiographic divisions of India and their geological, geomorphologic and tectonic characteristics, study of important geological formations of India namely: Vindhyan, Gondwana, and Deccan traps with respect to: distribution, lithology, tectonics, economic importance etc. significance of these studies in civil engineering

**Module 2: Sub-surface exploration** **(8 Lectures)**

Steps in geological studies of project site, engineering consideration of structural features, exploratory drilling, preservation of cores, core logging, graphical representation of core log, limitations of exploratory drilling method, numerical problems on core drilling, introduction to geological map

**Sub-surface water:** Runoff, fly off and percolation of surface water, juvenile, connate and meteoric water, water table, zones of subsurface water, perched water table, aquifer theory

**Module 3: Engineering geology of Deccan traps** **(8 Lectures)**

Types of basalts and associated volcanic rocks, engineering characteristics, infillings of gas cavities, compact and amygdaloidal basalt as construction material, effect of jointing, hydrothermal alteration and weathering on engineering behaviour, tail channel erosion problem in Deccan trap region, suitability for tunnelling, problems due to columnar basalt, dykes, red bole, tachylitic basalt, volcanic breccias and fractures, laterites: origin, occurrence and engineering aspects, ground water bearing capacity of rocks of Deccan trap region, percolation tanks

**Module 4: Geology of soil formations** **(6 Lectures)**

Soil genesis, geological classification of soils, residual and transported soils, soil components, characteristics of soils derived from different types of rocks, nature of alluvium and sand from rivers of Deccan trap region, scarcity of sand

**Geophysics:**

Various methods: magnetic, gravitational and electrical resistivity methods, applications of electrical resistivity method using Wenner configuration in civil engineering problems such as: finding thickness of over burden and depth of hard rock, locating the spot for ground water well, seepage of water finding,

**Module 5: Rock mechanics:** **(8 Lectures)**

General principles, engineering properties of rocks and their dependence upon geological characters, in- built stresses in rocks, measurements of these stresses

Plate tectonics, seismic zones of world, seismic activity of Deccan trap region, various theories on the origin of the seismic activity of Deccan trap region, prediction of earthquake, earthquake resistant constructions, numerical problems based on seismic data, cause and prediction and preventive measurement of landslide in Deccan trap region.

**Text Books**


- Gupte R. B., "A Text Book of Engineering Geology", Pune Vidyarthi Griha Prakashan, Pune.
- Gokhale K.V.G.K. and Rao D. M., "Experiments in Engineering Geology", TMN, New-Delhi.
- Mukerjee P. K., "A Text Book of Geology", The World Press Pvt. Ltd., Calcutta.
- Prabin Singh, "Engineering and General Geology", S. K. Katariya and sons, Delhi.


**Reference Books**


- Tyrrell G. W., "Principles of Petrology", B. I. Publication Pvt. Ltd., New Delhi.
- Holmes A., "Principles of Physical Geology", ELBS Chapman &Hall,London.
- Billings M. P., "Structural Geology", Prentice Hall of India Private Ltd., New Delhi.
- Farmer L. W., "Engineering Properties of Rocks", Champman& Hall, London.
- SathyaNarayanSwamiB. S., "Engineering Geology", DhanpatRai& Co.(P) Ltd, Delhi


**Course Outcomes:** On completion of the course, the students will be able to:

CO1 :Understand geological time scale and physiographic division of India and their geological and characteristics different geological formation in India.
CO2: Perform sub surface exploration and interpret core log.
CO3:Solve numerical problem based on core drilling and seismic data.
CO4 :Familiar with origin of earthquake, seismic wave and landslide in Deccan trap.

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# BTCVPE 506C Hydraulic Engineering Design

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(6 Lectures)**

Design of Spillways and Energy Dissipation for Flood Control Storage and Conveyance Systems, major features of dams (e.g., type, design basis, spillway type), Analysis of Spillway flow, Design of stilling basis

**Module 2: Hydraulic Processes: Pressurized Pipe Flow** **(8 Lectures)**

Continuity and energy equations to pipe network, problems, Calculation of friction losses, DarcyWeisbach, Colebrook-White, Jain, Hazen-Williams, Manning's, loss coefficient tables to estimate local energy losses, analysis of pipe networks by interpreting energy and hydraulic grade lines

**Module 3: Boundary Layer Theory** **(8 Lectures)**

Concept, Boundary layer along thin plate- Characteristics, Laminar, Turbulent Boundary Layer, laminar sub layer, Various Thicknesses-Nominal, displacement, Momentum, Energy. Hydraulically smooth and Rough boundaries, Separation of Boundary layer, control of Separation, Introduction to Drag and Lift on submerged bodies (Flat plates, Sphere, Cylinder, aerofoil), Stokes law, Concept of Drag and Lift coefficients.

**Module 4:** **(8 Lectures)**

Impulse momentum principle, impact of jet on Vanes-flat, curved (stationary and moving), inlet & outlet velocity triangles under various conditions, Series of flat, curved vanes mounted on wheel.

**Module 5:** **(6 Lectures)**

Pump Performance, Analysis of pump performance with regards to pump location, multi-pump system performance in a specified hydraulic system

**Text Books**:

- Rajnikant M. Khatsuria "Hydraulics of Spillways and Energy Dissipators by"
- R.S.Varshney, S.C. Gupta, R.L. Gupta Theory and Design of Hydraulic Structures Vol. 1 and 2
- Bansal R.K., "Fluid Mechanics", Laxmi Publications, 9th edition 2017
- Garde R. J., "Fluid Mechanics through Problems", New Age Publications, 3rd edition 2011
- Jain A. K., "Fluid Mechanics", Khanna Publications, 8th edition, 2003, Delhi
- Subramanian K., "Fluid Mechanics through Problems" Tata McGraw-Hill Pub. Co., Delhi

**Reference Books**

- Streeter, "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Hughes & Brighton, "Fluid Mechanics", Tata McGraw Hill
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**Course Outcomes**:On completion of the course, the students will be able to:

CO1: Analyse spillway flow

CO2: Compute drag and lift coefficients using the theory of boundary layer flows.

CO3: Analyse Pump performance

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# BTCVPE 506D Advanced Water Resources

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Hydrogeology** **(8 Lectures)**

Porosity and Permeability of Rocks, Groundwater in Igneous, Metamorphic, Sedimentary Rocks and Non Industrated Sediments, Hydro-geological Regions of India, Surface and Subsurface Geophysical methods for Groundwater Explorations..

**Module 2: Well Hydraulics** **(8 Lectures)**

Aquifers and Aquifer Parameters, Darcy's law, Hydraulic Conductivity and its Characteristics, Dupuit Equation, Groundwater Flow Direction Steady Groundwater Flow, Groundwater Flow Equation, Estimation of Aquifer Parameters from Pumping Test Data, Graphical Techniques and their Limitations, Groundwater Well Losses, Interference among Wells, Potential Flow, Image well theory and its Application in Groundwater Flow.

**Module 3: Water Well Design and Well Drilling** **(8 Lectures)**

Water Well Design and Well Drilling: Well Screen, Development and Completion of Well, Rotary Drilling and Rotary Percussion Drilling, maintenance of Wells.

**Module 4: Groundwater Management** **(6 Lectures)**

Groundwater Management: Conjunctive Use, Alternative Basin Yields, Artificial Recharge of Groundwater, Groundwater Quality.
Groundwater Modelling: Groundwater Flow, mathematical, Analog and Digital modeling, Regional Groundwater Modelling.

**Module 5: Ground Water Development** **(6 Lectures)**

Introduction, Development of artificial recharging, Methods of artificial recharging, Suitability of artificial recharging methods.

**Text Books:**


- Walton, W.C.(1970) "Groundwater Resources Evaluation", McGraw Hill Inc, n York .
- Todd, D.K. (1995), "Groundwater Hydrology", John Wiley & Sons, Singapore
- Johnson, E.E. (1966),"Groundwater", E. Johnson Inc. Washington.
- Raghunath, H.M. (1992) "Groundwater", Wiley Eastern Ltd, N Delhi
- Sharma, H.D. and Chawla, A.S. (1977), "Manual on Groundwater and Tube Wells", Technical Report No. 18, CBIP, New Delhi,
- Davis, S.N. and De Weist, R.J.M. (1966), "Hydrogeology", John Wiley & Sons, N York.
- Garg, S.P. (1993) "Groundwater and Tube Wells", Oxford and IBH Publishing C. N Delhi.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Apply methods to recharge ground water

CO2: Ability to know about various surface and subsurface geophysical methods for groundwater explorations.

CO3: Ability to know about well hydraulics

CO4: Ability to know about design principles of well

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# BTCVPE 506E Geomatics

**Teaching Scheme:** (3 Lectures) hours/week

**Contents**

**Module 1: Tachometry** **(8 Lectures)**

Significance and systems, principle, constants, basic formulae and field work stadia method, auto reduction tachometer, tangential system

**Electronic Distance Measurement:** Importance, principles of electronic distance measuring (EDM) instruments, classification of EDM's based on carrier waves used, study and use of total station

**Module 2: Triangulation** **(8 Lectures)**

Principle & classification, system, selection of station, base line measurement, correction and use of subtense bar, signals, satellite station, reduction to center, spherical excess, angular observations, tri-iteration

**Triangulation Adjustments:** Theory of errors, laws of weights, concept of most probable value

**Module 3: Field Astronomy** **(8 Lectures)**

Terms, co-ordinate systems, determination of latitude and true bearing by observation on the sun and pole star

**Curves:** Horizontal and vertical curves, simple curves, setting with chain and tapes, tangential angles by theodolite, double theodolite, compound and reverse curves, transition curves, functions and requirements, setting out by offsets and angles, vertical curves, sight distance requirements

**Module 4: Photogrammetry** **(6 Lectures)**

Terms, types, vertical photographs, scale, ground coordinates, relief displacement, flight planning photomaps and mosaics, stereoscopy and photo interpretation

**Module 5: Introduction to Remote Sensing** **(6 Lectures)**

Introduction, classification and principles, electromagnetic energy and its interaction with matter, idealized systems, sensors, platforms, and application in civil engineering, G.P.S & G.I.S. as surveying techniques – Overview, uses and applications

**Text Books**


- Bannister A., Raymond S., Wartikar J.N., Wartikar P.N.,1992 "Surveying", ELBS, 6th Editon,
- Heribert Kahmen and Wolfgang Faig,1995 "Surveying ", Walter de Gruyter,
- Kanetkar T.P., "Surveying and Leveling", Vols. I, II and III, Vidyarthi Gruh Prakashan, Pune
- Punmia B.C., "Surveying", Vols. I , II and III, Laxmi Publications


**Reference Books**


- James M. Anderson and Edward M. Mikhail, "Introduction to Surveying", McGraw Hill Book Company
- Clark D., "Plane and Geodetic Surveying", Vol. I and II, C.B.S. Publishers and Distributors, New Delhi, Sixth Edition
- Agor, "Advanced Surveying", Khanna Publications, Delhi
- Arora K. L., "Surveying", Vol.1 & 2
- Basak, "Surveying and Levelling"
- Duggal S. K., "Surveying", Vol 1 & 2, Tata Mcgraw Hill Publications, New Delhi
- Gopi S., Satikumar R. and Madhu N., "Advanced Surveying", Pearson Education
- Chandra A. M., "Higher Surveying", New Age International Publication


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand basics different types of curves on roads and their preliminary survey.

CO2: Perform setting of curves, buildings, culverts and tunnels.

CO3: Comprehend different geodetic methods of survey such as triangulation, trigonometric leveling.

CO4: Comprehend modern advanced surveying techniques.

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# BTCVPE 506 F Town and Urban Planning

**Teaching Scheme:** Lectures: 3 Hours / Week

**Course Contents**

**Module 1:** **(8 Lectures)**

Necessity and scope of Town Planning, Brief history, Greek and Roman Towns, Planning in ancient India - Indus Valley Civilization, Vedic Period, Buddhist Period, Medieval Period, Mogul Period, British Period, Post-Independence Period, Theories in urban and regional planning

**Module 2:** **(8 Lectures)**

Town Planners in Modern Era such as Sir Patrick Geddes, Sir Ebenezer Howard, Clarence stein, Sir Patrick Abercrombie, Le Corbusier, Present Status of Town Planning in India, Efficiency Measures, Planners skills, Integrated Area Planning in India. Distribution and sizes of Settlements

**Module 3:** **(8 Lectures)**

Layout of Residential Units, Neighborhood Unit Planning, Radburn Plan, Grid Iron Pattern, Shoe String Development, Growth Pattern of Towns, Concentric Satellite, Ribbon Development, Scattered growth

**Module 4:** **(6 Lectures)**

Elements of Town, Various Zones, Development Control Rules and Building Bye Laws, Urban Roads: Objective, Classification, Road Networks, Data Collection Surveys, Analysis of data,

Town aesthetics, Landscape Architecture, Suitability of Trees, Treatment of Traffic Islands, Open Spaces Walkways Public Sit-outs, Continuous Park System, Green ways

Town Planning works with reference to M.R.T.P. Act, Land Acquisition Act, Necessity and procedure of acquisition

**Module 5:** **(6 Lectures)**

Village Planning, Multilevel Planning, Decentralization Concepts, Rural Developments, Planning Methodology, GrowthCentre Approach, Area Development Approach, Integrated Rural Development Approach

**Text Books:**


1. Hiraskar G.K. (2018) “Town and country Planning”DhanpatRai Publication, N. Delhi
2. Rangawala S.C. (2015) “Town Planning”, Charotar Publications, Anand
3. Sundaram K.V. (1978) “Urban and Regional Planning in India”, Vikash Publishing House P.L
4. MRTP Act 1966 & 2002
5. Land Acquisition Act - 1894
6. Misra S. N. (1984) “Rural Development Planning-Design and Method”, Satvahan Publications, N. Delhi


**Reference Books**


1. Eisner S. and Gallion A. (1993) “The Urban Pattern”, John Wiley & Sons, N. Delhi


**Outcomes:** Upon completion of the course the students will be able to:

1. Understand town and Urban planning and their essential attributes
2. Identify elements of planning and regulations of the same
3. Implement guidelines provided by standard authorities

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# BTCVPE506 G. Materials, Testing &Evaluation

**Teaching Scheme:** (3 Lectures) hours / Week

**Course Contents**

**Module1:** **(8 Lectures)**

Basic Properties of Materials: importance of materials in civil engineering construction, types of materials such as ceramics, concrete, composites, optical /electronics materials, glass, metals, nano-materials ,polymers and plastics, wood and other materials. some basic properties of materials such as temperature, energy, specific heat, thermal conductivity, coefficient of thermal expansion ,mechanical properties of metals ,stress, strain modulus of elasticity, ,stress-strain behavior, elastic and plastic deformations, elastic properties of materials, tensile properties, ductility, resilience and toughness ,compressive, shear and torsional deformation, hardness. Variability of material properties.

**Module2:** **(8 Lectures)**

Civil Engineering Materials: introduction to cement and concrete, uses of cement, strength of cement and concrete ,sand, coarse aggregates, mortar and grouts, masonry mortars, rendering, cementitious grouts, RCC, clay bricks ,calcium silicate bricks, concrete blocks., rubbles, steel , steel grades, mechanical properties of steel, different applications, floor and roofing tiles, slates, timber, strength of timber ,Engineered wood products, metals, glass for glazing, glass fibres, glass wool, bituminous materials, binder properties, binder mixtures, asphalt mixture.

**Module3:** **(6 Lectures)**

Composite Materials: RCC, FRC, steel/concrete composite bridge decks, fibre reinforced plastics structural insulated panels.
Comparison of Different Materials, Introduction, comparison of strengths of various materials, comparison for environmental impact, health and safety.

**Module 4:** **(6 Lectures)**

New Techniques in Constructions—Introduction,3D printing, photo catalytic admixture, self-healing concrete, zero cement concrete ,hemp lime, wood-glass epoxy composites, bamboo.

**Module 5:** **(8 Lectures)**

Material Testing ,Machines And Equipment Requirements---Necessity of material testing, various testing methods, destructive tests, classification of destructive tests---static, impact and cyclic testing,
non-destructive testing—its classification ,visual inspection, penetration test, magnetic detection, ultrasonic test, radiography test and spark test. Types of testing machines, UTM and CTM, force and displacement controlled machines, loading frames. Hardness testing machines, fracture tests.

**Recommended Books:**

- Deodhar S.V. (1990) Civil Engineering Materials' Allied Publishers, N. Delhi.
- RangwalaS.C. (1983)Civil Engineering Materials', DhanpatRai and Sons, N. Delhi.

**References:**

- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.

**Course Outcomes:** The required course for emphasis in development engineering will help students

CO1: To develop skill to construct strong and durable structures by applying knowledge of material science.
CO2: To make the students aware of quality assurance and control in their real life as a professional.
CO3: To propose suitable material in adverse conditions

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# BTCVPE506 H. Construction Economics & Finance

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1** **(8 Lectures)**

Engineering Economics, Time Value of Money, Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis

**Module 2** **(8 Lectures)**

Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, |Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios

**Module 3** **(6 Lectures)**

Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes

**Module 4** **(8 Lectures)**

Financial Management, Introduction, Charts of Accounts, Balance Sheet, Financial Ratios, Working Capital Management, Budgeting and budgetary control, Performance budgeting. Profit & Loss, statement, Ratio analysis, Appraisal through financial statements, International finance forward

**Module 5** **(6 Lectures)**

PPP in Projects Public Private Participation in Projects- PPP Models, BOOT, BOT, Joint Ventures, BOOT, BOT, Annuity, DBFO, External Commercial Borrowings, International Finance, FIDIC.

**Text Books**


- Blank, L.T., and Tarquin, A. J., (1988). *Engineering Economy*, Mc-Graw Hill Book Co.
- Collier C. and Gla Gola C. (1998). *Engineering Economics & Cost Analysis*, Addison Wesley Education Publishers,
- Patel, B. M., (2000). *Project management- strategic Financial Planning, Evaluation and Control*, Vikas Publishing House Pvt. Ltd. New Delhi,
- Shrivastava, U. K., (2000). *Construction Planning and Management*, Galgotia Publications Pvt. Ltd. New Delhi.


**References**


- Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
- Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition.
- Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
- Brigham, E.F. (1978). Fundamentals of Financial Management, the Dryden Press, Hinsdale, Illinios,
- Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management, D.C. Heath & Co.
- Walker, E.W. (1974). Essentials of Financial Management, Prentice Hall of India Private Limited, New Delhi.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Adopt as per principles of economics and financing
CO2: Analyze available alternatives and propose best suitable among them
CO3: Apply various models of financial management and accounting

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# BTCVES507 Software Applications in Civil Engineering

**Teaching Scheme:** (2 Lectures) hours/week

## Course Contents

**Module 1:** **(5 Lectures)**

Importance and need of software for modeling, analysis and design in Civil Engineering field, Advantages and limitations of software, causes for errors, validation of software results. Failures due to errors in modeling, data entry and interpretation of software results.

**Module 2:** **(5 Lectures)**

Determination of Bending Moment Diagram, Deflections for different loading conditions for a Simply Supported Beam and Cantilever Beam. Determination of fixed end moments for different loading conditions of a fixed beam. Calculation of Influence line diagrams at any section of a Simply Supported Beam.

**Module 3:** **(5 Lectures)**

Application of problems in Hydraulics such as Hardy cross method in the Analysis of pipe network, Computation of water surface profiles in open channel flows. Estimation of Settlement of foundations in Cohesive Soil, Stability Analysis of Slopes. Estimation Earth Pressures in Cohesive and Cohesionless soils.

**Module 4:** **(5 Lectures)**

Application of problems in Environmental engg., Transportation Engg. Design of Slabs using I.S. Code method. Analysis and Design of Beams by using Limit state method. Design of columns subjected to axial load and Uni-axial Moment. Design of Isolated Footing. Design of rolled steel columns, built up columns, Beams and built-up Beams.

**Module 5:** **(4 Lectures)**

Software application in various disciplines of Civil Engineering: Learning and practice of any one software: from at least any 4 domain from 14 domain

1. Drafting and drawing: AutoCAD,
2. building information modelling:
3. Numerical Analysis and Mathematical operations:
4. Structural Analysis and Design:
5. Finite Element Analysis:
6. Project Management: MS Project
7. Geotechnical Engineering:
8. Quantity Surveying:
9. Environmental Engineering:
10. Remote Sensing and Geographical Information System: QGIS,
11. Transportation Engineering:
12. Hydraulics and Water Resources Engineering:
13. Different Open-source software used for specific problems
14. MS Excel: Conduct concrete mix design for M40 grade concrete. or any exercise of Civil Engineering domain.

(Any open source softwares such as Auto CAD, MS Project, QGIS may be used for above purpose and along with that other appropriate softwares can be used for the same.)

**Text Books**

- Computer aided design, software and analytical tools by C.S. Krishnamoorthy & S. Rajesh.
- Computer applications in Civil Engineering by S.K. Parikh.
- Computer aided design in Reinforced concrete by V.L. Shah.

**Reference Books**

- http://www.stepinau.com/offline/Civil/4-1/COMPUTER%20APPLICATIONS%20IN%20CIVIL%20%20ENGINEERING/COMPUTER%20APPLICATIONS%20IN%20CIVIL%20%20ENGINEERING.html#.YrANZXZBxQI
- https://www.inspirenignite.com/mh/ce-c507-software-applications-in-civil-engineering-syllabus-for-ce-6th-sem-2018-pattern-mumbai-university/

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand & Analyse civil engineering softwares

CO2: Use applications of various softwares in specialized works of civil engineering

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## BTCVL508 SDD of Steel Structures Lab

**Practical:** 2 Hours / Week

Term work shall consist of detailed analytical report for structural design and drawing of any one of the following steel structures from Group A and B. Student may use IS 800 1984 or 2007.

**Group A**

1) Industrial Shed: Roof Truss with Necessary Bracing System, Purlins, Column and Column Bases
2) Industrial Shed: With Portal or Gable Frames of Solid or Open Web Sections with Necessary Bracing System, Purlins, Column and Column Bases
3) Industrial Shed: Gantry Girder, Columns with Necessary Bracing System, Purlins, Column and Column Bases
4) G + 3 Building Structure

**Group B**

1) Foot Bridge: Analysis using Influence lines for Main Truss, Cross Beams, Raker, and Joint Details
2) Plate Girder: Analysis and Design of Rivetted or Welded Plate Girder.
3) Elevated Water Tank: Analysis and Design of Staging and Tank Body.
4) Steel Chimneys

**Course Outcomes:** on completion of the course, student will be able to

CO1: simulate a practical design requirement in to a theoretical statement to solve mathematically to arrive at a safe economical and realistic feasible solution that can be executed.

## BTCVL509 Geotechnical Engineering Lab

**Practical:** 2 hours / week

Term work shall consist of performance of at least seven experiments from the following mentioned list of experiments.

1) Specific gravity determination of coarse and fine grained soil
2) Particle size distribution-Mechanical sieve analysis, wet sieve analysis
3) Determination of Atterberg's consistency limit
4) Permeability- Determination of coefficient of permeability
5) Field density determination
6) Direct shear box test
7) Procter compaction test
8) Tri-axial test
9) Unconfined compression test
10) One dimensional consolidation test

**Course Outcomes:** On completion of the course, the students will able to:

CO1: Determine different engineering properties of soil.

CO2: Identify and classify soils based on standard geotechnical engineering practices.

CO3: Perform Laboratory oratory compaction and in-place density tests.

CO4: Perform and interpret direct shear tests and estimate shear strength parameters.

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## BTCVL 510 Concrete Technology Laboratory

**Practical:** 2 Hours / Week

Term work shall consist of performing minimum five experimental sets from the list below.

1) Testing of Cement: Consistency, Fineness, Setting Time, Specific Gravity,
2) Soundness and Strength Test for Cement
3) Testing of Aggregates: Specific Gravity, Sieve Analysis, Bulking of Fine Aggregate, Flakiness Index, Elongation Index and Percentage Elongation
4) Placement Tests on Concrete: Workability Tests: Slump, Compaction,
5) Strength Tests on Concrete: Compression, Flexure, Split & Tensile Test,
5) Effects of Admixture: Accelerator, Retarder, Super Plasticizer,
6) Exercise and verification of Concrete Mix Design,
7) Non-destructive Testing for Concrete.

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## Evaluation of (BTCVP410) Field Training/Internship/Industrial Training

Evaluation of industrial training undergone by students in Summer Vacation after Semester IV. A neat detailed report on activities carried out during training has to be submitted, along with a presentation to evaluate the training work.

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# Detailed Syllabus

## *Dr. Babasaheb Ambedkar Technological University, Lonere*

## Teaching & Evaluation Scheme for Third Year B Tech Civil Engg.

| Semester- VI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 14 | BTCVC601 | Design of RC Structures | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 15 | BTCVC602 | Foundation Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 16 | BTCVC603 | Transportation Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC 2 | BTCVPE604 | K. Industrial Waste Treatment<br>L. Managerial Techniques<br>M. Open Channel Flow<br>N. Water Power Engineering<br>O. Ground Improvement Techniques<br>P. Structural Audit<br>Q. Intelligent Transportation Systems<br>R. Plastic Analysis of Structures<br>S. Numerical Methods in Civil Engg.<br>T. Engineering Management | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC 1 | BTCVOE605 | L. Environmental Impact Assessment<br>M. Basic Human Rights<br>N. Business Communication and Presentation Skills<br>O. Composite Materials<br>P. Experimental Stress Analysis<br>Q. Python Programming<br>R. Operation Research<br>S. Applications of Remote Sensing and Geographic Information Systems<br>T. Civionics: Instrumentation & Sensor Technologies for Civil Engineering<br>U. Planning for Sustainable Development<br>V. Development Engineering | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC4 | BTHM606 | Indian Constitution | 2 | - | - | 50 | - | - | 50 | Audit |
| LC 10 | BTCVL607 | SDD of RC Structures Lab. | - | - | 2 | 20 | - | 30 | 50 | 1 |
| LC 11 | BTCVL608 | Transportation Engineering Lab | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Project | BTCVM609 | Mini Project | - | - | 2 | 20 | - | 30 | 50 | 1 |
| Internship | | **Mandatory (BTCVP610)**<br>Field Training/ Internship/Industrial Training<br>(minimum of 4 weeks training in Summer Vacation after Semester VI and appear at examination in Semester VII.) | - | - | - | - | - | - | - | Credits to be evaluated in VII Sem |
| **Total** | | | **17** | **2** | **6** | **210** | **100** | **390** | **700** | **20** |

# BTCVC 601 Design of RC Structures

**Teaching Scheme:** (3 Lectures + 1 Tutorial) hours/week

## Course Contents

**Module 1: Introduction** **(4 Lectures)**

Basic Aspects of Structural Design, Introduction to Design Philosophies, Stress Strain behavior of Materials Working stress method, Ultimate load method and Limit state method, Comparison of Different Philosophies, Factor of Safety, Estimation of Loads.

**Working Stress Method**

**Module 2:** **(8 Lectures)**

Stress block parameters, permissible stresses, balanced, under reinforced and over reinforced section, analysis and design for flexure, shear, analysis and design of singly and doubly reinforced beams. Design of axial and uniaxial eccentric loaded columns, Isolated Column Footings, WSM design requirements as per Annexure B of IS 456:2000

**Limit State Method**

**Module 3: Introduction to LSM** **(10 Lectures)**

Introduction to limit state approach, types and classification of limit states, characteristics strength and characteristics load, load factor, partial safety factors, strain variation diagram, stress variation diagram, serviceability criteria

**Limit State of Collapse in Shear and Bond**

Design for shear: shear failure, types of shear reinforcement, minimum shear reinforcement, design of shear reinforcement

Design for bond: types, factors affecting, resistance, check for development length, detailing of reinforcement

**Module 4: Limit State of Collapse in Flexure** **(16 Lectures)**

**Design of beams:** Analysis and Design: Singly and Doubly Reinforced Beams, Flanged (L and T) sections.

**Design of Slabs:** One-Way and Two-Way Slab: Behavior of slabs, types, support conditions, analysis and design with various conditions Staircases, effective span and load distribution, design of dog- legged and open well stair case.

**Module 5: Limit State of Collapse in Compression** **(10 Lectures)**

**Design of columns, and footings**

Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), construction of Interaction diagrams for uni-axial bending and its application in design, concept of design charts, concept of bi-axial bending, concept of interaction surface, Design of isolated column footing for axial load, and uni-axial bending.

**Text Books**


- IS: 456-2000, IS: 456-1978, Bureau of Indian Standards, New Delhi
- Karve and Shah, “Limit State Theory & Design”, Structures Publications, Pune
- Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
- Sinha and Roy, “Fundamentals of Reinforced Concrete”
- Sinha S.N., “Reinforced Concrete Design, Vol. I, II”, Tata Mc-Graw Hill
- Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
- Mehra H. and V.N. Vazirani, “Limit State Design of Reinforced Concrete Structures”, Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-162-9
- Vazirani V.N. and Ratwani M.M., “Design of Reinforced Concrete Structures”, Khanna Publishers, N. Delhi, ISBN No: 978-81-7409-232-8
- Pillai S Unnikrishna, and Menon Devdas., “Reinforced Concrete Design” Tata Mc-Graw Hill


**Reference Books**


- Punmia B.C., “Reinforced Concrete Design, Vol. I, II”, Laxmi Publications
- Relevant Publications by Bureau of Indian Standards, New Delhi


**Course Outcomes:** On completion of the course, the students will be able to comprehend the various design philosophies used in design of reinforced concrete. Analyze and design the reinforced concrete sections using working stress and limit state method.

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# BTCVC 602 Foundation Engineering

**Teaching Scheme:** (3 Lectures + 1 Tutorial) hours/week

**Course Contents**

**Module 1:** **(8 Lectures)**

**Introduction,** General requirements to be satisfied for satisfactory performance of foundations, Soil exploration: Necessity, Planning, Exploration Methods, Soil Sampling Disturbed and undisturbed, Rock Drilling and Sampling, Core Barrels, Core Boxes, Core Recovery, Field Tests for Bearing Capacity evaluation, Test Procedure & Limitations

**Module 2:** **(10 Lectures)**

**Bearing Capacity Analysis** - Failure Modes, Terzaghi's Analysis, Specialization of Terzaghi's Equations, Skempton Values for Nc, Meyerhof's Analysis, I.S. Code Method of Bearing Capacity Evaluation, Effect of Water Table, Eccentricity of load, Safe Bearing Capacity and Allowable Bearing Pressure, Settlement Analysis: Immediate Settlement - Consolidation Settlement, Differential Settlement, Tolerable Settlement, Angular distortion

**Module 3:** **(10 Lectures)**

**Foundations for Difficult Soils** - Guidelines for Weak and Compressible Soils, Expansive soil, Parameters of Expansive Soils, Collapsible Soils and Corrosive Soils, Causes of Moisture changes in Soils, Effects of Swelling on Buildings, Preventative measures for Expansive Soils, Design of Foundation on Swelling Soils, Ground Improvement Methods: for general considerations, for Cohesive Soils, for Cohesionless Soils,

**Shallow Foundations**: Assumptions & Limitations of Rigid Design Analysis, Safe Bearing Pressure, Settlement of Footings, Design of isolated, Combined, Strap Footing (Rigid analysis), Raft Foundation (Elastic Analysis), I. S. Code of Practice for Design of Raft Foundation

**Module 4:** **(10 Lectures)**

**Deep foundations:** Pile Foundation: Classification, Pile Driving, Load Carrying Capacity of Piles, Single Pile Capacity, Dynamic Formulae, Static Formulae, Pile Load Tests, Penetration Tests, Negative skin Friction, Under Reamed Piles, Group Action of Piles,
**Caissons Foundations:** Box, Pneumatic, Open Caissons, Forces, Grip Length, Well Sinking, Practical Difficulties And Remedial Measures
**Sheet Piles**: Classification, Design of Cantilever Sheet Pile in Cohesionless and Cohesive soils. Design of Anchored Sheet Pile by Free Earth Support Method, Cellular Cofferdams: Types, Cell Fill Stability Considerations

**Module 5:** **(10 Lectures)**

**Slope Stability:** Different Definitions of Factors of Safety, Types of Slope Failures, Stability of an Infinite Slope of Cohesionless Soils, Stability Analysis of an Infinite Slope of Cohesive Soils, Stability of Finite Slopes- Slip Circle Method, Semi Graphical and Graphical Methods, Friction Circle Method, Stability Number: Concept and its use

**Text Books**

- Kasamalkar, B.J., "Foundation Engineering", Pittsburgh vintage Grand Prix
- Murthy V.N.S., "Soil Mechanics and Foundation Engineering", CRC Press 2002
- Arora K.R., "Soil Mechanics and Foundation Engineering", Standard publication 2009
- Punmia B. C., "Soil Mechanics And Foundation Engineering", Laxmi publication 16th 2017
- Nayak N.V., "Foundation Design Manual", DhanpatRai And Sons
- Brahma S.P., "Foundation Engineering", Tata McGraw-Hill 5th Edition
- Braja Das, "Principles of Geotechnical Engineering", Engage Learning 9th edition
- Bowles J.E., "Foundation analysis & Design", McGraw-Hill Higher Education 5th edition

**References Books**

- Teng W.C., "Foundation Design", Prentice-Hall Inc
- Tomlinson M.J., "Foundation Design & Construction", Prentice-Hall; 7th edition
- Lee, "Sheet Piles" Concrete Publication,1961
- Relevant Publications by Bureau of Indian Standards, New Delhi
- IS 6403:1981, IS 1904:1986, IS 4091:1979

**Course Outcomes:** On completion of the course, the students will be able to:

To predict soil behavior under the application of loads and come up with appropriate solutions to foundation design queries. Analyze the stability of slope by theoretical and graphical methods.
Analyze the results of in-situ tests and transform measurements and associated uncertainties into relevant design parameters. Synthesize the concepts of allowable stress design, appropriate factors of safety, margin of safety, and reliability.

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# BTCVC603 Transportation Engineering

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction** **(6 Lectures)**
Importance of various modes of transportation, Highway Engineering, Road Classification, Developments in RoadConstruction, Highway Planning, Alignment and Surveys

**Module 2:** **(6 Lectures)**
Geometric Design- Cross section elements, Sight distances, Horizontal alignment, Vertical alignment, Intersections, Construction of Pavements, Construction and Maintenance of Drainage, Road Arboriculture

**Module 3:** **(8 Lectures)**
**Highway Materials:** Soil – relevant properties, Various tests, Aggregates – strength, hardness, toughness, soundness, durability, shape, specific gravity, water absorption, Bituminous materials – Bitumen, Tar, and Asphalt – various properties, Design of Bituminous paving mixes-Marshall stability test

**Module 4: Traffic Engineering** **(8 Lectures)**
Traffic Characteristics, Speed, Journey Time and Delays, Vehicle Volume Counts, Origin and Destination Studies, Analysis and Interpretation of Survey Data, Traffic Operations, Design of Signals and Rotary intersections, Parking Space Design,Highway Lighting, Planning and Administration, Road Markings, Signs
**Road Accidents and Safety:**Classification, Causes, Mitigation and Control Measures, Aspects of Safety in Usage of Roads, Type and Design of anti-crash barriers, Introduction to Intelligent Transport Systems (ITS).

**Module 5: Pavement Design** **(8 Lectures)**
Basic Principles, Methods for different Types of Pavements, Design of flexible pavement using IRC: 37- 2012, Design of rigid pavement using IRC: 58-2011
**Other modes of Transport**
Introduction to Railways, Airways, Waterways, Pipeline Transportation, Classification, Requirements, Comparative Studies

**Text Books**


- Khanna and Justo, “Highway Engineering”, Nemchand& Bros., Roorkee
- Khanna S.K., “Highway Engineering”,
- Arora N. L., “Transportation Engineering”
- Bindra and Arora, “Highway Engineering”, Standard Publishers
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, VolIKhanna Publishers, N. Delhi
- Vazirani V.N. and Chandola S.P., “Transportation Engineering”, Vol II Khanna Publishers, N. Delhi ISBN NO: N/A
- Shahani P.B, “Road Techniques” Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-197-1 PRICE 149/-
- Kadiyali L.R, “Traffic Engineering and Transport Planning”, Khanna Publishers, N. Delhi, ISBN NO:978-81-7409-220-X


**Reference Books**


- Garber, N.J. and Hoel, L.A., “Traffic and Highway Engineering”, West Publishing Company, New York
- Jones, J.H., “Geometric Design of Modern Highways’, E & FN SPON Ltd., London.
- Khistry, C.J., “Transportation Engineering – An Introduction’, Prentice Hall of India Ltd.
- Agor R., “Surface Transportation (Railways and Highways)”,Khanna Publishers, N. Delhi ISBN NO: 978-81-7409-273-1


**CO:** On completion of the course, the students will be able to:

Comprehend various types of transportation systems and their history of the development Comprehend to various types of pavements
Design the pavements by considering various aspects associated with traffic safety measures.

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# BTCVPE 604A Industrial Waste Treatment

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction** **(8 Lectures)**

Water use in industry, Industrial water quality requirements, Deterioration of water quality, Classification and characterization of Industrial wastewater, Standards of Disposal, Monitoring of wastewater flow, Quality and quantity variations in waste discharge. Liquid wastes from industries – their volumes and characteristics, Effect of disposal into natural water courses, Municipal sewers and on land, River standards and effluent standards. Designated Water Quality Standards, Type of samples-Grab and Composite.

**Module 2: Treatment objectives and strategies** **(6 Lectures)**

Waste Volume reduction, Strength reduction techniques, Segregation, proportioning, Waste Neutralization methods for acidic and alkaline waste, Equalization tank- online and offline, design problem. Recycle, reuse and byproduct recovery, Concept of Zero liquid Discharge (ZLD)

Treatment objectives and strategies, Treatment techniques for removal of specific pollutants in industrial wastewaters, e.g., oil and grease, cyanide, fluoride, calcium, magnesium, toxic organics, heavy metals, radioactivity.

**Module 3: Manufacturing processes for industries** **(6 Lectures)**

Manufacturing process flow sheets along with sources and characteristics of wastewater for various industries sugar, Distillery, Textile, Tannery, Paper and pulp mill, dairy, Fertilizer, steel mill, power plant etc.

Development of Treatment flowsheets based on characteristics of industrial wastewater. Industrial wastewater Treatment alternatives (Treatment Flowsheets) for above listed industries

Dewatering and disposal of sludge – floatation, vacuum filtration, centrifugation, filter press and membrane filters.

**Module 4: Effluent Treatment Plants** **(8 Lectures)**

Water pollution control act and Environmental Protection act - organizational set up of central and state boards for water pollution control, other important provisions. Classification of river on water use, minimal national standards, socio-economic aspects of water pollution control. Modern Trends in Environmental Engineering, Cleaner Production Technologies, Environmental Bio-Technology, Bioremediation.

Common Effluent Treatment Plants (CETPs): Concept, Need, Objectives, Methodology, grouping of industries, Location, Design, Operation and Maintenance Problems and Economical aspects.

**Module 5: Treatability and environmental aspects** **(8 Lectures)**

Treatability index, Population equivalent, Treatability aspects of raw industrial wastewater with domestic sewage, partially treated industrial wastewater with domestic sewage, Completely treated industrial wastewater with domestic sewage. Stream and effluent standards, Introduction to Water Quality Index (WQI) - simple problems.

**Introduction to environmental impact assessment and environmental audit**.

ISO 14000- introduction, how it is helpful to industries. Importance of Environmental management plan and environmental monitoring plan, Consent to operate and consent to establish

**Text Books**


- Metcalf and Eddy,1995,Wastewater Engineering - Collection, Treatment, Disposal and Reuse, McGraw Hill Pub. Co.,.
- Nelson Leonard Nemerow,2007 Industrial Waste Treatment, Butterworth-Heinemann,
- Nelson Nemerow. Theories and Practices of Industrial waste treatment
- M. N. Rao & Datta. Waste water treatment:
- IS Standard guide for treatment and disposal of various industries.
- Industrial Waste Treatment: Contemporary Practice and Vision for the Future

- Woodard, F., Industrial Waste Treatment Handbook, Butterworth-Heinemann, Woodard & Curran
- J.D. Edwards, Industrial Wastewater Treatment CRC Press
- Government of India Publication, "Water Supply and Treatment Manual"
- Publications by renowned organizations such as WHO, NEERI, MERI, MPCB, CWPRS, etc.
- Hammer M.J., "Water and Waste Water Technology", PHI Private Limited
- Peavy and Rowe, Environmental Engineering , TMH.
- Numersorn, N.L., Liquid Waste from Industry – Theories, Practice and Treatment, Addison-Wesley,


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Identify and analyze the characteristics of industrial wastewater

CO2: Describe pollution effects of disposal of industrial effluent.

CO3: Identify and design treatment options for industrial handling industrial liquid waste

CO4: Formulate environmental management plan

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## BTCVPE 604 B. Managerial Techniques

**Teaching Scheme**:(3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction to Managerial Techniques** **(Lectures 06)**

Introduction, Evolution of Managerial techniques, Managerial aspects, management characteristics, Essentials of Managerial Techniques

**Module 2: Process Control Techniques in Management** **(Lectures 08)**

Quality- Improvement Programs, Starting a Quality Improvement Program, Experimental Designs for Quality improvement, Quality Control - Statistical process control: concepts of stable industrial processes, Systematic variation, random variation, Control Charts for Measurements, Control Charts for Attributes, Tolerance Limits, Acceptance Sampling

**Module 3: Method Study and Work Study and Motion Study** **(Lectures 08)**

**Method Study:** Analysis of Operations, job work, systems involving man and machines. Schematic methods, charts and other aids for analysis
**Work Study:** Method of work measurement, stopwatch study; PMTS; work sampling, setting of time standards.
**Motion Study:** Principles of motion economy and work center design

**Module 4: Technology based Managerial Techniques** **(Lectures 08)**

Introduction, Need of Technological advancements in management, MIS, Resources Management using softwares, Planning softwares, BIM, MSP, Primavera, Advantages, Applications

**Module 5: Introduction to Six Sigma Technique** **(Lectures 06)**

Introduction, Concept, Tools, DMAIC, DMADV, Justifying six sigma, Readiness of six sigma, Advantages, Applications

**Text Books:**


- Jain P. L. (2001) "Quality Control and Total Quality Management", Mc-Graw Hill Book Co.,New Delhi
- Breu G.(2002) "Six Sigma for Managers", Mc-Graw Hill Book Co., New Delhi
- Arora P. N., Arora S., Arora S. Arora A.(2007) "Comprehensive Statistical methods", S Chand Publishing, New Delhi
- Jhamb L. C. (2000) "Work Study & Ergonomics" Everest Publishing House, Pune


**References:**


- IS: 15883 (Part I): 2008 "Construction Project Management" BIS, New Delhi 2008
- Munro R. A. and Ramu G. (2012) "The certified six sigma green belt Handbook" American Society of Quality,


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Inculcate various managerial techniques in practices
CO2: Analyze process control tools and techniques to improve the outcome
CO3: Adopt modern technological advancements to suit the project characteristics, at large.

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# BTCVPE604C Open Channel Flow

**Teaching Scheme**: 3 Hours /week

**Course Contents**

**Module 1: Open Channel Flow** **(08 Lectures)**
Introduction, difference between pipe flow and open channel flow, types of open channels, types of flows in open channel, geometric elements, velocity distribution, measurement of velocity-(pitot lube, current meter), Discharge through open channel.

**Module 2: Steady and Uniform flow** **(08 Lectures)**
Chezy's & Manning's formula, Roughosity coefficient, uniform flow computations, hydraulically efficient section considerations for rectangular, triangular, trapezoidal, circular sections

**Module 3: Specific energy** **(06 Lectures)**
Specific energy: definition & diagram, concept of critical, sub-critical, super-critical flow, specific force, specific discharge derivation of relationships and numerical computations

**Module 4:** **(08 Lectures)**
**Gradually varied flow**
Definition, classification of channel Slopes, Back water curve and its length, Afflux, dynamic equation of G.V.F. (Assumption and derivation), classification of G.V.F. profiles-examples, direct step method of computation of G.V.F. profiles
**Rapidly varied flow**
Definition, examples, hydraulic jump- phenomenon, relation of conjugate depths, loss of energy, parameters, uses, types of hydraulic jump

**Module 5: weir & spillway** **(06 Lectures)**
Introduction, Classification, Discharge over various notches and weirs (Rectangular, Triangular, Stepped, Broad-Crested, Narrow crested), Velocity of Approach, Cipolletti Weir, calibration of weir, time of emptying tank with weir, profile of ogee spillway, flow below gates, Most economical sections in channels: Rectangular, Trapezoidal, Circular.

**Text Books:**

- Modi P. N. and Seth S. M.(2017) "Fluid Mechanics – Hydraulic & Hyd. Mechanics" Standard Book HouseN. Delhi
- Bansal R.K. (2017) "Fluid Mechanics", Laxmi Publications, N. Delhi
- Garde R. J.(2011) "Fluid Mechanics through Problems", New Age Publications, Hyderabad
- Jain A. K. (2003) "Fluid Mechanics", Khanna Publications, 2003, Delhi
- Rangaraju K. G. (2001) "Open Channel flow", Tata McGraw-Hill Pub. Co., Delhi
- Subramanian K. (2015) "Fluid Mechanics through Problems" Tata McGraw-Hill Pub. Co., Delhi


**Reference Books**

- Streeter V. (2017) "Fluid Mechanics" McGraw-Hill International Book Co., 3rd edition, Auckland
- Chaw V. T. (2009) "Flow in Open Channel", McGraw-Hill International Book Co., Auckland


**Course Outcomes:** On completion of the course, the students will be able to:

1. Understand phenomena of hydraulic jump.
2. Compute Discharge through various open channel sections.
3. Discuss different applications of gradually varied flow profiles.

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# BTCVPE 604D Water Power Engineering

**Teaching Schemes: (**Lectures: 3) Hours/Week

**Course Contents**

**Module 1** **(8 Lectures)**

Introduction, Sources of Energy, Types of Power Plants, Choice of Type of Generation, Components of Water Project, Types of Hydro Power Schemes, General Layouts, Estimation of Hydro Power, Nature of Demand: Load Curve, Load Duration Curves, Load Factor, Firm Power Secondary Power

**Module 2** **(8 Lectures)**

Intake, Types, Hydraulics of Intake, Trash Rack Transition, Conduits: Types, Economic Section, Power Canals, Pen-stock Types, Hydraulic Design, Anchor Blocks

Tunnels: Classification, Location, Hydraulic Design, Tunnel Linings

Surge Tank: Functions, Behavior, Location, Types of Surge Tanks, Basic Design Criteria of Simple Surge Tank, Forebay

**Module 3** **(6 Lectures)**

General Arrangements of Power Station, Power House, Sub-structure and super structure Under Ground Power Station: Necessity, Types, Development and Economics

**Module 4** **(6 Lectures)**

Turbines: Classification, Characteristics of Different Types, Choice of Specific Type, Turbine Setting and Cavitation, Tail Race: Functions, Types, Channel and Tunnel Draft Tubes

**Module 5** **(6 Lectures)**

Pumped Storage Plants, Purpose, General Layout, Types, Typical Arrangements of the Upper Reservoirs, Economics of Pumped Storage Plants**,** Tidal Power Stations: Necessity, Advantages, Classification, Limitations

**Text Books**

- Dandekar and Sharma, “Water Power Engineering”, Vikas Pub. House Pvt. Ltd.
- Bhattacharya P. K., “Water Power Engineering”, Khanna Publications, New Delhi
- Deshmukh M. M. “Water Power Engineering”, Dhanapatrai and Sons N. Delhi

**References**

- Creager and Justin, “Hydro – Electric Hand Book”
- Brown G., “Hydro-electric Engineering Practice”, Vol. I to III
- Mosonvi, “Water Power Development”

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Identify potential energy sources and adapt as per the requirement

CO2: inculcate basics of electricity generation and power plants

CO3: propose suitable energy source for running a project optimistically.

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# BTCVPE604E Ground Improvement Techniques

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(8 Lectures)**

Dewatering: Introduction – Scope and necessity of ground improvement in Geotechnical engineering basic concepts. Drainage – Ground Water lowering by well points, deep wells, vacuum and electroosmotic methods. Stabilization by thermal and freezing techniques - Applications.

**Module 2:** **(8 Lectures)**

Compaction and Sand Drains: Insitu compaction of granular and cohesive soils, Shallow and Deep compaction methods – Sand piles – Concept, design, factors influencing compaction. Blasting and dynamic consolidation – Preloading with sand drains, fabric drains, wick drains etc. – Theories of sand drain – design and relative merits of various methods – Case studies.

**Module 3:** **(6 Lectures)**

Stone Column, Lime Piles and Soil Nailing: Stone column, lime piles – Functions – Methods of installation– design, estimation of load carrying capacity and settlement. Root piles and soil nailing – methods of installation – Design and Applications - Soil liquefaction mitigation methods - case studies.

**Module 4** **(6 Lectures)**

Earth Reinforcement: Earth reinforcement – Principles and basic mechanism of reinforced earth, simple design: Synthetic and natural fiber-based Geotextiles and their applications. Filtration, drainage, separation, erosion control – case studies.

**Module 5** **(8 Lectures)**

Grouting: Grouting – Types of grout – Suspension and solution grouts – Basic requirements of grout. Grouting equipment – injection methods – jet grouting – grout monitoring – Electro – Chemical stabilization – Stabilization with cement, lime - Stabilization of expansive clays – case studies.

**Text Books**


- Pappala, A.J., Huang,J., Han, J., and Hoyos, L.R., "Ground Improvement and Geosynthetics; Geotechnical special publication No.207, Geo Institute, ASCE, 2010
- Cox, B.R., and Grifiths S.C., "Practical Recommendation for Evaluation and mitigation of Soil Liquefaction" in Arkansas, (Project Report), 2010.
- Day, R.W., "Foundation Engineering Handbook, McGraw – Hill Companies, Inc. 2006.
- Rowe, R.K., "Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
- Das, B.M., "Principles of Foundation Engineering, Fourth Edition, PWS Publishing, 1999.


**References Books**


- Moseley, M.P., "Ground Treatment, Blackie Academic and Professionals, 1998.
- Koerner, R.M., "Designing with Geosynthetics, Third Edition, Prentice Hall 1997.
- Hehn, R.W., "Practical Guide to Grouting of Underground Structures, ASCE, 1996.
- Jewell, R.A., "Soil Reinforcement with Geotextiles, CIRIA, London, 1996.
- Koerner, R.M. and Welsh, J.P., "Construction and Geotechnical Engineering using Synthetic Fabrics, John Wiley, 1990.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: To identify and evaluate the deficiencies if any in the deposits of the given project area.

CO2: Capable of providing alternative methods to improve its quality so that the structures built on it will be stable and serve the intended purpose.

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# BTCVPE 604F Structural Audit

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(08 Lectures)**

Introduction to Structural Audit, Objectives, Bye-laws, Importance, Various Stages involved, Visual inspection: scope, coverage, limitations, Factors to be keenly observed. Aspects of audit of Masonry buildings, RC frame buildings, Steel Structures.

**Module 2:** **(06 Lectures)**

Causes and types of deterioration in Structures: Permeability of concrete, capillary porosity, air voids, Micro cracks and macro cracks, corrosion of reinforcing bars, sulphate attack, alkali silica reaction.

Causes of deterioration in Steel Structures: corrosion, Uniform deterioration, pitting, crevice, galvanic, laminar, Erosion, cavitations, fretting, Exfoliation, Stress, causes of defects in connection

**Module 3:** **(08 Lectures)**

Elementary aspects of Non-Destructive Testing, Concrete Strength Assessment: Rebound hammer, Ultrasonic Pulse velocity, Penetration resistance, Pull out test, Chemical test: Carbonation test, Chloride test, Corrosion potential assessment, Fire damage assessment: Differential thermal analysis, X ray diffraction, Structural Integrity and soundness assessment: Radiography, Impact echo test, dynamic testing of structure, Interpretation and evaluation of test results.

**Module 4** **(08 Lectures)**

Strength Evaluation of Existing Structures, Reserve strength, identification of critical sections, structural system and its validation, evaluation of damage in RC structures

**Module 5:** **(06 Lectures)**

Approach to conduct Structural Audits Guidelines of Statutory Bodies, Legal aspects, Responsibility of calling Structural Audit, Scope of Investigation.

Structural Audit Report, Study of sample Structural audit report for up-gradation of existing building, Audit for continuation of usage of old Buildings, Audit for Buildings damaged due to Earthquakes, Fire,

**References**


- Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.


**Outcomes:** Upon completion of the course the students will be able to:

- Gain the knowledge of Bye laws, procedure of Structural audit and study the typical problems in structures.
- Aware of causes and types of deterioration in structures.
- Develop skills for use of various Nondestructive tests required during auditing of structures.
- Strength evaluation of existing structures.
- Acquire knowledge of legal procedure to conduct structural audits.
- Prepare a Structural audit report.

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# BTCVPE 604G Intelligent Transport Systems

**Teaching Scheme:** (3 Lectures) hours/week

## Course Contents

**Module 1: Introduction** **(06 Lectures)**

Definition of intelligent transport system (ITS), History of ITS, Objectives, Benefits, data collection techniques: Detectors, automatic vehicle location, automatic vehicle identification, geographic information system.

**Module 2: Telecommunication in ITS** **(08 Lectures)**

Importance of telecommunication, information Management, Traffic management centers, vehicle roadside communication, vehicle positioning system.

**Module 3: Functional areas** **(08 Lectures)**

Traffic management systems, traveler information system, commercial vehicle operations, vehicle control system, public transportation system, rural transportation system.

**Module 4: User needs and services** **(06 Lectures)**

Travel and traffic management, Public transportation management, electronic payment, commercial vehicle operations, emergency management, advanced vehicle safety systems, information management.

**Module 5: Automated highway systems** **(06 Lectures)**

Vehicles in plantoons, integration of automated highway systems, implementations in developed countries and developing countries.

**Text Books**

Sarkar, P. K. and Jain, A.K., Intelligent Transportation systems. PHI learning pvt.ltd.
Chen P. K., & Miles, J., Recommendations for world road Association (PIARC). Its Hand book

## References


1. M A Chowdhary and A Sadek. Fundamentals of Intelligent Transportation systems planning. Artech House Inc., US, 2003.
2. Bob Williams. Intelligent transportation systems standards. Artech House, London, 2008


**Outcomes:** Upon completion of the course the students will be able to:

- Gain the knowledge Intelligent transport components
- Understand functional areas of ITS
- Management of ITS and correlated systems

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# BTCVPE604H Plastic Analysis of Structures

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(8 Lectures)**

Plasticity in ductile materials, stress-strain for mild steel, elasto-plastic behavior of beam in flexure, shape factor for different cross sections, yield zones, concept of plastic hinge

**Module 2:** **(8 Lectures)**

Collapse loads of determinate and indeterminate structures such as beams and rectangular portal frames, statical and kinematical methods, mechanisms. Bending moment diagram at collapse

**Module 3:** **(6 Lectures)**

Philosophy of Limit State design, requirement of steel for design, Limit State of Strength and Serviceability, partial safety factors, design of laterally supported beams, shear resistance

**Module 4:** **(8 Lectures)**

Secondary design considerations, design of beams with high shear, interaction of bending and shear, interaction of bending and axial force

**Module 5:** **(6 Lectures)**

Design of portal frames, design of corner connection with and without haunches, Consideration of deformations, calculation of deflections for plastically deformed structures

**Text Books:**

- Bureau of Indian Standards, "Handbook for Structural Engineers: Application of Plastic Theory in Design of Steel Structures SP: 6 (6)".
- Bureau of Indian Standards, "IS: 800 Code of Practice for General Construction in Steel"
- Arya A.S. and Ajmani J.L., "Design of Steel Structures", Nemchand& Bros., Roorkee
- Ramchandra, "Design of Steel Structures Vol – II", Standard Book House, Delhi
- Neal B.G., "Plastic Method of Structural Analysis", Chapman & Hall
- Beedle L.S., "Plastic Design of Steel Frames", John Wiley & Sons

**References:**

- Bureau of Indian Standards, "Handbook for Structural Engineers SP 6"
- INSDAG Kolkata, "Teaching Resource for Structural Steel Design"
- "Steel Designers Manual" ELBS

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand modes of structural collapse

CO2: Perform the plastic analysis and design of various determinant and in-determinant structures.

CO3: Adapt plastic theory of design for various structures

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# BTCVPE604I Numerical Methods in Civil Engineering

**Teaching Scheme :**( 3 Lectures) hours/week

**Course Contents**

**Module 1** **(Lectures 8)**

Basis of Computations, Matrix Operations on Computer, Multiplication and Inversion, Solution of Simultaneous Equations, Gauss Elimination Method, Cholesky Decomposition method, Gauss Jordan and Gauss Sceidal Methods

**Module 2** **(Lectures 8)**

Roots of Equation, Trial and Error, Bisection, Secant Iteration, Newton Rapson Method, Solution of Ordinary Differential Equation, Euler's Method, Modified Euler's Method and Runga Kutta Methods.

**Module 3** **(Lectures 08)**

Interpolation with Newton's Divided Differences, Lagrange's Polynomial, Finite Difference Method, Central, Forward and Backward Differences, Least Square Polynomial Approximations Application in Deflection of Determinate Beams, Buckling Load of Long Columns

**Module 4** **(Lectures 04)**

Numerical Integration: Trapezoidal Rule, Simpon's Rules, Gauss Quadrature Rules

**Module 5** **(Lectures 08)**

Statistical Analysis of Experimental Data, Mean, Median, Mode, Deviation, Measures of Dispersion, Least Square Method, Regression Analysis: Linear, Parabolic, Curve Fitting

**Text Books**


- Balaguruswami E., "Numerical Methods", Tata Mc-Graw Hill
- Scheid F, "Numerical Analysis (Schaum's series)", Tata Mc-Graw Hill
- Chapra. S. C. and Canale R. P., "Numerical Methods for Engineers", by, Tata Mc-Graw Hill
- Shantha Kumar M , "Computer Based Numerical Analysis", Khanna Publication
- Grewal B.S. and Grewal J.S., "Numerical Methods in Engineering and Science", Khanna Publication, N. Delhi
- Sastry, S.S., "Introductory Methods of Numerical Analysis", Printice Hall of India, New Delhi


**Reference Books**


- Jain, Aryengon, "Numerical Methods for Scientific and Engineering Applications", Wiley Eastern Publication
- Numerical Recipe , Oxford Publishing
- Manuals for the Commercial Computer Programmes


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# BTCVPE604J Engineering Management

**Teaching Scheme:** 3 hours/week

## Course Contents

**Module 1: Evolution of Management Thought** **(Lectures 06)**

Scientific, human behavior, system approach, introduction to elements of systems – input, output, process restriction, feedback, contingency approach, contributions by Taylor, Frank and Lillion, Gilbreth, Henry Fayol, Elton Mayo, McGregor (theory X and theory Y), H. L. Gantt, Maslo

**Module 2: Functions of Management** **(Lectures 06)**

Planning – nature and purpose of planning, strategies and policies, management by objectives, formal and informal organization, centralization, decentralization, line, line and staff, functional organization, principles of site layout, leading and directing, controlling and coordination (introduction only), communication process, motivation

**Module 3: Decision Making** **(Lectures 06)**

Importance of decision making, steps in decision making, analysis of decision, decision under certainty, uncertainty and decision under risk, criterion of optimism and regret, sensitivity of criteria and decision under conflict, expected monitory value, decision tree, theory of games (dominance pure and mixed strategy

**Module 4: Operations Research & Simulation Studies** **(Lectures 12)**

Linear programming, simple l-p model, simplex method - duality, sensitivity analysis, application of linear programming in transportation and assignment models

**Simulation Studies**

Monte-Carlo simulation, queuing or waiting line theory (simple problems), dynamic programming.

**Module 5: Material management** **(Lectures 06)**

Introduction to emerging optimization techniques Material management – purchasing principles, stores, coding system function, responsibilities, record and accounting. Inventory control – an introduction, inventory cost, EOQ analysis, ABC analysis, safety stocks

**Text Books:**


- Deshpande S. H., 1976, "Operation Research", S Chand Delhi.
- Deshpande A. S., "A Text book of Management"
- Gopal Krishnan, 2015, "Material Management", Sudeshan.
- Taha, 1971, "Operation Research", Pearson.
- Banga and Sharma, 2017, "Engineering Management", Khanna publishing.


**References:**


- Stoner, 2018, "Engineering Management", Pearson education.
- Davar, 1980, "Principles of Management", Progressive corporation Pvt. Limited.
- Koontz, Dounell and Weigrick, 2015, "Essentials of Management", McGraw Hill publishers.
- Kast and Rosinweig, 1973, "Management and Organization", Tata McGraw Hill Publication.
- Wagner, "Operation Research", Wikey Easter Ltd., New Delhi
- Zhamb L.C.,1999, "Quantitative Techniques in Management", Vol. I,
- Miller and Stars, 1960, "Executive Decisions & Operation Research", Prentice Hall of India


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Demonstrate the nuances of management functions.
CO2: Analyze the framework of a business organization.
CO3: Adopt an empirical approach toward business situations.
CO4: Apply various Management techniques.

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# BTCVOE 605A Environmental Impact Assessment

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction** **(8 Lectures)**

The Need for EIA, Indian Policies Requiring EIA, The EIA Cycle and Procedures, Screening, Scoping, Baseline Data, Impact Prediction, Assessment of Alternatives, Delineation of Mitigation Measure and EIA Report, Components of EIA, Roles in the EIA Process. Government of India Ministry of Environment and Forest Notification (2000), List of projects requiring Environmental clearance, Application form, Composition of Expert Committee, Ecological sensitive places, International agreements.

**Module 2: Identifying the Key Issues** **(6 Lectures)**

Key Elements of an Initial Project Description and Scoping, Project Location(s), Land Use Impacts, Consideration of Alternatives, Process selection - Construction Phase, Input Requirements, Wastes and Emissions, Air Emissions, Liquid Effluents, Solid Wastes, Risks to Environment and Human, Health, Socio-Economic Impacts, Ecological Impacts, Global Environmental Issues

**Module 3: EIA Methodologies** **(6 Lectures)**

Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation, Methods-Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods,

**Reviewing the EIA Report**:

Scope, Baseline Conditions, Site and Process alternatives, Public hearing, Construction Stage Impacts, Project Resource Requirements and Related Impacts, Prediction of Environmental Media Quality, Socio-economic Impacts, Ecological Impacts, Occupational Health Impact, Major Hazard/ Risk Assessment, Impact on Transport System

**Module 4: Review of EMP and Monitoring** **(8 Lectures)**

Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, What should be monitored? Monitoring Methods, Who should monitor? Pre-Appraisal and Appraisal.

**Module 5: Case Studies** **(6 Lectures)**

Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Pharmaceutical industry, thermal plant, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Tannery industry.

**Text Books**


- Wathern. P Environmental Impact Assessment- Theory and Practice, Routledge Publishers, London, 2004.
- Rau, J.G. and Wooten, D.C., Environmental Impact Assessment, McGraw Hill Pub. Co., New York, 1996.
- Anjaneyulu. Y and Manickam. V., Environmental Impact Assessment Methodologies, B.S. Publications, Hyderabad, 2007.
- Jain, R.K., Urban, L.V., Stracy, G.S., Environmental Impact Analysis, Van Nostrand Reinhold Co., New York, 1991.
- Barthwal, R. R., Environmental Impact Assessment, New Age International Publishers, 2002


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Identify the environmental attributes to be considered for the EIA study

CO2: Formulate objectives of the EIA studies

CO3: Identify the methodology to prepare rapid EIA

CO4: Prepare EIA reports and environmental management plans

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## BTCVOE605B Basic Human Rights

**Teaching Scheme:**(3 Lectures) hours/week

**Course Contents**

**Module 1: Basic Concepts** **(Lectures 06)**

Individual, group, civil society, state, equality, justice. Human Values, Human rights & Human Duties: Origin, Contribution of American bill of rights, French revolution. Declaration of independence, Rights of citizen, Rightsof working & exploited people

**Module 2: Fundamental Rights and Economic Program** **(Lectures 06)**

Society, religion, culture, and their inter-relationship. Impact of social structure on human behavior, Social Structure and Social Problems: Social and communal conflicts and social harmony, rural poverty, unemployment, bonded labour.

**Module 3: Workers and Human Rights** **(Lectures 08)**

Migrant workers and human rights violations, human rights of mentally and physically challenged. State, Individual liberty, Freedom and democracy.

**NGOs and Human Rights in India**

Land, Water, Forest issues.

**Module 4: Human Rights in Indian Constitution and Law** **(Lectures 08)**

i) The Constitution of India: Preamble; ii) Fundamental rights; iii) Directive principles of state policy; iv) Fundamental duties; v)Some other provisions

**Module 5: UDHR and Indian Constitution** **(Lectures 08)**

Universal declaration of human rights and provisions of India; Constitution and law; National human rights commission and state human rights commission.

**References**

1) Shastry, T. S. N., "India and Human Rights: Reflections", Concept Publishing Company India (P Ltd.), 2005.

2) C. J. Nirmal, "Human Rights in India: Historical, Social and Political Perspectives (Law in India)", Oxford India.

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## BTCVOE605C Business Communication & Presentation Skills

**Teaching Scheme:** (3 Lectures) hours / Week

**Course Contents**

**Module 1: Language for Technical Purpose and Presentation Tools** **(06 Lectures)**

Technical vocabulary, Sentence structures, Computer Aids, Graphical presentations
Drafting Letters, e-Mails, Memos, Notices, Circulars, Schedules.

**Module 2: Project Proposals and Project Reports** **(08 Lectures)**

Abstract, Aims, Background & significance, Design & methods, writing a sample proposal,
Project Report: Types of reports, planning a report, Collection & organization of information, Structure & style, Proof reading etc.

**Module 3: Leadership Skill and Team Building, Working** **(08 Lectures)**

Leadership Skills**:** Leadership quality and styles, Emotional intelligence, Diplomacy and Tact and effective communication, Case studies. Need of team, Effective teams, Group development

**Module 4: Business Meetings** **(08 Lectures)**

Understanding role of meetings, planning meetings, developing meeting agendas, scheduling meetings, Taking notes and publishing minutes

**Module 5: Presentation Skills** **(06 Lectures)**

Use of presentation tools, Presentation, nonverbal techniques, handling questions

**References:**

- Hariharan S. (2010)"Soft Skills" MJP Publishers, Chennai
- Seely S. (2009)"Oxford Guide to Effective Writing and Speaking" Oxford University Press, UK
- Huckin T. N. and Olsen L. A."Technical Writing and Professional Communication for Nonnative Speakers of English"Tata McGraw Hills, UK
- Masters A. & Harold R. W. (2011) Personal Development for Life & Work, Learning India Private Limited.

**Course Outcomes:** On completion of the course, the students will be able to:

- CO1: Inculcate basics of business communication skills & relevant tools.
- CO2: Understand business SOPs and essentials of the same.

- CO3: Adapt modern skills regarding communication, presentation & team working

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## BTCVOE605D Composite Materials

**Teaching Scheme :**( 3 Lectures) hours/week

**Course Contents**

**Module1 Introduction:** **(8Lectures)**
Classifications of Engineering Materials, Concept of composite materials, Matrix materials, Functions of a Matrix, Desired Properties of a Matrix, Polymer Matrix (Thermosets and Thermoplastics), Metal matrix, Ceramic matrix, Carbon Matrix, Glass Matrix etc.

**Module2 Types of Reinforcements/Fibers** **(6Lectures)**
Role and Selection or reinforcement materials, Types of fibres, Glass fibers, Carbon fibers, Aramid fibers , Metal fibers, Alumina fibers, Boron Fibers, Silicon carbide fibers, Quartz and Silica fibers, Multiphase fibers, Whiskers, Flakes etc., Mechanical properties of fibres. Material properties that can be improved by forming a composite material and its engineering potential

**Module3 Various types of composites** **(8 Lectures)**
Classification based on Matrix Material: Organic Matrix composites, Polymer matrix composites (PMC), Carbon matrix Composites or Carbon-Carbon Composites, Metal matrix composites (MMC),

Ceramic matrix composites (CMC); Classification based on reinforcements: Fiber Reinforced Composites, Fiber Reinforced Polymer (FRP) Composites, Laminar Composites, Particulate Composites, Comparison with Metals, Advantages & limitations of Composites

**Module 4 Fabrication methods** **(6Lectures)**
Processing of Composite Materials: Overall considerations, Autoclave curing, Other Manufacturing Processes like filament welding, compression molding, resin-transplant method, pltrusion, pre-peg layer, Fiber-only performs, Combined Fiber-Matrix performs, Manufacturing Techniques: Tooling and Specialty materials, Release agents, Peel plies, release films and fabrics, Bleeder and breather plies, bagging films

**Module 5 Testing of Composites** **(8Lectures)**
Mechanical testing of composites, tensile testing, Compressive testing, Intra-laminar shear testing, Inter-laminar shear testing, Fracture testing etc

**Text Books**

- ASM hand book, Materials characterization, Vol. 10,
- G. Dieter, Mechanical Metallurgy, Mc-Graw Hill
- R.F. Speyer Thermal Analysis of Materials, Marcel Decker
- A.K Bhargava Engineering Materials: Polymers, Ceramics and Composites Prentice Hall India

**Reference Books:**

- Jones, R.M., (2015) “Mechanics of Composite Materials” McGraw Hill Co., New Delhi
- Whitney, Daniel I. M. and Pipes R. B. (1984)“Experimental Mechanics of Fibre Reinforced Composite Materials” Prentice Hall, New Jersey
- Hyer, M.W. (1998)“Stress Analysis of Fibre Reinforced Composite Materials” Mc Graw Hill Co., New Delhi
- Herakovich C. T. (1998)“Mechanics of Fibrous Composites” John Wiley Sons Inc., N. Delhi

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand fundamental knowledge in mechanical analysis
CO2: Understand design of structures made of composite materials.
CO3: Propose suitable materials in relation with the project

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# BTCVOE605E Experimental Stress Analysis

**Teaching Scheme:** 3 Hours /week

**Course Contents**

**Module 1:** **(6 Lectures)**

Introduction to Theory of Elasticity, Assumptions made in strength of materials and theory of Elasticity, Necessary and sufficient conditions for analyzing a structure,

**Module 2:** **(8 Lectures)**

State of stress at a point, Specification of stress at a point-Determination of Normal thrust and Shear stress, Problems on specification of stress at a point.
Concept of Orthogonal Transformation of axes and Problems, Determination of Stress invariants, Determination of Principal Stresses and Planes, Determination of Maximum shear Stresses and their corresponding plane systems, Tresca's criteria.

**Module 3:** **(6 Lectures)**

Derivation of Equilibrium conditions in three dimensions, Concept of Strain at a point, Determination of Normal and Shear Strain, Generalized Hooke's Law and problems on interrelationship between stress and Strain in three dimensions.

**Module 4:** **(8Lectures)**

Formulation of a stress analysis problem using the necessary and sufficient conditions in three dimensions and modifying the same to identify the unknowns in plane cases, Derivation of Airy's Stress function using the boundary conditions, equilibrium equations, compatibility conditions.

**Module 5:** **(8 Lectures)**

Solution to stress analysis problems, Torsion of circular shafts, Strain Measurement- Types of Strain gauges, Characteristics of ideal strain gauges, gauge factor, Strain gauge Rosettes, Introduction to two dimensional photo elasticity, Stress-Optic law.

**References:**


- Timoshenko S. P. and Goodier J. N. (2010) Theory of Elasticity, 3rd Ed., McGraw Hill**.,** N. Delhi
- NPTEL Course on Experimental Stress Analysis, https://nptel.ac.in/courses/112/106/112106068/
- Swayam Course on Experimental Stress Analysis by Prof. K. Ramesh, IIT Madras, https://swayam.gov.in/nd1_noc20_me02/preview


**Course Outcomes:**On completion of the course, the students will be able to

1. Apply principles of elasticity theory to determine stresses and strains.
2. Apply theory of elasticity and formulate plane stress and plane strain problems.
3. Formulate the stress analysis problems using elasticity theory.
4. Apply experimental techniques to solve field problems.

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# BTCVOE605F Python Programming

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Basics of C** **(8 Lectures)**

Editing, Compiling, Error Checking, executing, testing and debugging of programs. IDE commands. Eclipse for C Program development, Flowcharts, Algorithms, Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation.

**Module 2: Algorithmic Problem Solving** **(7 Lectures)**

Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, and guess an integer number in a range, Towers of Hanoi.

**Module 3: Data, Expressions, Statements** **(7 Lectures)**

Python interpreter and interactive mode; values and types: int, float, Boolean, string, and list; variables, expressions, statements, tuple assignment, precede operators comments ;modules and functions, function definition and use, flow of execution, parameters and arguments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

**Module 4: Control Flow, Functions** **(8 Lectures)**

Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope,.

Functions: Function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

**Module 5: Lists, Tuples, Dictionaries** **(6 Lectures)**

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing – list comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

**Files, Modules, Packages**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file.

**Text Books**


- Martin C. Brown, Python: The Complete Reference.
- R. Nageswara Rao Core Python Programming.
- Kenneth A. Lambert, Introduction to Python.
- Vittorio Lora, Python for Civil and Structural Engineers.
- https://www.pythonforengineers.com/.
- W. Chun, Core Python Programming, Pearson.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Experience with an interpreted Language.

CO2: To build software for real needs

CO3: Prior Introduction to testing software

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# BTCVOE605G Operation Research

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction to Operation Research** **(06 Lectures)**

Introduction, History of operation research, Stages of development operation research, OR tools and techniques, Applications of Operation research, Modelling approach, Defining the problem and gathering data, Formulating a mathematical model, Deriving solutions from the model, Testing the model, Preparing to apply the model, Implementation, Limitations of operation research.

**Module 2: Linear Programming and graphical analysis** **(06 Lectures)**

Introduction to linear programming, Assumptions, Linear programming model, Formulation with different types of constraints, Graphical analysis of linear programming, Graphical linear programming solution.

**Module 3: Simplex method and Duality method** **(08 Lectures)**

Simplex Method: Introduction, Basics of simplex method, Simplex method computation, Algebra of the simplex method, Simplex method in tabular form, Simplex method in matrix form, Tie breaking in the simplex method, Adapting to other model forms, Post optimality analysis.
Duality: Introduction, Economic interpretation of duality, Primal–Dual relationships, Duality problems, Duality results, Dual problem and the simplex table, Role of duality theory in sensitivity analysis, Sensitivity analysis.

**Module 4: Assignment Problems** **(08 Lectures)**

Introduction, Assignment problems, Unbalanced assignment problem, Balanced assignment problem, Infeasible assignment problem, Minimization & Maximization, special algorithm for the assignment problem.

**Module 5: Transportation Problems** **(08 Lectures)**

Introduction, Methods for initial basic feasible solution, balanced transportation problem, Minimization & Maximization, Vogel's approximation method, Optimization, Modified distribution method, Streamlined simplex method for the transportation problem, Dual of the transportation problem.

**Text Books**

- Gupta P. K., Hira D. S. "Operation Research" S Chand Publishers, 2006
- Taha H. A. "Operation Research", Pearson, 2014
- G.Srinivasan "Operations Research:Principles and Applications", PHI Learning Pvt. Ltd.
- Ishizika A., Nemery P., "Multi-criteria Decision Analysis", John Wiley & Sons, 2013

**References:**

- Vohra, N. D. "Operations Research", Tata McGraw Hill Co., New Delhi.
- Wagner, "Operation Research", Wiley Eastern Ltd., New Delhi
- Zhamb L.C., "Quantitative Techniques in Management", Vol. I,
- Miller and Stars, "Executive Decisions & Operation Research", Prentice Hall of India
- Hillier and Liberman "Operations Research: Concepts and Cases" McGraw-Hill

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Adopt Operation Research tools and techniques while working in industry

CO2: Analyze the problem statement with computational approach

CO3: Apply various models to propose suitable outcomes.

CO4: Apply various decision-making tools to propose best suitable alternatives, at large.

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## BTCVOE605H Applications of Remote Sensing and GIS

**Teaching scheme**: (3 Lectures) hour/week

### Course contents

**Module 1: Remote Sensing** **(Lectures 8)**

Basic concepts in remote sensing, information and data collection, Remote Sensing process advantages & limitations, necessity, importance and use; basic laws of electromagnetic radiation, Atmospheric effects on radiation, Interaction of EM energy with matter

**Module 2: Applications of remote sensing** **(Lectures 8)**

Resolution in remote sensing, Satellite remote sensing, Problems confronting in remote sensing system. Ideal and real remote sensing systems. Applications of remote sensing in civil engineering.

**Module 3: Visual Interpretation of Satellite Images** **(Lectures 8)**

Elements of interpretation, Interpretation keys characteristics of digital satellite image, image enhancement, filtering, classification, integration of GIS and remote sensing, urban applications- integration of GIS and remote sensing water resources, urban analysis and watershed management.

**Module 4: Geographical Information System** & **Geo-referencing** **(Lectures 8)**

Introduction to Geographic Information System. Applications of GIS such as visibility analysis, slope analysis, watershed analysis & preparation of thematic maps. Limitations of GIS.

**Geo-referencing;** GIS data, spatial (raster & vector) & a spatial data. Introduction to vector and raster data analysis such as network analysis, overlay analysis etc. for vector, DEM, Management of a spatial data.

**Module 5: Coordinate Systems and Projections** **(Lectures 4)**

Geographic coordinate system: approximation of the earth, datum; map projections: types of map projections, map projection parameters, commonly used map projections, projected coordinate systems.

**Text Book:**


- Chandra A. M. and Ghosh S. K., 2015, "Remote sensing and Geographical Information System", Narosa Publishing House.
- Gopi S., Sathikumar R. and Madhu N., 2017, "Advanced Surveying -Total Station, GIS and Remote Sensing", Pearson publication.
- Lilles and Kiefer," Remote sensing & image interpretation", John Wiley Pub.
- Jensen J. R., "Remote sensing of the environment – An earth resources perspective" 2nd edition Pearson Education.
- Reddy M. A., 2001, "Textbook of Remote sensing and Geographical information system", B.S. Publications, Hyderabad.


**References:**


- Burragh P.A. and Mc Donnnell R. A., 2016, "Principals of Geo physical Information system", Oxford Publications, 2004.
- Kumar A., 2016, "Basics of remote sensing & GIS", Laxmi publications.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Acquire knowledge demonstrating of earth resources management using remote sensing.
CO2: Gain skills in storing, managing digital data for planning and development.
CO3: Acquire skills in advance software's deals with remote sensing data for utilization.

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## BTCVOE605I Civionics: Instrumentation & Sensor Technologies for Civil Engg.

**Teaching scheme**: (3 Lectures) hour/week

### Course contents

**Module 1: Instrumentation** **(Lectures 8)**

Piezometer: measure pore water pressure open standpipe vibrating wire (push in). Pneumatic Inclinometers: measure tilts Strain gauges, Full Bridge, Half bridge and Quarter Bridge. Linear Variable Differential Transformer, LVDT (Linear Variable Displacement Transducer), Load Cells.

**Module 2: Calibration of Instruments** **(Lectures 8)**

Mechanical, electrical, electronic system and their calibration, various types of sensors for displacement, velocity, acceleration, pressure, loads, strains, full-field measurements.

**Module 3: Sensor Technologies for Civil Infrastructures** **(Lectures 8)**

Similitude and structural models: dimensional analysis, Buckingham's Pi theorem, scale factors and dynamic similitude; Uses and applications of models: types of model investigation, indirect and direct models, elastic and inelastic model (steel, concrete and masonry), size effects.

**Module 4: Analysis of Experimental Data** **(Lectures 6)**

Error and uncertainty in experiment, measurement systems, accuracy in models and reliability of results; Test planning, design and implementation: testing sequence and experimental plan, loading systems, devices, actuators and their control.

**Module 5: Data Acquisition System and Data Processing** **(Lectures 6)**

Analog systems, digital systems using personal computers, dynamic measurement

**Data Processing:** numerical and graphical data processing and archiving. Experiments to illustrate buckling of structural members; load-deformation behavior of beams, columns, joints, and frames under various loads.

**Text Books:**


- Wang M., Lynch L.J.P. and Sohn H., "Sensor Technologies for Civil Infrastructures, Applications in
- Structural Health Monitoring (Woodhead Publishing Series in Civil and Structural Engineering)"
- Chen H. P., 2018, "Structural Health Monitoring of Large Civil Engineering Structures", Wiley-Blackwell.
- Blake L. S., 1994, "Civil Engineer's Reference Book Butterworth-Heinemann".
- Brunelle A. and Don J., 2017, "Calibration Handbook of Measuring Instruments", the International Society of Automation (ISA).


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand workings of sensors and transducers.
CO2: Determine the in-situ characterization and various properties.
CO3: Carry out subsurface measurements and techniques of data collection.
CO4: Understand ongoing studies on use of sensors in civil engineering practice &research.

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## BTCVOE605J Planning for Sustainable Development

**Teaching Scheme:** (3 Lectures) hours/week

### Course Contents

**Module 1:** **(Lectures 06)**
Sustainable Development-explains and critically evaluates the concept of sustainable development

**Module 2:** **(Lectures06)**
Environmental degradation and poverty Sustainable development: its main principles, the evolution of ideas about sustainability

**Module 3:** **(Lectures 06)**
Strategies for promoting sustainable development, resistances to the concept, and some alternative approaches. Examine some important current issues and areas of debate in relation to sustainable development.

**Module 4:** **(Lectures 06)**
Innovation for sustainable development- Environmental management and innovation strategies.

**Module 5:** **(Lectures 12)**
Societal transformations. Institutional theory, Governance for sustainable development. Policy responses to environmental degradation. Capacity development for innovation. Research methods.

**Text/Reference Books:**


- Harris, J.M., 2004, " Basic Principles for Sustainable Development, Global Development and Environment"
- Robinson, J., 2004, “Squaring the circle? Some thoughts on idea of sustainable Development” Ecological Economics
- Hjorth, P. & A. Bagheri, 2006, “Navigating towards Sustainable Development: A System Dynamics Approach”, Futures
- Mog, J.M., 2004, "Struggling with Sustainability – A Comparative Framework for Evaluating Sustainable Development Programs‟, World Development 32(12): 2139–2160. IISD Commentary on the OECD's Draft Principles for International Investor Participation in Infrastructure
- Arundel, A., R. Kemp, and S. Parto, 2004,"Indicators for Environmental Innovation: What and How to Measure, forthcoming in International Handbook on Environment and Technology Management (ETM), edited by D. Annandale, J. Phillimore and D. Marinova, Cheltenham, Edward Elgar.


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# BTCVOE605K Development Engineering

**Teaching Scheme:** (3 Lectures) hours / Week

**Course Contents**

**Module1** **(6 Lectures)**

Introduction to Development Engineering: need of development engineering, core disciplines and concept, major issues in development; urban development; rural development; socioeconomic development; scientific social research, formulation of research problem, field work and data collection, report drafting

**Module 2** **(6 Lectures)**

Design of Sustainable Communities: Concept and development of sustainable communities; Sustainable design, principles, building regulations, codes and standards - ANSI, ASTM, ASHRAE, approval process; green buildings- green building techniques- energy solutions, site solutions, site solutions, exterior and interior solutions, Certification -BREEAM, GRIHA, NAHB, LEED, IGBC;

**Module 3** **(8 Lectures)**

Town / City Planning: Town Planning- history of town planning 111 India, characteristics of city/town, town planning at national, regional and local levels, planning standards, master plan, site layout and development, zoning and density control, green belt, slum redevelopment; Smart city planning- introduction to city planning, infrastructure elements of smart city planning, dimensions of smart cities - global standards and performance benchmark; smart solutions- e governance, waste management, water management, energy management, urban mobility, citizen services, other services such as tele-medication and education, trade facilitation, skill development; GIS for planning

**Module 4** **(8 Lectures)**

Planning and Development of Rural Areas: District administration, District Planning, introduction to various sectors of rural areas such as drinking water, waste water treatment, electricity, public transport, irrigation, sanitation and cooking energy; issues and challenges associated with these sectors; People's participation and role in development of rural areas; various schemes and policies floated by state and central government - phases in the schemes; life cycle costing of these schemes.

**Module 5** **(8 Lectures)**

Geoinformatics for Planning and Development: Introduction to Geoinformatics; Advantages, benefits and limitations; Interdisciplinary applications; Data extraction; use of Geoinformatics for planning, mapping and preparation of layouts.

Development aspects: Urban and Rural: Planning and designing of a model town / city and using AutoCad and/ or GIS. Visit to a village or small town - The project will be carried out in groups. Problem faced by the villagers pertaining to various sectors or existing schemes; define the need, method, tools and techniques for development; deliver technology based solution.

**Recommended Books:**


- Chand, M. and Puri, U.K.( 1983),'Regional Planning in India', Allied Publishers, N. Delhi.
- Kaiser, E. J ., et.al. (1995), 'Urban Land use Planning', (ed) Urbana, University of Illinois Press.
- Sundaram, K.V. 1985 'Geography & Planning', Concept Publishing Co., New Delhi.
- Ayyar, C.P.V. (1987), 'Town Planning in Early South India', Mittal Publications, Delhi.
- Reeder, L. Hoboken, NJ, 'Guide to green building rating systems', John Wiley &Sons, Inc., 2010.
- Longley, P.A., Michael F. Goodchild, Maguire, D.J., Rhind, D. W. (2005), 'Geographic Information Systems and Science', Second Edition 2005: John Wiley &, Sons, New York.
- Desai, V. (2005), 'Rural Development of India', Himalaya publishing house, Mumbai.
- Rau, S.K. (200 I), 'Global Search for Rural Development', NIRD, Hyderabad

**References:**


- Institute of Town Planners, India, Ministry of Urban Affairs & Employment, Government of India, New Delhi, UDPFI Guidelines, 1996.
- Miles R. Simon, 1970, 'Metropolitan Problems' Methuen Publications, Canada.
- B.I.S., 1980, "National Building Code of India', ISI, New Delhi.
- ANSI/ASHRAE/USGBC/IES Standard 189.1, Standard for the Design of High-Performance Green Buildings Except Low -Rise Residential Buildings
- ASHRAE Standard 90. 1, Energy Standard for Buildings Except Low-Rise Residential Buildings


**Course Outcomes:** The required course for emphasis in development engineering will help students

CO 1 : To develop multi scaled perspective about decisions in the built environment,

CO 2 : To expose the students to the analysis and evaluation of real world problems aiming to bring desired change in the society.

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## BTHM606 Indian Constitution

**Teaching Scheme:** 2 Lecture / week

The constitution of India:

1. Preamble
2. Fundamental Rights
3. Directive principles of state policy
4. Fundamental Duties
5. Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

**Module.1 Introduction** **(5 Lectures)**
Constitution' meaning of the term,, Indian Constitution: Sources and constitutional history, Features: Citizenship, Preamble, Fundamental Rights and Duties, Directive, Principles of State Policy

**Module.2 Union Government and its Administration** **(5 Lectures)**
Structure of the Indian Union: Federalism, Centre- State, relationship, President: Role, power and position, PM and Council of ministers, Cabinet and Central Secretariat, Lok Sabha, Rajya Sabha

**Module.3 State Government and its Administration** **(4 Lectures)**
Governor: Role and Position, CM and Council of ministers, State Secretariat: Organisation, Structure and Functions

**Module.4 Local Administration** **(5 Lectures)**
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

**Module.5 Election Commission** **(5 Lectures)**
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

**TEXT/REFERENCE BOOKS:**


- Sastry, T. S. N., (2005). India and Human rights: Reflections, Concept Publishing Company India (P Ltd.),
- Nirmal, C.J., (1999). Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.


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## BTCVL607 SDD of RC Structures Lab

Term work shall consist of detailed analytical report for structural design and drawing of the following RC structures:

A) G + 2 Building

B) Any one of the following

(The introduction, analysis and design of these topics shall be studied in self-study mode. If required the subject teacher should address the student's queries during tutorials).

1) Retaining wall
2) Elevated water tank: analysis and design of staging and tank body.
3) Staircase of special form such as helicoidal stair
4) Shell roofs
5) Special foundation type such as combined footing, raft, pile foundation

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## BTCVL608 Transportation Engineering Lab

**Practical:** 2 Hours / Week

Practical Work consists of all experiments from (a) and at least six performances among the list (b) below and detailed reporting in form of journal and Project Reports. Practical examination shall be based on above

**a) Tests on Aggregates**

1) Shape Test
2) Specific Gravity and Water Absorption Test
3) Stripping Value Test
4) Soundness Test
5) CBR Test on Soil and Aggregates

**b) Test on Bituminous Materials**

1.

1. Penetration Test
2. Softening Point Test
3. Flash and Fire Point Test
4. Ductility Test
5. Viscosity Test
6. Specific Gravity Test
7. Demonstration of Marshall Test
8. Pavement design exercise based on flexible pavement consisting of bituminous concrete.
9. Visit to Road construction site for studying different construction equipment's.

**Course Outcomes:** On completion of the course, the students will be able to:

Perform tests on various road construction materials.

PerformCBRtestsonlocalsoilstodeterminesubgradepropertiesneededforroadways

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## BTCVM609 Mini Project

Student shall choose a topic of his interest in consultation with faculty in the department. The topic for mini projectmay be related to Civil Engineering area and/or interdisciplinary area. Student shall attempt to collect necessary informationand present a summary indicating comprehension of the topic and acquired depth of knowledge. It is desirable to obtainindustry or community sponsorship. Simplified tools or devices may be presented in form of working model and a brief reportstating development.A power point presentation shall also be submitted.

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## BTCVP 610 Field Training /Internship /Industrial Training

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training for minimum 4 weeks which can be completed partially in V Semester and VI Semester or in at one time after VI Semester. Evaluation will be done in VII Semester.

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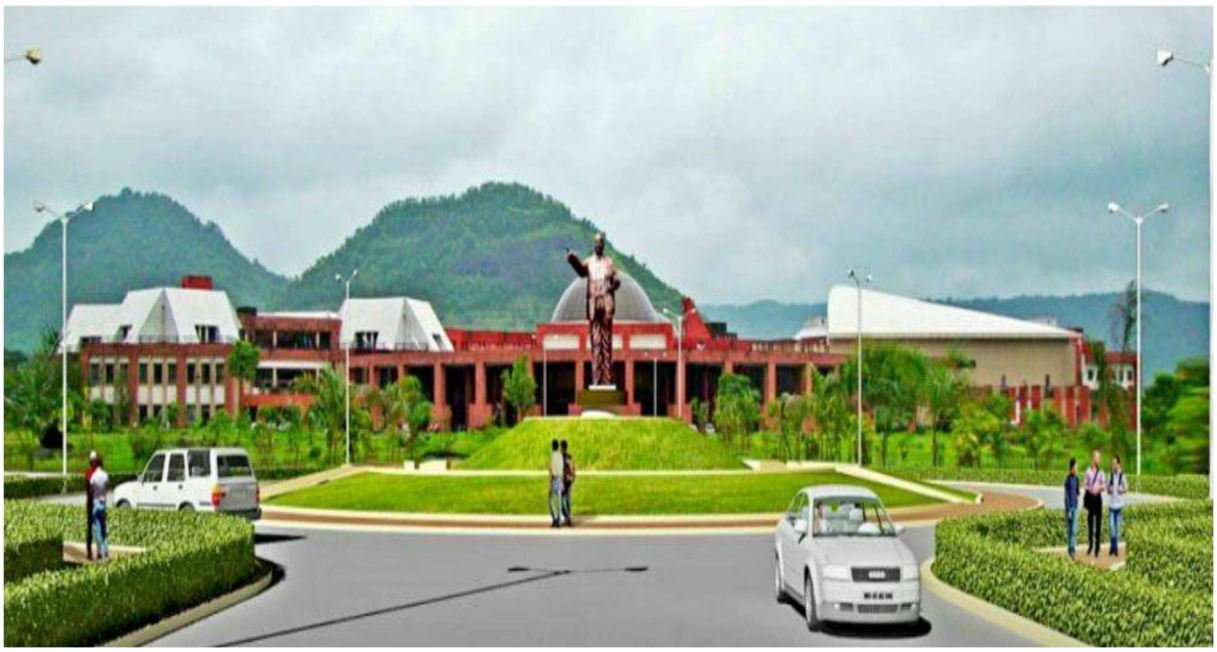
# Dr. Babasaheb Ambedkar Technological University, Lonere

**(Established as a University of Technology in the State of Maharashtra)**
**(Under Maharashtra Act No. XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra**
**Telephone and Fax.: 02140 - 275142**
**www.dbatu.ac.in**

## Draft Copy of Curriculum for Undergraduate Degree Programme

## B. Tech. in Civil Engineering

### With effect from (Fourth Year) AY 2023-24



# Dr. Babasaheb Ambedkar Technological University

## B.Tech. Civil Engineering

**Course Structure for Semester VII (Fourth Year) w.e.f. 2023-2024**

| Course Code | Type of Course | Course Title | Weekly Teaching Scheme | | | Evaluation Scheme | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| BTCVC701 | **Core** | Design of Reinforced & Prestressed Concrete Structures | 3 | 1 | -- | 20 | 20 | 60 | 100 | 4 |
| BTCVC702 | **Core** | Infrastructure Engineering | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVC703 | **Core** | Construction Techniques | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVC704 | **Core** | Professional Practices | 3 | 1 | -- | 20 | 20 | 60 | 100 | 4 |
| BTCVE705A | **Elective IV** | Engineering Economics | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVE705B | | Finite Element Method | | | | | | | | |
| BTCVE705C | | Limit State Design of Steel Structures | | | | | | | | |
| BTCVE705D | | Rock Mechanics | | | | | | | | |
| BTCVE705E | | Applications of Drone Technology | | | | | | | | |
| BTCVE705F | | Advanced RC Design | | | | | | | | |
| BTCVE705G | | Applied Hydrology & Flood Control | | | | | | | | |
| BTCVE705H | | Legal Aspects in Civil Engineering Contracts | | | | | | | | |
| BTCVE705I | | Bridge Engineering | | | | | | | | |
| BTCVOE706A | **Open Elective V** | Advanced Structural Analysis | 3 | -- | -- | - | -- | -- | -- | Audit |
| BTCVOE706B | | Air Pollution Control | | | | | | | | |
| BTCVOE706C | | Applications of AI and ML in Civil Engineering | | | | | | | | |
| BTCVOE706D | | Introduction to Earthquake Engineering | | | | | | | | |
| BTCVOE706E | | Internet of Things | | | | | | | | |
| BTCVOE706F | | Tunneling and Underground Excavations | | | | | | | | |
| BTCVOE706G | | Bamboo Construction Technology | | | | | | | | |
| BTHM707A | | Essence of Indian Traditional Knowledge | 2 | -- | -- | -- | -- | -- | -- | Audit |
| BTHM707B | | Foreign language## | | | | | | | | |
| BTCVL708 | | Design & Drawing of Prestressed Concrete | -- | -- | 2 | 30 | -- | 20 | 50 | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Lab. | Structures | | | | | | | | |
| BTCVL709 | | Professional Practices | -- | -- | 2 | 30 | -- | 20 | 50 | 1 |
| BTCVP610 | Training | Field Training / Internship/Industrial **Evaluation** | -- | -- | -- | -- | -- | 50 | 50 | 1 |
| BTCVS710 | BTS | Seminar | -- | -- | 2 | -- | -- | 50 | 50 | 1 |
| BTCVP711 | BTP | Project Stage-I** | -- | -- | 4 | -- | 50 | 50 | 100 | 3 |
| | | **Total** | **20** | **2** | **10** | **160** | **150** | **490** | **800** | **24** |

# B.Tech. Civil Engineering

## Course Structure for Semester VIII [Fourth Year] w.e.f. 2023-2024

| Course Code | Type of Course | Course Title | Weekly Teaching Scheme | | | Evaluation Scheme$ | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| BTCVSS801A | (Self-Study Course) # | Characterization of Construction Materials | 02** | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVSS801B | | Geo synthetics and Reinforced Soil Structures | | | | | | | | |
| BTCVSS801C | | Higher Surveying | | | | | | | | |
| BTCVSS801D | | Maintenance and Repair Of Concrete Structures | | | | | | | | |
| BTCVSS801E | | Structural Dynamics | | | | | | | | |
| BTCVSS801F | | Engineering Systems & Development | | | | | | | | |
| BTCVSS801G | | Sustainable River Basin Management | | | | | | | | |
| BTCVSS801H | | Modern Construction Materials | | | | | | | | |
| BTCVSS801J | | Advanced Town & Urban Planning | | | | | | | | |
| BTCVSS802A | (Self-Study Course) # | Energy Efficiency Acoustics and Day lighting in Building | 02** | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVSS802B | | Environmental Remediation of Contaminated Sites | | | | | | | | |
| BTCVSS802C | | Remote Sensing Essentials | | | | | | | | |
| BTCVSS802D | | Mechanical Characterization of Bituminous Materials | | | | | | | | |
| BTCVSS802E | | Soil Structure Interaction | | | | | | | | |
| BTCVSS802F | | Design of Water Supply Systems | | | | | | | | |
| BTCVP803 | **Project Stage-II** | Project Stage II or Internship | -- | -- | 24 | 100 | -- | 100 | 200 | 12 |
| | | Total | 04 | -- | 24 | 140 | 40 | 220 | 400 | 18 |

[##] ***Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course run by university***

[#] ***The subjects are to be studied on self-study mode using SWAYAM/NPTEL/any other online source approved by the University.***

[**] ***If required Coordinator may be appointed for each Self-study course and an administrative load of 02 hours per week may be considered for monitoring and assisting the students, and to conduct examination (if required), evaluation and preparation of result.***

[$] ***If the examination schedule for the online Self study course chosen by student do not match with the University's Academic Schedule, University/Institute have to conduct exam for such courses.***

**** Internship of One Semester as per BTCEP803: One Faculty guide from the Institute side and one Mentor from the Industry should be identified to monitor the progress of work. During the period of Internship, a review of work should be taken followed by a final presentation at the end.***

## *Dr. Babasaheb Ambedkar Technological University, Lonere*

## Teaching & Evaluation Scheme for Final Year B Tech Civil Engg.

| Course Code | Type of Course | Course Title | Weekly Teaching Scheme | | | Evaluation Scheme | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| BTCVC701 | **Core** | Design of Reinforced & Prestressed Concrete Structures | 3 | 1 | -- | 20 | 20 | 60 | 100 | 4 |
| BTCVC702 | **Core** | Infrastructure Engineering | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVC703 | **Core** | Construction Techniques | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVC704 | **Core** | Professional Practices | 3 | 1 | -- | 20 | 20 | 60 | 100 | 4 |
| BTCVE705A | **Elective IV** | Engineering Economics | 3 | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVE705B | | Finite Element Method | | | | | | | | |
| BTCVE705C | | Limit State Design of Steel Structures | | | | | | | | |
| BTCVE705D | | Rock Mechanics | | | | | | | | |
| BTCVE705E | | Applications of Drone Technology | | | | | | | | |
| BTCVE705F | | Advanced RC Design | | | | | | | | |
| BTCVE705G | | Applied Hydrology & Flood Control | | | | | | | | |
| BTCVE705H | | Legal Aspects in Civil Engineering Contracts | | | | | | | | |
| BTCVE705I | | Bridge Engineering | | | | | | | | |
| BTCVOE706A | **Open Elective V** | Advanced Structural Analysis | 3 | -- | -- | - | -- | -- | -- | Audit |
| BTCVOE706B | | Air Pollution Control | | | | | | | | |
| BTCVOE706C | | Applications of AI and ML in Civil Engineering | | | | | | | | |
| BTCVOE706D | | Introduction to Earthquake Engineering | | | | | | | | |
| BTCVOE706E | | Internet of Things | | | | | | | | |
| BTCVOE706F | | Tunneling and Underground Excavations | | | | | | | | |
| BTCVOE706G | | Bamboo Construction Technology | | | | | | | | |
| BTHM707A | | Essence of Indian Traditional Knowledge | 2 | -- | -- | -- | -- | -- | -- | Audit |
| BTHM707B | | Foreign language[##] | | | | | | | | |
| BTCVL708 | Lab. | Design & Drawing of Prestressed Concrete Structures | -- | -- | 2 | 30 | -- | 20 | 50 | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| BTCVL709 | | Professional Practices | -- | -- | 2 | 30 | -- | 20 | 50 | 1 |
| BTCVP610 | Training | Field Training / Internship/Industrial **Evaluation** | -- | -- | -- | -- | -- | 50 | 50 | 1 |
| BTCVS710 | BTS | Seminar | -- | -- | 2 | -- | -- | 50 | 50 | 1 |
| BTCVP711 | BTP | Project Stage-I** | -- | -- | 4 | -- | 50 | 50 | 100 | 3 |
| | | **Total** | **20** | **2** | **10** | **160** | **150** | **490** | **800** | **24** |

# Detailed Syllabus (VII Semester)

## BTCVC701 Design of RC and PSC Structures

Teaching Scheme: (3 Lectures + 1 Tutorial) hours/week

### Course Contents
### Limit State Method for RC Structures

**Module 1:** **(6 Lectures)**
Limit State of Collapse (Torsion) - Types of torsion, behavior of R.C. rectangular sections subjected to torsion, Design of sections subjected to combined bending and Torsion

**Module 2:** **(6 Lectures)**
Analysis and design of axially and eccentrically loaded short columns (Circular and Rectangular), detailing of reinforcement, and construction of Interaction diagrams for uni-axial bending, concept of bi-axial bending.

### Pre-stressed Concrete Structure

**Module 3:** **(8 Lectures)**
Introduction to prestressed concrete, concepts, types, systems and methods of pre stressing,

**Module 4:** **(10 Lectures)**
Stress analysis for rectangular and symmetrical I sections, Pressure Line, Cable Profiles
Losses in Prestressing for Pre-tensioned & Post tensioned members

**Module 5:** **(6 Lectures)**
Design of Rectangular and Symmetrical I sections, Design of End Block
Structural audit of various structures such as load bearing wall type, RCC, Steel Framed, Prestressed Concrete, etc.: conceptual introduction to elaborate necessity, implementation of audit, format of reporting, consequences

**Text Books**


1. IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi
2. Karve& Shah, “Limit State Theory & Design”, Structures Publications, Pune
3. Lin T.Y., “Prestressed Concrete”, John Willey & Sons New York
4. Jain A.K., “Reinforced Concrete Design (Limit State)”, Nemchand Brothers, Roorkee
5. Sinha S.N., “Reinforced Concrete Design”, Vol. I, II, Tata Mc-Graw Hill
6. Sinha& Roy, “Fundamentals of Reinforced Concrete”, S. Chand & Co. New Delhi
7. Sinha& Roy, “Prestressed Concrete”, S. Chand & Co. New Delhi
8. Krishnaraju N., “Prestressed Concrete”, Tata Mc-Graw Hill


**Reference Books**


1. Punmia B.C., “Reinforced Concrete Design”, Vol. I, II, Laxmi Publications
2. Varghese P.C., “Limit State Design of Reinforced Concrete”, Prentice Hall of India, New Delhi
3. Relevant Publications by Bureau of Indian Standards, New Delhi
4. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.


**Course Outcomes:** On completion of the course, the students will be;
CO1: Able to identify the behavior, analyze and design of the beam sections subjected to torsion.
CO2: Able to analyze and design of axially and eccentrically loaded column and construct the interaction diagram for them.
CO3: Understand various concepts, systems and losses in pre-stressing.
CO4: Able to analyze and design the rectangular and symmetrical I-section pre-stressed beam/girders.

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# BTCVC702 Infrastructure Engineering

**Teaching Scheme:** (3 Lectures) hours/week

## Course Contents

**Module 1** **(8 Lectures)**

Railway Engineering: Permanent Way, gauges, rails, sleepers, ballast, sub grade formation, fixtures and fastenings, Geometric Design of tracks- Horizontal Alignment, Vertical Alignment

**Module 2** **(8 Lectures)**

Points and Crossings: Standard types, Design of simple turnout, various types of Junctions, Stations and Yards: Purpose, Location, Site selection, general layouts of Terminus and Junction, Signaling and Interlocking, Construction and Maintenance of Track, Modern trends in Railways

Metro Rail: Introduction to mass rapid transit system in India, Options of Mass Rapid Transit Systems (MRTS), Choice of Metro Rail as a Mode of Mass Transit, Advantages and disadvantages, Planning and Implementation of Metro Rail Projects, Private participation and public private partnership (PPP), Financing options of metro rail project in India, Alignment and track structure requirement, Track components- Rail, Rail to sleeper Fastenings, Base slab

**Module 3:** **(6 Lectures)**

Dock and Harbor Engineering: Inland Water Transport in India, Tides, Winds and Waves Erosion, Transport of Sediments, Beach Drift, Littoral Drift, Sand Bars, Coast Protection, Classification of Ports and Harbors, Site Selection, Features of Break Waters, Jetties, Wharves, Piers, Facilities required, Dry Docks, Wet Docks, Lift Docks, Floating Docks, Spillways, Navigational Aids, Lighthouses, Terminal Buildings, and Dredging- Special Equipment.

**Module 4:** **(6 Lectures)**

Airport Engineering: Planning, Airport Surveys, Site Selection, Zoning Laws, Runways, Geometric Design, Airport Capacity, Terminal Buildings, Parking Systems, Taxiways, Hangers, Airport Drainage, Air Traffic Control, Airport Lighting

**Module 5:** **(8 Lectures)**

Tunnel Engineering: Shape and Size of Tunnel Shafts, Pilot Tunnels, Tunneling in Hard Rock, Tunneling in Soft Materials, Drilling-Patterns, Blasting, Timbering, Mucking, Tunnel Lining, Advances In Tunneling Methods, Safety Measures, Ventilation, Lighting and Drainage of Tunnels

**Text Books**


1. Saxena S. C. and Arora S. (2003) “A Course in Railway Engineering,” Dhanpat Rai & Sons, Delhi
2. Arora N. L. (1995) “Transportation Engineering”, IPH New Delhi
3. Bindra S. P. “Bridge Tunnel and Railway Engineering”, Dhanpatrai and Sons, New Delhi
4. Hariharan K. V. (2002) “Multimodal Transport & Infrastructure Development in India”, Shroff Publishers, Mumbai
5. Quinn A. D. “Planning and Construction of Docks and Harbours”, Tata McGraw Hill, New Delhi
6. Oza H. P. and Oza G. H. (2012) “Dock and Harbour Engineering”, Chartor Publishing House, Anand
7. Shrinivasan R. (2016) “Dock, Harbour and Tunnel Engineering”, Chartor Publishing House, Anand
8. Khanna S. K. and Arora N. L. (1999), “Airport Engineering” Nemchand& Bros., Roorkee
9. Rangawala S. C. (2012) “Airport Engineering”, Charotar Publishing House Pvt. Limited, Anand


**References**


1. Publications of Bureau of Indian Standards, New Delhi, Relevant To the Syl Laboratories
2. Cormick H. F. (1975) “Dock and Harbour Engineering” Giffin Publishers
3. Horonjeff R. (2012) “Planning and Design of Airports”, Tata McGraw Hill, New Delhi


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Know about the basics and design of various components of railway engineering
CO2: Understand the types and functions of tracks, junctions and railway stations.
CO3: Able to understand Airport engineering.
CO4: Able to understand Docks and Harbours.
CO5: Know about the aircraft characteristics, planning and components of airport.
CO6: Understand the types and components of docks and harbors.

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## BTCVC703 Construction Techniques

**Teaching Scheme: (**3 Lectures) hours/week

### Course Contents

**Module 1:** **(8 Lectures)**

Introduction, planning of a new project, site access and services, mechanical and manual construction, excavation in earth: Understanding basics and functions of equipment, earthmoving equipment - Tractors, Bulldozers, Scrappers, Power shovel, Hoes, simple numerical problems based on cycle time and production rates, drag line, Clamshell, Trenchers, Compactors- types and performance, operating efficiencies, lifting capacities

**Module 2:** **(6 Lectures)**

Excavation in hard rock, Rippers, jack hammers, drills, compressors and pneumatic equipment, blasting explosives, detonators, fuses, drainage in excavation – necessity and methods of dewatering

**Module 3:** **(6 Lectures)**

RMC Plant, layout and production capacity, type of concrete mixers, machinery for vertical and horizontal transportation of concrete, grouting, Shotcreting, under water concreting, Type of formwork, Slip formwork, equipment for placing of concrete in normal and difficult situations

**Module 4:** **(6 Lectures)**

Prefabricated construction: Relative economy, steel construction: planning and field operations, erection equipment, cranes of various types such as tower, crawler, luffing jib tower crane, floating and dredging equipment

**Module 5:** **(8 Lectures)**

Road construction aspects, asphalt mixing and batching plant (Hot Mix Plant), sensor paver for rigid roads, crushing plants belt conveyers, cableway, construction of a new railway track, aspects of bridge construction

Diaphragm walls: purpose and construction methods, safety measures in construction, prevention of accidents and introduction to disaster management

**Text Books**


1. Peurifoy R.L. (2010). Construction, Planning, Equipment & Methods, McGraw hill Book Co. N. Delhi
2. Verma Mahesh, (1975). Construction Equipment, Metropolitan book Co., New York
3. Singh J., (2006). Heavy Construction - Planning, Equipment & Methods, Oxford & IBH Pub., N. Delhi


**Reference Books**


1. Quin A. (1961), Planning and Construction of Docks and Harbors, Mc-Graw Hill Company, New York.
2. Stubbs F. W., (1971). Hand Book of Heavy Construction, Mc-Graw Hill Inc, US 2nd edition.
3. Boyes R.G.H, (1975). Structural & cut off Diaphragm Walls, Applied Science Publishers Ltd. London.
4. Ataev S. S., (1999). Construction Technology, Mir Publishers, Mascow.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand the planning of new project with site accessibility and services required.
CO2: Comprehend the various civil construction equipment's.
CO3: Familiar with layout of RMC plant, production, capacity and operation process.
CO4: Recognize various aspect of road construction, construction of diaphragm walls, railway track construction etc.

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## BTCVC704 Professional Practices

**Teaching Scheme :**(3 Lectures + 1 Tutorial) hours/week

### Course Contents

**Module 1: Introduction of Estimate** **(8 Lectures)**

Introduction to estimating, purpose, types, items of inclusion, modes of measurement for different works, administrative approval and technical sanction to estimates; Quantity Surveying: Specifications: purpose general and detailed specifications for various items of work, prime cost, provisional sums and provisional quantities, taking out quantity, P.W.D. method, recording of measurements

**Module 2: Costing** **(8 Lectures)**

Analysis of rates for various items of construction of civil engineering works, standard schedule of rate, price escalation, detailed and approximate estimates for buildings, R.C.C works, culverts, earthwork for canals, roads including hill roads and other civil engineering works.

**Module 3: Tendering** **(8 Lectures)**

Types, preparation of tender papers, conditions of contracts, competitive bidding, types of bids, invitation of tenders, scrutiny and acceptance of tenders, award of jobs, introduction to B.O.T. and similar other basis of execution.

**Module 4: Contracts** **(6 Lectures)**

Essentials of legally valid contract, types and forms of contract between various agencies, organizational set up of P.W.D. classification of works, method of carrying out work in P.W.D. mode of payment, bill forms, introduction to arbitration.

**Module 5: Valuation** **(6 Lectures)**

Principles, types, price and cost, attributes of value, valuer and his duties, factors affecting the valuation of properties, methods of valuation, different types of lease. Valuation from yield and from life, gross yield and net yield, sinking fund, depreciation, different methods of calculating depreciation, depreciated cost, obsolescence.

**Text Books**


1. Dutta B. N. (2012) "Estimating and Costing", UBS Publishers Distributors, New Delhi.
2. Namavati R. H. (2016) "Professional Practice Estimating and Valuation", Lakhani book Depot, Mumbai.
3. Patil B. S. (2015) "Civil Engineering Contracts and Estimates", Universities Press, Hyderabad.
4. Bhasin P. L. (1987) "Quantity Surveying", S. Chand & Co. Ltd., Mumbai.
5. Rangwala S. C. (1990), "Elements of Estimating and Costing", Charotar Publication, Anand.
6. Birdi G. S. (2014) "Estimating and Costing", DhanpatRai& Sons, N. Delhi.
7. Chakroborty M. (2010) "Estimating, Costing & Specification in Civil Engineering", M. Chakraborty Publication, Nepal.
8. Rangwala S. C. (2011) "Valuation of real Properties", Charotar Publication, Anand.


**References**


1. Govt. of Maharashtra P.W. and Housing Department Publication edition 1979 and 1981.
2. P. W. D. Maharashtra, "Standard Specifications", Volumes I & II.
3. C.P.W.D. Specifications.
4. C.P.W.D. Schedule of Rates .
5. P.W.D. Maharashtra Schedule of Rates.
6. Publications of Bureau of Indian Standards: IS 1200 all parts, and other relevant.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand the importance of preparing the types of estimates under different conditions for various structures.

CO2: Know about the rate analysis and bill preparations and to study about the specification writing.

CO3: Know the various types of contract, accounts in PWD, methods for initiating the works in PWD and tendering.

CO4: Understand the valuation of land and buildings, various methods and factors affecting valuation.

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## BTCVE705A Engineering Economics

**Teaching Scheme**: (3 Lectures) hours/week

**Course Contents**

**Module 1** **(06 Lectures)**

Introduction to engineering economics, importance, demand and supply, types of costs, types of interests, value of money – time and equivalence, tangible and intangible factors, introduction to inflation.

**Module 2** **(06 Lectures)**

Cash Flow diagram, Nominal and effective interest – continuous interest, Single Payment Compound Amount Factor, Uniform series of Payments, comparing alternatives, Present worth Analysis, Annual worth Analysis, Future worth Analysis, Rate of Return Analysis, Break Even Analysis, Benefit/Cost Analysis.

**Module 3** **(06 Lectures)**

Economics of Project Parameters, Equipment Economics, Operating Costs, Buy, Rent and Lease Options, |Replacement Analysis, Cost Estimates, Type of Estimates, Parametric Estimate, Management Accounting, Financial accounting principles, basic concepts, Financial statements, accounting ratios.

**Module 4** **(08 Lectures)**

Investment Evaluation and Financing Projects, Taxation, Depreciation, switching between different depreciation methods, Inflation, Sources of finance, equity, debit, securities, borrowings, debentures, Working capital requirement, financial institutes.

**Module 5** **(08 Lectures)**

Financial Management, Introduction, Charts of Accounts, Balance Sheet, Financial Ratios, Working Capital Management, Budgeting and budgetary control, Performance budgeting. Profit & Loss, statement, Ratio analysis, Appraisal through financial statements, international finance forward.

**Text Books**

1. Blank, L.T., and Tarquin, A. J., (1988). Engineering Economy, Mc-Graw Hill Book Co.
2. Collier C. and GlaGola C. (1998). Engineering Economics & Cost Analysis, Addison Wesley Education.

**Publishers**,

3. Patel, B. M., (2000). Project management- strategic Financial Planning, Evaluation and Control,Vikas Publishing House Pvt. Ltd. New Delhi,
4. Shrivastava, U. K., (2000). Construction Planning and Management, Galgotia Publications Pvt. Ltd. New Delhi.

**References**

1. Van Horne, J.C. (1990). Financial Management and Policy, Prentice-Hall of India Ltd.
2. Taylor, G.A. (1968). Managerial and Engineering Economy. East-West Edition.
3. Thuesen, H.G. (1959). Engineering Economy, Prentice-Hall, Inc.
4. Brigham, E.F. (1978). Fundamentals of Financial Management, the Dryden Press, Hinsdale, Illinios,
5. Kolb, R.W. and Rodriguez, R.J. (1992). Financial Management, D.C. Heath & Co.
6. Walker, E.W. (1974). Essentials of Financial Management, Prentice Hall of India Private Limited, New Delhi.

**Course Outcomes**: On completion of the course, the students will be able to:

CO1: Adopt as per principles of economics and financing

CO2: Analyze available alternatives and propose best suitable among them

CO3: Apply various models of financial management and accounting

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## BTCVE705B Finite Element Method

**Teaching Scheme:** (3Lectures) hours/week

**Course Contents**

**Module 1: Introduction to FEM & Approximate Methods** **(06 Lectures)**

Introduction, Overview of Various Methods to Solve Integral & Differential Equations (Point Collocation Method, Method of Least Square, Weighted Residual Method, Galerkin's Method), Variational Calculus (Hamilton's Variational Principle, Minimum Potential Energy Principle, Euler Lagrange Equation), Partial FEM (Kentorvich Method/ Finite Strip Method/ Semi-Analytical Method), Local & Global Finite Element Methods (Rayleigh-Ritz Method), Stepwise Procedure.

**Module 2: One Dimensional FE Analysis** **(06 Lectures)**

Application of FEM to Solve various 1-D problems (Shape Functions for 1-D Elements, Properties of Shape Functions, Lagrange Interpolating Polynomials), C0 Continuity, 1-D FE Analysis (Discretization, Selection of Shape Function, Defining Gradients of Primary Unknowns & Constitutive Equations, Derivation of Element Equations, Assembly & Application of Boundary Conditions, Computation of Primary and Secondary Unknowns), Direct Approach for Assembly, Boundary Conditions (Geometric, Natural), Concept of Sub-Structuring (Static Condensation), Stiffness Matrix for Basic Bar & Beam Element, Representation of Distributed Loading, The Assembly Process within the PMPE Approach, Element Stresses).

**Module 3: FE Analysis by Direct Approach** **(06 Lectures)**

C1 Continuity, Formulation of 1-D Beam Element, Classical Beam Theory, Element Equation Formulation (Galerkin's Approach, Rayleigh-Ritz Approach), Derivation of Scalar Functional from Differential Equation and Vice Versa, Simple applications to Beams.

**Module 4: Two Dimensional FE Analysis** **(06 Lectures)**

Conditions of Symmetry & Anti Symmetry (Applications), 2-D FE Analysis, Review of Theory of Elasticity, CST Element (3-Node Triangular Element), Pascal's Triangle and Pyramid, Area Co-ordinate, Stepwise Formulation, Equivalent Load Vector, Plane Stress Problems using CST Elements, 2-D Stress Analysis using 4-noded Rectangular Element, Stepwise Formulation, Effect of Aspect Ratio, Explicit & Implicit Iso-parametric Formulation, Iso-parametric Elements for Plane Problems.

**Module 5: Three-Dimensional FE Analysis** **(06 Lectures)**

3-D Stress Analysis using FEM, Iso-parametric Formulation, 3-D Brick Element, FEA of Axi-symmetric Solids Subjected to Axi-symmetric and Asymmetric Loads (all contents at introductory level).

Computer Implementation of FEM, Application of FEM to Time Dependent Problems, Partial FEM, h-version of FEM, p-version of FEM, Adaptive Meshing, Exposure to Hybrid FEM (Mixed/ Hybrid Formulation, Unidirectional Composites), Introduction to software's, elementary problem-solving using freeware.

**Reference Books**:


1. Mukhopdhyay, M., (1984). Concept and Application of Finite Element Analysis, Oxford and IBH Publishing Co. Pvt. Ltd.
2. Zienkiewicz, O.C and Taylor R.L., (2000). The Finite Element Method, Vol 1 & 2; 5th Ed, Butterworth- Heinemann.
3. Reddy J. N. (2005). An Introduction to Finite Element Method, McGraw Hill , 3rd Ed.
4. Cook R.D., Malcus D.S. and Plesha, (1997). Concepts and Applications of Finite Element Analysis,4th Ed, Wiley.
5. Hutton D.V., (2004). Fundamentals of Finite Element Analysis, Tata McGraw Hill Pub.
6. Desai C. S. & Abel J. F., (1974). Introduction to the Finite Element Method, CBS Pub.
7. Krishnamoorthy C. S, (1994). Programming in the Finite Element Method, Tata McGraw Hill.
8. Chandrupatla T. R. and Belegundu,(2002). Introduction to the Finite Element in Engineering, Pearson Education.
9. Bathe K.J., (1996). Finite Element Procedures, PHI learning Pvt. Ltd.
10. Desai Y.M., and Eldho T.I, (2011). Finite Element Method with application in Engineering, Pearson, Delhi.
11. Bhavikatti S. S. (2015). Finite Element Analysis, New Age International Publication.


**Course Outcomes**: Upon completion of the course the students will be able to:

CO1: Understand the different energy methods in structural analysis and basic concepts of finite element method.

CO2: Analyze 1-D problems related to structural analysis like Bars, Trusses, Beams and Frames using finite element approach.

CO3: Find solution to problems using direct approach methods like Rayleigh – Ritz or Galerkin's Method.

CO4: Solve 2-D problems using knowledge of theory of elasticity.

CO5: Students will be able to implement the knowledge of numerical methods in FEM to find the solution to the various problems in statics and dynamics.

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## BTCVE705C Limit State Design of Steel Structures

**Teaching Scheme:** (3Lectures) hours/week

**Course Contents**

**Module 1: Introduction** **(4 Lectures)**

Introduction, advantages & disadvantages of steel structures, permissible stresses, factor of safety, methods of design, types of connections, various types of standard rolled sections, types of loads and load combinations

**Module 2: Connections** **(4 Lectures)**

Types: Riveted, Bolted, Welded; Analysis of axially & eccentrically loaded connections (subjected to bending & torsion), Permissible Stresses, Design of connections, failure of joints.

**Module** 3: **Axially Loaded Members** **(6 Lectures)**

Tension members: Common sections, net effective area, load capacity, connection using weld / bolts, design of tension splice

Compression members: Common sections used, effective length and slenderness ratio, permissible stresses, load carrying capacity, connection using weld / bolt.

**Module 4: Beams** **(6 Lectures)**

Laterally supported & unsupported beams, design of simple beams, built up beams using flange plates, curtailment of flange plates, web buckling & web crippling, secondary and main beam arrangement, beam to beam connections.

**Module 5: Industrial Roofing** **(6 Lectures)**

**Gantry girder:** Forces acting on a gantry girder, commonly used sections, introduction to design of gantry girder as laterally unsupported beam, connection details.

**Roof trusses:** Components of an industrial shed, types of trusses, load calculations and combinations, design of purlins, design of truss members, design of hinge & roller supports.

**Note:** Contents in Module 1 to part of 5 shall be taught with help of relevant text or reference books based on elastic **design concept and shall be taught with reference to IS 800 2007**

Use of IS 800: 1984 and 2007, IS 875 (All Parts), IS: Handbook No.1 for Steel Section and Steel Table is permitted for theory examination.

**Text Books:**


1. Duggal S. K. (2017) "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi.
2. Gambhir M. L. (2017) "Fundamentals of Structural Steel Design", Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Negi L. S. (2017) "Design of Steel Structures", Tata McGraw Hill Pub. Co. Ltd., New Delhi.
4. Chandra Ram (2016) "Design of Steel Structures", Vol. I & Vol. II, Standard Book House, New Delhi.
5. Subramanian N. (2010) "Steel Structures: Design and Practice" Oxford Univ. Press, Delhi.
6. Sai Ram K. S. (2015) "Design of Steel Structures", Pearson Education, Delhi.


**Reference Books:**


1. Arya A. S. and Ajamani J.L. (2014) "Design of Steel Structures", Nemchand and Brothers, Roorkee.
2. Vazirani V.N. and Ratwani M.M. (1988) "Design of Steel Structures", Standard Book House, New Delhi.
3. Publications of Bureau of Indian Standards, New Delhi, IS 800:1984, 2007, IS 875 (Part I to V).
4. Gaylord E.H. and Gaylord C.N. (1991) "Design of Steel Structures" McGraw Hill, New York.
5. Salmon C. G. and Johnson J. E. (2008) "Steel Structures: Design and Behaviour", Harper and Row, New York.
6. Steel Designers Manual.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Identify and compute the design loads and the stresses developed in the steel member.
CO2: Analyze and design the various connections and identify the potential failure modes.
CO3: Analyze and design various tension, compression and flexural members.
CO4: Understand provisions in relevant BIS Codes.

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## BTCVE705D Rock Mechanics

**Teaching Scheme:** (3Lectures) hours/week

### Course Contents

**Module 1: Introduction** **(Lectures 08)**

Introduction, Development, Objective, and Scope of Rock Mechanics, Applications of Rock Mechanics: Slopes, Underground Excavations, Foundations, and Rock Support Systems. Physical and Mechanical Properties of Rocks, Factors Affecting the Strength and Deformation of Rocks, Lineaments, Discontinuities in Rocks, and Associated Problems.

**Module 2: Rock Testing** **(Lectures 08)**

Introduction; Rock Sampling, Laboratory Testing, and In-Situ Determination of Strength of Rock Samples and identifying its Properties like Density, Porosity, and Water Absorption, Using Methods like Uniaxial Compressive Strength, Tri-Axial Compressive Test, Tensile Strength, Shear Strength, Flexural Strength, Swelling and Slake Durability, Permeability, and Point Load Strength.

**Module 3: Engineering Classification Rock Mass** **(Lectures 08)**

Concept of Rock Mass, Geological Strength Index, Rock Quality Designation, Classification systems, Rock Mass Rating, Rock Structure Rating, Deere and Miller classification, Geo-mechanics and NGI Classification Systems, and Applications in Civil Engineering Projects.

**Module 4: Rock Mass Behavior at Slope** **(Lectures 06)**

Stability of Rock Slopes, Modes of Failure, Methods of Analysis, Prevention, and Control of Rock Slope Failure, and Slope Monitoring Techniques.

**Module 5: Strength Criteria and Improvement Techniques of Rock Mass** **(Lectures 06)**

Mohr-Coulomb criterion, Hoek and Brown criterion, Barton's Theory of Rock Mass Stability, Methods of Improving Rock Properties, Rock Reinforcement & Rock Bolting: Rock Bolts, Rock Anchors, Steel Mats, Precast Concrete Segments, Shotcrete, and Grouting, etc.

**Text Books:**

1. Ramamurthy, T (2007). "Engineering in Rocks for Slopes, Foundation, and Tunnels." N. Delhi, PHI Pvt. Ltd.
2. Singh, B and Goel RK (2011). "Engineering Rock Mass Classification" Oxford, UK, Elsevier Inc.
3. Sivakugan, N, Shukla, SK and Das, BM (2013). "Rock Mechanics: an introduction". Boca Raton, FL, CRC Press.

**Reference Book:**

1. Goodman R. E., "Introduction to Rock Mechanics", John Wiley and Sons, India.
2. Obert and Duvall, "Rock Mechanics and Hydraulic Structures", John Wiley and Sons, India.
3. Winterkorn and Fang, "Foundation Engineering Hand Book" Springer, Boston, MA.
4. Relevant Indian Standards.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand about rock mechanics and its applications.

CO2: Able to determine the engineering properties of rocks and sub-surface conditions.

CO3: Identify various causes of slope failure and suggest some preventive measures for them.

CO4: Categorize rock mass into various classes for recognizing overall rock mass quality.

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## BTCVPE705E Applications of Drone Technology

**Teaching Scheme:** (3Lectures) hours/week

### Course Contents

**Module 1: Introduction to Drone Technology (6 Lectures)**

Overview of drone technology and its versatility, Importance of drones in civil engineering projects,, Understanding the role of data in drone applications, Examples of successful drone applications in civil engineering, Introduction to different types of drones and their capabilities, Brief introduction to relevant drone regulations and certifications

**Module 2: Drone Data Acquisition (8 Lectures)**

Comparison of drones with traditional surveying and inspection methods.Flight planning fundamentals for civil engineering projects, Understanding the importance of mission objectives and data requirements, Factors influencing drone flight, such as weather conditions and airspace restrictions,, Introduction to LiDAR (Light Detection and Ranging) technology and its applications, Data acquisition for various civil engineering projects, including surveying, construction, Water Management and infrastructure inspection, Safety precautions and emergency procedures during drone operations.

**Module 3: Drone Application in Civil Engineering (8 Lectures)**

Overview of drone applications in civil engineering disciplines, including surveying, construction, inspection, and environmental monitoring, Importance of drones in enhancing efficiency and accuracy in civil engineering projects, Benefits and limitations of using drones in civil engineering projects, Construction site management using drones: Progress monitoring, material tracking, and site safety assessment.

**Module 4: Drone Data Processing and Analysis (6 Lectures)**

Data processing software and tools, 3D modeling and point cloud analysis, GIS integration and mapping, Data interpretation and visualization, Emerging trends in drone technology, Discussion on drone payload options for various data collection needs, Case studies illustrating the economic and environmental advantages of using drones in civil engineering projects

**Module 5: Advanced Topics in Drone Technology (8 Lectures)**

Drones in transportation engineering: Road and highway planning and monitoring, Surveying and mapping with drones: Topographic mapping and contour generation, Infrastructure inspection and monitoring with drones: Bridges, buildings, dams, and roads, Drones in water resources engineering: Flood modeling and hydrological monitoring, Drones in flood mapping, forest monitoring and post-disaster damage assessment.

**Text Books:**

1. Randal W. Beard and Timothy W. McLain: Small Unmanned Aircraft.
2. Theory and Practice, Princeton University Press, 2012.
3. Kimon P. Valavanis: Advances in Unmanned Aerial Vehicles: State of the Art and the Road to Autonomy, Springer, 2007.

**Reference Books:**


1. Drone Technology in Architecture, Engineering, and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation by Daniel Tal and Jon Altschuld, 2021.
2. Drones: Technology and Business Plan for Civil Engineering by Thiago Prudêncio and Gleydson Carlos Almeida, 2023.
3. Small Unmanned Aircraft Systems Guide: Exploring Designs, Operations, Regulations, and Economics by Brent Terwilliger, 2017.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand about drone technology and its applications.

CO2: Able to understand drone data acquisition techniques.

CO3: Able to understand application of drone in Civil Engineering Project.

CO4: To analyze different drone data processing software and tools.

CO5: To understand different advanced methods used in drone technology.

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## BTCVPE705F Advanced RC Design

**Teaching scheme:** (3 Lectures) hour/week

### Course Contents

**Module 1: Circular Slabs** **(10 Lectures)**

Introduction, Slabs freely supported at edges and carrying UDL, Slabs fixed at edges and carrying UDL, , Slabs simply supported at the edges with load UDL w Uniformly distributed along the circumference of a concentric circle, Slab simply supported at edges with UDL inside a concentric circle, Slab simply supported at edges with a central hole and carrying UDL Slab simply supported at edges with a central hole and carrying w Uniformly distributed along the circumference of a concentric circle.

**Module 2: Flat Slabs** **(10 Lectures)**

Introduction, Components of Flat Slab Construction, IS Code Recommendations (IS: 456-2000), Direct Design Method, Equivalent Frame Method, Shear in Flat Slab, Slab Reinforcement, Openings in Flat Slab.

**Module 3: Domes** **(5 Lectures)**

Introduction, Nature of Stresses in Spherical Domes, Analysis of Spherical Domes, Stresses due to Wind load, Design of RC Domes, Conical Domes.

**Module 4: Bunkers and Silos** **(5 Lectures)**

Introduction, Janssen's theory, Airy's theory, Bunkers, Hopper Bottom, Indian Standard on Design of Bins (IS :4995-1968).

**Module 5: Chimneys** **(6 Lectures)**

Introduction, wind pressure, stresses in chimney shaft due to self-weight and wind, stresses in horizontal reinforcement due to wind shear, stresses due to Temperature difference, combined effect of self-load,wind and temperature, temperature stresses in horizontal reinforcement, Design of RC Chimneys.

**Text Books**


1. IS: 456, IS 1343, SP16, SP24, SP34 of Recent Editions, Bureau of Indian Standards, New Delhi.
2. Karve & Shah, "Limit State Theory & Design", Structures Publications, Pune.
3. Lin T.Y., "Prestressed Concrete", John Willey & Sons New York.
4. Jain A.K., "Reinforced Concrete Design (Limit State)", Nemchand Brothers, Roorkee.
5. Sinha S.N., "Reinforced Concrete Design", Vol. I, II, Tata Mc-Graw Hill
6. Sinha& Roy, "Fundamentals of Reinforced Concrete", S. Chand & Co. New Delhi
7. Sinha& Roy, "Prestressed Concrete", S. Chand & Co. New Delhi.
8. Krishnaraju N., "Prestressed Concrete", Tata Mc-Graw Hill.


**Reference Books:**


1. Punmia B.C., "Reinforced Concrete Design", Vol. I, II, Laxmi Publications
2. Varghese P.C., "Limit State Design of Reinforced Concrete", Prentice Hall of India, New Delhi

3. Relevant Publications by Bureau of Indian Standards, New Delhi
4. Indian Standard codes related with nondestructive testing, Government Resolutions related to Structural Audits (BMC Act, etc.), Field manuals and reports by Expert Consultants.

**Course Outcomes:** On completion of the course, the students will be;

CO1: Able to identify the behavior, analyze and design of circular slabs, flat slab.
CO2: Able to analyze design domes, bunkers and silos and Chimneys.

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## BTCVPE705G Applied Hydrology and Flood Control

**Teaching scheme:** (3 Lectures) hour/week

### Course Contents

**Module 1:** **(6 Lectures)**

**Precipitation**: Types of precipitation, measurement, Presentation of rainfall data mass rainfall curves, Hyetograph, Concepts of depth area duration analysis, Frequency analysis frequency of point rainfall and plotting position, Intensity duration curves, Maximum Intensity duration frequency analysis.

**Module 2:** **(6 Lectures)**

Runoff, Introduction, Factors affecting runoff, Rainfall Runoff relationships, Empirical Techniques to determine runoff, Runoff hydrograph Introduction, Factors affecting Flood Hydrograph, Components of Hydrograph, Base flow separation, Effective rainfall, Unit hydrograph theory, S curve hydrograph, uses and limitations of Unit Hydrograph

**Module 3:** **(6 Lectures)**

Floods: Types of floods, Estimation of peak flow, Rational formula and other methods, Flood frequency analysis, Gumbel's method, Design floods.

**Module 4:** **(6 Lectures)**

Flood Estimation and Routing: Estimation of design flood, SPF/MPF empirical methods, Statistical methods, Frequency analysis, Unit hydrograph method, Flood estimation in small watersheds and mountainous region, Estimation by lumped, distributed model, Routing, Lumped, Distributed, Hydraulic and hydrological routing.

**Module 5:** **(6 Lectures)**

Flood Control and Management: Flood routing, Hydrological channel routing by Muskingham method, Hydrologic reservoir routing. Flood control methods, Structural and non-structural measures Flood plain Zoning, Flood disaster monitoring and mitigation procedure, Methods of forecasting, Data analysis and warning, Flood fighting Remote Sensing for flood management.

**Text books:**


1. Das G., Hydrology and Soil Conservation Engineering 2nd Edition. Prentice Hall of India Pvt. Ltd. New Delhi. 2009.
2. Subramanya K., Engineering Hydrology, Tata McGraw-Hill Book Co., New Delhi. 1984.
3. Chow V.T., Maidment D.R., and Mays L.W., Applied Hydrology, McGraw Hill, 1998.
4. Applied Hydrology by K.N. Mutreja, Tata Mc-Graw Hill Book Co., New Delhi. 1985.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand the hydrologic extremes of floods.
CO2: Estimate severity and extent of damages and mitigation measures to combat them.
CO3: Understand the climate system, being aware of the impact of climate change on society.
CO4: Understand role of hydrological cycle precipitation and runoff in civil engineering systems.

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## BTCVPE705H Legal Aspects in Civil Engineering Contracts

**Teaching scheme:** (3 Lectures) hour/week

### Course Contents

**Module 1:** **(08 Lectures)**

Professional Practice and Administration Contracts: The standard form of building contracts, Indian contract Act, The right of building owner, Right of Contractor, Types of Civil Engineering contracts, RERA

**Module 2:** **(08 Lectures)**

**Bailment:** Nature of Transactions, Delivery of Bailee, care to be taken, Bailee's Responsibility, Termination, Bailment of pledges. **Injunction:** Types Temporary, Perpetual, Mandatory when referred, Indemnity and Guarantee: Difference between the two, The Contract of Guarantee and Indemnity,

**Module 3:** **(06 Lectures)**

Industrial Acts and Labour Laws: Indian factories Act, Industrial Dispute Act, Payment of Wages Act, Work Compensation Act, Trade Union Act, The Building and Other Constructions Workers' (Regulation of Employment and Conditions of Service) Act, 1996

**Module 4:** **(06 Lectures)**

Arbitration and Award: Indian Arbitration Act, Arbitration Agreement, Conduct of Arbitration, Power and Duties of Arbitration, Rules of Evidence, E- Tendering, Preparation and publication of ward, Methods of Enforcement impending and Awards.

**Module 5:** **(08 Lectures)**

Safety Engineering: Sources, Classification, Cost of Accident and Injury Workmen's Compensation Act, Safety Programme, Safety Organization. Employers Liability Act, Employers Insurance Act, Safety and Health Standards Occupations Hazards, personal Protective equipment, preventive measures Factory Act, Fatal accidents

**Reference Books:**


1. Indian Contract Act Avatar Singh.
2. Indian contract Act Jhamb.


**Text Books:**


1. Indian arbitration Act by B. S. Patil.
2. Indian Contract Act.
3. Safety Engineering, Govt. of India Publication.
4. Professional Practice, Roshan Namavati.
5. Legal Aspects of building and Engineering Contracts by B. S. Patil.


**Course Outcome (CO):**

CO1: Students will learn Indian contract act, Arbitration act and contract administration.
CO2: Student will gain knowledge about bailment and FIDIC.
CO3: Students will understand the labour laws.
CO4: Students will be exposed to safety engineering and relevant act.

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## BTCVPE705I Bridge Engineering

**Teaching Scheme:** (3 Lectures) hours/week

### Course Contents

**Module 1: Introduction** **(6 Lectures)**

History of bridges, components and definitions, classification of road bridges, span length, classicalexamples of each type, people involved in the total process, history of analysis

**Module 2: Selection of site and initial decision process** **(8 Lectures)**

Survey and alignment, geotechnical investigations and interpretations River Bridge: Selection of bridge site and planning, collection of bridge design data, hydrological calculation, waterway calculation, scour calculation, depth of foundation, freeboard. Road Bridge: Selection of bridge site and planning, collection of bridge design data, vertical clearance.

**Module 3: Standard loading for bridge design as per different codes** **(6 Lectures)**

Road Bridges: IRC, BS code, AASHTO code. dead load, live load, impact factor, centrifugal force, wind loads, hydraulic forces, longitudinal forces, seismic forces, earth pressure, buoyancy, lane concept, equivalent loads, traffic load, width of roadway and footway, use of influence lines for maximum forces in members, transverse distribution of live loads among deck longitudinal, load combinations for different working state and limit state designs.

Railway Bridges: Loadings for railway bridges, rail road data, pre-design considerations, rail road vs. highway bridges.

**Module 4: Superstructures** **(8 Lectures)**

Selection of main bridge parameters, design methodologies, choices of superstructure types: orthotropic plate theory, load distribution techniques, grillage analysis, finite element analysis(Preferable), different types of superstructures (RCC and PSC), Longitudinal analysis of bridge, slab bridge and voided slab bridge, beam-slab bridge, box girder bridge

Different types of bridge bearings and expansion joints, Design of bearings and joints.
Parapets for highway bridges: Definitions, classification of bridge parapets, various details

**Module 5: Substructure** **(6 Lectures)**

Pier, abutment, wing walls, importance of soil structure interaction
Foundations: open foundation, pile foundation, well foundation, examples - simply supported bridge, continuous bridge.

**Text/Reference Books:**


1. Victor D. J., Essentials of Bridge Engineering, Oxford & IBH.
2. Raju N. K., Design of Bridges, Oxford & IBH.
3. Ponnuswamy S., Bridge Engineering, Tata McGraw Hill.
4. Raina V K, “Handbook for Concrete Bridges” Vol. 1 and 2, Shroff Publishers, Mumbai.
5. Raina V. K., Concrete Bridge Practice, (Analysis, Design Economics), 4th Edition, Shroff Publishers, Mumbai.
6. Raina V. K., Concrete Bridge Practice, (Construction, Maintenance, Rehabilitation), 2nd Ed., Shroff Publishers, Mumbai.
7. Raina V. K., Field Manual for Highway and Bridge Engineers”, 3rd Edition, Shroff Publishers, Mumbai.
8. Raina V. K., “World of Bridges”, Shroff Publishers, Mumbai.


**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand components of bridges and its various types.

CO2: Understand site selection criteria and comprehend various forces acting on bridges.

CO3: Analyze bridge structures using different analysis techniques.

CO4: Understand the importance of different types of bridge bearings.

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## BTCVOE706A Advanced Structural Analysis

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Review of basic concepts in structural analysis:** **(06 Lectures)**

Type of structure, loads, response, statically determinate structures, principle of virtual work and displacement-based and force-based energy principles deriving stiffness and flexibility coefficients, Force method, Displacement Methods

**Module 2: Matrix concepts and Matrix analysis of structures:** **(06 Lectures)**

Matrix; vector; basic matrix operations; rank; solution of linear simultaneous equations; eigenvalues andeigen vectors. Introduction; coordinate systems; displacement and force transformation matrices; Contra-gradient principle; element and structure stiffness matrices; Element and structure flexibility matrices; equivalent joint loads; stiffness and flexibility approaches

**Module 3: Matrix analysis of structures with axial elements:** **(08 Lectures)**

Introduction: Axial stiffness and flexibility; stiffness matrices for an axial element (two dof), plane truss element (four dof) and space truss element (six dof); One-dimensional axial structures: Analysis by conventional stiffness method (two dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;

Plane trusses: Analysis by conventional stiffness, method (four dof per element) and reduced element stiffness method (single dof); Analysis by flexibility method;

Space trusses: Analysis by conventional stiffness method (six dof per element) and reduced element stiffness method (single dof).

**Module 4: Matrix analysis of beams and grids:** **(10 Lectures)**

Conventional stiffness method for beams: Beam element stiffness (four dof); generation of stiffness matrix for continuous beam; dealing with internal hinges, hinged and guided-fixed end supports; accounting for shear deformations;

Reduced stiffness method for beams: Beam element stiffness (two dof); dealing with moment releases, hinged and guided-fixed end supports;

Flexibility method for fixed and continuous beams: Force transformation matrix; element flexibility matrix; solution procedure (including support movements); Stiffness method for grids: Introduction; torsional stiffness of grid element and advantage of torsion release; analysis by conventional stiffness method using grid element with six dof; analysis by reduced stiffness method (three dof per element);

**Module 5: Matrix analysis of plane frames:** **(06 Lectures)**

Conventional stiffness method for plane frames: Element stiffness (six dof); generation of structure stiffness matrix and solution procedure; dealing with internal hinges and various end conditions;

Reduced stiffness method for plane frames: Element stiffness (three dof); ignoring axial deformations; dealing with moment releases, hinged and guided fixed end supports;

Flexibility method for plane frames: Force transformation matrix; element flexibility matrix; solution procedure(including support movements);Ignoring axial deformations;

**Reference Books:**


1. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009.
2. Asslam Kassimali, "Matrix Analysis of Structures", Brooks/Cole Publishing Co., USA, 1999.
3. Amin Ghali, Adam M Neville and Tom G Brown, "Structural Analysis: A Unified Classical and Matrix Approach", Sixth Edition, 2007, Chapman & Hall.
4. Devdas Menon, "Structural Analysis", Narosa Publishing House, 2008.


**Course Outcomes:** On successful completion of this course the students will be able

CO1: To analyse the indeterminate structures by force and displacement methods of analysis.

CO2: To understand the fundamental concepts of the matrix for analysis of structures.

CO3: To analyse the one-dimensional axial structures by matrix approach.

CO4: To analyse the beams and grid structures by matrix approach.

CO5: To analyse the plane frames by matrix approach.

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## BTCVOE706B Air Pollution Control

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction to Air Pollution:** **(6 Lectures)**

The Structure of the atmosphere, Composition of dry ambient air and properties of air. BIS Definition and scope of Air Pollution, Scales of air pollution, Types of exposures. Air Pollutants,

**Module 2: Classification:** **(8 Lectures)**

Classifications, Natural and Artificial, Primary and Secondary, point and Non-Point, Line and Area Sources of air pollution. Stationary and mobile sources, composition of particulate& gaseous pollutant, units of measurement. Effect of different air pollutants on man, animals, vegetation, property, aesthetic value and visibility, air pollution episodes. Global effects of air pollution- global warming, ozone depletion, acid rain and heat island effect.

**Module 3: Meteorology and Air pollution:** **(8 Lectures)**

Solar radiation, wind circulation, factors affecting dispersion of pollutants, Lapse rate, stability conditions, wind velocity profile, Maximum mixing depth (MMD), visibility, Wind rose diagram, General characteristics of stack plume (Plume behavior). Gaussion diffusion model for finding ground level concentration. Plume rise. Formulae for stack height and determination of minimum stack height.

**Module 4: Air Sampling and Analysis:** **(6 Lectures)**
Air pollution survey, basis and statistical considerations of sampling sites. Devices and methods used for sampling gases and particulates. Stack emission monitoring, isokinetic sampling. Analysis of air samples chemical and instrumental methods. Ambient air quality monitoring.

**Module 5: Photochemical Smog, Odour Pollution & Indoor Pollution:** **(8 Lectures)**
Chemistry of air pollution, Chain reactions of hydrocarbons, nitrogen oxide, Sulphuric oxides and intermediates, photochemical smog formation, air pollution indices -aerosols, fog, smog index. Odour pollution: Theory, sources, measurement and methods of control of odour pollution. Indoor air pollution: Causes of air pollution, sources and effects of indoor air pollutants, changes in indoor air quality, control of indoor air pollutants and air cleaning systems.

**Text Books:**


1. Wark K. and Warner C. F. (1997) "Air pollution: Its Origin and Control" Pearson Education, Delhi.
2. Rao M. and Rao H. V. N. (2017) "Air Pollution" Tata McGraw Hill Pub. Co. Ltd., New Delhi.
3. Peavy S. H. and Rowe D. R. (2017) "Environmental Engineering" Tata McGraw Hill Pub. Co. Ltd., New Delhi.
4. Muralio Krishna K. V. S. G. (2017) "Air Pollution and Control" Jain Brothers, Mumbai


**Reference Books:**


1. Crawford M. (1984) "Air pollution Control Theory" McGraw Hill, New York
2. Anjaneyulu Y. (2002) "Air Pollution and Control Technologies" Allied Publishers, Mumbai
3. Raju B. S. N. (2018) "Fundamentals of Air Pollution" CBS Publishers and Distributors Pvt. Ltd., N. Delhi


**Course Outcomes:** On successful completion of this course the students will be able to

CO1: Identify the sources of air pollutants and their effect on human, plants and materials.

CO2: Apply knowledge of meteorology for controlling air pollution

CO3: Design air pollution controlling equipment.

CO4: Apply knowledge of legislation for prevention and control of air pollution.

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## BTCVOE706C Applications of AI and ML in Civil Engineering

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Introduction to AI and ML in Civil Engineering:** **(5 Lectures)**
Understanding the fundamentals of AI and ML, Overview of AI techniques and Algorithms, AI and ML applications in Civil Engineering, Modeling concept.

**Module 2: AI and ML Techniques:** **(8 Lectures)**
Artificial Neural Networks, Machine Learning Algorithm, Neural Language Processing, Concurrent Neural Networks, Linear regression, Descriptive statics- Data exploration (histograms, scatter Plot etc), measure of central tendency, positions, dispersion and other measures, statistical analysis- measure of distribution (Skewness and Kurtosis), relation between attributes and other statistical graphs, data management- data acquisition, data pre processing and preparation, data quality and transformation.

**Module 3: AI and ML in Transportation Engineering and Construction Planning:** **(6 Lectures)**
AI applications in Traffic flow optimization and analysis, intelligent transportation systems and traffic control, real time traffic prediction using ML Algorithms.
Resource allocation and optimization in construction projects, Implementing AI based construction planning tools.

**Module 4: AI and ML in Water Resource Engineering and Environment Engineering:** **(7 Lectures)**
Model application in Water Resource Engineering- Classification, prediction and forecasting: time series data, Fuzzy model application in Water Resources Engineering: Runoff Hydrograph Simulation, Hydrograph Simulation at watershed scale, Peak discharge prediction
Predictive models for Air pollution levels, Water availability, climate change impacts, Waste management data analysis,

**Module 5: AI and ML in Structural Design and Structural Health Monitoring:** **(7 Lectures)**
Implementing AI and ML in Structural Design task, AI and ML for structural analysis and simulation, Structural design optimization, Importance of predictive maintenance in civil infrastructure, Models for structural health assessment.

**Text Books:**

1. Gebrail Bekdas (2019), "Artificial Intelligence and Machine Learning applications in Civil, Mechanical and Industrial Engineering" IGI Global Publication
2. G. Tyfure (2012), "Soft Computing in Water Resources Engineering", WIT Press, Southampton, UK
3. N. K. Bose and P. Liang (1996), "Neural Networks Fundamentals with Graphs, Algorithms, and applications" Tata McGraw-Hill Publication.

**Reference Books:**

1. B. Kosko (1993), "Neural Networks and Fuzzy Systems: A Dynamical Approach to Machine Intelligence", Prentice- Hall.
2. Publications in peer reviewed international unpaid journals.

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand the fundamental concepts of artificial intelligence and machine learning and their relevance to civil engineering applications.

CO2: Analyze real-time traffic data and apply machine learning models to optimize traffic flow and control in transportation systems.

CO3: Implement AI-based approaches to optimize water resource management and predict water demand, air quality model, climate change in civil engineering projects.

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## BTCVOE706D Introduction to Earthquake Engineering

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1** **(6 Lectures)**

Elements of seismology: Terminology, structure of the earth, causes of an earthquake, seismic waves, magnitude and intensity, seismograph, strong motion earthquakes, Accelerogram, prominent earthquakes of India.

**Module 2** **(6 Lectures)**

Structural dynamics: Free and forced vibrations of single degree of freedom systems, un-damped and viscously damped vibrations, equations of motion, Duhamel integral.

**Module 3:** **(6 Lectures)**

Response Spectrum Theory: construction of Design Response Spectrum, effect of foundation and structural damping on design spectrum, design spectrum of IS 1893, evaluation of lateral loads.

**Module 4** **(6 Lectures)**

Principles of Earthquake Resistant Design (EQRD), planning aspects, resistance of structural elements and structures for dynamic load, design criteria, ductile detailing of RCC members, energy absorption, provisions of IS 13920.

**Module 5** **(10 Lectures)**

Construction aspects of masonry and timber structures, retrofitting and strengthening techniques of low cost and low-rise buildings, provisions of IS 4326.

Dynamic properties of soils, field and Laboratory tests, site evaluation, behavior under dynamic loads, effect on bearing capacity, settlement, liquefaction.

**Text Books:**

1. IS 456, IS 1498, IS 1893, IS 1905, IS 2131, IS 13920, IS 4326 of recent editions, Bureau of IS,New Delhi.
2. Chopra A.K. (2001). *Dynamics of Structures*, 2nd Edi, Pearson Education Pvt. Ltd., India, ISBN 81-7808-472-4.
3. Mario Paz, (1985). *Structural Dynamics*, CBS Publication.
4. Arya A.S., (1987). *Elements of Earthquake Engineering*, South Asian Pub., New Delhi.

**Reference Books:**

1. Clough R.W. and Penzien J.(1993), Dynamics of Structures, McGraw Hill New York
2. Humar J. L., (2002). Dynamics of Structures, 2nd Edition Swets and Zeitlinger, Netherlands.
3. Farzad Naiem, (2001). The Seismic Design Handbook, Kluwer Academic Pub. Massachusetts, ISBN: 0-7923- 7301-4.
4. Dowrick D. J., (1977). Earthquake Resistant Design for Engineers & Architects, John Wiley and Sons Ltd.
5. Pauley T. and Priestley M.J.N., (1992). Seismic Design of Reinforced Concrete and Masonry Buildings, John Wiley &

Sons Inc., USA, ISBN 0-471-54915-0.
6. Nayak N. V., (1985). Foundation Design Manual, Dhanpat rai and Sons, Delhi.
7. Housner G.W. & Hudson D. E., (1950). Applied Mechanics- Dynamics, East-West Edition, N. Delhi.
8. Kramer S. L., (2003). Geotechnical Earthquake Engineering, Pearson Education.

**Course Outcomes:** On completion of the course, the students will be able to:
CO1: Capture complexities in earthquake resistant design of structures
CO2: Grasp Nature of earthquake vibration and associated forces on structures
CO3: Understand importance of designing the building to targeted seismic performance.

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## BTCVOE706E Internet of Things

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1:** **(7 Lectures)**
Introduction to IoT Defining IoT, Characteristics of IoT, Physical design of IoT, Logical design of IoT, Functional blocks of IoT, Communication models & APIs, Machine to Machine, Difference between IoT and M2M, Software define Network.

**Module 2:** **(5 Lectures)**
Network & Communication aspects, Wireless medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination.

**Module 3:** **(6 Lectures)**
Challenges in IoT Design challenges, Development challenges, Security challenges, other challenges.

**Module 4:** **(7 Lectures)**
Domain specific applications of IoT, Home automation, Industry applications, Surveillance applications, Other IoT applications.

**Module 5:** **(7 Lectures)**
Developing IoTs Introduction to Python, Introduction to different IoT tools, developing applications through IoT tools, developing sensor-based application through embedded system platform, Implementing IoT, concepts with python.

**Text Books:**
1. Pethuru Raj and Anupama C. Raman "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by (CRC Press).
2. Samuel Greengard "The Internet of Things" MA: MIT Press, 2015.

**Reference Books:**
**1.** Vijay Madisetti, Arshdeep Bahga, "Internet of Things: A Hands-On Approach"
**2.** Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice.

**Course Outcomes:** On completion of the course, the students will be able to:
CO1: Understand the concepts of Internet of Things.
CO2: Analyze basic protocols in wireless sensor network.
CO3: Design IoT applications in different domain and be able to analyze their performance.
CO4: Implement basic IoT applications on embedded platform.

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# BTCVOE706F Tunnelling and Underground Excavation

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Tunneling Methods** **(6 Lectures)**

Types and purpose of tunnels; factors affecting choice of excavation technique; Methods - soft ground tunneling, hard rock tunneling, shallow tunneling, deep tunneling; Shallow tunnels – cut and cover, cover and cut, pipe jacking, jacked box excavation techniques, methods of muck disposal, supporting, problems encountered and remedial measures.

**Module 2: Tunneling by Drilling and Blasting** **(8 Lectures)**

Unit operations in conventional tunneling; Drilling – drilling principles, drilling equipment, drilling tools, drill selection, specific drilling; Blasting - explosives, initiators, blasting mechanics, blast holes nomenclature; types of cuts- fan, wedge and others; blast design, tunnel blast performance - powder factor, parameters influencing, models for prediction; mucking and transportation equipment selection.

**Module 3: Tunneling by Road headers and Impact Hammers** **(8 Lectures)**

Cutting principles, method of excavation, selection, performance, limitations and problems. Tunneling by Tunnel Boring Machines: Boring principles, method of excavation, selection, performance, limitations and problems; TBM applications.

**Module 4: Excavation of large and deep tunnels Introduction** **(6 Lectures)**

Purpose and use of large and deep tunnels; excavation issues governing large and deep tunnels; excavation methods of large and deep tunnels - unit operations, different equipment, types of rocks.
pressure and methods to deal, roof and wall supports, case studies from hydel, road and rail tunnels.

**Module 5: Shield Tunneling** **(8 Lectures)**

Introduction; advantages of shield tunneling; classification; different types of shields tunneling techniques – open shield, close shield, half shield; conventional shields, special features in shield tunneling; factors affecting selection of a shield; slurry shield, earth pressure balance shield, slime shields, other shield development methods, problems encountered with possible remedies.

## Text Books:


1. Srinivasan R., (2016). Harbour, Docks and Tunnel Engineering, Charotar Pub. House.
2. Saxena S. C. (2015). Tunnel Engineering, DhanpatRai Publications.
3. Tatiya R. R., (2013), Surface and Underground Excavation, CRC Press.


## Reference Books:


1. Stack, B. (1982). Handbook of Mining and Tunnelling Machinery, Wiley, New York.
2. Chugh, C.P., (1977). Drilling Technology Handbook, Oxford & IBH Publication.
3. Bickel J.O. and. Kuesel T.R, (2018). Tunnel Engineering Handbook, CBS Publishers and Distributors Pvt. Ltd.
4. Brebbia C.A., Kaliampakos D., Prochazka P., (2008). Underground Spaces Design, Engineering and Environmental Aspects, WIT Press,


## Web links:

1. https://www.isrm.net
2. www.nirm.in
3. http://umich.edu/~gs265/tunnel.html
4. http://se.sze.hu/images/ngm_se108_1/Tunnels_2015-03-20_Toth_1-Excavation.pdf
5. https://www.usbr.gov/ssle/safety/RSHS/sec23.pdf
6. https://www.osha.gov/Publications/osha3115.html

**Course Outcomes:** On completion of the course, the students will be able to:

CO1: Understand types of tunnels and tunneling methods conforming to site conditions.

CO2: Investigate various tunneling operations and relevant machinery required.

CO3: Understand methods and operations of excavating large and deep tunnels.

CO4: Propose suitable tunneling and excavations methods to optimize the same.

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## BTCVOE706G Bamboo Construction Technology

**Teaching Scheme:** (3 Lectures) hours/week

**Course Contents**

**Module 1: Understanding bamboo plant** **(6 Lectures)**
Understanding Bamboo anatomy, Bamboo species in India & worldwide, Traditional use of bamboo in India & worldwide, Field visit to understand bamboo plant

**Module 2: Environmental impact** **(6 Lectures)**
Understanding environmental issues, Carbon Foot print of various building materials, Energy analysis, Response to Climate Change, environmental benefit of bamboo house

**Module 3: Bamboo as a Construction Material** **(6 Lectures)**
Various properties of bamboo, comparative analysis with steel, timber etc. structural properties of various bamboo species, Bamboo preservation techniques, Field visit to understand preservation of bamboo

**Module 4: Understanding Bamboo** **(6 Lectures)**
Various joints in bamboo, Preparation of drawing for bamboo structures, structural analysis of bamboo structure, Various components in bamboo e.g. door, window, sky light, trusses etc. , Case study, Field visit to understand Bamboo house

**Module 5: Bamboo Economy** **(6 Lectures)**
Estimation of bamboo structure, pre fabrication in bamboo construction, income generation from bamboo plantation, Case study – well known bamboo structure

**Text books:**
1. David Farrelly, "The book of Bamboo ", Sep 2002, University of California press.
2. Vinu Kale, "(Venu Bharati) '', CAPART publication, New Delhi.
3. Jain A.K., "The Idea of Green Building" Khanna Publishers, N. Dehli, ISBN No. 978-81-7409-256-4.

**Reference books:**
1. SP 7- National Building Code Group 1 to 5- B.I.S. New Delhi (Part 6 – section 3).
2. IS 9096 (2006) Preservation of Bamboo.

**Course Outcomes**: On completion of the course, the students will be able to
CO1: Understand need of Bamboo in construction.
CO2: Understand bamboo as a construction material.
CO3: Develop construction techniques in bamboo

☑☑☑☑☑☑☑☑☑☑☑

## BTCVHM707A Essence of Indian Traditional Knowledge

**Teaching Scheme:** 1 Lecture / week

**Course Contents**

**Module 1:** **(4 Lectures)**
Ancient Education System in India, History of Indian Knowledge System, Sources of knowledge transmission and preservation, Indian Artistic Tradition: Chitrakala, Moorthikala, Vasthukala, Sthapthya, Sangeetha, Nruthya, Sahithya

**Module 2:** **(4 Lectures)**
Indian Linguistic Tradition (Phonology, morphology, syntax & semantics), Yoga & Holistic Health care.

**Module 3:** **(4 Lectures)**
Philosophical Traditions in ancient India, Relevance in today's life.

**Module 4:** **(4 Lectures)**
Glimpses of ancient Indian science and technology, Ancient structures in India, Traditional materials, Construction styles and Techniques, Developments in construction materials, living styles and habitation, Town Planning, Case Studies.

**Module 5:** **(6 Lectures)**
Developments in water supply, sanitation, irrigation and agriculture, Case Studies.
Developments in transportation and communication, Case Studies.

**Text / Reference Books:**


1. V. Sivaramakrishna, “Cultural Heritage of India”, Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edi., 2014.
2. Swami Jitatmanand, “Modern Physics and Vedant”, Bharatiya Vidya Bhavan.
3. Fritz of Capra, “Tao of Physics”.
4. Fritz of Capra, “The wave of Life”.
5. 5Jha V. N. (English Trans,), “Tarkasangraha of Annam Bhatta”, Inernational Chinmay Foundation, Velliarnad, Arnakulam.
6. “Yoga Sutra of Patanjali”, Ramakrishna Mission, Kolkata.
7. Jha GN (English Trans.), R N Jha, “Yoga-darshanam with Vyasa Bhashya”, Vidyanidhi Prakasham, Delhi, 2016.
8. Jha RN, “Science of Consciousness Psychotherapy and Yoga Practices”, Vidyanidhi Prakasham, Delhi, 2016.
9. P R Sharma (English translation), “Shodashang Hridayam”.
10. Indian Journal of Traditional Knowledge.
11. https://www.niscair.res.in/sciencecommunication/researchjournals/rejour/ijtk/ijtk0.asp
12. Swayam Course by Prof. D. P. Mishra, IIT Kanpur: https://swayam.gov.in/nd1_noc19_ae07/preview.


☑☑☑☑☑☑☑☑☑☑

## BTCVHM707B Foreign Language

Student may take foreign language course from online platform NPTEL/SWAYAM/any other approved foreign language course by university such as;

**German I** https://onlinecourses.nptel.ac.in/noc19_hs51/preview
**Spanish** https://onlinecourses.swayam2.ac.in/cec19_lg03/preview
**French** https://onlinecourses.swayam2.ac.in/cec19_lg04/preview
**Japanese** https://onlinecourses.nptel.ac.in/noc19_hs52/preview

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## BTCVL708 Design and Drawing of Prestressed Concrete Structures Lab

Practical: 2 Hours / Week Term Work: 50 Marks

Term work shall be based on the syllabus of BTCVC701. It consists of:

1. Assignment on prestress Loss calculation.
2. Assignment on stress calculation.
3. Assignment on resistance of PSC members against shear and torsion.
4. Design, detailing and drawing of prestressed slab.
5. Design, detailing and drawing of prestressed girder.
6. Two site visit reports of R.C.C. and P.S.C structure.

There should be separate design data for a group size of **maximum four** students.

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## BTCVL709 Professional Practices Lab

Practical:2 Hours / Week

Term work include detailed study and working of following set of assignments
1) Detailed estimate for a two storied RCC or load bearing wall building
2) Preparing detailed estimate for any four of the following:
   a) A small culvert
   b) A stretch of a road about 1 Km. long including earthwork
   c) A reach of canal about 1 Km. long
   d) A percolation tank
   e) A factory shed of steel frame
   f) Water supply scheme
   g) Drainage scheme
   h) Water Treatment plants
3) Valuation report including valuation certificate for any one of the following:
   a) A building for residential purpose or commercial purpose
   b) A hotel
   c) A theatre
   d) Any one construction machine.
4) Drafting of Detailed specification for any five civil engineering items. This shall include at least one item each from Roads, Irrigation works, Water Supply, Sanitation and buildings.
Assignment (1) and (2) shall include Rate Analysis of at least two items.

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## BTCVP 610

## Field Training /Internship /Industrial Training (Evaluation)

Students are expected to undergo industrial training for at least four weeks at factory / construction site / design offices or in combination of these. Training session shall be guided and certified by qualified engineer / architect / contractor in civil engineering. A neat detailed report on activities carried out during training is expected. Students should undergo training for minimum 4 weeks which can be completed partially in V Semester and VI Semester or in at one time after VI Semester. Evaluation will be done in VII Semester.

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## BTCVS710 Seminar

**Teaching Scheme:** 2 hours per week

Student shall visit to ongoing construction sites in field to witness and collect information from works of execution of roads. It is desirable to collect basic information on components of roads, construction machinery, etc. Intention of the work is to introduce the student to the sequential order of execution of road works, preparation of road alignment and various surveys

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## BTCVM711 Project Stage I

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student.

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## Semester VIII

| Course Code | Type of Course | Course Title | Weekly Teaching Scheme | | | Evaluation Scheme$ | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| BTCVSS801A | (Self-Study Course) # | Characterization of Construction Materials | 02** | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVSS801B | | Geo synthetics and Reinforced Soil Structures | | | | | | | | |
| BTCVSS801C | | Higher Surveying | | | | | | | | |
| BTCVSS801D | | Maintenance and Repair Of Concrete Structures | | | | | | | | |
| BTCVSS801E | | Structural Dynamics | | | | | | | | |
| BTCVSS801F | | Engineering Systems & Development | | | | | | | | |
| BTCVSS801G | | Sustainable River Basin Management | | | | | | | | |
| BTCVSS801H | | Modern Construction Materials | | | | | | | | |
| BTCVSS801J | | Advanced Town & Urban Planning | | | | | | | | |
| BTCVSS802A | (Self-Study Course) # | Energy Efficiency Acoustics and Day lighting in Building | 02** | -- | -- | 20 | 20 | 60 | 100 | 3 |
| BTCVSS802B | | Environmental Remediation of Contaminated Sites | | | | | | | | |
| BTCVSS802C | | Remote Sensing Essentials | | | | | | | | |
| BTCVSS802D | | Mechanical Characterization of Bituminous Materials | | | | | | | | |
| BTCVSS802E | | Soil Structure Interaction | | | | | | | | |
| BTCVSS802F | | Design of Water Supply Systems | | | | | | | | |
| BTCVP803 | Project Stage-II | Project Stage II or Internship | -- | -- | 24 | 100 | -- | 100 | 200 | 12 |
| | | Total | 04 | -- | 24 | 140 | 40 | 220 | 400 | 18 |

### BTCVSS801 A Characterization of Construction Materials

https://archive.nptel.ac.in/content/syllabus_pdf/105106200.pdf

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### BTCVSS801 B Geo-synthetics and Reinforced Soil Structures

https://archive.nptel.ac.in/content/syllabus_pdf/105106052.pdf

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**BTCVSS801 C Higher Surveying**
https://archive.nptel.ac.in/content/syllabus_pdf/105103176.pdf

☑☑☑☑☑☑☑☑☑

**BTCVSS801 D Maintenance and Repair of Concrete Structures**
https://archive.nptel.ac.in/content/syllabus_pdf/105106202.pdf

☑☑☑☑☑☑☑☑☑

**BTCVSS801 E Structural Dynamics**
https://archive.nptel.ac.in/content/syllabus_pdf/105106151.pdf

☑☑☑☑☑☑☑☑☑

**BTCVSS801 F Engineering systems and development**
https://archive.nptel.ac.in/content/syllabus_pdf/110104074.pdf

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**BTCVSS801 G Sustainable River Basin Management**
https://nptel.ac.in/content/syllabus_pdf/105106145.pdf
https://onlinecourses-archive.nptel.ac.in/noc15_ce03/preview

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**BTCVSS801 H Modern Construction Materials**
https://archive.nptel.ac.in/content/syllabus_pdf/105106053.pdf

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**BTCVSS802 A Energy Efficiency Acoustics and Daylighting in Building**
https://archive.nptel.ac.in/content/syllabus_pdf/105102175.pdf

☑☑☑☑☑☑☑☑☑

**BTCVSS802 B Environmental Remediation of Contaminated Sites**
https://archive.nptel.ac.in/content/syllabus_pdf/105107181.pdf

☑☑☑☑☑☑☑☑☑

**BTCVSS802 C Remote Sensing Essentials**
https://archive.nptel.ac.in/content/syllabus_pdf/105107201.pdf
☑☑☑☑☑☑☑☑☑

**BTCVSS802 D Mechanical Characterization of Bituminous Materials**
https://archive.nptel.ac.in/content/syllabus_pdf/105106203.pdf
☑☑☑☑☑☑☑☑☑

## BTCVSS802 E Soil Structure Interaction

https://archive.nptel.ac.in/content/syllabus_pdf/105105200.pdf

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## BTCVP803 Project Stage II or Internship

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarise the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student in Industry based project or In-house project or Internship.

☑☑☑☑☑☑☑☑☑☑

**Dr. Babasaheb Ambedkar Technological University**
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**(under Maharashtra Act No. XXIX of 2014)**
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**Telephone and Fax. 02140 - 275142**
**www.dbatu.ac.in**

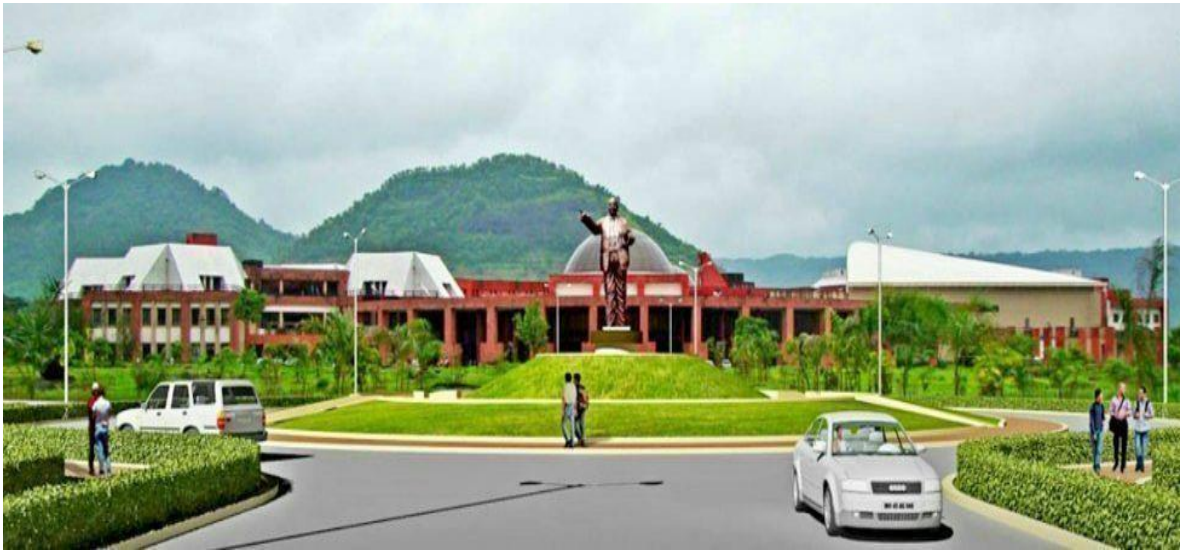
# PROPOSED CURRICULUM

# UNDER GRADUATE PROGRAMME

# B.TECH

## COMPUTER ENGINEERING

## WITH EFFECT FROM THE ACADEMIC YEAR 2020-2021



# Category – wise total number of credits

| Sr. No. | Category of courses | Minimum credits to be Earned |
|---|---|---|
| 1 | Basic Science Course (BSC) | 25 |
| 2 | Engineering Science Course (ESC) | 20 |
| 3 | Humanities and Social Science including Management Courses (HSSMC) | 12 |
| 4 | Professional Core Course (PCC) | 44 |
| 5 | Professional Elective Course (PEC) | 09 |
| 6 | Open Elective Course (OEC) | 06 |
| 7 | Seminar / Mini Project / Internship / Major Project | 22 |
| 8 | Emerging Courses | 22 |
| | **TOTAL** | **160** |

## Semester –III (Second Year)

## Proposed Scheme w.e.f. July – 2021

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTBS301 | Engineering Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC302 | Discrete Mathematics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC303 | Data Structures | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC304 | Computer Architecture & Organization | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC305 | Elective –I<br>(a) Object - oriented Programming in C++<br>(b) Object Oriented Programming in Java | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOL306 | Data Structures Lab & Object Oriented Programming Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOS307 | Seminar – I | - | | 4 | 60 | - | 40 | 100 | 2 |
| | BTES211P | Field Training / Internship / Industrial Training Evaluation | - | - | - | - | - | - | - | Audit |
| | | **TOTAL** | **15** | **5** | **8** | **220** | **100** | **380** | **700** | **24** |

## Semester –IV (Second Year)

## Proposed Scheme w.e.f. January – 2022

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTCOC401 | Design & Analysis of Algorithms | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC402 | Operating Systems | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTHM403 | Basic Human Rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTBS404 | Probability Theory and Random Processes | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTES405 | Digital Logic Design & Microprocessors | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOL406 | Operating Systems & Python Programming Lab | 1* | - | 4 | 60 | - | 40 | 100 | 3 |
| | BTCOS407 | Seminar – II | | | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOF408 | Field Training / Internship / Industrial Training Evaluation | | | | | | - | - | Audit to be evaluated in V Sem. |
| **TOTAL** | | | **16** | **3** | **8** | **220** | **100** | **380** | **700** | **23** |

*Note: Lecture should be conducted only for Python Programming

# (A) BTCOC 305: Object Oriented Programming in C++

**[Unit 1] Introduction to Object Oriented Programming and Objects and Classes [7 Hours]**

Need of object oriented programming, The object oriented approach, Characteristics of object oriented languages, class, Objects as data types, Constructors, Objects as function arguments, Returning objects.

**[Unit 2] Operator Overloading, Inheritance and Polymorphism [7 Hours]**

Overloading unary and binary operators, Data conversion. Derived and base class, Public and private inheritance, Levels of inheritance, **multiple** inheritance Examples.

**[Unit 3] Polymorphism [7 Hours]**

Virtual functions, Dynamic binding, Abstract classes and pure virtual functions, Friend functions, this pointer.

**[Unit 4] Streams and Files [7 Hours]**

Streams, Stream output and input, Stream manipulators, Files and streams, Creating, Reading, Updating sequential and random files.

**[Unit 5] Templates, Exception Handling and STL [7 Hours]**

Function templates, Overloading function templates, Class templates, Exception handling overview, Need of exceptions, An exception example, Multiple exceptions, Exception specifications. Standard Template Library (STL) Introduction to STL-Containers, Iterators, Algorithms, Sequence containers, Associative containers, Container adapters.

**Text Book:**

1. E. Balagurusamy, Object Oriented Programming with C++, McGraw-Hill Publication, 6th Edition, 2013.

**Reference Books:**

1. Robert Lafore, Object Oriented Programming in C++, Sams Publishing, 4th Edition, 2001.
2. Dr. B. B. Meshram, Object Oriented Paradigms with C++ Beginners Guide for C and C++, SPD Publication, 1st Edition, 2016.
3. Rajesh R. Shukla, Object-Oriented Programming in C++, Wiley India Publication, 1stEditio,2008
4. Bjarne Stroustrup, The C++ Programming Language, Addison-Wesley Publication, 4th Edition, 2013.
5. P. J. Deitel, H. M. Deitel, C++ How to Program, PHI Publication, 9th Edition, 2012.
6. John Hubbard, Programming with C++, Schaum‘s Outlines, McGraw-Hill Publication, 2nd Edition, 2000.
7. Nicolai M. Josuttis, Object-Oriented Programming in C++, Wiley Publication, 1st Edition, 2002.

# Elective –I
# (B) BTCOC 305: Object Oriented Programming in JAVA

**[Unit 1] Introduction to Java Applications** **[7 Hours]**

Introduction, Java Class Libraries, Typical Java Development Environment, Memory Concepts, Arithmetic. Introduction to Classes and Objects: Introduction, Classes, Objects, Methods and Instance Variables, Declaring a Class witha Method and Instantiating an Object of a Class, Declaring a Method, Instance variables, *set* Methods and *get* Methods, Primitive Types vs. Reference type double Types ,Initializing Objects with Constructors, floating point numbers.

**[Unit 2] Control Statements** **[7 Hours]**

Control structures *if* single-selection statement, *if….else* double-selection statement, *while* repetition statement, *do….while* repetition statement, *switch* multi-selection statement, *break* and *continue* statements, logical operators. Methods :Introduction, Program modules in Java, *static* methods, *static* Fields and *Class Math*, declaring methods with multiple parameters, scope of declaration, method overloading and Java API packages.

**[Unit3]Arrays** **[7 Hours]**

Arrays,declaring and creating arrays in java, examples using arrays, passing arrays to methods, multidimensional arrays, variable-length argument lists, using command-line arguments.

**[Unit 4] Inheritance and Polymorphism in Java** **[7 Hours]**

Inheritance: Super classes and Subclasses, protected members, relationship between super classes and subclasses, constructors in subclasses, objectclass. Polymorphism: Abstract classes and methods, final methods and classes, polymorphism examples and Interfaces.

**[Unit 5] Exception-handling and Java script** **[7 Hours]**

Exception-handling overview, handling *Arithmetic Exceptions* and *Input Mismatch Exceptions*, when to use exception handling, java exception hierarchy, *finally* block. Introduction to Java Applets. Java script: Introduction to client side scripting, Syntax basics, Operators, Comparisons, Statements, Loops, Events, Objects, and User defined functions, Validations using object functions, Validations using regular expressions, JS document object model, popovers, windows

**Text Book:**

1. Paul Deitel and Harvey Detail, *Java: How to Program*, Pearson's Publication, 9thEdition.

**Reference Books:**

1. Joel Murach and Michael Urban, *Murach's Beginning Java with Eclipse*, Murach's Publication, 1st Edition, 2016. Doug Lowe, *Java All-in-One For Dummies*, Wiley Publication, 4th Edition,2014.
2. Herbert Schildt, *Java The Complete Reference*, McGraw-Hill Publication, 9thEdition.
3. Patrick Niemeyer, Daniel Leuck, *Learning Java*, O'Reilly Media, 4th Edition,2013.
4. ―JavaScript: The Good Parts‖, Douglas Crockford, O'Reilly, ISBN: 9782744055973. ―Microsoft® .NET: Architecting Applications for the Enterprise‖, Microsoft Press; 1st edition, ISBN:978-0735626096

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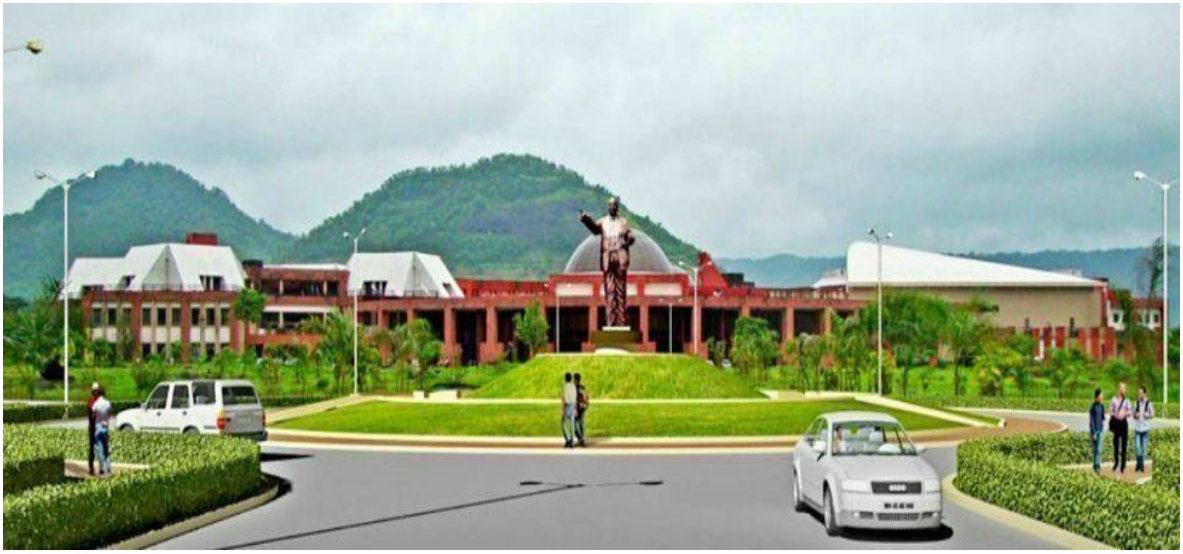
# B.TECH

## COMPUTER ENGINEERING

## WITH EFFECT FROM THE ACADEMIC YEAR 2020-2021



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| 7 | Seminar / Mini Project / Internship / Major Project | 22 |
| 8 | Emerging Courses | 22 |
| | **TOTAL** | **160** |

## Semester –V (Third Year)

## Proposed Scheme w.e.f. July – 2022

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTCOC501 | Database Systems | 3 | 1 | - | 20 | 20 | 20 | 100 | 4 |
| | BTCOC502 | Theory of Computation | 3 | 1 | - | 20 | 20 | 20 | 100 | 4 |
| | BTCOC503 | Software Engineering | 3 | 1 | - | 20 | 20 | 20 | 100 | 4 |
| | BTCOE504 | Elective – II<br>(A) Human computer Interaction<br>(B) Numerical Methods | 3 | - | - | 20 | 20 | 20 | 100 | 3 |
| | BTHM505 | Elective – III<br>(A) Economics and Management<br>(B) Business Communication | 3 | - | - | 20 | 20 | 20 | 100 | 3 |
| | BTCOL506 | Database Systems & Software Engineering Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOM507 | Mini-project – I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOF408 | Field Training / Internship / Industrial Training Evaluation | - | - | - | - | - | - | - | Audit |
| **TOTAL** | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

## Semester –VI (Third Year)
## Proposed Scheme w.e.f. January – 2023

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTCOC601 | Compiler Design | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC602 | Computer Networks | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOC603 | Machine Learning | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTCOE604 | Elective – IV<br>(A) Geographic Information System<br>(B) Internet of Things<br>(C) Embedded Systems | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTHM605 | Elective – V<br>(A) Development Engineering<br>(B) Employability and Skill Development<br>(C) Consumer Behaviour | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTCOL606 | Competitive Programming & Machine Learning Lab | 1* | - | 4 | 60 | - | 40 | 100 | 3 |
| | BTCOM607 | Mini-project – II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOF608 | Field Training / Internship / Industrial Training | - | - | - | - | - | - | - | Audit to be Evaluated in VII Sem. |
| **TOTAL** | | | **16** | **3** | **8** | **220** | **100** | **380** | **700** | **23** |

*Note: Lecture should be conducted only for Competitive Programming

# BTCOE504 (A): Human Computer Interaction

**[Unit 1]** **[7 Hours]**

Introduction: Course objective and overview, Historical evolution of the field, The Human, The Computer, The Interaction.

**[Unit2]** **[7 Hours]**

Design processes: Interaction Design basics, Concept of usability – definition and elaboration, HCI in the Software Process, Design Rules.

**[Unit3]** **[7 Hours]**

Implementation and Evaluation: Implementation Support, Evaluation Techniques, Universal Design, Use Support.

**[Unit4]** **[7 Hours]**

Models: Cognitive Models, Socio – Organizational Issues and Stakeholders Requirements, Communication and Collaboration models. Theories: Task Analysis Dialog notations and Design Models of the system Modeling Rich Interactions.

**[Unit5]** **[7 Hours]**

Modern Systems: Group ware, Ubiquitous Computing and Augmented Realities, Hypertext, Multimedia and World Wide Web.

**Text Book:**

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale ―Human Computer Interaction‖, Pearson Education, 3rd Edition, 2003.

**Reference Books:**

1. B. Shneiderman, Designing the User Interface, Addison-Wesley Publishing Company.
2. Jenny Preece, Helen Sharp, Yvonne Rogers, Interaction Design: Beyond Human-Computer Interaction, Wiley Publication, 4th Edition, 2015.
3. Gerard Jounghyun Kim, Human–Computer Interaction: Fundamentals and Practice, CRC Press, 2015.
4. Jenifer Tidwell, Designing Interfaces, Patterns for Effective Interaction Design, O‘Reilly Media, 2nd Edition, 2010.

**NPTEL Course:**

1. Human Computer Interaction, Prof. K. Ponnurangam, Dept. of Computer Science and Engineering, IIIT Delhi.

# BTCOE504 (B): Numerical Methods

**[Unit 1]** **[7 Hours]**

Solution of Algebraic and Transcendental Equation: Bisection method, Method of false position, Newton's method and Newton-Raphson method.

**[Unit 2]** **[7 Hours]**

Solution of Linear Simultaneous Equation: Gauss elimination method, Gauss-Jordan method, Iterative method of solution- Jacobi iteration method, Gauss-Seidal iteration method, Relaxation method.

**[Unit 3]** **[7 Hours]**

Finite Differences: Forward difference operator, Backward difference operator, Central difference operator, New- ton's interpolation formulae, Newton's forward–backward-central interpolation formulae.

**[Unit 4]** **[7 Hours]**

Differentiation and Integration: Newton-Cortes formula, Trapezoidal rule, Simpson one–third rule, Simpson three- eighth rule.

**[Unit 5]** **[7 Hours]**

Numerical Solution of ODE: Picard's methods, Taylor series method, Euler's method, Modified Euler's method, Runge Kutta method.

**Text Book:**

1. B. S Grewal, Higher Engineering Mathematics, 40th edition, Khanna publication

**Reference Books:**

1. S. S. Shastri, Introduction to Numerical Methods, PHI publication.
2. V. Rajaraman, Computer Oriented Methods, 3rd edition, PHI publication.
3. Conte and De boor, Elementary Numerical Analysis, BPB publication.
4. E. Kreyszig, Advanced Engineering Mathematics, BPB publication.
5. Steven C Chapra, Numerical Methods for Engineers, 5th edition, McGraw Hill publication.

**NPTEL Course:**

1. Numerical Methods, Prof. Ameeya Kumar Nayak and Prof. Sanjeev Kumar, IIT Roorkee.

# BTHM505 (A): Economics and Management

**[Unit 1]** **[7 Hours]**

Introduction, Market Equilibrium: Demand and Supply, Elasticity of Demand Forecasting, Production, Exercises on Economics, Cost-Volume-Profit Relationships, Cost Management Systems and Activity Costing System.

**[Unit 2]** **[7 Hours]**

Relevant Information and Decision Making, Cost Allocation, Exercises on Economics, Double-Entry Bookkeeping, Job Casting, Process Costing, The Master Budget, Flexible Budgets and Variance Analysis.

**[Unit 3]** **[7 Hours]**

Financial Statements, Analysis of Financial Statements, Time Value of Money, Comparison of Alternatives.

**[Unit 4]** **[7 Hours]**

Depreciation Accounting, Evolution of Management Thoughts, Functions of Management Directing.

**[Unit 5]** **[7 Hours]**

Product Development, Forecasting Revisited, Capacity Planning, Product / Services Strategies and Plant Layout, Production Planning and Control.

**Text Book:**

1. R. Paneerselvam, Engineering Economics, PHI publication.

**Reference Books:**

1. Robbins S.P. and Decenzo David A., Fundamentals of Management: Essential Concepts and Applications, Pearson Education.
2. L. M. Prasad, Principles and Practices of Management.
3. K. K. Dewett & M. H. Navalur, Modern Economic Theory, S. Chand Publications.

**NPTEL Course:**

1. Economics / Management / Entrepreneurship, by Prof. P. K. J. Mohapatra Department of Industrial Engineering & Management, IIT Kharagpur.

# BTHM505 (B): Business Communication

**[Unit 1]** **[6 Hours]**

Introduction, Definitions & Concepts, Communicative Competence.

**[Unit 2]** **[6 Hours]**

Intercultural Communication, Nonverbal Communication, Thought and Speech, Translation as Problematic Discourse.

**[Unit 3]** **[6 Hours]**

Barriers to Communication, Listening, Communication Rules, Communication Style.

**[Unit 4]** **[6 Hours]**

Interpersonal Communication, Relational Communication, Organizational Communication. Collaboration, Communication in Groups and Teams, Persuasive Communication.

**[Unit 5]** **[7 Hours]**

Negotiation and Conflict Management, Leadership, Written Communication in International Business, Role of Technology in international Business Communication, Moving to Another Culture, Crisis Communication, Ethics in Business Communication.

**Text Book:**

1. Mary Ellen Guffey, Essentials of Business Communication, Sixth Edition, South-Western College Publishing

**Reference Books:**

1. Bovee, Courtland, John Thill & Mukesh Chaturvedi, Business Communication Today: Dorling kindersley, Delhi.
2. Kaul, Asha, Business Communication, Prentice-Hall of India, Delhi.
3. Monippally, Matthukutty M. Business Communication Strategies. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
4. Sharma, Sangeeta and Binod Mishra, Communication Skills for Engineers and Scientists, PHI Learning Pvt. Ltd., New Delhi.

**NPTEL Course:**

1. International Business Communication, by Aradhana Malik, IIT Kharagpur.

# BTCOE604 (A): Geographic Information System

**[Unit 1]** **[6 Hours]**

What is Geographic Information Systems?, Different components of GIS, Different types of vector data, Raster data models and their types TIN data model.

**[Unit 2]** **[6 Hours]**

Advantages and disadvantages associated with vector, raster and TIN Non-spatial data attributes and their type Raster data compression techniques Different raster data file formats spatial database systems and their types.

**[Unit 3]** **[6 Hours]**

Pre-processing of spatial datasets Different map projections, Spatial interpolation techniques Different types of resolutions Digital Elevation Model (DEM).

**[Unit 4]** **[6 Hours]**

Quality assessment of freely available DEMS GIS analysis-1

**[Unit 5]** **[6 Hours]**

GIS analysis-2 and applications Errors in GIS Key elements of maps.

**Text Book:**

1. Ian Heywood, Sarah Cornelius and Steve Carver, An Introduction to Geographical Information Systems (4th Edition) 2012.

**Reference Books:**

1. Chang Kang-tsung (Karl), Introduction to Geographic Information Systems, 2006
2. Tor Bernhardsen Geographic Information Systems: An Introduction, May 2002

**NPTEL Course:**

1. Dr. Arun K. Saraf, Introduction to Geographical Information System, IIT Roorkee.

# BTCOE604 (B): Internet of Things

**[Unit 1] IoT Introduction** **[7 Hours]**

Genesis of IoT, IoT and Digitization, IoT Impact, Convergence of IT and IoT, IoT Challenges, IoT Network Architecture and Design, Drivers Behind New Network Architectures, Comparing IoT Architectures, A Simplified IoT Architecture, The Core IoT Functional Stack, IoT Data Management and Compute Stack.

**[Unit 2] Smart Objects** **[7 Hours]**

The ―Things‖ in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

**[Unit 3] IP Layer** **[7 Hours]**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The Transport Layer, IoT Application Transport Methods.

**[Unit 4] Data and Analytics for IoT** **[7 Hours]**

An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IoT Security, Common Challenges in IoT Security, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment

**[Unit 5] IoT Physical Devices and Endpoints** **[7 Hours]**

Building iot with Arduino: Arduino–Interfaces-Arduino IDE–Programming, RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture, Smart City Security Architecture, Smart City Use-Case Examples.

**Text Book:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet Things‖, 1st Edition, Pearson Education.

**Reference Books:**

1. Srinivasa K G, ―Internet of Things‖, CENGAGE Leaning India, 2017.
2. Vijay Madisetti and Arshdeep Bahga, ―Internet of Things (A Hands-on-Approach)‖, 1st Edition, VPT, 2014.
3. Raj Kamal, ―Internet of Things: Architecture and Design Principles‖, 1st Edition, McGraw Hill Education, 2017.

## BTCOE604 (C): Embedded Systems

**[Unit 1]** **[7 Hours]**

Introduction: Embedded system overview, Design challenge, Processor technology, IC technology, Design technology, Custom single processor technology, Hardware-combinational logic, Sequential logic, Custom single purpose processor design, RT-level custom single purpose processor design, Optimizing custom single purpose processors.

**[Unit 2]** **[7 Hours]**

General purpose processor Software: Basic architecture, Operation, Programmers view, Development environment, Application specific instruction set processor, Selecting a microprocessor, General purpose processor design. Introduction, ARM7TDMI-S processor, Block diagram, Memory mapping, Memory accelerator module.

**[Unit 3]** **[7 Hours]**

System control: Pin description, Register description, Crystal oscillator, External interrupt inputs, Other system controls, Memory mapping control, Phase locked loop, Power control, Reset, APB divider, Wakeup timer. GPIO: GPIO register map, Timer-TIMER / COUNTER0 and TIMER / COUNTER1 register map, Example timer operation, Architecture.

**[Unit 4]** **[7 Hours]**

UART: UART0/1 - UART0/1 register map, UART0/1 baud rate, UART0/1 auto-baud, UART0/1 block diagram. Serial peripheral interface: SPI data transfers, SPI pin description, SPI register map, SPI block diagram; I2C-bus interface: I2C bus configuration, I2C operating modes, I2C Bus serial interface block diagram, Summary of I2C registers.

**[Unit 5]** **[7 Hours]**

Introduction, Process scheduling, Examples of RTOS, Microprocessor and microcontroller based system design, typical design examples, system design and simulation using simulation software such as Proteus VSM. Digital Camera Example Introduction, Introduction to a Simple Digital Camera; User‘s Perspective, Designer‘s perspective requirements specification non functional requirements, Informal functional specification, refined functional specification.

**Text Book:**

1. Frank Vahid ―Embedded System Design- A Unified system Hardwar/Software Introduction‖, (3rd Edition, John Wiley India) ISBN 978-81-265-0837-2.

**Reference Books:**

1. LPC 214x User manual (UM10139):- www.nxp.com..
2. Andrew N. Sloss, Dominic Symes and Chris Wright ―ARM System Developer‘s Guide – Designing and Optimizing System Software‖, (Elsevier) ISBN: 1-55860-874-5.
3. LPC 17xx User manual (UM10360) :- www.nxp.com
4. ARM architecture reference manual : - www.arm.com
5. Steve Furber ―An Engineer‘s Introduction to the LPC2100 series‖ Trevor Martin (Hitex (UK) Ltd.).―ARM System-on-Chip Architecture‖ (2nd Edition, Addison-Wesley Professional)ISBN-13: 9780201403527

# BTHM605 (A): Development Engineering

**[Unit 1]** **[7 Hours]**

Introduction, Various Definitions of Development Engineering.

**[Unit 2]** **[7 Hours]**

World Poverty and Development, Poverty in the India, Sustainable Development, Culture and Global Competence, The Engineer‘s Role.

**[Unit 3]** **[7 Hours]**

Social Justice, Social Justice and Engineering, Religious Perspectives, Secular Perspectives.

**[Unit 4]** **[7 Hours]**

Development Strategies: Society, Technological Change, and Development, Development Economists‘ Perspectives, Global Health Perspective, International Education Perspective, Social Business Perspectives.

**[Unit 5]** **[7 Hours]**

Engineering for Sustainable Community Development: The Engineer as a Helper Participatory Community Development, Teamwork and Project Management, Community Assessment: Learning About a Community, Project Selection, Humanitarian Technology, Participatory Technology Development, Humanitarian STEM Education. ICT for Development, AI for Humanitarian purposes, Blockchain and Social Development.

**Text Book:**

1. Kevin M. Passino, Humanitarian Engineering: Advancing Technology for Sustainable Development.

# BTHM605 (B): Employability and Skill Development

**[Unit 1] Soft Skills & Communication basics: [7 Hours]**

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.

**[Unit 2] Arithmetic and Mathematical Reasoning and Analytical Reasoning and Quantitative Ability: [7 Hours]**

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem).
Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy).

**[Unit 3] Grammar and Comprehension: [7 Hours]**

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing.

**[Unit 4] Skills for interviews: [7 Hours]**

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication- body movement, physical appearance, verbal sounds, closeness, time.

**[Unit 5] Problem Solving Techniques: [7 Hours]**

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.
Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

**Text Book:**

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, ―Soft Skills- An integrated approach to maximize personality‖, ISBN: 987-81-265-5639-7, First Edition 2016

**Reference Books:**

1. Wiley Wren and Martin, "English grammar and Composition", S. Chand publications.
2. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
3. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
4. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
5. Eugene Ehrlich, Daniel Murphy, "Schaum;s Outline of English Grammar", McGraw Hills.
6. David F. Beer, David A. McMurrey, ―A Guide to Writing as an Engineer‖, ISBN: 978- 1-118-30027-5 4th Edition, 2014, Wiley.

## BTHM605 (C): Consumer Behavior

**[Unit 1]** **[7 Hours]**

Introduction to the Study of Consumer Behavior: Defining Consumer Behavior, Scope and Application of Consumer Behavior, Why Study Consumer Behavior, Evolution of Consumer Behavior as a Field Of Study and its relationship with Marketing: Behavioral Dimension, The Interdisciplinary Nature of Consumer Behavior. Market Research and Consumer Behavior, Relevance of Market Research with Consumer Behavior, Approaches to Consumer Behavior Research, Quantitative Research, Qualitative Research.

**[Unit 2]** **[7 Hours]**

Market Segmentation and Positioning, Market Segmentation, Basis for Segmentation, Alternatives available for Segmentation, Positioning. The Consumer Decision Making Process: Buying Motives, Buying Roles, Consumer Decision Making Process, Levels of Consumer Decision Making, Perspectives to Consumer Decision Making, Consumer Decision Making Process.

**[Unit 3]** **[7 Hours]**

Models of Consumer Behavior: The Economic model, Learning model, Psychoanalytic model, The sociological model. The Howard Sheth model of Buying Behaviour, The Nicosia model, The Engel - Kollat - Blackwell Model, Engel, Blackwell and Miniard (EBM) model.

**[Unit 4]** **[7 Hours]**

Psychological Influences on Consumer Decision Making: Consumers Needs & Motivation, Emotions and Mood, Consumer Involvement, Consumer Learning, Personality, Self-concept and Self-image, Consumer Perception, Risk and Imagery. Consumer Attitude: Belief, Affect, Attitude and Intention, Attitude Formation and Attitude Change, Consumer Communication. Sociological Influences on Consumer Decision Making: Consumer groups, Consumer reference groups, Family and Life cycle, Social class and mobility, lifestyle analysis, Culture; Sub-Culture, Cross Culture, Interpersonal Communication and influence, Opinion Leadership.

**[Unit 5]** **[7 Hours]**

Diffusion of innovation Diffusion Process, Adoption Process, Consumer Innovators, Multiplicative innovation adoption (MIA) model. Organizational Buying: Differences between Industrial Markets and Consumer Markets, Differences between Organizational and Consumer Buying, Buying Decisions in Organizational Buying Process, Types of Decision Making, Organization Buyer's Decision Making Process, and Factors influencing Organizational Buying Behaviour, Decision Makers in Organizational Buying, Webster and Wind model of Organizational buying behaviour, The Sheth model of Industrial buying, The Sheth model of Industrial buying Consumer Behavior Analysis and Marketing Strategy: Consumer Behavior and Product Strategy, Consumer Behavior and Pricing Strategy, Consumer Behavior and Distribution Channel Strategy, Consumer Behavior and Promotion Strategy.

**Text Book:**

1. Consumer Behavior, Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

**Reference Books:**

1. Consumer Behavior, Concepts and Applications, Loudon, D.L. and Bitta, A.J.D, Tata McGrawHill.
2. Consumer Behavior and Marketing Startegy, Peter, J.P. and Olson, J.C., Schiffman, L.G. and Kanuk L.L., Prentice Hall, India.

**Dr. Babasaheb Ambedkar Technological University**
**(Established as a University of Technology in the State of Maharashtra)**
**(under Maharashtra Act No. XXIX of 2014)**
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**www.dbatu.ac.in**

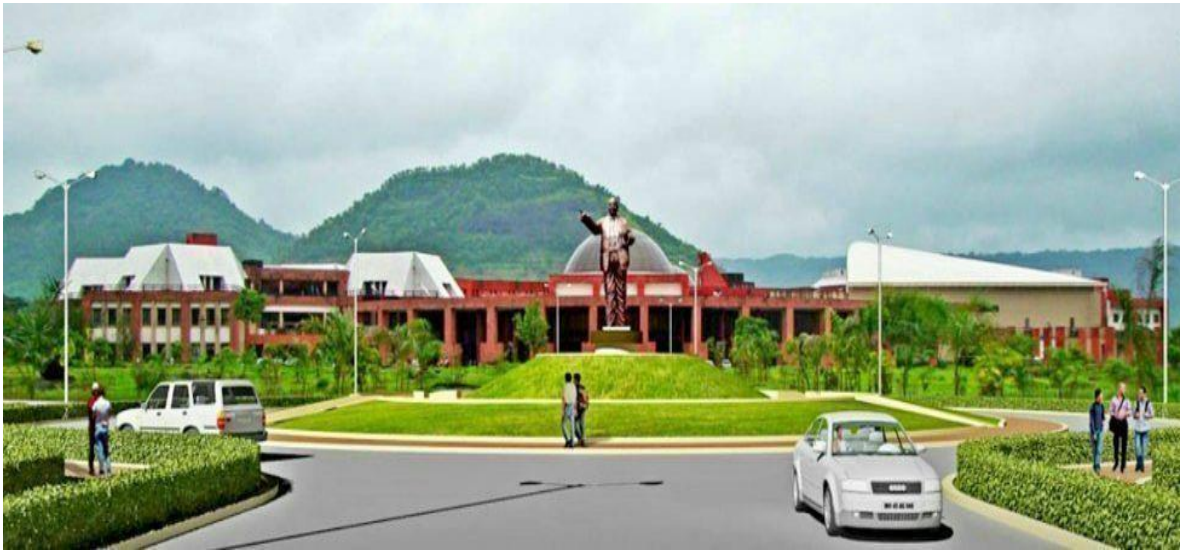
# PROPOSED CURRICULUM

# UNDER GRADUATE PROGRAMME

# B.TECH

## COMPUTER ENGINEERING

## WITH EFFECT FROM THE ACADEMIC YEAR 2020-2021



# Category – wise total number of credits

| Sr. No. | Category of courses | Minimum credits to be Earned |
|---|---|---|
| 1 | Basic Science Course (BSC) | 25 |
| 2 | Engineering Science Course (ESC) | 20 |
| 3 | Humanities and Social Science including Management Courses (HSSMC) | 12 |
| 4 | Professional Core Course (PCC) | 44 |
| 5 | Professional Elective Course (PEC) | 09 |
| 6 | Open Elective Course (OEC) | 06 |
| 7 | Seminar / Mini Project / Internship / Major Project | 22 |
| 8 | Emerging Courses | 22 |
| | **TOTAL** | **160** |

## Semester –VII (Final Year)
## Proposed Scheme w.e.f. July – 2023

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTCOC701 | Artificial Intelligence | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTCOC702 | Cloud Computing | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTCOE703 | Elective – VI<br>(A) Bioinformatics<br>(B) Distributed System<br>(C) Big Data Analytics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTCOE704 | Open Elective – VII<br>(A) Cryptography and Network Security<br>(B) Business Intelligence<br>(C) Block chain Technology | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTCOE705 | Open Elective – VIII<br>(A) Virtual Reality<br>(B) Deep Learning<br>(C) Design Thinking | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTHM706 | Foreign Language Studies | - | - | 4 | - | - | - | - | Audit |
| | BTCOL707 | Artificial Intelligence & Cloud Computing Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| | BTCOS708 | Project Phase – I | - | - | - | 60 | - | 40 | 100 | 2 |
| | BTCOF608 | Field Training / Internship / Industrial Training | - | - | - | - | - | - | - | Audit |
| | | **TOTAL** | **15** | **-** | **8** | **220** | **100** | **380** | **700** | **19** |

## Semester –VIII (Final Year)
## Proposed Scheme w.e.f. January – 2024

| Course Category | Course Code | Course Title | Weakly Teaching Hrs | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| | BTCOF801 | Project phase – II (In-house) / Internship and Project in Industry | - | - | 24 | 60 | - | 40 | 100 | 12 |
| **TOTAL** | | | **-** | **-** | **24** | **60** | **-** | **40** | **100** | **12** |

# BTCOE703 (A): Bioinformatics

**[Unit 1] Introduction to Bioinformatics** **[6 Hours]**

The Brain of Biotechnology Evolutionary Biology Origin & History of Bioinformatics Origin of Bioinformatics/Biological Databases Importance of Bioinformatics Use of Bioinformatics Basics of Molecular Biology Definitions of Fields Related to Bioinformatics Applications. Biological Databases: Introduction Categories of Biological Databases The Database Industry Classification of Biological Databases The Creation of Sequence Databases Bioinformatics Programs and Tools Bioinformatics Tools Application of Programmes in Bioinformatics.

**[Unit 2] Genomics & Proteomics** **[7 Hours]**

DNA, Genes and Genomes DNA Sequencing Genome Mapping Implications of Genomics for Medical Science Proteomic Application of Proteomics to Medicine Difference between Proteomics and Genomics Protein Modeling. Sequence Alignment: Introduction Pairwise Sequence Alignment Sequence Alignment (MSA) Substitution Matrices Two Sample Applications.

**[Unit 3] Phylogenetic Analysis** **[7 Hours]**

Introduction Fundamental Elements of Phylogenetic Models Tree Interpretation Importance of Identifying Paralogs and Orthologs Phylogenetic Data Analysis Alignment Building the Data Model Determining the Substitution Model Tree-Building Methods Tree Evaluation. Microarray Technology: A Boon to Biological Sciences Introduction to Microarray Microarray Technique Potential of Microarray Analysis Microarray Products Microarray Identifying Interactions Applications of Microarrays.

**[Unit 4] Bioinformatics in Drug Discovery** **[6 Hours]**

A Brief Overview Introduction Drug Discovery Informatics and Medical Sciences Bioinformatics and Medical Sciences Bioinformatics in Computer-Aided Drug Design Bioinformatics Tools.

**[Unit 5] Human Genome Project** **[6 Hours]**

Human Genome Project: Introduction Human Genome Project Genome Sequenced in the Public (HGP) and Private Project Funding for Human Genome Sequencing DNA Sequencing Bioinformatics Analysis: Finding Functions Insights Learned from the Human DNA Sequence Future Challenges.

**Text Book:**

1. S. C. Rastorgi et al, Bioinformatics Concepts Skills and Applications; 2nd Edition, CBS Publishers & Distributors.

**NPTEL Course:**

1. Prof. M. Michael Gromiha, Algorithms and Applications.

# BTCOE703 (B): Distributed Systems

**[Unit1]Introduction** **[7 Hours]**

Introduction to Distributed Computing System, Evolution of Distributed Computing System, Distributed Computing System models, Distributed Computing System Gaining Popularity, Distributed Operating System, Introduction to Distributed Computing Environment (DCE), Desirable Features of a Good Message- Passing System, Issues in IPC by Message-Passing, Synchronization, Buffering, Multidatagram message, Encoding and Decoding of message data, Process addressing, Failure Handling, Group Communication, Case Study: BSD UNIX IPC Mechanism.

**[Unit 2] Remote Procedure Calls** **[7 Hours]**

RPC model, Transparency of RPC, Implementing RPC Mechanism, Stub Generation, RPC messages, Marshaling arguments and Results, Server Management, Parameter Passing Semantics, Call Semantics, Communication Protocols for RPCs, Complicated RPCs, Client- Server Binding, Exception Handling, Security, Some Special Types of RPCs, Case studies: Sun RPC, DCE, RPC.

**[Unit 3] Distributed Shared Memory** **[6 Hours]**

General Architecture of DSM Systems, Design and Implementation Issues of DSM, Granularity, Structure of Shared Memory Space, Consistency Models, Replacement Strategy, Thrashing, Other Approaches to DSM, Heterogeneous DSM, Advantages of Synchronization: Clock Synchronization, Event Ordering, Mutual Exclusion, Deadlock, Election Algorithms.

**[Unit 4] Resource Management And Process Management** **[6 Hours]**

Desirable Features of a Good Global Scheduling Algorithm, Task assignment Approach, Load-Balancing Approach, load Sharing Approach, Process Migration, Threads.

**[Unit 5] Distributed File System** **[6 Hours]**

Desirable Features of a Good Distributed File System, File Models, File Accessing Models, File Sharing Semantics, File Caching Schemes, File Replication, Fault Tolerance, Atomic Transactions, Design Principles, Case Study: DCE Distributed File Service.

**Text Book:**

1. P. K. Sinha, Distributed Operating System, PHI Publication

**Reference Books:**

1. Colorouis, Distributed Systems, Addison Wesley Publication.
2. M. L. Liu, Distributed Computing: Principles and Applications, Addison-Wesley, 2004.

**NPTEL Course:**

1. Distributed Systems, Prof. Rajiv Mishra, IIT Patna.

# BTCOE703 (C): Big Data Analytics

**[Unit 1] Introduction to Big Data** **[6 Hours]**

Why Big Data and Where did it come from?, Characteristics of Big, Challenges and applications of Big Data, Enabling Technologies for Big Data, Big Data Stack, Big Data distribution packages.

**[Unit 2] Big Data Platforms** **[7 Hours]**

Overview of Apache Spark, HDFS, YARN, MapReduce, MapReduce Programming Model with Spark, MapReduce Example: Word Count, Page Rank etc, CAP Theorem, Eventual Consistency, Consistency Trade-O-s, ACID and BASE, Zookeeper and Paxos, Cassandra, Cassandra Internals, HBase, HBase Internals.

**[Unit 3] Big Data Streaming Platforms** **[6 Hours]**

Big Data Streaming Platforms for Fast Data, Streaming Systems, Big Data Pipelines for Real-Time computing, Spark Streaming, Kafka, Streaming Ecosystem.

**[Unit 4] Big Data Applications** **[6 Hours]**

Overview of Big Data Machine Learning, Mahout, Big Data Machine learning Algorithms in Mahout- kmeans, Naive Bayes etc. Machine learning with Spark, Machine Learning Algorithms in Spark, Spark MLlib, Deep Learning for Big Data, Graph Processing: Pregel, Giraph, Spark GraphX.

**[Unit 5] Database for the Modern Web** **[7 Hours]**

Introduction to mongoDB key features, Core server tools, MongoDB through the JavaScript‘ sshell, Creating and querying through Indexes, Document-oriented, principles of schema design, Constructing queries on databases, collections and documents, MongoDB query language.

**Text Book:**

1. Bart Baesens ―Analytics in a Big Data World: The Essential Guide to Data Science and its Applications‖, Wiley and SAS Business Series.

**Reference Books:**

1. Rajkumar Buyya, Rodrigo N. Calheiros, Amir M Vahid Dastjerdi, Morgan Kaufmann, ―Big Data Principals and Paradiagram‖, Elsevier, ISBN: 978-0-12-805394-2
2. Kyle Banker, Peter Bakkum and Shaun Verch, ―MongoDB in Action‖, 2nd Edition Dream tech Press, ISBN: 978-9351199359.
3. Anand Rajaraman, Jeffrey D. Ullman, ―Mining of Massive Datasets‖, 3rd edition, Cambridge University Press
4. Sima Acharya, Subhashini Chhellappan, ―BIG Data and Analytics‖, ,Willey publication, ISBN: 978-8126554782.

**NPTEL COURSE:**

1. Big Data Computing by Prof. Rajiv Misra, Dept. of Computer Science and Engineering, IIT Patna

# BTCOE704 (A): Cryptography & Network Security

**[Unit 1]** **[6 Hours]**

Introduction and Mathematical Foundations: Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory. Classical Cryptosystems: Classical Cryptosystems, Crypt-analysis of Classical Cryptosystems, Shannon's Theory.

**[Unit 2]** **[6 Hours]**

Symmetric Key Ciphers: Symmetric Key Ciphers, Modern Block Ciphers (DES), Modern Block Cipher (AES).Crypt-analysis of Symmetric Key Ciphers: Linear Crypt-analysis, Differential Crypt-analysis, other Crypt-analytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers.

**[Unit 3]** **[6 Hours]**

Stream Ciphers and Pseudo-randomness: Stream Ciphers, Pseudo-random functions. Hash Functions and MACs: Hash functions: The Merkle Damgard Construction, Message Authentication Codes (MACs).

**[Unit 4]** **[6 Hours]**

Asymmetric Key Ciphers: Construction and Crypt-analysis: More Number Theoretic Results, The RSA Cryptosystem, Primality Testing, Factoring Algorithms, Other attacks on RSA and Semantic Security of RSA, The Discrete Logarithm Problem (DLP) and the Diffie-Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm, Crypt-analysis of DLP.

**[Unit -5]** **[6 Hours]**

Digital Signatures: Signature schemes: I, Signature schemes: II. Modern Trends in Asymmetric Key Cryptography: Elliptic curve based cryptography: I, Elliptic curve based cryptography: II. Network Security: Secret Sharing Schemes, A Tutorial on Network Protocols, Kerberos, Pretty Good Privacy (PGP), Secure Socket Layer (SSL), Intruders and Viruses, Firewalls.

**Text Book:**

1. Douglas Stinson, *"Cryptography Theory and Practice"*, 2nd Edition, Chapman & Hall/CRC.

**Reference Books:**

1. B. A. Forouzan, *"Cryptography & Network Security"*, McGraw Hill Publication.
2. William Stallings, *"Cryptography and Network Security"*, Pearson Education.
3. Dr. B. B. Meshram, *TCP/IP & Network Security*, SPD Publication.
4. Wenbo Mao, *"Modern Cryptography, Theory & Practice"*, Pearson Education.
5. Hoffstein, Pipher, Silvermman, *"An Introduction to Mathematical Cryptography"*, Springer.
6. Alang.Konheim, *Computer Security and Cryptography*, Wiley Publication.
7. A. Joux, *"Algorithmic Crypt-analysis"*, CRC Press.
8. S. G. Telang, *"Number Theory"*, McGraw Hill.
9. Matt Bishop, *"Computer Security"*, Pearson Education.

# BTCOE704 (B): Business Intelligence

**[Unit 1] Business Intelligence Introduction [6 Hours]**

Definition, Leveraging Data and Knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics, BI Life Cycle. Data for BI – Data Issues and Data Quality for BI.

**[Unit 2] BI Implementation [6 Hours]**

Key Drivers, Key Performance Indicators and operational metrics, BI Architecture/Framework, Best Practices, Business Decision Making. Business Analytics: Objective Curve, Web Analytics and Web Intelligence, Customer Relationship Management.

**[Unit 3] Business/Corporate Performance Management [6 Hours]**

Dash Boards and Scorecards, Business Activity Monitoring, Six Sigma. Advanced BI: Big Data and BI, Social Networks, Mobile BI, emerging trends. Working with BI Tools: Overview of managerial, strategic and technical issues associated with Business Intelligence and Data Warehouse design, implementation, and utilization. Critical issues in planning, physical design process, deployment and ongoing maintenance.

**[Unit 4] Data Warehousing (DW) [6 Hours]**

Data Warehousing (DW): Introduction & Overview; Data Marts, DW architecture – DW components, Implementation options; Meta Data, Information delivery. ETL: Data Extraction, Data Transformation – Conditioning, Scrubbing, Merging, etc., Data Loading, Data Staging, Data Quality.

**[Unit 5] Dimensional Modeling [6 Hours]**

Dimensional Modeling: Facts, dimensions, measures, examples; Schema Design – Star and Snowflake, Fact constellation, slow changing Dimensions. OLAP: OLAP Vs OLTP, Multi-Dimensional Databases (MDD); OLAP – ROLAP, MOLAP, HOLAP; Data Warehouse Project Management: Critical issues in planning, physical design process, deployment and ongoing maintenance.

**Text Book:**

1. Efraim Turban, Ramesh Sharda, Jay Aronson, David King, Decision Support and Business Intelligence Systems, 9th Edition, Pearson Education, 2009

**Reference Books:**

1. David Loshin, Business Intelligence – The Savy Manager's Guide Getting Onboard with Emerging IT, Morgan Kaufmann Publishers, 2009.

# BTCOE704 (C): Blockchain Technology

**[Unit 1] Introduction** **[6 Hours]**

Overview of Blockchain, Public Ledgers, Bitcoin, Smart Contracts, Block in a Blockchain, Transactions, Distributed Consensus, Public vs. Private Blockchain, Understanding Crypto currency to Blockchain, Permissioned Model of Blockchain, Overview of Security aspects of Blockchain. Basic Crypto Primitives: Cryptographic Hash Function, Properties of a hash function, Hash pointer and Merkle tree, Digital Signature, Public Key Cryptography, A basic crypto currency.

**[Unit 2] Bitcoin and Blockchain** **[7 Hours]**

Creation of coins, Payments and double spending, Bitcoin Scripts, Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay. Working with Consensus in Bitcoin: Distributed consensus in open environments, Consensus in a Bitcoin network, Proof of Work (PoW) – Hashcash PoW, Bitcoin PoW, Attacks on PoW and the monopoly problem, Proof of Stake, Proof of Burn and Proof of Elapsed Time, The life of a Bitcoin Miner, Mining Difficulty, Mining Pool.

**[Unit 3] Permissioned Blockchain** **[7 Hours]**

Permissioned model and use cases, Design issues for Permissioned blockchains, Execute contracts, State machine replication, Overview of Consensus models for permissioned blockchain-Distributed consensus in closed environment, Paxos, RAFT Consensus, Byzantine general problem, Byzantine fault tolerant system, Lamport- Shostak-Pease BFT Algorithm, BFT over Asynchronous systems.

**[Unit 4] Enterprise application of Blockchain** **[6 Hours]**

Cross border payments, Know Your Customer (KYC), Food Security, Mortgage over Blockchain, Blockchain enabled Trade, We Trade – Trade Finance Network, Supply Chain Financing, Identity on Blockchain.

**[Unit 5] Blockchain Application Development** **[6 Hours]**

Hyperledger Fabric- Architecture, Identities and Policies, Membership and Access Control, Channels, Transaction Validation, Writing smart contract using Hyperledger Fabric, Writing smart contract using Ethereum, Overview of Ripple and Corda.

**Text Book:**

1. Melanie Swan, ―Blockchain: Blueprint for a New Economy‖, O‘Reilly, 2015.

**Reference Books:**

1. Josh Thompsons, ―Blockchain: The Blockchain for Beginners-Guide to Blockchain Technology and Leveraging Blockchain Programming‖.
2. Daniel Drescher, ―Blockchain Basics‖, Apress; 1st Edition, 2017.
3. Anshul Kaushik, ―Blockchain and Crypto Currencies‖, Khanna Publishing House, Delhi.
4. Imran Bashir, ―Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained‖, Packt Publishing.
5. Ritesh Modi, ―Solidity Programming Essentials: A Beginner‘s Guide to Build Smart Contracts for Ethereum and Blockchain‖, Packt Publishing.
6. Salman Baset, Luc Desrosiers, Nitin Gaur, Petr Novotny, Anthony O‘Dowd, Venkatraman Ramakrishna, ―Hands-On Block Chain with Hyperledger: Building Decentralized Applications with Hyperledger Fabric and Composer‖, Import, 2018.

**NPTEL Course:**

1. Prof. Sandip Chakraborty, Department of Computer Science And Engineering, IIT Kharagpur and Dr. Praveen Jayachandran, Research Staff Member, IBM.

# BTCOE705 (A): Virtual Reality

**[Unit 1] Introduction to Virtual Reality** **[6 Hours]**

Virtual Reality and Virtual Environment: Computer graphics, Real time computer graphics, Flight Simulation, Virtual environment requirement, benefits of virtual reality, Historical development of VR, Scientific Landmark 3D Computer Graphics: The Virtual world space, positioning the virtual observer, the perspective projection, human vision, stereo perspective projection, 3D clipping, Colour theory, Simple 3D modelling, Illumination models, Reflection models, Shading algorithms, Radiosity, Hidden Surface Removal, Realism- Stereographic image.

**[Unit 2] Geometric Modelling** **[6 Hours]**

From 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Frames of reference, Modelling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

**[Unit 3] Virtual Environment** **[6 Hours]**

Animating the Virtual Environment: The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, shape & object in betweening, free from deformation, particle system.

**[Unit 4] Physical Simulation** **[4 Hours]**

Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft.

**[Unit 5] VR Hardware and Software** **[6 Hours]**

Human factors: The eye, the ear, the somatic senses. VR Hardware: Sensor hardware, Head-coupled displays, Acoustic hardware, Integrated VR systems. VR Software: Modelling virtual world, Physical simulation, VR toolkits, Introduction to VRML.

VR Applications: Engineering, Entertainment, Science, Training. The Future: Virtual environment, modes of interaction

**Text Book:**

1. John Vince, ―Virtual Reality Systems ―, Pearson Education Asia, 2007.

**Reference Books:**

1. Anand R., ―Augmented and Virtual Reality‖, Khanna Publishing House, Delhi.
2. Adams, ―Visualizations of Virtual Reality‖, Tata McGraw Hill, 2000.
3. Grigore C. Burdea, Philippe Coiffet, ―Virtual Reality Technology‖, Wiley Inter Science, 2nd Edition, 2006.
4. William R. Sherman, Alan B. Craig, ―Understanding Virtual Reality: Interface, Application and Design‖, Morgan Kaufmann, 2008.
5. www.vresources.org
6. www.vrac.iastate.edu
7. www.w3.org/MarkUp/VRM

# BTCOE705 (B): Deep Learning

**[Unit 1]** **[6 Hours]**

History of Deep Learning, Deep Learning Success Stories, McCulloch Pitts Neuron, Thresholding Logic, Perceptrons, Perceptron Learning Algorithm, Multilayer Perceptrons (MLPs), Representation Power of MLPs, Sigmoid Neurons, Gradient Descent, Feed forward Neural Networks.

**[Unit 2]** **[6 Hours]**

FeedForward Neural Networks, Backpropagation. Gradient Descent (GD), Momentum Based GD, Nesterov Accelerated GD, Stochastic GD, AdaGrad, RMSProp. Principal Component Analysis and its interpretations, Singular Value Decomposition.

**[Unit 3]** **[6 Hours]**

Auto encoders and relation to PCA, Regularization in auto encoders, Denoising auto encoders, Sparse auto encoders, Contractive auto encoders. Regularization: Bias Variance Tradeoff, L2 regularization, Early stopping, Dataset augmentation, Parameter sharing and tying. Greedy Layer wise Pre-training, Better activation functions, Better weight initialization methods, Batch Normalization.

**[Unit 4]** **[6 Hours]**

Convolutional Neural Networks, LeNet, AlexNet, ZF-Net, VGGNet, GoogLeNet, ResNet, Learning Vectorial Representations of Words,

**[Unit 5]** **[6 Hours]**

Recurrent Neural Networks, Back propagation through time, Encoder Decoder Models, Attention Mechanism, Attention over images.

**Text Book:**

1. Ian Goodfellow and Yoshua Bengio and Aaron Courville, "Deep Learning", 1st Edition, MIT Press

**Reference Books:**

1. Raúl Rojas, Neural Networks: A Systematic Introduction, 1996.
2. Christopher Bishop, Pattern Recognition and Machine Learning, 2007.

**NPTEL Courses:**

1. Prof. Prof. Mitesh M. Khapra, Prof. Sudarshan Iyengar, Dept. of Computer Science and Engineering, IIT Madras & IIT Ropar, NPTEL Course on Deep Learning (Part-I).

# BTCOE705 (C): Design Thinking

**[Unit 1] Overview of Design Thinking Process** **[6 Hours]**

Design Thinking Process: Business context of innovation for applying design thinking, two models of design thinking, phases of design thinking, correlation with other philosophies. Introduction to design thinking: Definition, Origin of design thinking, Importance of design thinking, Design vs. Design thinking, Problem solving, Understanding design thinking and its process model, Design thinking tools. Human-Centered Design (HCD) process - Empathize, Define, Ideate, Prototype and Test and Iterate or Empathize, Analyze, Solve and Test.

**[Unit 2] Empathize** **[5 Hours]**

Design thinking phases, How to emphasize, Role of empathy in design thinking, purpose of empathy maps, Things to be done prior to empathy mapping, creation of user personas, customer journey mapping, How might we questions.

**[Unit 3] Analyze or Define** **[5 Hours]**

Root cause analysis, conflict of interest, perspective analysis, big picture thinking through system operator, big picture thinking through function modeling Silent brainstorming, metaphors for ideation, CREATE and What-If tool for ideation, introduction to TRIZ, Inventive principles and their applications.

**[Unit 4] Test (Prototyping and Validation)** **[5 Hours]**

Prototyping, Assumptions during the design thinking process, Validation in the market, best practices of presentation.

**[Unit 5] Design Innovation** **[5 Hours]**

Benefits of iteration in the design thinking process, taking the idea to the market, introduction to innovation management in a company.

**Text Book:**

1. Bala Ramadurai, ―Karmic Design Thinking‖, First Edition, 2020.

**Reference Books:**

1. Vijay Kumar,‖ 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization ―.
2. Human-Centered Design Toolkit: An Open-Source Toolkit to Inspire New Solutions in the Developing World by IDEO.
3. This is Service Design Thinking: Basics, Tools, Cases by Marc Stickdorn and Jakob Schneider.
4. Ulrich, Karl T. Design: Creation of artifacts in society, 2011.

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## B. Tech in Electronics & Telecommunication Engineering
## Curriculum for Second Year

**Semester III**

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| BSC | BTBS301 | Engineering Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 1 | BTETC302 | Electronic Devices & Circuits | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 2 | BTETC303 | Digital Electronics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| ESC | BTES304 | Electrical Machines and Instruments | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| LC | BTETL305 | Electronic Devices & Circuits Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| LC | BTETL306 | Digital Electronics Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| Seminar | BTETS307 | Seminar I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTES211P | Internship – 1 Evaluation | - | - | - | - | - | - | - | Audit |
| | | **Total** | **12** | **4** | **8** | **260** | **80** | **360** | **700** | **20** |

**Semester IV**

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 3 | BTETC401 | Network Theory | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 4 | BTETC402 | Signals and Systems | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC | BTHM403 | Basic Human Rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| BSC | BTBS404 | Probability Theory and Random Processes | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC 1 | BTETPE405 | (A) Numerical Methods and Computer Programming<br>(B) Data Compression & Encryption<br>(C) Computer Organization and Architecture<br>(D) Introduction to MEMS<br>(E) Python Programming | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| LC | BTETL406 | Network Theory Lab & Signals and Systems Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Seminar | BTETS407 | Seminar II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTETP408 (Internship – 2) | Field Training /Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at onetime). | - | - | - | - | - | - | - | Audit (evaluation will be in V Sem.) |
| | | **Total** | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

2023-2024, Sem-II

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course
PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
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## Curriculum for Third Year

| Semester V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 5 | BTETC501 | Electromagnetic Field Theory | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 6 | BTETC502 | Digital Signal Processing | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 7 | BTETC503 | Analog Communication | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 2 | BTETPE504 | Group A | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 1 | BTETOE505 | Group B | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| LC | BTETL506 | Digital Signal Processing Lab & Analog Communication Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Project | BTETM507 | Mini Project – 1 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTETP408 | Internship – 2 Evaluation | - | - | - | - | - | - | - | Audit |
| | | **Total** | **15** | **5** | **8** | **220** | **100** | **380** | **700** | **24** |

| Semester VI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 8 | BTETC601 | Antennas and Wave Propagation | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 9 | BTETC602 | Digital Communication | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 3 | BTETPE603 | Group A | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 2 | BTETOE604 | Group B | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC | BTHM605 | Employability and Skill Development | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| LC | BTETL606 | Digital Communication Lab & Professional Elective Course 3 Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Project | BTETM607 | Mini Project – 2 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTETP608 (Internship – 3) | Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time). | - | - | - | - | - | - | - | Audit (evaluation will be in VII Sem.) |
| | | **Total** | **15** | **4** | **8** | **220** | **100** | **380** | **700** | **23** |

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**Semester V** 2023-2024 sem - I

| **BTETPE504 Program Elective 2 (Group A)** | **BTETOE505 Open Elective 1 (Group B)** |
|---|---|
| (A) Analog Circuits | (A) Control System Engineering |
| (B) Embedded System Design | (B) Artificial Intelligence and Machine learning |
| (C) Digital System Design | (C) Optimization Techniques |
| (D) Automotive Electronics | (D) Project Management and Operation Research |
| (E) Mixed Signal Design | (E) Augmented, Virtual and Mixed Reality |
| (F) Power Electronics | (F) Open Source Technologies |

**Semester VI** 2023-2024 Sem II

| **BTETPE603 Program Elective 3 (Group A)** | **BTETOE604 Open Elective 2 (Group B)** |
|---|---|
| (A) Microprocessors and Microcontrollers | (A) IoT and Industry 4.0 |
| (B) CMOS Design | (B) Deep Learning |
| (C) Nano Electronics | (C) Computer Network |
| (D) Advanced Digital Signal Processing | (D) Industrial Drives and Control |
| (E) Information Theory and Coding | (E) Robotics Design |
| (F) VLSI Signal Processing | (F) Patents and IPR |
| (G) VLSI Design & Technology | (G) Acoustic Engineering |

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## B. Tech in Electronics & Telecommunication Engineering
## Curriculum for Final Year

| Semester VII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 10 | BTETC701 | Microwave Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 4 | BTETPE702 | Group A | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 3 | BTETOE703 | Group B | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 4 | BTETOE704 | Group C | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC | BTHM705 | Engineering Economics and Financial Mathematics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC | BTHM706 | Foreign Language Studies | - | - | - | - | - | - | - | Audit |
| LC | BTETL707 | Microwave Engineering Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| Project | BTETM708 | Mini Project – 3 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTETP608 | Internship – 3 Evaluation | - | - | - | - | - | - | - | Audit |
| | | **Total** | **15** | **4** | **6** | **220** | **100** | **380** | **700** | **22** |
| **Semester VIII** | | | | | | | | | | |
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| Project/ Internship | BTETP801 | Project work/ Internship | - | - | 24 | 60 | - | 40 | 100 | 12 |
| | | **Total** | **-** | **-** | **24** | **60** | **-** | **40** | **100** | **12** |

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2023-2024 Sem-I.

| BTETPE702 Program Elective 4 (Group A) | BTETOE703 Open Elective 3 (Group B) | BTETOE704 Open Elective 4 (Group C) |
|---|---|---|
| (A) Digital Image Processing | (A) Wireless Sensor Networks | (A) Soft Computing |
| (B) RF Circuit Design | (B) Block Chain Technology | (B) Big Data Analytics |
| (C) Satellite Communication | (C) Cyber Security | (C) Data Structure & Algorithms Using Java Programming |
| (D) Fiber Optic Communication | (D) Mobile Computing | (D) Entrepreneurship Development |
| (E) Bio-medical Signal Processing | (E) Mobile Communication and Networks | (E) Software Defined Radio |
| (F) Principles of Modern Radar Engineering | (F) EMI and EMC | (F) E Waste Management |

**Total Credits: 160**



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# PROPOSED CURRICULUM UNDER GRADUATE PROGRAMME

# B. TECH

**Electronics and Computer Engineering**

Second Year [2022-23]
Third Year [2023-24]
Final Year [2024-25]

# Course Structure for Third Year

**B. Tech in Electronics and Computer Engineering**

| Semester V ( Term 5) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC5 | BTECPC501 | Computer Networks and Cloud Computing | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC6 | BTECPC502 | Digital Signal & Image Processing | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC-2 | **BTECPE503** | **Professional Elective Course (PEC) -II** | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTECPE503 A | 1. Sensors and Robotics Technology | | | | | | | | |
| | BTECPE503 B | 2. Data Warehouse & Data Mining | | | | | | | | |
| | BTECPE503 C | 3. Wireless & Mobile Computing | | | | | | | | |
| | BTECPE503 D | 4. Software Engineering | | | | | | | | |
| OEC-1 | **BTECOE504** | **Open Elective Course (OEC) - I** | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTECOE504A | 1. Microelectronics Devices and Circuits | | | | | | | | |
| | BTECOE504B | 2. Analog & Digital Communication | | | | | | | | |
| | BTECOE504C | 3. Programming in JAVA | | | | | | | | |
| | BTECOE504D | 4. Electrical Machines and Instrumentation | | | | | | | | |
| HSSMEC -4 | **BTECHM505** | **Humanities and Social Sciences including Management Elective Course - I** | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTECHM505A | 1. Economics and Management | | | | | | | | |
| | BTECHM505B | 2. Business Communication | | | | | | | | |
| LC3 | BTECPL506 | Computer Networks and Cloud Computing Lab and Competitive Programming Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ | BTECM507 | Mini Project I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTECP508 | Internship –II (Evaluation) | - | - | - | - | - | - | - | Audit |
| | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

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# Course Structure for Second Year

**B. Tech in Electronics and Computer Engineering**

| Semester IV ( Term 4) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC3 | BTECPC401 | Python Programming | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC4 | BTECPC402 | Database Management System | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC3 | BTHM403 | Basic Human Rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| BSC8 | BTBS404 | Probability Theory and Random Processes | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PEC-1 | **BTECPE405** | **Professional Elective Courses –I** | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTECPE405 A | 1.Microcontroller and Advanced Processor | | | | | | | | |
| | BTECPE405 B | 2. Data Analysis | | | | | | | | |
| | BTECPE405 C | 3.Electromagnetic Engineering and Wave Propagation | | | | | | | | |
| | BTECPE405 D | 4.Linux OS | | | | | | | | |
| LC2 | BTECPL406 | Python Programming Lab and Database Management System Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Seminar | BTECS407 | Seminar - II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTECP408 | Internship -II | - | - | - | - | - | - | - | Audit |
| | | | **15** | **3** | **8** | **220** | **100** | **380** | **700** | **22** |

Note: The Lab of Professional Elective Courses –I (PEC1) (BTECPE405) should be conducted as per syllabus contents.

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# Course Structure for Third Year

**B. Tech in Electronics and Computer Engineering**

| Semester VI ( Term 6) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | |
| | | | L | T | P | CA | MSE | ESE | Total | Credit |
| PCC7 | BTECPC601 | Internet of Things | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC8 | BTECPC602 | Artificial Intelligence and Machine Learning | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC-3 | **BTECPE603** | **Professional Elective Course (PEC) -III** | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTECPE603A | 1. Industrial Automation and Control (PLC) | | | | | | | | |
| | BTECPE603B | 2. Big Data Analytics | | | | | | | | |
| | BTECPE603C | 3.Microwave and Optical Fibre Comm | | | | | | | | |
| | BTECPE603D | 4. Software Testing | | | | | | | | |
| OEC-2 | **BTECOE604** | **Open Elective Course (OEC) - II** | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| | BTECOE604A | 1. VLSI Design | | | | | | | | |
| | BTECOE604B | 2.Information Theory & Coding | | | | | | | | |
| | BTECOE604C | 3.Andriod Programming | | | | | | | | |
| | BTECOE604D | 4. Electrical Drives and Control | | | | | | | | |
| HSSMEC-5 | **BTECHM605** | **Humanities and Social Sciences including Management Elective Course (HSSMEC) - II** | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| | BTECHM605A | 1. Development Engineering | | | | | | | | |
| | BTECHM605B | 2. Employability and Skill Development | | | | | | | | |
| | BTECHM605C | 3. Consumer Behaviour | | | | | | | | |
| LC4 | BTECPL606 | Internet of Things Lab and Artificial Intelligence and Machine Learning Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ | BTECM607 | Mini Project II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTECP608 | Internship –III | - | - | - | - | - | - | - | Audit |
| | | | **15** | **4** | **8** | **220** | **100** | **380** | **700** | **22** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

# Dr. Babasaheb Ambedkar Technological University, Lonere.

## B. Tech in (Electronics Engineering)

### Curriculum for Final Year

| Semester VII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 10 | BTEXC701 | Embedded System Design | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 4 | BTEXPE702 | Group A | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 3 | BTEXOE703 | Group B | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| OEC 4 | BTEXOE704 | Group C | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC | BTHM705 | Engineering Economics and Financial Mathematics | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC | BTHM706 | Foreign Language Studies | - | - | - | - | - | - | - | Audit |
| LC | BTEXL707 | Embedded System Design Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| Project | BTEXM708 | Mini Project – 3 | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTEXP608 | Internship – 3 Evaluation | - | - | - | - | - | 50 | 50 | Audit |
| | | **Total** | **15** | **4** | **6** | **220** | **100** | **430** | **750** | **22** |

| Semester VIII | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | L | T | P | CA | MSE | ESE | Total | |
| Project/ Internship | BTEXP801 | Project work/ Internship | - | - | 24 | 60 | - | 40 | 100 | 12 |
| | | **Total** | **-** | **-** | **24** | **60** | **-** | **40** | **100** | **12** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course

PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course

HSSMC = Humanities and Social Science including Management Courses

| (BTEXPE 702) Program Elective 4 (Group A) | (BTEXOE 703) Open Elective 3 (Group B) | BTEXOE 704) Open Elective 4 (Group C) |
|---|---|---|
| (A) Microwave Engineering | (A) Wireless Sensor Networks | (A) Soft Computing |
| (B) Advanced Industrial Automation | (B) Block Chain Technology | (B) Big Data Analytics |
| (C) Satellite Communication | (C) Cyber Security | (C) Data Structure & Algorithms Using Java Programming |
| (D) Fiber Optic Communication | (D) Bio-medical Signal Processing | (D) Entrepreneurship Development |
| (E) CMOS Design | (E) Mobile Communication and Networks | (E) Software Defined Radio |

**Total Credits: 160**

# Dr. Babasaheb Ambedkar Technological University, Lonere.

**Dr. Babasaheb Ambedkar Technological University**

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**(under Maharashtra Act No. XXIX of 2014)**

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**Telephone and Fax. : 02140 -275142**

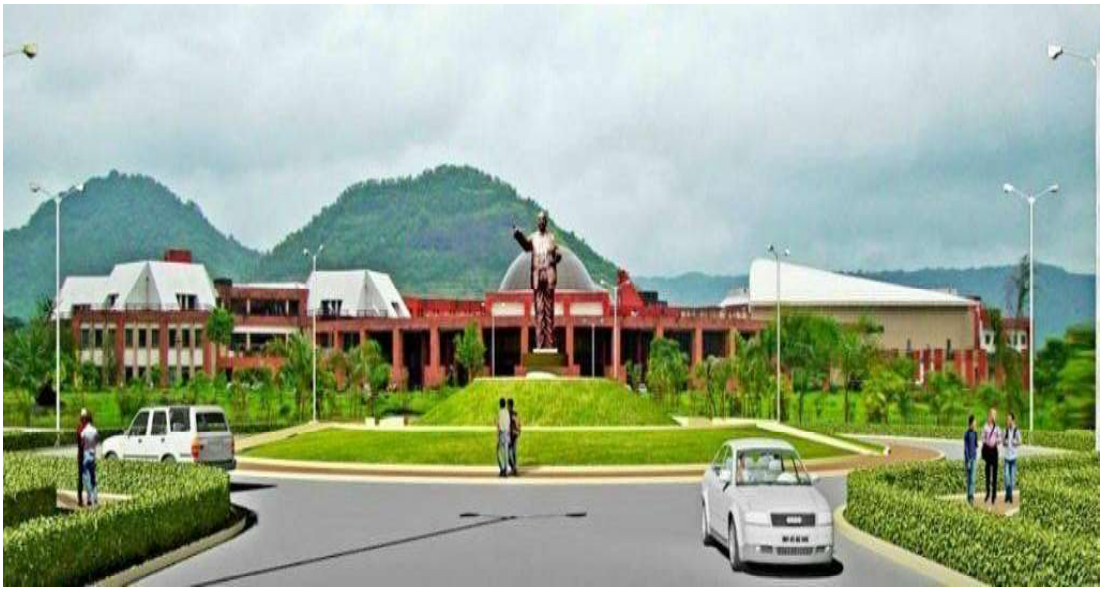
**www.dbatu.ac.in**

# COURSE STRUCTURE AND SYLLABUS

For

## Final Year Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

## With effect from the Academic Year 2023-2024



# Dr. Babasaheb Ambedkar Technological University, Lonere.

## B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

### Curriculum for Semester VII

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC10 | BTEEC701 | High Voltage Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC11 | BTEEC702 | Power System Operation & Control | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC4 | BTEEPE703 | Group F | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC3 | BTEEOE704 | Group G | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC4 | BTEEOE705 | Group H | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC | BTHM706 | Engineering Operations and Project Management | - | - | - | - | - | - | - | Audit |
| LC | BTEEL707 | High Voltage Engineering Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| Project | BTEEM708 | Inhouse Project Part-I /Miniproject-III | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTEEP609 | Internship-III Evaluation | - | - | - | - | - | 50 | 50 | 1 |
| | | **Total** | **15** | **2** | **10** | **340** | **100** | **510** | **950** | **21** |

### Semester VIII

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PEC5 | BTEEPE801 | NPTEL online courses | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| Project/Internship | BTEEP802 | Inhouse Project Part-II /Internship in Industry. | - | - | 26 | 60 | - | 40 | 100 | 12 |
| | | **Total** | | | | | | | | 15 |

BSC= Basic Science Course, ESC= Engineering Science Course, PCC= Professional Core Course, PEC= Professional Elective Course, OEC= Open Elective Course, LC= Laboratory Course, HSSMC= Humanities and Social Science including Management Course

**Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.**

### Semester VII

| BTEEPE703 Professional Elective (Group F) | BTEEOE704 Open Elective (Group G) | BTEEOE705 Open Elective (Group H) |
|---|---|---|
| (A) Energy Audit and Conservation | (A) Process Control Instrumentation | (A) Testing, Maintenance and Commissioning of Electrical Equipment |
| (B) Electrical System Design for Building | (B) Biomedical Instrumentation | (B) Electric and Hybrid Electric Vehicles |
| (C) Applications of Power Electronics in Power System | (C) Mechatronics | (C) Internet of Things (IoT) |
| (D) Electrical Utilization | | |

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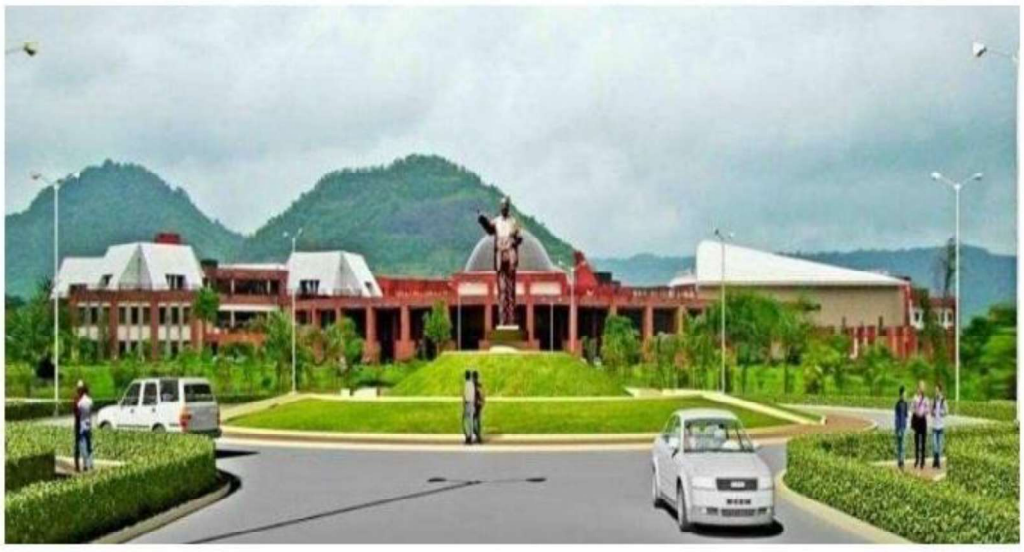
# COURSE STRUCTURE AND SYLLABUS

for

## Second Year B. Tech. Electrical and Computer Engineering

## With effect from the Academic Year 2023-24



## Sem-IV

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC4 | BTECC401 | Network Theory | 3 | 1 | - | 20 | 20 | 60 | 100 | **4** |
| PCC5 | BTECC402 | Power System-I | 3 | - | - | 20 | 20 | 60 | 100 | **3** |
| PCC6 | BTECC403 | Electrical Machines-II | 3 | 1 | - | 20 | 20 | 60 | 100 | **4** |
| PEC1 | BTECPE404 | Group A | 3 | - | - | 20 | 20 | 60 | 100 | **3** |
| PCC7 | BTECC405 | Computer Architecture and Operating System | 3 | - | | 20 | 20 | 60 | 100 | **3** |
| LC | BTECL406 | Electrical Machines-II Lab | - | - | 2 | 60 | - | 40 | 100 | **1** |
| LC | BTECL407 | Python Programming Lab | 1 | - | 2 | 60 | - | 40 | 100 | **2** |
| LC | BTECL408 | Power System-I Lab | | | 2 | 60 | - | 40 | 100 | **1** |
| Seminar | BTECS409 | Seminar | - | - | 2 | 60 | - | 40 | 100 | **1** |
| Internship | BTECP410 | Internship-II (Minimum of 4 weeks which can be completed partially in 3rd or 4th Sem or in at one time) | - | - | - | - | - | - | - | **Credit to be evaluated in 5th Sem** |
| | | | 16 | 2 | 8 | 340 | 100 | 460 | 900 | **22** |

BTECPE404 **Group A (Professional Elective)**

(A) Computer Algorithm

(B) Competitive Programming

(C) Numerical Methods and Programming

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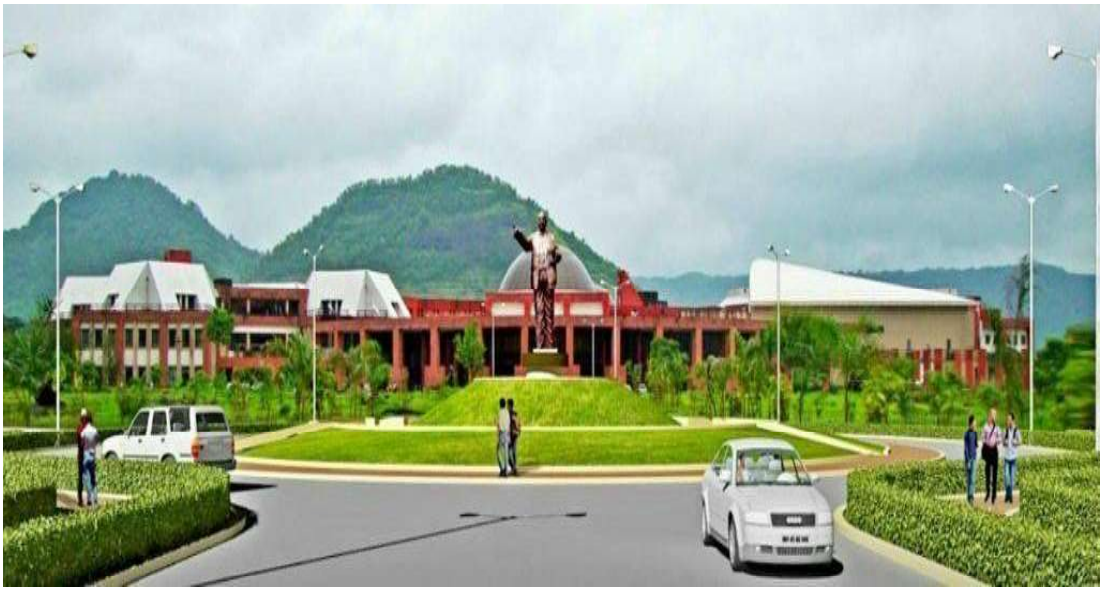
# COURSE STRUCTURE AND SYLLABUS

For

## Final Year Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering

## With effect from the Academic Year 2023-2024



# Dr. Babasaheb Ambedkar Technological University, Lonere.

## B.Tech (Electrical Engineering / Electrical Engineering (Electronics and Power)/ Electrical & Electronics Engg / Electrical & Power Engineering)

### Curriculum for Semester VII

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC10 | BTEEC701 | High Voltage Engineering | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC11 | BTEEC702 | Power System Operation & Control | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC4 | BTEEPE703 | Group F | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC3 | BTEEOE704 | Group G | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC4 | BTEEOE705 | Group H | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| HSSMC | BTHM706 | Engineering Operations and Project Management | - | - | - | - | - | - | - | Audit |
| LC | BTEEL707 | High Voltage Engineering Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| Project | BTEEM708 | Inhouse Project Part-I /Miniproject-III | - | - | 4 | 60 | - | 40 | 100 | 2 |
| Internship | BTEEP609 | Internship-III Evaluation | - | - | - | - | - | 50 | 50 | 1 |
| | | **Total** | **15** | **2** | **10** | **340** | **100** | **510** | **950** | **21** |

### Semester VIII

| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CA | MSE | ESE | Total | |
| PEC5 | BTEEPE801 | NPTEL online courses | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| Project/Internship | BTEEP802 | Inhouse Project Part-II /Internship in Industry. | - | - | 26 | 60 | - | 40 | 100 | 12 |
| | | **Total** | | | | | | | | 15 |

BSC= Basic Science Course, ESC= Engineering Science Course, PCC= Professional Core Course, PEC= Professional Elective Course, OEC= Open Elective Course, LC= Laboratory Course, HSSMC= Humanities and Social Science including Management Course

**Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.**

### Semester VII

| BTEEPE703 Professional Elective (Group F) | BTEEOE704 Open Elective (Group G) | BTEEOE705 Open Elective (Group H) |
|---|---|---|
| (A) Energy Audit and Conservation | (A) Process Control Instrumentation | (A) Testing, Maintenance and Commissioning of Electrical Equipment |
| (B) Electrical System Design for Building | (B) Biomedical Instrumentation | (B) Electric and Hybrid Electric Vehicles |
| (C) Applications of Power Electronics in Power System | (C) Mechatronics | (C) Internet of Things (IoT) |
| (D) Electrical Utilization | | |

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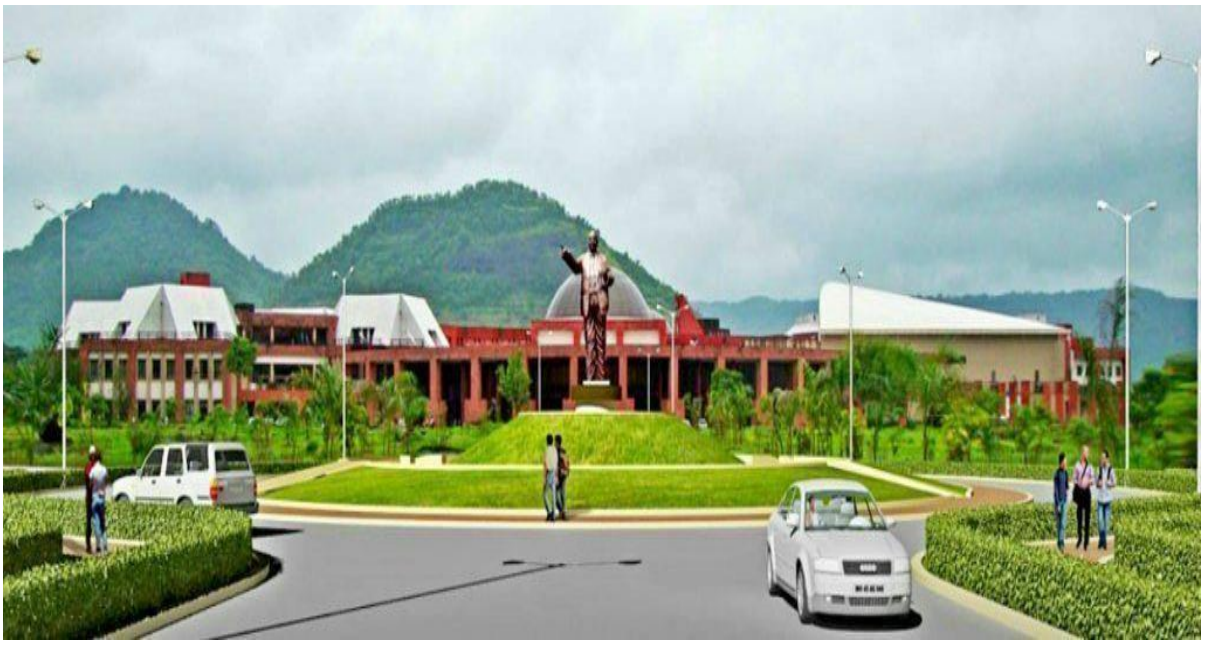
CURRICULUM

## UNDERGRADUATEPROGRAMME

## S. Y. B. Tech. (Instrumentation Engineering)

**With effect from the Academic Year2021-2022**



# B. Tech in Instrumentation Engineering

## Curriculum for Second Year

| Semester III | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No. | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | BSC | BTBS301 | Engineering Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 2 | PCC 1 | BTINC302 | Sensor and Transducer | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 3 | PCC 2 | BTINC303 | Network Analysis and Synthesis | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 4 | ESC | BTINES304 | Analog Electronics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 5 | LC | BTINL305 | Sensor and Transducer Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 6 | LC | BTINL306 | Analog Electronics Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 7 | Seminar | BTINS307 | Seminar I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| 8 | Internship | BTINS211P | Internship – 1 Evaluation | - | - | - | - | - | 50 | 50 | 1 |
| **Total** | | | | **12** | **4** | **8** | **260** | **80** | **410** | **750** | **21** |

| Semester IV | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | PCC 1 | BTINC401 | Digital Electronics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 2 | PCC 2 | BTINC402 | Feedback Control System | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 3 | HSSMC | BTHM403 | Industrial Management and Economics | 4 | - | - | 20 | 20 | 60 | 100 | 4 |
| 4 | BSC | BTINBS404 | Electrical and Electronics Measurement | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 5 | PEC 1 | BTINPE405 | Group A | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 6 | LC | BTINL406 | Digital Electronics Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 7 | LC | BTINL407 | Feedback Control System Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 8 | Seminar | BTINM408 | Mini Project I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| 9 | Internship | BTINP409 | Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time). | - | - | - | - | - | - | - | Credits To be evaluated in V Sem. |
| **Total** | | | | **16** | **4** | **8** | **220** | **100** | **380** | **700** | **24** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

- **Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.**

### Group A [Sem- IV] (Professional Elective)

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINPE405 A | Microprocessor based systems |
| 02 | BTINPE405 B | Industrial Safety |
| 03 | BTINPE405 C | Signals and Systems |

# Semester III

## BTBSC 301 Engineering Mathematics – III

**Teaching Scheme:**
Lectures: 03
Tutorial: 01

Course Credits : 04

**Examination Scheme :**
End semester exam (ESE): 60 marks
Internal Sessional Exams (ISE): 40 marks
Duration of ESE: 03 hours

**Prerequisite course(s):** $11^{th}$ & $12^{th}$ Mathematics, Mathematics-I and II

**Course objectives:**

1. To introduce the solution methodologies for Fourier transform, Z-Transform and Laplace transform with applications in engineering.
2. To provide an overview of probability and statistics to engineers.

**Course outcomes:**

Upon completion of this course, students will be able to solve field problems in engineering involving ordinary differential equations using Laplace Transform. They can also formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.

**Course Syllabus**

| | | |
|---|---|---|
| **Unit - I : Laplace Transform** | **No. of Lectures:** 06 Hours | **Marks:** 12 |

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by $t^n$, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

| | | |
|---|---|---|
| **Unit - II : Inverse Laplace Transform** | **No. of Lectures:** 06 Hours | **Marks:** 12 |

Inverse transforms of some elementary functions; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find solutions of linear differential equations.

| | | |
|---|---|---|
| **Unit - III : Fourier Transform and Z-transform** | **No. of Lectures:** 09 Hours | **Marks:** 12 |

**Fourier Transform:** Fourier sine and cosine integrals, Fourier sine transform, Fourier cosine transform, Inverse Fourier transform.

**Z-transform :** Definition, Region of convergence, Properties of Z-Transform ( without proof ), Inverse Z-Transform

| | | |
|---|---|---|
| **Unit - IV : Basic Statistics** | **No. of Lectures:** 07 Hours | **Marks:** 12 |

Introduction to measures of central tendency, Moments, skewness and Kurtosis, Correlation and regression, Probability distributions: Binomial, Poisson and Normal distributions.

| | | |
|---|---|---|
| **Unit - V : Functions of Complex Variables** | **No. of Lectures:** 08 Hours | **Marks:** 12 |

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

**Text Books:-**


1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010,2016.
2. H.K.DASS "Advance Engineering Mathematics" S. Chand publications. Fifteenth revised edition 2006.
3. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
4. S. C. Gupta "Fundamentals of Statistics", Himalaya Publishing House ,sixth revised edition 2008.
5. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.


**Reference Books : -**


1. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.
4. Wylie C.R. & Barrett , "Advanced Engineering Mathematics," Mc Graw Hill.
5. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.

# BTINC 302. SENSORS AND TRANSDUCERS

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Prerequisite | Basic electrical engineering | |
| Course Objective | To familiarize the students with Sensors and transducer | |
| Course Outcome | To expose the students to various sensors and transducers for measuring mechanical quantities.<br>To understand the specifications of sensors and transducers.<br>To learn the basic conditioning circuits for various sensors and transducers.<br>To introduce advances in sensor technology. | |
| Unit | Contents | Contact Hrs |
| 1 | **Introduction to Transducers**<br>Transducer: Definition, classification, selection criteria, specifications. static and dynamic characteristics of a measurement system.<br>Errors, loading effects, basic configuration of control system.<br>Displacement, force and torque transducers. Force measuring transducers, electrical load cell, LVDT.<br>Piezoelectric, vibrating type. Torque-strain gauge and other suitable transducers. | 8 |
| 2 | **Speed, Vibration and Temperature Transducers**<br>Tachometers, toothed rotor tachometers, Photoelectric, stroboscopic principal<br>Theory of acceleration pick- ups, their calibration, Type of accelerometer, Jerk meter.<br>Temperature Transducers: fills system thermometers, semiconductor temperature detector( thermostat and p-n junction IC and PTAT type) resistance thermometer, thermometer ultrasonic, crystal, infrared thermometer. | 8 |
| 3 | **Level and Flow Measurement**<br>Level transducers for liquid and solids- float type displacer, Air plug method, diaphragm box level gauge, DP cell, Load cell, bicolor direct reading, Vibrating, Ultrasonic, radioactive transducers, Reed switches, microwave sensors.<br>Flow transducer: Basic measurement principle, Bernoulli's theorem, Differential pressure type (orifice, venturi, pitot type), Variable area type, target type, magnetic, Ultrasonic vortex shedding, cross co-relation, positive displacement type, Mass flow meter, anemometer, total flow meter. | 6 |
| 4 | **Pressure, Viscosity Transducers**<br>Pressure transducer: Pressure scale and standards, manometer, elastic (Bellows, bourdon tube, diaphragm ) type.<br>Dead weight and vaccum gauge, testers, electrical pressure sensors (LVDT, strain gauge, load cell, piezo- electric, capacitive).<br>Tuning fork type, differential sensors (capacitive, force balance and vibrating cylinder type). | 6 |

| | | |
|---|---|---|
| | Vacuum pressure measurement: McLeod gauge, thermal conducting and ionization type,<br>Viscosity and density sensing and measurement: capillary type, Shearle's rotating cylinder, cone and plate, falling and rolling ball type viscometers. | |
| 5 | **PH, Conductivity, Humidity Sensors and Transducers**<br>PH and conductivity sensors: pH scale and standards, principle of pH measurement. Different type of reference and measuring electrodes, ion selective electrodes.<br>Principle of conductivity measurement, conductivity cells and bridges-their application. Effect of temperature on pH and conductivity sensors.<br>Humidity and misc. transducers: Pyrometer, Hygrometer (Hair, wire and Electrolysis type), Dew point meter, piezoelectric humidity meter, Infrared conductance and capacitive type probes for moisture measurement.<br>Flow detectors, leak detectors, Acoustic transducers and sound level measurement. Introduction to Biosensors | 8 |
| | **Reference Books:**<br>1. Bentley J.P., "Principles of Measurement Systems", Third Edition, Pearson Education Asia pvt.ltd.<br>2. Doebelin, E.O., "Measurement Systems", McGraw Hill Book Co.<br>3. Patranabis D, "Sensors and Transducers", Wheeler Publishing Co., Ltd. New Delhi.<br>4. Murthy, D.V.S., "Transducers and Instrumentation", Prentice Hall of India Pvt. Ltd.,<br>New Delhi.<br>5. Neubert, H.K.P., "Instrument Transducers", Clarenden Press, Oxford.<br>6. R. K. Jain, "Mechanical and Industrial Measurement".<br>7. http://nptel.iitm.ac.in | |

# BTINC 303. NETWORK ANALYSIS AND SYNTHESIS.

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Prerequisite | Basic electrical engineering | |
| Course Outcome | To review basic components of electric network.<br>To design and develop network equations and their solutions.<br>To apply Laplace theorem for electric network analyses<br>To analyze AC circuit. | |
| Unit | Contents | Contact Hrs |
| 1 | Active & Passive Circuit Element:- Independent & dependent voltage & current sources, R, L, C, self and mutual inductance circuit parameters, Their mathematical models, Voltage- current- power relations, Independent voltage and current sources, dependent sources, Source transformation, star-delta conversion. Classification of element: Lumped and distributed, Linear and non-linear, Unilateral and Bilateral, Time invariant and variant, | 6 |
| 2 | Network theorems: - Kirchhoff‘s laws (KCL and KVL), Mesh analysis, nodal analysis, super node and super mesh analysis, Superposition theorem, Thevenin‘s theorem, Norton‘s theorem, Reciprocity theorem, Maximum power transfer theorem, Substitution theorem, Millman‘s Theorem, Tellegen's theorem for D.C and A.C. circuits.<br>Graph Theory:- Network topology, graph, Tree, Branches, Chords, incidence, cut set and tie set matrix using network topology, Concept of duality & dual networks. | 6 |
| 3 | Two port network:- Terminals& terminal pairs, Driving points & transfer admittance, Transfer functions, Concept of poles & zeroes, Two port networks, Z, Y & the transmission parameters relationship between parameter sets. | 6 |
| 4 | Application of Laplace’s Transform:- Solution of differential equation using Laplace transform, Unit step, Impulse & ramp functions, Laplace transform of singular & shifted function, Convolution integral, Concept of complex frequency, Transform impedance & transform admittance, Series & parallel combination of these networks. | 6 |
| 5 | Sinusoidal Steady State A. C. Circuit:- R-L-C series circuits, Series resonance Variation of Z with frequency, maximum value of VC & VL, Magnification, Bandwidth, Q factor. Parallel Resonance: Resonance frequency for tank circuit frequency, Locus diagram of series R-L, R-C with variable R & X. Filter: Introduction classification, Low pass, High pass, Band pass & band reject filter, active & passive filters. Application of Fourier series, Expansion for periodic & non-sinusoidal waveforms. | 6 |

| | | |
|---|---|---|
| | **Referance Books:-**<br>1. Mac.E Van Valkenburg, “Network Analysis”,<br>2. Franklin Fa-Kun. Kuo, “Network Analysis & Synthesis”, John Wiley & Sons.<br>3. M. L. Soni, J. C. Gupta, “A Course in Electrical Circuits and Analysis”,<br>4. Mac.E Van Valkenburg, “Network Synthesiss”,<br>5. Joseph A. Edminister, Mahmood Maqvi, “Theory and Problems of Electric Circuits”, Schaum's Outline Series, | |

# BTINC 304. ANALOG ELECTRONICS.

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Prerequisite | Basic electronics engineering | |
| Course Objective | To understand operational and performance characteristics of analog electronic devices<br>To design and analyze transistor circuits | |
| Course Outcome | Analyze transistor circuit using h parameter model.<br>Design and analyze different op-amp circuits for various applications.<br>Describe characteristics of various power devices and power converters. | |
| Unit | Contents | Contact Hrs |
| 1 | **Diode Theory**<br>Basic review of diode theory & Types of diode & their applications, Rectifiers, Filters, Clippers, clampers, Voltage Multipliers- Doublers, Trippler, quadrupler, Diode current equation. | 7 |
| 2 | **Basic Review of Transistor Configuration**<br>Transistor biasing & Thermal stabilization, Bias compensation, Thermal runaway, Load line, Q –point, Transistor at low frequencies (h-parameter), Transistor at high frequencies (h-parameter), Darlington circuits, Frequency response of amplifier, Oscillators, Multivibrators. | 7 |
| 3 | **Basic Review Of Field Effect Transistor**<br>Small signal FET analysis & FET applications, Single stage amplifier, Analog switches, Voltage variable resistance, UJT & its application, MOSFET & its application, IGBT & its application. | 6 |
| 4 | **Power amplifiers, Signal Generators and filters**<br>Power amplifiers, audio power amplifier, classA/class-AB/class-B/classC; Push-pull class-AB power amplifier.<br>Signal Generators and filters: Multi vibrators, triangular wave generator, saw tooth wave generator, square wave generator, sine wave generator, Bootstrap Sweep generator, basic low pass filters, low pass and high pass Butterworth filters, band pass, band reject filters, applications of filters | 6 |
| 5 | **Power Converters, Regulators**<br>Power Converters: SMPS, working principles, performance parameters, DC-DC converters: different types, working principles and analysis, applications. Voltage regulators, stability of regulators. | 5 |
| | **References :**<br>1. Robert L. Boylestad and Louis Nashelsky, "Electronic Devices and Circuit Theory" Pearson Education, Tenth ed., 2009.<br>2. RamakantGayakwad, "Op-Amp and Linear Integrated Circuits", PHI,4th ed.,2000<br>3. M.Rashid, "Power Electronics Circuit,Devices &Applications "Pearson Edu., Third ed.2004 | |

# BTINL 305. SENSOR AND TRANSDUCER LAB

**Teaching scheme:**

Lab Work : 2 Hrs

Total credit: 1

**Examination Scheme:**

Continuous Assessment (T/W): 60 Marks

Pr/Oral: 40 Marks

| | |
|---|---|
| Pre requisite | Basic electrical and electronics engineering |
| Course Objective | To understand operational and performance characteristics of sensors and transdducers |
| Course Outcome | Identify various elements required for characterization of given transducers/sensors. Designand conduct experiments for measurement, characterization, and ability to analyze and interpret data Communicate effectively in oral and written form while formulating experiments, reports and other related documents. |
| Expt. No | Title of Expt. |
| 1 | To determine the LVDT characteristics. |
| 2 | To determine the characteristics of capacitive displacement transducer. |
| 3 | Speed Measurement using Magnetic pickup. |
| 4 | To determine Strain gauge characteristics. |
| 5 | To determine Thermocouple characteristics. |
| 6 | To determine RTD and Thermistor characteristics. |
| 7 | To study and calibration of Dead weight Tester for pressure gauge. |
| 8 | To Study of flow transducer measurement. |
| 9 | To Study of level transducer measurement. |
| 10 | Study of DP Cell . |
| | |

# BTINL306. ANALOG ELECTRONICS LAB

Teaching scheme:

**Lab work : 2 hrs**

Total credit: 1

**Examination Scheme:**

**Continuous Assessment (T/W): 60 Marks**

Pr/oral: 40 Marks

| | |
|---|---|
| Pre requisite | Basic electrical engineering |
| Course Objective | To understand and apply various network theorems for solution of engineering problems |
| Course Outcome | Understand and apply various network theorems for solution of engineering problems |
| Expt. No | Title of Expt. |
| 1 | To study characteristics of JFET |
| 2 | To study clipping circuits. |
| 3 | To study clamping circuits. |
| 4 | To study voltage multiplier circuits. |
| 5 | To study half wave rectifier. |
| 6 | To study full wave rectifier. |
| 7 | To study frequency response of two-stage RC coupled amplifier. |
| 8 | To study Hartley oscillator. |
| 9 | Design and implementation of Astable multivibrator and Monostable multivibrator |
| 10 | Design and implementation of Phase Shift Oscillator |
| 11 | Design inverting and non-inverting amplifier using OPAMP |

# Semester –IV

## BTINC 401. DIGITAL ELECTRONICS.

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
**Mid-term test: 20 Marks**
**Internal Assessment: 20 Marks**
**End semester exam: 60 Marks**

| | | |
|---|---|---|
| Pre requisite | Basic electrical technology, | |
| Course Objective | To familiarize the students with Digital Electronics. | |
| Course Outcome | To Work with a variety of number systems and numeric representations, including signed andunsigned binary, hexadecimal, 2's complement.<br>To introduce basic postulates of Boolean algebra and show the correlation between Booleanexpression.<br>To introduce the methods for simplifying Boolean expressions.<br>To outline the formal procedures for the analysis and design of combinational circuits andsequential circuits. | |
| Unit | Contents | Contact Hrs |
| 1 | Number system and fundamental concepts of digital circuits:<br>Number system –different types of number system like binary Octal, Decimal and hexadecimal, Signed binary numbers, Conversion methods of one type number system to another type, Fundamental concepts: Digital circuits.(AND,OR,NOT,NOR,NAND and Exclusive-OR operation), Different types of codes – binary code, Gray code, BCD code.<br>f. Excess- 3 code, Hamming code, ASCII code, Comparison of digital logic families such as RTL, DCTL, DTL, HTL, TTL, PMOS and CMOS Causes, Boolean algebra laws. | 8 |
| 2 | Combinational logic design:<br>Standard representation for logical function, SOP & POS form, Min-term & Max-term. Simplification of logical function specified in min-term & max-term or along with don't care condition using K- MAP, Design examples such as half and Full adder, half and full Subtractor, BCD to Seven segment decoder. | 8 |
| 3 | Combinational logic design using MSI circuits:<br>Multiplexer and Demultiplexer operations, Adder and Digital comparator circuits. Parity generator /chekers, Code convertors BCD to binary , Binary to BCD, BCD to Excess-3 ,Binary to gray. | 8 |
| 4 | Sequential Logic Design:<br>1 Bit memory cell, clocked S-R flip-flop, master slave J-K flip flop, D and T types of flip flops, Excitation tables of flip flop, Conversion of one type of flip flop into another type, Registers, classifications, shift registers, counters, synchronous, asynchronous, Analysis of clocked sequential circuits, state table, state diagram, next state equation and state reduction. | 8 |

| | | |
|---|---|---|
| 5 | Convertor circuits and digital storage devices:<br>Digital to analog converter, weighted register D/A converter, R/2R ladder D/A converter, Analog to digital conveter, parallel comparator, A/D converter, successive approximation A/D converter, dual slope A/D converter, Digital storage devices such as ROM, RAM, EPROM, EEPROM, CAM (content addressable memory), CCD, ROM as PLD and PLA, PAL, field programmable gate arrays (FPGA), ERA (Electrically reconfigurable arrays) | 8 |
| | **REFERENCES:**<br>Donald D Givone, Digital Principles and Design, Tata McGraw Hill, 2003.<br>Thomas L Floyd, Digital Fundamentals, Pearson Education, 8th edition, 2003.<br>Donald P Leach, Albert Paul Malvino, Digital Principles and Applications, TMH, 2006. | |

# BTINC 402. FEEDBACK CONTROL SYSTEM

Teaching scheme:
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Laplace Transform, Differential Equations | |
| Course Objective | • To understand the use of transfer function models for analysis physical systems and introduce the control system components.<br>• To provide adequate knowledge in the time response of systems and steady state error analysis.<br>• To accord basic knowledge in obtaining the open loop and closed-loop frequency responses of systems.<br>• To introduce stability analysis and design of compensators<br>• To introduce state variable representation of physical systems and study the effect of state feedback. | |
| Course Outcome | Develop TF models of physical systems | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction: Concept of open & closed loop control system, Servomechanism, Multivariable control system, Applications in non-engineering field | 7 |
| 2 | Physical Systems and Transfer Function: a) Concept of system: physical system, Physical model, Linear and nonlinear systems, Time variant and invariant system. b) Equations of physical systems (Mass-Spring-Dashpot system, R-L-C series & parallel circuit) transfer function, Procedure of obtaining transfer function Control system components: Derivation of transfer functions of following components a)DC servomotors (Armature and field control) b) AC servomotors c) Amplidyne generators d),Synchros e) DC and AC tacho generators f) Potentiometer error detectors | 9 |
| 3 | Block diagrams and Signal flow graphs: a) Block diagram algebra, Diagram reduction, Numerical examples. b) Signal flow graph; Masons gain formula for deriving overall transfer function of systems. Feedback characteristics of control system: Concept of negative and positive feedback, Sensitivity of the system to parameter variation, using negative and positive feedback | 8 |
| 4 | Time domain analysis: Typical test signals, Time domain specifications, Steady state response, Types of system, Steady state error constants and steady state error, (With different input), Numerical examples, transient response, Numericals, Concept of stability, Determination of stability by Routh - Hurwitz criterion | 8 |
| 5 | Frequency domain analysis: Introduction to frequency response, Advantages of frequency domain analysis, Polar plots, Numericals, Bode plots, Principle of argument, Nyquist criterion, Relative stability from Nyquist criterion, Numericals. Definition of Root Locus, Construction of root locus, Stability from root locus plots, Root counters, Effect of addition of poles & zeros on root locus plots. | 8 |

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|---|---|---|
| | **REFERENCES:**<br>1. K. Ogata – Modern Control Engineering (Prentice Hall Of India).<br>2. Kuo B. C.– Automatic Control System.(Prentice Hall Of India).<br>3. I. J. Nagarath & M. Gopal – Control System(Willey Earstern)<br>4. Gopal .M.– Control System.(Prentice Hall Of India). | |

# BTHM403. Industrial Management and Economics

**Teaching scheme:**
Theory: 3 hrs

Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic Knowledge of Management | |
| Course Objective | To study concept of time value of money, demand<br>To study Market concept | |
| Course Outcome | To understand Meaning of Production and factors of Production | |
| Unit | Contents | Contact Hrs |
| 1 | Principles of Management<br>a. Basic Concepts: Definition, Nature, Importance, Management: Art and Science & as a Profession, Management Vs Administration, Evolution of Management: Introduction to Scientific Management by Taylor, Administrative, Management by Fayol, Contribution of Peter Drucker, Levels & Functions of Management, Forms of Business Organization. b. Approaches to Management: Decision Theory Approach, Contingency Approach, Systems Approach. c. Organization: Formal & Informal, Line & Staff relationship, Centralization vs. Decentralization, Span of Management, Departmentation, MBO. | 8 |
| 2 | Economics<br>a. Introduction: Meaning & Scope of Economics, Basic Theories, Law of Demand & Supply, Elasticity of Demand & Supply. b. Consumer Theories: Meaning of Utility & Law of Diminishing Utility. c. Cost Concepts: Opportunity Costs, Sunk Costs, Marginal Cost, Total & Variable Costs, Fixed Costs, Contribution, Law of Diminishing Return. | 6 |
| 3 | Economic appraisal techniques<br>a. Economic appraisal techniques: Long- Range and Short range Budgeting, b. Criteria for Project Appraisal, c. Social benefit-cost analysis, d. Depreciation: concepts and Techniques. | 6 |
| 4 | Marketing Management<br>a. Introduction to Marketing: Concept of Market, b. Types of Market, Definition, Nature & Scope of Marketing, c. Marketing Approaches, Marketing Process, Functions of Marketing Management, d. 4 P's of Marketing. Advertising media of advertising market forecasting | 8 |
| 5 | Financial Management<br>a. Introduction to Financial Management: Meaning, Nature & Scope of Financial Management, b. Capital Structure, Types & Sources of Finance. c. Money Market & Capital Market, | 7 |
| | **Reference Books:**<br>1. O P Khanna, "Industrial Engineering Managements"<br>2. L.M.Prasad, "Principles of Management", Himalaya Publications Ltd<br>3. D.N. Dwivedi, "Managerial Economics", Vikas Publications<br>4. Engineering Economics : Degramo. | |

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|---|---|---|
| | 5. A Text Book of Economic Theory : Sammuelson<br>6. Philip Kotler, "Marketing Management", Tata McGraw Hill<br>7. Ravi M. Kishor, "Financial Management", Taxmann Publication | |

# BTINBS 404 ELECTRICAL AND ELECTRONICS MEASUREMENT

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic electrical engineering | |
| Course Objective | To familiarize with different measurement and instrumentation devices. | |
| Course Outcome | To understand philosophy of measurement.<br>To understand different methods analog and digital measurement.<br>To study principle of construction and operation of different transducer and dismay methods. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction: Static and Dynamic characteristics of instruments, dead zone, hysteresis, threshold, resolution, input & output impedance, loading effects, fundamentals of measurements, Types of Error, Statistical Analysis, Probability of Errors, Limiting Errors, calibration of instruments, Traceability, calibration report & certification. | 8 |
| 2 | Analog Indicating Instrumentation: DC galvanometer, PMMC and Moving Iron instruments, voltmeters, ammeters, ohmmeters, multimeters and extension of range of instruments, AC indicating instruments, Potential and current transformers, wattmeters, energy meters, DC Potentiometers, self-balancing potentiometers, standardization, application | 8 |
| 3 | Bridge Circuits: DC bridges: Wheatstone bridge and Kelvin bridge design, bridge sensitivity, errors in bridge circuits, null type and deflection type bridges, current sensitive and voltage sensitive bridges, applications of DC bridges AC bridges: General equations for bridge balance, Maxwell bridge, Hey bridge, Schering bridge, Wein bridge, phasor diagrams, storage and dissipation factor, applications of AC bridges | 8 |
| 4 | Oscilloscope: Introduction, Oscilloscope Block Diagram, Cathode Ray Tube, CRT Circuits, Vertical Deflection System, Delay Line, Multiple Trace, Horizontal Deflection System, front panel controls, deflection sensitivity, dual trace CRO, Oscilloscope Probes ,measurement of electrical parameters like voltage, current, frequency, phase, Z-modulation, Digital Storage Oscilloscope. | 8 |
| 5 | Digital Instruments: Block diagram, principle of operation, Accuracy of measurement Digital Multimeter, Kilo Watt Hour meter, Phase meter, Digital Tachometer, Ultrasonic Distance meter, Digital Thermometer, Recording Instruments and Waveform Generation: Principle and working of strip chart and X-Y recorders, single and multi-channel recorders, driving systems for pen and chart, chart speed and their applications, Waveform generation methods, Function generator. | 8 |

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|---|---|---|
| | **REFERENCES:**<br>1. Electrical and Electronics Measurements and Instruments , Sahwaney A K<br>2. W. D. Cooper & A. D. Helfrick, 'Electronic Instrumentation And Measurement Techniques', PHI,4th e/d, 1987<br>3. David Bell, 'Electronic Instrumentation and Measurements', PHI, 2e/d,<br>4. Anand M. M. S., 'Electronic Instruments and Instrumentation Technology', PHI, 2004<br>5. Kalsi H. S., 'Electronic Instrumentation', TMH, 2nd e/d, 2004<br>6. R. Subburaj, 'The foundation for ISO 9000 and TQM',<br>7. Bouwens A. J., 'Digital Instrumentation' | |

# BTINPE405A. MICROPROCESSOR BASED SYSTEM

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Digital electronics | |
| Course Objective | To introduce architecture of microprocessor and its programming skill | |
| Course Outcome | Understands principles of architecture of microprocessor.<br>Apply programming skill to different day to day applications. | |
| Unit | Contents | Contact Hrs |
| 1 | **Architecture of 8085 Microprocessor:** Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles and timing diagrams | 7 |
| 2 | **Programming :**Instruction formats, Addressing modes, Instruction set, Need for Assembly language, Development of Assembly language programs | 8 |
| 3 | **Interfacing:** Memory Interfacing: Interface requirements, Address space partitioning,Buffering of Buses, timing constraints, Memory control signals, Read and write cycles, interfacing SRAM, EPROM and DRAM sections | 8 |
| 4 | **I/O Interfacing:** Memory mapped I/O Scheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports, Programmable peripheral interface (8255). Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes, Interfacing, Simple keyboards and LED displays | 8 |
| 5 | **Interrupts and DMA:** Interrupt feature, Need for interrupts, Characteristics of Interrupts, Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Development of Interrupt service subroutines, Multiple interrupt request and their handling, need for direct memory access, Devices for Handling DMA, Programmable DMA controller 8237.<br>**Applications:** Interfacing of A/D converters (ADC 0800/ADC 0808/ADC 0809), Interfacing of D/A converters (DAC 0800), Waveform generators, Multiplexed seven segment LED display systems, Measurement of frequency, phase angle and power factor- Traffic light controller, Stepper motor control | 9 |
| | **REFERENCES:**<br>1. Goankar, R.S., "Microprocessor Architecture Programming and Applications withthe 8085/8080A", 3rd Edition, Penram International Publishing House, 1997.<br>2. Singh. I.P., "Microprocessor Systems", Module 9 : Microcontrollers and their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997.<br>3. Douglas, V.Hall., "Microprocessor and Interfacing Programming and Hardware",2ndEdition, McGraw Hill Inc., 1992.<br>4. Kenneth, L.Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987 | |

# BTINPE405B. INDUSTRIAL SAFETY

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Course Objective | To understand various techniques and methods of analysis which occur in the variousregions of the spectrum.<br>To study important methods of analysis of industrial gases.<br>To understand the important radio chemical methods of analysis | |
| Course Outcome | Ability to understand and analyze Instrumentation systems and their applications to various industries. | |
| Unit | Contents | Contact Hrs |
| 1 | **Safety and Health Management : i.** Occupational Health Hazards, Promoting Safety, Safety and Health training, Stress and Safety. ii. Ergonomics - Introduction, Definition, Objectives, Advantages. Ergonomics Hazards - Musculoskeletal Disorders and Cumulative Trauma Disorders. iii. Importance of Industrial safety, role of safety department, Safety committee and National safety council Function Understanding basic safety Terms , Hazard definition , classification , What is Risk , Hazzard –Risk-Accident matrix. Personal Protective Equipments: Need, selection, supply, use, care and maintenance, Personal protective devices for head, ear, face, eye, foot, knee and body protection, Respiratory personal protective devices. | 8 |
| 2 | **Industrial Hazzards,** Risk and Prevention: Industrial noise: -Sources, and its control, Effects of noise on the auditory system and health, Measurement of noise , Different air pollutants in industries: Effect of different gases and particulate matter ,acid fumes ,smoke, fog on human health. Vibration : effects, measurement and control measures, Machine and Plant layouts , ii. Machine guards and its types, automation. High pressure hazards, emptying, inspecting, repairing, hydraulic and nondestructive testing, hazards and control in mines. | 8 |
| 3 | **Electrical Hazards :** i. Safe limits of amperages, voltages, distance from lines, etc., Joints and connections, Overload and Short circuit protection, Earthling standards and earth fault protection , Protection against voltage fluctuations, Effects of shock on human body , Hazards from Borrowed neutrals, Electrical equipment in hazardous atmosphere, Criteria in their selection, installation, maintenance and use, Control of hazards due to static electricity, Importance of Insulation ,Introduction to CEA Safety Regulation 2010 Static Electricity and associated hazards , Hazards in Electronics and Instrumentation manufacturing industry | 8 |
| 4 | **Fire Safety :** General causes and classification of fire, Detection of fire, extinguishing methods, fire-fighting installations with and without water., Type of Fire extinguishers, Use, hands on experience, Evacuation procedures, Mock drills introduction to Maharashtra Fire Prevention & Life Safety Measure Act, 2006 , Maharashtra Fire Prevention and Life Safety Measures Rules, 2009 | 8 |
| 5 | **First aid and Emergency Procedures :** Body structure and Functions, Position of causality, the unconscious casualty, fracture and dislocation, Injuries in muscles and | 8 |

| | | |
|---|---|---|
| | joints, Bleeding, Burns, Scalds and accidents caused by electricity, Respiratory problems, Rescue and Transport of Casualty. CPR, poisoning, wounds | |
| | **REFERENCES:**<br><br>1. NPTEL course material | |

# BTINPE405C. SIGNALS AND SYSTEMS

**Teaching scheme:**
Theory: 2 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic electrical engineering | |
| Course Objective | To familiarize the students with elements of signals and systems. | |
| Course Outcome | Understand standard concepts and tools that will serve as building blocks towards signal and system analysis | |
| Unit | | Contact Hrs |
| 1 | **Classification of signals:** Continuous time signals (CT signals), discrete time signals (DT signals) - Step, Ramp, Pulse, Impulse, Exponential, Classification of CT and DT signals - periodic and periodic, random signals, representation of signals. | 5 |
| 2 | **Classification of systems:** CT systems and DT systems, Basic properties of systems - Linear Time invariant Systems and properties | 5 |
| 3 | **Analysis of continuous time signals:** Fourier series analysis, Spectrum of C.T. signals, Fourier Transform and Laplace Transform in Signal Analysis | 7 |
| 4 | **Linear time invariant –continuous time systems** Differential equation, Block diagram representation, Impulse response, Convolution integral, frequency response , Fourier and Laplace transforms in analysis, State variable equations and matrix representation of system.<br>**Linear time invariant - discrete time systems** Difference equations, Block diagram representation, Impulse response, Convolution sum, State variable equations and matrix representation of systems. | 9 |
| 5 | **Analysis of discrete time signals** Sampling of CT signals and aliasing, DTFT andproperties, Z-transform and properties of Z transform. | 6 |
| | **REFERENCES:**<br>1.Allan V.Oppenheim, S.Wilsky and S.H.Nawab, Signals and Systems, Pearson Education, 2007.<br>2. Edward W Kamen& Bonnie's Heck, "Fundamentals of Signals and Systems", Pearson Education, 2007<br>3. H P Hsu, RakeshRanjan" Signals and Systems", Schaum's Outlines, Tata McGraw Hill, Indian Reprint, 2007<br>4. S.Salivahanan, A. Vallavaraj, C. Gnanapriya, Digital Signal Processing, McGraw Hill International/TMH, 2007.<br>5. Simon Haykins and Barry Van Veen, Signals and Systems John Wiley & sons , Inc,2004.<br>6. Robert A. Gabel and Richard A.Roberts, Signals & Linear Systems, John Willy | |

# BTINL406. DIGITAL ELECTRONICS LAB

**Teaching scheme:**
Lab work : 2 hrs

Total credit: 1

**Examination Scheme:**

Continuous Assessment (T/W): 60 Marks

Pr/oral: 40 Marks

| | | |
|---|---|---|
| Pre requisite | Digital electronics theory | |
| Course Objective | Understands designing of various digital circuits | |
| Course Outcome | Design and verifies various digital circuits | |
| Expt. No | Title of Expt. | |
| 1 | Verification of truth table of various TTL logic gates. | |
| 2 | Verification of Boolean algebra laws. | |
| 3 | Verification of given logical expression using universal gates. | |
| 4 | To Design and test adder circuits (half and full adder) using K-map. | |
| 5 | To Design and test binary to gray code converter circuits and test using IC7486. | |
| 6 | To Design and test BCD to Exess-3 code converter circuit. | |
| 7 | To Design and test one bit comparator circuit using K-map. | |
| 8 | Verification of truth table of multiplexer using IC74153. | |
| 9 | Verification of truth table of De-multiplexer using IC74155. | |
| 10 | Verification of BCD to 7-segment display using IC7447. | |
| 11 | Verification of ring counter using IC7493. | |

# BTINL407. FEEDBACK CONTROL SYSTEM LAB

**Teaching scheme:**

Lab work : 2 hrs

Total credit: 1

**Examination Scheme:**

Continuous Assessment (T/W): 60Marks

Pr/oral: 40 Marks

| | | |
|---|---|---|
| Pre requisite | Basics of Feedback control System | |
| Course Objective | To understand characteristics of second order system,<br>To understand behavior of different compensation networks | |
| Course Outcome | Design various compensation networks.<br>Design feedback controller and observer | |
| Expt. No | Title of Expt. | |
| 1 | Study of Open loop and Closed loop. | |
| 2 | Time response Characteristic of a First order system | |
| 3 | Time response Characteristic of a second order system | |
| 4 | Frequency response Characteristic of a first order system | |
| 5 | Frequency response Characteristic of a second order system | |
| 6 | To draw Root Locus for a given transfer function. | |
| 7 | To draw Bode plot for a given transfer function. | |
| 8 | Design of lead compensation networks | |
| 9 | Design of lag compensation networks | |
| 10 | Design of compensation lead-lag networks | |

# BTINM 408. MINI PROJECT

**Teaching scheme:**
Lab work : 2 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| | |
|---|---|
| Objective | To provide platform to apply engineering knowledge |
| Outcome | 1. Able to simulate hardware for verification of engineering principles<br>2. Demonstration of sensor circuits, extraction of signals and signal conditioning, measurement of various parametersincluding electrical, thermal, Mechanical communication parameters etc. |

# Dr. Babasaheb Ambedkar Technological University, Lonere

**Dr. Babasaheb Ambedkar Technological University**
**(Established as a University of Technology in the State of Maharashtra)**
**(Under Maharashtra Act No XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra Telephone and Fax: 02140 – 275142**
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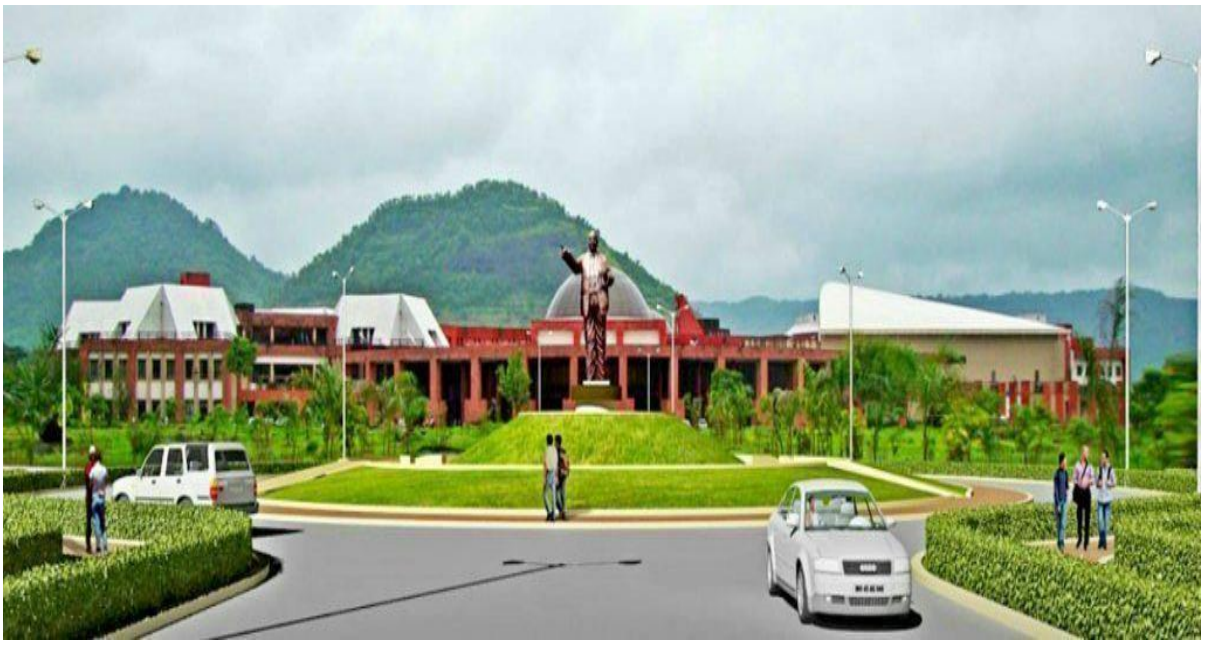
CURRICULUM

## UNDERGRADUATEPROGRAMME

## T. Y. B.Tech. (Instrumentation Engineering)

**With effect from the Academic Year2022-2023**



# B. Tech in Instrumentation Engineering

## Curriculum for Third Year

| Semester V | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | PCC 1 | BTINC501 | Process Loop Components | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 2 | PCC 2 | BTINC502 | Microprocessor and Microcontroller | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 3 | PCC 3 | BTINC503 | Digital Signal Processing | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 4 | PEC 2 | BTINPE504 | Group B | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 5 | OEC 1 | BTINOE505 | Group C | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 6 | HSSMC | BTHM506 | Human Rights | - | - | - | - | - | - | - | Audit |
| 7 | LC | BTINNL507 | Process Loop Components Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 8 | LC | BTINNL508 | Digital Signal Processing Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 9 | Project | BTINM509 | Mini Project I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| 10 | Internship | BTINP408 | Internship – 2 Evaluation | - | - | - | - | - | 50 | 50 | 1 |
| **Total** | | | | **15** | **3** | **8** | **220** | **100** | **430** | **850** | **23** |

| Semester VI | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | PCC 1 | BTINC601 | Digital Control System | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 2 | PCC 2 | BTINC602 | Industrial Automation and Control | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 3 | PCC 3 | BTINC603 | Power Electronics and Drives | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| 4 | PEC 3 | BTINPE604 | Group D | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 5 | OEC 2 | BTINOE605 | Group E | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 6 | LC | BTINL606 | Industrial Automation and Control Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 7 | LC | BTINL607 | Power Electronics and Drives Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 8 | Project | BTINM608 | Mini Project II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| 9 | Internship | BTINP609 | Field Training / Internship/Industrial Training (minimum of 4 weeks which can be completed partially in third semester and fourth semester or in at one time). | - | - | - | - | - | - | - | Credits To be evaluated in VII Sem. |
| **Total** | | | | **15** | **3** | **8** | **220** | **100** | **380** | **800** | **22** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course HSSMC = Humanities and Social Science including Management Courses

- **Important Note: Minimum Eight Experiment to perform based on the syllabus for the laboratory subject.**

**Group B [Sem - V] (Professional Elective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINPE504 A | Multi-sensors and Data Fusion |
| 02 | BTINPE504 B | Linear Techniques |
| 03 | BTINPE504 C | Soft Computing |

**Group C [Sem - V] (Open Elective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINOE505 A | Control System |
| 02 | BTINOE505 B | Artificial neural network |
| 03 | BTINOE505 C | Biomedical Instrumentation |

**Group D [Sem - VI] (Professional Elective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINPE604 A | Instrumentation Unit Operations |
| 02 | BTINPE604 B | Power Plant instrumentation |
| 03 | BTINPE604 C | Embedded Systems |

**Group E [Sem - VI] (Open Elective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINOE605 A | Industrial data communication |
| 02 | BTINOE605 B | Fiber Optics and Laser instrumentation |
| 03 | BTINOE605 C | Robotics and Control |

# SEMESTER V

## BTINC501 Process Loop Components

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basics of Control System Components | |
| Course Objective | The objective of the course is to provide students with a firm grasp of the essential principles of control system components | |
| Course Outcome | 1. Apply the knowledge of the control system components for controlling various Industrial parameters.<br>2. Able to identify, formulate and solve a problem using hydraulic, electrical & pneumatic system.<br>3. Analyse the process characteristics and apply suitable controller to that process.<br>4. Correctly select type and size of control valves for industrial use. | |
| Unit | Contents | Contact Hrs |
| 1 | Fundamentals of process control and Transmitters Elements of process control loop, Concept of Process variables, set point, controlled variable, manipulated variable, load variable. Representation of Process loop components using standard symbols (basics with reference to control loop), and Examples of process loops like temperature, flow, level, pressure etc. Need of transmitter (concept of field area & control room area), Need for standardization of signals, Current, voltage, and pneumatic signal standards, Concept of live & dead zero. | 8 |
| 2 | Transmitters and Converters:<br>Types of transmitters: Two and four wire transmitters, Electronic and Pneumatic transmitters Electronic Capacitive Differential Pressure Transmitter: Types, Mounting (Installation), Manifold, Calibration setup, DPT, Span & zero adjustment, Application of DPT for Flow and Level measurement, Zero elevation, suppression, Square root extractor. SMART: Comparison with conventional transmitter, Block schematic, Converters: Difference between converter & Transmitter, Pneumatic to current converter, Current to pneumatic converter. | 8 |
| 3 | Control Valves:<br>Terminology, types and characteristics, Selection of control valves, Concept of Cv, calculation of Cv and trim size, Cavitation and flashing, Noise in control valves, testing of control valve, Valve positioners: necessity, types and effect on performance of control valves, Electrical, Pneumatic and Hydraulic Actuators, Electro-pneumatic and Electro-Hydraulic Actuators. | 8 |

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|---|---|---|
| 4 | PID Controllers and PLC<br>On-Off controller, Pneumatic, hydraulic and Electronic Proportional (offset), Integral (Reset windup), Derivative, Proportional- Integral, Proportional- Derivative, Proportional- Integral-derivative, reset windup, Rate before Reset, PID controllers and their tuning, Digital PID controllers: Velocity & Position algorithm.<br>PLC Relay ladder diagrams, introduction to programmable logic controllers (PLC), Architecture and specifications of PLC, Ladder Programming, Development of ladder diagrams for various applications, Advance PLC programming. | 8 |
| 5 | Auxiliary components: Synchro transmitter and receiver, Servo motor, Stepper motor, Feeders and Dampers. Intrinsic safety and components. Gyroscope Indicators and Alarm Annunicator, Control Panel and their design. | 8 |
| | **Reference books:**<br>1. Process control and Instrument technology, C. D. Johnson, TMH<br>2. Introduction to Programmable Logic Controller, Gary Dunning<br>3. Process Control, Instrument Engineering Hand book, B.G. Liptak | |

# BTINC502 Microprocessor and Microcontroller

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Digital electronics, electronics devices and circuits | |
| Course Objective | To know the architecture of 8085 and 8051.<br>To understand interfacing and interrupt features of 8085 and 8051.<br>To develop program for basic applications | |
| Course Outcome | 1. Understand concept of microprocessors and microcontrollers.<br>2. Design and debug programming of microprocessors and microcontrollers.<br>3. Identify and select an appropriate microcontroller as well as development tools for given applications | |
| Unit | Contents | Contact Hrs |
| 1 | Architecture of 8085 Microprocessor and Programming: Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals, Machine cycles and timing diagrams. Instruction formats, Addressing modes, Instruction set, Need for Assembly language, Development of Assembly language programs | 8 |
| 2 | Interfacing: Memory Interfacing: Interface requirements, Address space partitioning, Buffering of Buses, timing constraints, Memory control signals, Read and write cycles, interfacing SRAM, EPROM and DRAM sections. I/O Interfacing: Memory mapped I/O Scheme, I/O mapped I/O scheme, Input and Output cycles, Simple I/O ports, Programmable peripheral interface (8255). Data transfer schemes: Programmable data transfer, DMA data transfer, Synchronous, Asynchronous and interrupt driven data transfer schemes, Interfacing, Simple keyboards and LED displays. | 8 |
| 3 | Interrupts and DMA: Interrupt feature, Need for interrupts, Characteristics of Interrupts, Types of Interrupts, Interrupt structure, Methods of servicing interrupts, Development of Interrupt service subroutines, Multiple interrupt request and their handling, need for direct memory access, Devices for Handling DMA, Programmable DMA controller 8237, Applications of microprocessors. | 8 |
| 4 | Intel 8051 Microcontroller : Architecture of 8051, Memory Organization, Addressing modes, Instruction set, Boolean processing, Simple programs | 8 |
| 5 | 8051 Peripheral Functions : 8051 interrupt structures, Timer and serial functions, parallel port features : Modes of operation, Power control, features, Interfacing of 8051, Typical applications, MCS 51 family features | 8 |
| | **Ref Books:**<br>1. Goankar, R.S., "Microprocessor Architecture Programming and Applications with the 8085/8080A", 3rd Edition, Penram International Publishing House, 1997.<br>2. Singh. I.P., "Microprocessor Systems", Module 9: Microcontrollers and | |

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|---|---|---|
| | their Applications", IMPACT Learning Material Series IIT, New Delhi, 1997.<br>3. Douglas, V. Hall. "Microprocessor and Interfacing Programming and Hardware", 2ndEdition, McGraw Hill Inc., 1992.<br>4. Kenneth, L. Short., "Microprocessors and Programmed Logic", Prentice Hall of India, 2nd Edition, 1987. | |

# BTINC503 Digital Signal Processing

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Signals and systems network analysis and synthesis. | |
| Course Objective | To study different signals, systems, design procedure for filters.<br>To understand time domain and frequency domain of systems.<br>To analyses system signals and digital filter structure.<br>To design digital filter for engineering application. | |
| Course Outcome | 1. Ability to apply the various programming techniques on DSPs<br>2. Ability to design FIR and IIR filters using different techniques.<br>3. Ability to determine the frequency, steady state and transient response of LTI systems.<br>4. Ability to apply the DFT and FFT methods for various signals and determine their frequency response. | |
| Unit | Contents | Contact Hrs |
| 1 | Fourier series and Fourier transform & its properties.<br>Discrete time Fourier series & its properties.<br>Circular and Linear convolution, frequency response analysis of signal using DFT.<br>Linear filtering based on DFT FFT algorithms.<br>Use of FFT for spectral estimation, filtering & correlation. | 8 |
| 2 | Short Time Fourier Transform (STFT).<br>Introduction to multi-resolution transform.<br>Continuous wavelet transforms.<br>Discrete Wavelet Transform (DWT).<br>Simple application of DWT for noise filtering in one dimensional signal. | 8 |
| 3 | Introduction to Finite Impulse Response Filter, FIR filter design using different windowing techniques & frequency sampling method.<br>Design of linear phase FIR filter.<br>Introduction to computer-aided design of linear phase FIR filter.<br>Basic structure of FIR system. | 8 |
| 4 | Introduction to Infinite Impulse Response Filter, impulse invariance and bilinear transformation,<br>Design Specification of IIR Low pass filter and frequency transformation, Design of IIR filter using Butterworth, Chebyshev approximation.<br>Introduction to computer-aided design of IIR filter. Realization methods for IIR filter. | 8 |
| 5 | Introduction to multirate DSP, Introduction to DSP hardware.<br>TMS320C67XX processor, applications of TMS320C67XX e.g. square wave generator, matrix multiplication. | 8 |

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| | Applications of DSP processor for biomedical, speech, image processing. | |
| | **Reference Books:**<br>1. Proakis J.G., and Manolakis, Introduction to DSP, PHI, 2007<br>2. Sanjit K. Mitra, "Applications DSP a Computer based approach", TMH, 2006 Oppenheium, Schaffer ,"Digital Signal Processing", PHI.<br>3. A. Nagoor Kani , "Digital Signal Processing", Mc. Graw Hill.<br>4. Rulph Chassaing ,"Digital Signal Processing, applications using C & TMS320CSX DSK", WILLEY publication. | |

# BTINPE 504 A. Multi-Sensor Data Fusion

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | | |
| Course Objective | To learn the concepts and techniques used in sensor data fusion | |
| Course Outcome | To understand the concept of sensor fusion.<br>To apply algorithms for multi-sensor data fusion.<br>Interpret high performance data structures. | |
| Unit | Contents | Contact Hrs |
| 1 | Multi-sensor data fusion: Introduction, sensors and sensor data, Use of multiple sensors, Fusion applications. The interference hierarchy: output data. Data fusion model. Architectural concepts and issues. | 8 |
| 2 | Benefits of data fusion, mathematical tools used: Algorithms, Co-ordinate transformations, rigid body motion. Dependability and Markov chains. Meta – heuristics | 8 |
| 3 | Taxonomy of algorithms for multisensory data fusion. Data association. Identify declaration. | 8 |
| 4 | Estimation: Kalman filtering, practical aspects of Kalman filtering, extended Kalman filters. Decision level identify fusion. Knowledge based approaches. | 8 |
| 5 | Data information filter, extended information filter. Decentralized and scalable decentralized estimation. Sensor fusion and approximate agreement. Optimal sensor fusion using range trees recursively. Distributed dynamic sensor fusion. High performance data structures: Tessellated, trees, graphs and function. Representing ranges and uncertainly in data structures. Designing optimal sensor system with in dependability bounds. Implementing data fusion system | 8 |
| | **Ref Books:**<br>1. David L. hall, Mathematical techniques in multisensory data fusion, Artech House,<br>Boston.<br>2. R. R. Brooks and S. S. Iyengar, Multi-sensor Fusion: Fundamentals and applications<br>with Software, Prentice Hall Inc., New Jersey.<br>3. Arthur Gelb, Applied Optimal Estimation, M.I.T. press<br>4. James V. Candy, Signal Processing: The Model Based Approach, Mc Graw Hill | |

# BTINPE 504 B. Linear Techniques

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Course Objective | The objective of the course is to provide students with a firm grasp of the essential principles of Operational Amplifiers and its applications as well as signal sources and signal analysis. | |
| Course Outcome | 1. Apply basic Knowledge of science and engineering subject to understand the concept, working and application of Operational Amplifier.<br>2. Understand concept of negative and positive feedback applications using Operational Amplifiers.<br>3. Understand the characteristics of operational amplifiers. 4. Understand fundamentals and design of different signal sources and voltage regulators | |
| Unit | Contents | Contact Hrs |
| 1 | Differential Amplifiers: dual input-balanced output ; single input-balanced output; their analysis, constant current bias, current mirror, level translators, Basic Operational amplifier; equivalent circuit, IC Operational amplifiers-characteristics, specification , parameter measurements, frequency response, types (741,308,356,OP07) and their properties. | 8 |
| 2 | Negative feedback applications: Voltage amplifier, current amplifier, Voltage to current and current to voltage converter, Op-amp as integrator and differentiator, Instrumentation amplifier.<br>Positive feedback applications: Crystal oscillator and Function generator. | 8 |
| 3 | Comparator and Converter : basic comparator, zero-crossing detector, Schmitt trigger, precision AC/DC converters, logarithmic amplifier, sample-and –hold circuit, analog-todigital and digital-to –analog converters, clippers and clampers using op-amp. | 8 |
| 4 | Timer ICs.-Timer 555, its block diagram and applications- astable , monostable multivibrater, Timers- 7555 and XR2240, their block diagram and applications. Phase locked loop (PLL)- operating principle, IC 565 applications, Voltage controlled oscillator (VCO) and its applications. | 8 |
| 5 | Voltage regulators: 3 terminal positive and negative voltage regulators, variable voltage regulators (3085,723), tracking regulators.<br>Active filters: Butterworth & Chebychev filter, design and evaluation of second order filterslow pass, high pass , band pass, band reject and all pass filter. | 8 |
| | References:<br>1. Ramakant A. Gayakwad, 'Op-Amp and Linear Integrated Circuits', Third edition, Prentice-Hall of India<br>2. Graeme,Tobey and Huelsman, 'Operational Amplifiers: Design and | |

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|---|---|---|
| | Application', McGraw-Hill International edition.<br>3. D.Roy Choudhury and Shail Jaon, 'Linear Integrated Circuits' New Age International<br>4. Albert Paul Malvino, 'Electronic Principles', 6th edition, Tata McGraw-Hill. 6. R. Subburaj, 'The foundation for ISO 9000 and TQM',<br>7. Bouwens A. J., 'Digital Instrumentation' | |

# BTINPE 504 C. Soft Computing

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Set Theory | |
| Course Outcome | Various Soft Computing Techniques in Industrial Engineering. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction of Soft Computing<br>Introduction : Natural language processing , Machine Learning and Neural Networks, Fuzzy Systems, Pattern Recognition and Text Processing, Intelligent systems and their applications , Intelligent interfaces. Swarm Intelligence, Genetic Algorithm . Robotics and Kinematics. soft computing vs. hard computing; various types of soft computing techniques; applications of soft computing | 8 |
| 2 | Neural network model and algorithms<br>Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions, Neural network architecture, single layer and multilayer feed forward networks, Mc Culloch Pitts neuron model, perceptron model, Adaline and Madaline, multilayer perception model, back propogation learning methods, effect of learning rule coefficient, back propagation algorithm, factors affecting back propagation training, applications. | 8 |
| 3 | Advances in Neural Networks<br>Introduction of back propagation learning methods and algorithm, Counter propagation network architecture, functioning & characteristics of counter Propagation Network-Hopfield/ Recurrent network configuration, stability constraints associative memory and characteristics- limitations and applications, Hopfield v/s Boltzman machine, Adaptive Resonance Theory, Architecture- classifications Implementation and training, Associative Memory. | 8 |
| 4 | Fuzzy Logic Modeling and Control<br>Introduction to crisp sets and fuzzy sets- basic fuzzy set operation and approximate reasoning. Introduction to fuzzy logic modeling and control-Fuzzification inferencing and defuzzification-Fuzzy knowledge and rule Bases-Fuzzy modeling and control schemes for nonlinear systems. Self-organizing fuzzy logic control- Fuzzy logic control for nonlinear time delay system. | 8 |
| 5 | Genetic Algorithm<br>Basic concept of Genetic algorithm and detail algorithmic steps-adjustment of free Parameters- Solution of typical control problems using genetic algorithm- Concept on some other search techniques like tabu search and ant | 8 |

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|---|---|---|
| | colony search techniques for solving optimization problems. | |
| | Text / Reference Books:<br>1. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene V. Fausett, Pearson Education,<br>2. Fuzzy Logic with Engineering Applications, Timothy J. Ross, Wiley India.<br>3.Genetic Algorithms in Search, Optimization, and Machine Learning, David E. Goldberg, Pearson Education, 2009.<br>4. Fuzzy set theory and its Applications, Zimmermann H.J, Springer international edition, 2011.<br>5. Neural Networks for Control, W. T. Miller, R.S.Sutton and P.J.Webrose, MIT Press, | |

# BTINOE 505 A. Control System

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basics of Control systems | |
| Course Outcome | 1. Concept of control system in industry.<br>2. Design of Controllers.<br>3. Analysis of non-linear systems. | |
| Unit | Contents | Contact Hrs |
| 1 | Non-linear Control Systems: Peculiar behaviour of non-linear systems such as sub harmonics, jump resonance, limit cycle, Different types of non-linearities, Phase plane method, Singular Points, Methods of isoclines, Limit Lines & dividing lines on phase plane, Construction of phase plane, Obtaining time domain response from phase plane plots, merits & demerits.<br>Describing function (DF) method, definition & assumptions, Derivation for describing function for different non- linearities, Stability analysis using DF method. | 8 |
| 2 | PID controllers: Introduction to Proportional (P), Integral (I) & Derivative (D) controller, individual effect on overall system performance, P-PI & PID control and effect on overall system performance, Numerical examples. | 8 |
| 3 | State Variable Technique: Concept of state & state variable, General form of state equations, formulation of state equations for the physical system, (RLC network, Armature controlled & Field controlled DC servo motor, mechanical systems). | 8 |
| 4 | State Variable Analysis: Different forms of state variable representations (Phase, physical & canonical form), Concept of diagonalization, Obtaining state equations from transfer function representation and vice versa, solution of state equations, State transition matrix (STM), Methods of finding STM, Power series method, Laplace transform method, Calay Hamilton method, Controllability & observability of linear system, Kalman's test. | 8 |
| 5 | Discrete Data Control System: Methods of representation, Z-transform, Inverse Z-transforms, Pulse transfer function of closed loop system, Response between sampling instants, Concept of stability of discrete time systems, Stability by Jury's test.<br>Introduction to control system design, Compensation technique-Cascade & Feedback, Compensation network (lag, lead & lag-lead), Design by reshaping of Bode plots & Root locus technique. | 8 |
| | References:<br>1.Ogata K., 'Modem control Engineering', Prentice Hall<br>2.Kuo B. C., 'Automatic Control System' Prentice Hall<br>3. Nagarath I. J., Gopal M., 'Control System Engineering' Willey Eastern. | |

# BTINOE 505 B. Artificial Neural Network

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Concept of biological systems | |
| Course Objective | To study concept of neural network in engineering applications. | |
| Course Outcome | To review basic principles of neuron structure.<br>To understand building blocks artificial neural network.<br>To understand different networks of ANN<br>To develop different algorithm for learning.<br>To study and understand Fuzzy neural networks. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction and ANN Structure: Biological neurons and artificial neurons. Model of an ANN. Activation functions used in ANNs. Typical classes of network architectures.<br>Mathematical Foundations and Learning mechanisms: Re-visiting vector and matrix algebra. State-space concepts. Concepts of optimization. Error-correction learning.<br>Memory-based learning. Hebbian learning. Competitive learning. | 8 |
| 2 | Single layer perceptron: Structure and learning of perceptron. Pattern classifier introduction and Bayes' classifiers. Perceptron as a pattern classifier. Perceptron convergence. Limitations of a perceptron. | 8 |
| 3 | Feed forward ANN: Structures of Multi-layer feedforward networks. Back propagation algorithm. Back propagation - training and convergence. Functional approximation with back propagation. Practical and design issues of back propagation learning. | 8 |
| 4 | Radial Basis Function Networks: Pattern reparability and interpolation. Regularization Theory. Regularization and RBF networks. RBF network design and training. Approximation properties of RBF | 8 |
| 5 | Competitive Learning and Self organizing ANN: General clustering procedures. Learning Vector Quantization (LVQ). Competitive learning algorithms and architectures. Self -organizing feature maps. Properties of feature maps.<br>Fuzzy Neural Networks: Neuro-fuzzy systems. Background of fuzzy sets and logic. Design of fuzzy stems. Design of fuzzy ANNs | 8 |
| | References NPTEL course | |

# BTINOE 505 C. Biomedical Instrumentation

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Human Anatomy and Physiology, Analytical Instrumentation, Electronic Instrumentation, Signal Processing, Sensors and Transducers, Human Diseases | |
| Course Objective | Study of various biomedical instruments. | |
| Course Outcome | 1. Understands structure of human body<br>2. Understands use of Biomedical Instruments<br>3. Understands Transducers for biomedical instrumentation<br>4. To evolve an instrumentation system for diagnosis, supplementation, therapy of body functions.<br>5. Function in interdisciplinary team to solve engineering impact on human pathology .<br>6. Serve as engineer in medical field for safety of human being. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to gross anatomy of human body, major physiological systems, their structure and function. Cell structure, basic cell functions, Origin of bio potentials, electrical activity of cells, Introduction to biomedical instruments, classification and justification. | 8 |
| 2 | Transducers for biomedical instrumentation and selection, biomedical electrodes Cardiological systems: Structure of heart, rhythamicity, cardiac cycle, heart sounds, cardiac output, blood pressure measurement, direct, indirect, Spygmomanometer, Digital B. P. Cardio vascular instrumentation: ECG electrodes, & leads, Cinthoven triangle, ECG quantification, PC based ECG analysis. | 8 |
| 3 | Pacemakers, Defibrillators, Biotelemetry, bedside monitors, ICU, Heart Lang machine, Phonocardio graph, plentysmograph, Artificial Kidney, Blood cell counters, | 8 |
| 4 | Central Nervous system: The Brain, Receptors, sensory pathway and motor systems, Evoked potential, Electron rephalogram, EEG analysis, EMG. Mechanics of breathing O2/CO2 transport between lungs and tissue cells, Spirometer, Artificial respiration. | 8 |
| 5 | Imaging system: X-ray, CT Scan, Ultrasonography, MRI, Endoscopy.<br>Electrical safety: Significance of electrical danger, Physiological effects of | 8 |

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| | electrical current, Ground shock hazard, and methods of accident prevention. | |
| | **Text / Reference Books:**<br>1. Handbook of Biomedical Instrumentation , R S Khandpur, TMH, 2003<br>2. Cromwell, "Biomedical Instrumentation and Measurement, PHI<br>3. Introduction to Biomedical instrumentation, S G Kahalekar,<br>4. Handbook of Biomedical Instrumentation, Webster.<br>http://nptel.iitm.ac.in | |

## BTHM 506 Human Rights/ Foreign Language Audit Course

Online NPTEL Course

# BTINL507. Process Loop Components Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| Pre requisite | Basic electrical engineering | |
|---|---|---|
| Expt. No. | Title of Expt. | Contact Hrs |
| 1 | Study and calibration of D.P. Transmitter and its application for flow or level. | |
| 2 | Study and Calibration of 2 wire and 4 wire transmitter. | |
| 3 | Study of Square Root Extractor | |
| 4 | Study and Calibration of I/P and P/I converter | |
| 5 | Study & verification of different control actions (P, I, D, PI, PD, PID) for step Input | |
| 6 | Study of Control valve & plot the characteristics of Control valve | |
| 7 | Study of pneumatic components and simple pneumatic circuits. | |
| 8 | Study of PLC and PLC Programming. | |
| 9 | Study of hydraulic components and simple hydraulic circuits. | |
| 10 | Study of Alarm Annunicator | |
| 11 | Designing of intrinsic safety circuits | |

# BTINL508. Digital Signal Processing Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| Pre requisite | Digital Signal Processing Operations | |
|---|---|---|
| Expt. No. | Title of Expt. | Contact Hrs |
| 1 | Shifting and folding of digital signal. | |
| 2 | Linear convolution. | |
| 3 | Discrete Fourier transforms. | |
| 4 | Fast Fourier transforms. | |
| 5 | Design and implement FIR filter using windowing method. | |
| 6 | Design and implement IIR filter using Butterwoth approximation. | |
| 7 | Design and implement IIR filter using Chebeshev approximation. | |
| 8 | Sine/square wave generation using TMS32OC67XX. | |
| 9 | FIR filter implementation using TMS32OC67XX. | |
| 10 | IIR filter implementation using TMS32OC67XX. | |
| 11 | Filtering Using Discrete Wavelet transforms. | |

# SEMESTER VI

## BTINC601 Digital Control System

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Knowledge of Control systems at SE level & Control system | |
| Course Objective | Study and Analysis of Digital Control Systems | |
| Course Outcome | 1. Use and handle various blocks and instructions in control system toolbox of Matlab.<br>2. Plot response and stability analysis of the Discrete Time Control System for different standard signals.<br>3. Design and investigate State Space Analysis of Control Systems.<br>4. Find controllability and observability of a system. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to Discrete-Time Control Systems:<br>Introduction of DCS, Basic building blocks of Discrete time Control system, Quantization and Quantization Error, Sampling process and theorem, Z transform applications for solving differential equations | 8 |
| 2 | Z plane Analysis of Discrete-time Control Systems:<br>Introduction, Impulse Sampling and Data Hold, Transfer function of Zero Order Hold and First Order Hold, Pulse Transfer Function | 8 |
| 3 | Design of Discrete Time Control System by conventional methods:<br>Introduction, Mapping between the S plane and Z plane, Stability analysis in Z-plane, Jury stability criterion, Bilinear transformations, Digital Controller Design using Analytical Design Method | 8 |
| 4 | State Space Analysis of Discrete Time Control System, State space representation of discrete time systems, Solution of discrete time state space equations, Pulse transfer function matrix, Discretization of continuous time state space equations, Similarity transformations. | 8 |
| 5 | Pole Placement and Observer Design, Concept of Controllability and Observability, Useful transformations in state space analysis and design<br>Stability improvement by state feedback, Design via pole placement, State observers, Quadratic Optimal Control, Steady-State Quadratic Optimal Control | 8 |
| | **References:**<br>1. K. Ogata, Discrete Control System<br>2. M. Gopal, Digital Control and state variable methods, Tata McGraw Hill | |

# BTINC602 Industrial Automation and Control

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Control system I, industrial automation | |
| Course Outcome | To understand construction and working principle of different industrial measurement systems.<br>To understand new trends in industrial process control. | |
| Unit | Contents | Contact Hrs |
| 1 | Control Systems and Automation Strategy:<br>Control Systems and Automation Strategy, Evolution of instrumentation and control, Types of industries, Types of automation, Role of automation in industries, Benefits of automation, Automation strategy evolution. | 8 |
| 2 | **Instrumentation Standard Protocols**<br>Instrumentation Standard Protocols: Definition of protocol, Introduction to Open System Interconnection (OSI) model, Communication standard (RS232, RS485), Modbus (ASCII/RTU), Introduction to third party interface, concept of OPC (Object linking and embedding for Process Control), HART Protocol: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Foundation Fieldbus H1: Introduction, frame structure, programming, implementation examples, benefits, advantages and limitation. Comparison of HART, Foundation Fieldbus, Devicenet, Profibus, Controlnet, Industrial Ethernet. | 8 |
| 3 | **Programmable logic controllers (PLC)**<br>Introduction, architecture, definition of discrete state process control, PLC Vs PC, PLC Vs DCS, relay diagram, ladder diagram, ladder diagram examples, relay sequencers, timers/counters, high speed counter, PTO, PWM and PID blocks in PLC, PLC design, study of at least one industrial PLC. PLC programming methods as per IEC 61131, PLC applications for batch process using SFC, PLC interface to SCADA/DCS using communication links (RS232, RS485). | 8 |
| 4 | **Supervisory Control and Data Acquisition (SCADA)**<br>Introduction to (SCADA), Evolution of SCADA, Types of SCADA, Hardware and Software architecture of SCADA System, Objectives of SCADA, Functions of SCADA, SCADA in Process Control, SCADA applications. | 8 |
| 5 | **Distributed Control Systems**<br>Introduction to DCS. Evolution of DCS, DCS flow sheet symbols, architecture of DCS. Controller, Input and output modules, Communication module, data highway, local I/O bus, Workstations, Specifications of DCS. | 8 |

| | | |
|---|---|---|
| | Introduction to database management. Supervisory computer tasks DCS configuration. Supervisory computer functions, Control techniques, DCS & Supervisory computer displays. | |
| | **Reference Books:**<br>1. John Webb & Ronald, "PLC Principles and Application", Prentice Hall India.<br>2. S. K. Sigh, "Computer Aided Process Control", Prentice Hall India.<br>3. John Hackworth & Frederick D Hackworth, "PLC: Programming Methods and Applications", Pearson Education.<br>4. Krushna kant, "Computer Based Process Control" Prentice Hall India.<br>5. Prof. Rajesh Mehra and Er. Vikram Vij, "PLC and SCADA", Laxmi Publication,<br>6. Distributed Computer Control for Industrial Automation, Poppovik Bhatkar, Dekkar Publications<br>7. http://nptel.iitm.ac.in | |

# BTINC603 Power Electronics

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Knowledge of basic components of electronics and electrical circuits and networks | |
| Course Objective | The objective of the course is to provide students with a firm grasp of the essential principles of power electronics circuits and their classifications. The course aimed at acquiring an understanding of basic principles, operation, performance and applications of power electronics circuits. The subject is helpful in the study of technological aspects such as utilization semiconductor devices and technology in power systems, industrial drives, automation and control. | |
| Course Outcome | 1.To review principle of construction, operation and characteristics of basic semiconductor devices.<br>2. To understand and analyze performance of controlled and uncontrolled converters.<br>3. To understand and analyze performance of DC to DC converters. DC to AC converters.<br>4. To understand and analyze performance of AC voltage controllers. | |
| Unit | Contents | Contact Hrs |
| 1 | Power Family Components<br>Characteristics constructional details and working of Thyristor/SCR, Triac, Diac, SCS, SUS, LASCR.<br>Methods of turning on an SCR, turn-on, turn-off mechanism and characteristic, device specifications, rating and nomenclature of SCR.<br>SCR triggering circuits, R, RC, pulse and UJT triggering circuits, Protection circuits for SCR.<br>Multiple connection of SCR: series operation, parallel operation, string efficiency.<br>Commutation of SCR: Natural and Forced commutation techniques. | 8 |
| 2 | Rectifier and Inverter<br>Controlled rectifier: Single phase and three-phase controlled rectifier circuits, with R, RL Load, with FWD, Dual converters.<br>Inverters: Principle of operation of series inverter, parallel inverter and bridge inverter, designing of commutating component.<br>Design and operation of UPS & SMPS. | 8 |
| 3 | AC Voltage Controllers and Cycloconverters<br>AC Voltage controllers: single-phase & three-phase with R and RL load<br>Cycloconverter: Single-phase and Three-phase Cycloconverter.<br>Induction heating and dielectric heating, Resistance welding. | 8 |
| 4 | Chopper and Speed Control of Motor | 8 |

| | | |
|---|---|---|
| | Choppers: Classification of choppers, step-up, step-down chopper, Jones chopper, Morgan chopper, and principle of operation for each method. Chopper control techniques.<br>Speed control of single- phase induction motor-using SCR and Triac: various methods their circuit diagrams and working. | |
| 5 | Industrial Applications<br>Thyristor control Applications: AC and DC Static circuit breaker, Over Voltage protection circuit.<br>Zero voltage switch, Integral-cycle triggering, Time delay circuit, Soft start circuit. Temperature regulator, SCR-controlled dimmer circuit, Emergency light using SCR, Automatic water level indicator, automatic battery charger using SCR. | 8 |
| | **References:**<br>1.RashidM. H – Power Electronics circuits, devices and applications-(New Delhi Pearson Education).<br>2.Murthi.V. R- Power Electonics Devices, circuits and Industrial Applications.(Oxford).<br>3. Bimbhra.P. S- Power Electronics.(Khanna Publication).<br>4. Dr. P.S. Bimbhra, 'Power Electronics', Khanna Publisher.<br>5. M. Ramamoorty, 'An introduction to Thyristors and their applications', second edition, East-West Press.<br>6. M.D. Singh and K.B. Khanchandani, 'Power Electronics', Tata McGraw Hall.<br>7. S.K.Bhattacharya, S.Chatterjee, 'Industrial Electronics and Control' , Tata McGraw-Hill.<br>8. P.C.Sen, 'Power Electronics', Tata McGraw-Hill. | |

# BTINPE 604 A. Instrumentation in Unit Operations

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Chemical Processes, Laws of Thermodynamics, Control Systems, Controllers etc. | |
| Course Objective | Study concept of various unit operations in industry | |
| Course Outcome | 1. List chemical processes, units, and the corresponding equipments.<br>2. Make material balances and energy balance on unit operations and processes.<br>3. Understanding of the degrees of freedom analysis and its significance.<br>4. Get knowledge of basic principles of fluid mechanics<br>5. Analyze fluid flow problems with the application of the momentum and energy equations | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction: - Concept of unit operations & unit processes, material balance and energy balance.<br>Evaporation: - Liquid characteristics, types of evaporators, Methods of Feeding, operation of single effect and multi effect evaporator, capacity & economy of multiple effect evaporation, Vapour recompression, Operation of mechanical and thermal Recompression, Instrumentation and control for this process.<br>Drying: - Classification of dryers, Principle & operations, Drying equipments, Instrumentation for this process. | 8 |
| 2 | Distillation:- Equipment set up, Operation of flash Distillation, Batch Distillation, Continuous Distillation, Fractionating Column; slue plate arrangement, Rectification and stripping, Instrumentation and control for this process.<br>Leaching and Extraction: - Principles, Various types of equipments for this process. | 8 |
| 3 | Material Handling Equipments: - Transport Equipments, Positioning Equipments, Unit load formation Equipment, Storage equipment, Identification & control equipment.<br>Size Reduction:-Principle of commutation Equipments, Classification and operation of crushers & grinders. | 8 |
| 4 | Crystallization: - Definition, Magma, Super-saturation, formation of Crystal, Equipment classification& operation. Instrumentation & control for this process.<br>Mechanical separation: Screening, Filtration – Mechanisms of filtration, Types of Industrial filters- Rotary filter, filter press, Centrifuges, cyclones, Bag filter, electrostatic precipitators and Centrifuge separator. | 8 |
| 5 | Heat Exchangers:-Theory, Types of heat exchanger, temperature pattern in heat exchanger, condensers, Boilers. Application of above Unit operations in Paper, Cement, Fertilizer, Petrochemical and sugar industry. | 8 |
| | **Reference Books:** - | |

| | | |
|---|---|---|
| | 1.McCabe Smith, 'Unit Operation of Chemical Engineering', 5thEdition, McGraw Hill.<br>2.Perry, 'Chemical Engineers Handbook', 6thEdition, McGraw Hill int. Student ed. 1984.<br>3.Felder, Rotsseau, Herriot, 'Elementary principles of Chemical Processes', Wiley 1978<br>4.W.F. Stoeker, 'Design of Thermal System', 3rdEdition McGraw Hill int. ed. 1989.<br>5.M. Gopalrao& M. Sitting , 'Outline of Chemical Technology', 2ndedition east west 973.<br>6.http://nptel.iitm.ac.in | |

# BTINPE605 B. Power Plant Instrumentation

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic Knowledge of Power Plants | |
| Course Objective | To create awareness of energy resources and its scenario in India.<br>To study the concept of power generation using various resources.<br>To study the role of Instrumentation in power plants.<br>To study and compare various power plants for optimal performance | |
| Course Outcome | 1. Understand the over view of different power plants and its operation.<br>2. Understand the application of instrumentation for measurement, monitoring and safety of human being and assent of power plants.<br>3. Discharge the technical duties in field of power generation as maintenance and automation engineer.<br>4. Understand the safety awareness through latest through latest safety equipments.<br>5. Use latest software and tools of instrumentation for power plant. | |
| Unit | Contents | Contact Hrs |
| 1 | Power generation from conventional sources<br>Thermal, hydro, nuclear and gas power plants - their functions and control; types of prime movers, generators and excitation systems; Economic considerations in power systems. Alternate sources of power generation - solar, wind, geo-thermal, ocean-thermal, tidal, wave and MHD. | 7 Hours |
| 2 | Hydro-electric power plants<br>Selection of site, elements of power plant, classification, water turbines, governor action, hydro- electric generator, plant layout, pumped storage plants Thermal steam power plants: Selection of site, elements and operational circuits of the power plant, turbo-alternators, plant layout, steam turbines, controls and auxiliaries. | 7 Hours |
| 3 | Nuclear power plants<br>Selection of site, nuclear reaction – fission process and chain reaction, constituents of power plant and layout, nuclear reactor – working, classification, control, shielding and waste disposal. | 7 Hours |
| 4 | Renewable power plants<br>Solar power generation, Photo-voltaic and solar thermal generation, solar concentrators, Wind power generation, types of wind mills, wind generators, tidal, biomass, geothermal and magneto- hydro dynamic power generation, micro-hydel power plants, fuel cells and diesel and gas power plants | 7 Hours |

| | | |
|---|---|---|
| 5 | Combined operation of power plants<br>Plant selection, choice of size and number of generator units, interconnected systems, real and reactive power exchange among interconnected systems. Major electrical equipment in power plants, DC systems in power plants, station control - switch yard and control room. Economic considerations – types of costs, tariff and consumers. | 7 Hours |
| | Text/References Books<br>1. Wadhwa, C.L., _Generation Distribution and Utilisation of Electrical Energy',<br>New Age International Publishers, 3rd Edition, 2010.<br>2. J.B.Gupta, _A Course in Power Systems‘, S.K.Kataria and Sons, Reprint 2010-2011.<br>3. M. M. El-Wakil, Power Plant Technology, Mcgraw Hill, Digitized on Dec 2000<br>4. B. G. A. Skrotzki & W. A. Vopat, Power Station Engineering & Economy, McGraw Hill, Digitized on Dec 2007.<br>5. Chakrabarti A., Soni M.L., Gupta P.V., and Bhatnagar U.S., 'A Text Book on Power Systems Engg', Dhanpat Rai and Sons, New Delhi, 2nd Revised Edition, 2010. | |

# BTINPE 604 C. Embedded Systems

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Knowledge of Microcontrollers | |
| Course Objective | To learn about the Embedded Processors with Real World applications.<br>To introduce the concept of control applications in embedded systems.<br>To enhance the knowledge in interfacing processes with embedded controllers. | |
| Course Outcome | Write programs in an IDE and download it to the Processor.<br>Design and program Embedded circuits.<br>Design control algorithms in an embedded processor. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to Embedded systems, the build process for embedded systems, Structural units in Embedded processor, selection of processor & memory devices, DMA, Memory management methods, timer and counting devices, watchdog timer, real time clock, in circuit emulator, target hardware debugging. | 8 |
| 2 | Embedded networking: Introduction, I/O Device ports and buses, serial bus communication protocols, RS 232 standard, RS 422, RS 485, CAN Bus, Serial Peripheral Interface (SPI), Inter Integrated Circuits (I2C), need for device drivers. | 8 |
| 3 | Embedded Product Development Life Cycle: objectives, different phases of ELDC, Modelling of ELDC, issues I Hardware- software co-design Data flow graph, state machine model, sequential program model, concurrent Model, object oriented model. | 8 |
| 4 | OS Concepts and types, tasks & task states, process, threads, inter process communication, task synchronization, semaphores, and role of OS in real time systems, scheduling resource allocation, interrupt handling. | 8 |
| 5 | Introduction to basic concept of RTOS, multiprocessing and multitasking, preemptive and non- preemptive scheduling, task communication shared memory, message passing, inter process communication- synchronization between processes semaphores, mailbox, pipes, priority inversion, priority inheritance, comparisons of real time operating systems: Vx Works, uc/OS-II, RT Linux.<br>Case study of washing machine- automotive application- smart card system application. | 8 |
| | Text/Reference Books:<br>1. Rajkamal, Embedded system- architecture, programming, design, Mc Graw Hill<br>2. Peckol, Embedded system design, John Wiley & Sons.<br>3. Lyla B Das, Embedded Systems-an integrated approach, Pearson. | |

# BTINOE605 A. Industrial Data Communication

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basics of Communication Techniques | |
| Course Objective | Study concepts of communications techniques in industry at various levels. | |
| Course Outcome | Upon completing the course, the student should have understand the concepts required for building industrial systems. | |
| Unit | Contents | Contact Hrs |
| 1 | Interface: Introduction, Principle of interface, serial interface and its standards. Parallel interfaces and buses. | 8 |
| 2 | Fieldbus: Use of fieldbuses in industrial plants, functions, international standards, Performance, use of Ethernet networks, fieldbus advantages and disadvantages. Fieldbus design, installation, economics and documentation | 8 |
| 3 | Instrumentation network design and upgrade: Instrumentation design goals, cost optimal and accurate sensor networks. | 8 |
| 4 | Global system architectures, advantages and limitations of open networks, HART network and Foundation fieldbus network. | 8 |
| 5 | PROFIBUS-PA: Basics, architecture, model, network design and system configuration, Designing PROFIBUS-PA and foundation Fieldbus segments: general considerations, network design. | 8 |
| | Text/Reference Books:<br>1. Noltingk B.E., Instrumentation Reference Book, Butterworth Heinemann<br>2. B. G. Liptak, Process software and digital networks, CRC press. | |

# BTINOE605 B. Fiber Optics and Laser Instrumentation

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic Knowledge of Fiber Optics and Laser | |
| Course Outcome | Identify various sensors, Fiber optic and its specifications.<br>Understand principle of working of Fiber Optic used to measure Temperature, Displacement, Level, and various miscellaneous other sensors<br>Understand applications of Fiber Optics in industry. | |
| Unit | Contents | Contact Hrs |
| 1 | Optical Fiber and Their properties: Ray theory, wave guiding principles, Theory of optical wave propagation, Types and classification of optical fibers, optical fiber mode, single mode fiber, special fiber, fiber materials, fiber fabrication, transmission characteristics of fiber, absorption losses, scattering losses, dispersion, polarization, non-linear phenomena. | 8 |
| 2 | Optical Sources and Detectors, Power Launching and Coupling: Laser theory, Laser diodes, LED, PN diode, Pin diode, avalanche diode, solid, liquid, gas and semiconductor laser their characteristics modulation circuits, optical detection principles, quantum efficiency and detector noise, Source to fiber power launching, fiber alignment and fiber to fiber joints, splices, connectors, coupling losses, lensing schemes for coupling improvement, LED coupling to single mode fiber. | 8 |
| 3 | Optical Fiber Measurements: Measurement of attenuation, dispersion, refractive index profile of fiber and cut off wavelength, numerical aperture, OTDR, Measurement of flow, pressure, Temperature, displacement, acceleration and fluid level vibration measurement. | 8 |
| 4 | Fiber Optic Sensing Principles and Techniques: Classification and principle of fiber optic sensors, fiber grating and fiber Bragg grating technology and distributed optical fiber sensing. | 8 |
| 5 | Optical Amplification and Integrated Optics: Beam splitter, directional coupler, opto<br>isolators, multimode interference coupler(MMIC) optical modulators, fiber modulator optical amplifiers, optical switches, frequency translators, optoelectronic integration, Holography and Laser instruments in medical application and Remote Sensing: Basic principle, methods, Holographic interferometry. Application of laser in medical application, laser in industrial application. | 8 |
| | **Text/Reference Books:**<br>1. "Fiber optics – communication", Gerd Keiser.<br>2. "Integrated circuits and semiconductor devices theory and application" Deboo Burrous, McGraw Hill Second Edition. | |

# BTINOE 605 C. Robotics Control

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basic Knowledge of Robots and its elements | |
| Course Outcome | After studying the subject students will be able to design various controls in robotics. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction<br>Introduction to robots, Robot manipulators, Mobile robots, Robot anatomy, Coordinate systems, Work envelope, Types and classification, Specifications, Sensors, Actuators and drives. | 6 Hours |
| 2 | Forward and Inverse Kinematics<br>Introduction Representation of position and orientation of a rigid body, Homogeneous transformations Forward and inverse kinematics problems, Denavit - Hartenberg (D-H) notations and parameters Representation of joints, link representation using D-H parameters, Closed-form solutions, Geometric and Numerical methods | 8 Hours |
| 3 | Velocity and Statics analysis<br>Linear and angular velocity of links Velocity propagation, Jacobians for robotic manipulators, Statics and force transformation of robotic manipulators, Singularity analysis. | 8 Hours |
| 4 | Robot Dynamic analysis<br>Introduction, Forward and inverse dynamics, Mass and inertia of links, Lagrangian formulation for equations of motion for robotic manipulators, Newton- uler formulation method, Dynamic modelling, State space representation of dynamic equations of robotic manipulators. | 8 Hours |
| 5 | Trajectory Planning and Control 7 Hours Joint and Cartesian space trajectory planning and generation – Classical control concepts using the example of control of a single link – Independent joint PID control – Control of a multi-link manipulator – Nonlinear model-based control schemes. Simulation and experimental case studies on robotic manipulators. | 8 Hours |
| | **Text/Reference Books**<br>1. William B. Riddens, ―Understanding Automotive Electronics‖, 5th Edition, (Butterworth Heinemann Woburn), (1998).<br>2. Tom Weather Jr and Cland C. Hunter, ―Automotive Computers and Control System‖,Prentice Hall Inc. ,New Jeresy.<br>3. Jiri Marek, Hans Peter trah, ―Sensers Applications, Sensers for Automotive Technology‖ 1st Edition , Wiley<br>4. T. Mellard, Automotive Electronic Systems‖1987 by Heinenmann Professional. | |

# BTINL606. Industrial automation and Control Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| | List of Experiments |
|---|---|
| Expt. No. | Title of Expt. |
| 1 | Study of different PLC and their specification. |
| 2 | Study of installations and troubleshooting of PLC. |
| 3 | Solving example by LD and ST programming in PLC. |
| 4 | Solving example by timer and counter in PLC. |
| 5 | Solving example using SFC programming in PLC. |
| 6 | Study of Interfacing between PLC and Process loop. |
| 7 | Study of SCADA system. |
| 8 | Study different type of DCS and their latest trends. |
| 9 | Selection steps of DCS for industrial automation. |
| 10 | Study of specification list for DCS. |

# BTINL607. Power Electronics and Drives Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| | List of Experiments |
|---|---|
| Expt. No. | Title of Expt. |
| 1 | To plot the characteristics of SCR. |
| 2 | To plot the characteristics of Diac. |
| 3 | To plot the characteristics of Triac. |
| 4 | To Plot voltage vs firing angle for AC phase control using Triac. |
| 5 | Study of Forced commutation circuits. |
| 6 | To study and plot the line vs Load regulation for SMPS |
| 7 | To study Single phase half wave controlled converter |
| 8 | To study Single phase full wave controlled converter |
| 9 | Study and implement series inverter. |
| 10 | Study and implement parallel inverter. |

## BTINM608. Mini Project II

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 2

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

Students in group of three or four are expected to develop minor project on the concept learned in Semester V and VI subjects.

# Dr.BabasahebAmbedkarTechnologicalUniversity,Lonere

**Dr. Babasaheb Ambedkar Technological University**
**(Established as a University of Technology in the State of Maharashtra)**
**(Under Maharashtra Act No XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra Telephone and Fax: 02140 – 275142**
**www.dbatu.ac.in**

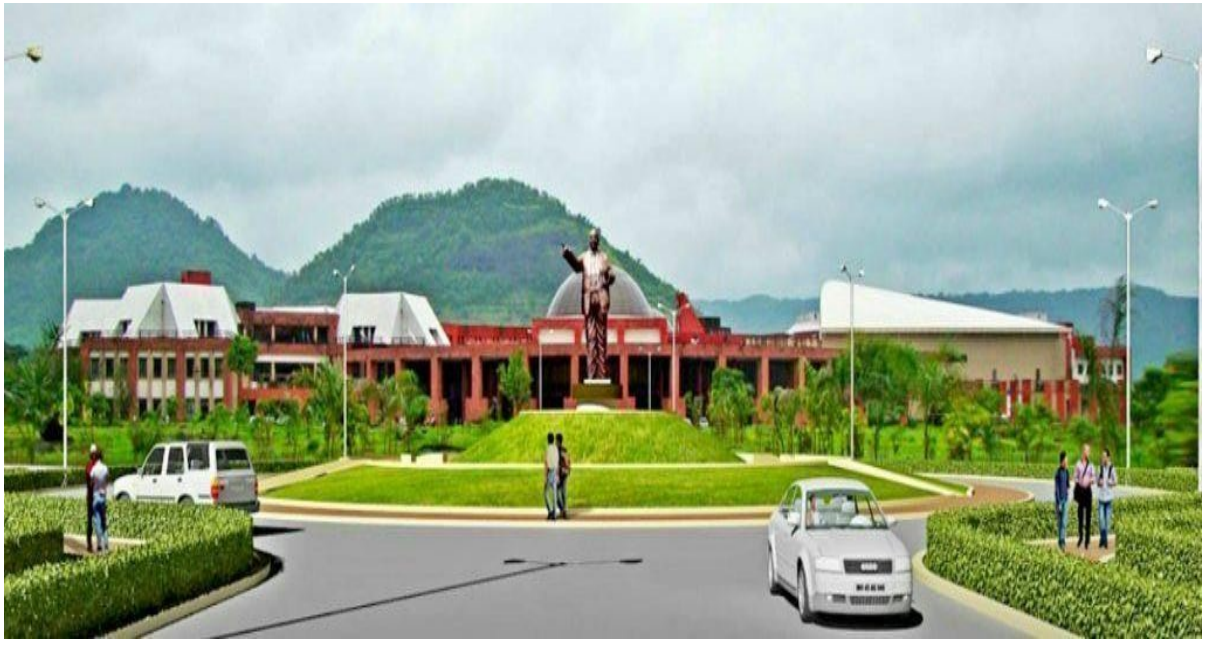
CURRICULUM

## UNDERGRADUATEPROGRAMME

## Final Year B.Tech.

## (Instrumentation Engineering/Instrumentation & Control)

**With effect from the Academic Year2023-2024**



**DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE**

## B. Tech in Instrumentation Engineering

## Curriculum for Final Year

| Semester VII | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | PCC 1 | BTINC701 | Process Instrumentation and Control | 4 | - | - | 20 | 20 | 60 | 100 | 4 |
| 2 | PEC 4 | BTINPE702 | Instrumentation System Design | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 3 | OEC 3 | BTINOE703 | Group F | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 4 | OEC 4 | BTINOE704 | Group G | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 5 | HSSMC | BTHM705 | Group H | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| 6 | HSSMC | BTHM706 | Project Engineering and Management | - | - | - | - | - | - | - | Audit |
| 7 | LC | BTINL707 | Process Instrumentation Lab | - | - | 2 | 60 | - | 40 | 100 | 1 |
| 8 | LC | BTINL708 | Instrumentation System Design Lab | | | 2 | 60 | | 40 | 100 | 1 |
| 9 | Project | BTINM709 | Project Phase – I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| 10 | Internship | BTINM609 | Internship – 3 Evaluation | - | - | - | - | - | 50 | 50 | 1 |
| | | | **Total** | **16** | **0** | **8** | **220** | **100** | **430** | **850** | **21** |

| Semester VIII | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SR. No | Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | Credit |
| | | | | L | T | P | CA | MSE | ESE | Total | |
| 1 | PEC5 | BTINPE801 | NPTEL – online courses | 3 | - | - | 20 | 20 | 60 | 100 | 03 |
| 2 | Project/ Internship | BTINP802 | Project work/ Internship | - | - | 24 | 60 | - | 40 | 100 | 12 |
| | | | **Total** | **-** | **-** | **24** | **60** | **-** | **40** | **200** | **15** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course
PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
HSSMC = Humanities and Social Science including Management Courses

- **ImportantNote:MinimumEightExperimenttoperformbasedonthesyllabusforthe laboratorysubject.**

**Group F [Sem - VII] (Professional Elective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINPE703 A | Industrial Project Planning and Estimation |
| 02 | BTINPE703 B | Agriculture Instrumentation |
| 03 | BTINPE703 C | Environmental Instrumentation |

**Group G [Sem - VII] (OpenElective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINOE704 A | Image Processing |
| 02 | BTINOE704 B | Internet of Things |
| 03 | BTINOE704 C | Building Automation |

**Group H [Sem - VII] (OpenElective)**

| Sr. No. | Course Code | Course Title |
|---|---|---|
| 01 | BTINOE705 A | Analytical Instrumentation |
| 02 | BTINOE705 B | Adaptive Control System |
| 03 | BTINOE705 C | Automobile Instrumentation |

**NPTEL – online courses**

| Sr. No. | Course Name | Duration (Weeks) | Institute offering course | Name of Professor |
|---|---|---|---|---|
| 1 | Analog Circuits And Systems Through SPICE Simulation | 12 Week | IIT Kharagpur | Prof. Mrigank Sharad |
| 2. | Computer Aided Power System Analysis | 12 Week | IIT Roorkee | Prof. Biswarup Das |
| 3. | Control Engineering | 12 Week | IIT Madras | Prof. RamkrishnaPasumarthy |
| 4. | DC Power Transmission Systems | 12 Week | IIT Madras | Prof. Krishna S. |
| 5. | Fundamentals Of Power ElectronicsSystems | 12 Week | IISc Bangalore | Prof. Vivek Agarwal, Prof. L. Umanand |
| 6. | Biomedical Signal Processing | 12 Week | IIT Kharagpur | Prof.SudiptaMukhopadhyay |

# Semester VII

## BTINC701 Process Instrumentation and Control

**Teaching scheme:**
Theory: 3 hrs
Tutorial: 1 hr
Total credit: 4

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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| Pre requisite | Concepts of process and its behaviour | |
| Course Objective | 1.To understand principles of elements in the control loop<br>2.To appreciate the properties of different control loops and suggest suitable control for it<br>3.To develop problem-solving skills applicable to real-world problems in the process industries. | |
| Course Outcome | 1. Summarize and classify characteristics of various control loops<br>2. Design and apply appropriate control for different control loops.<br>3. Familiarize with the advances in process instrumentation. | |
| Unit | Contents | Contact Hrs |
| 1 | Process characteristics: Types of Processes (Dead time, single and multi-capacity, Self and non-self-regulating, interacting and non-interacting, linear and nonlinear processes).<br>Process gains, process reaction curve, process time constant and constant step analysis method for finding time constant, Dead time.<br>Dynamic elements in control loops. PID control of processes. Process simulators. | 6 Hours |
| 2 | Analysis and properties of some common loops: Flow, pressure level, temperature, composition, pH etc.<br>Linear and non-linear controllers, review of PID with limitations(offset, saturation in D, & reset windup) rate before reset, PID variations, and tuning,<br>Digital controller (position and velocity algorithms, effect of sampling g time)hardware structures, features and specification.<br>Single loop and multiloop controllers and the application programs, Non-linear controller-two state, three state, proportional time, dual mode, optimal switching. | 8 Hours |
| 3 | Multi-loop and multivariable process control systems: Feedback, Feed forward Control, cascade control, ratio control, auto selective control, spit range control.<br>Predictive control systems and Adaptive control systems. | 8 Hours |

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| | Interaction and decoupling, Relative gain analysis, procedure to calculate relative gain, and its applications. | |
| 4 | Boiler instrumentation and Optimization, boiler equipment safety interlocks, Boiler efficiency and dynamics, boiler controls, combustion control, air to fuel ratio control.<br>3 element drum level control, steam pressure control, steam temperature control.<br>Burner management and control boiler optimization.<br>Furnace control of heat exchangers, steam and fired heaters control.<br>Reboilers, vaporization, heat exchanger and condensers. | 8 Hours |
| 5 | Instrumentation design for Pumps and compressor controls,<br>Instrumentation design for multi effect evaporators, distillation, dryer, chemical reactor and cooling tower.<br>Instrumentation design for size reduction, extruder, crystallizer, chiller. | 8 Hours |
| | **Text/Reference Books**<br>1. Process Control Systems by F. G. Shinskey (TMH).<br>2. Process Control by B. G. LIptak (Chilton).<br>3. Computer Based Industrial Control by Krishna Kant (PHI).<br>4. Distributed Computer Control for Industrial Automation by Popovic and Bhatkar (Dekker).<br>5. Chemical Process Control by G. Stephanopoulos (PHI).<br>6. Distillation Column Control by F. G. Shinskey (TMH).<br>7. Process control Instrumentation – C.D. Johnson<br>8. Process control designing processes and control system for dynamic processes Thomes E. narlin<br>9. Analog and Digital control – RamakantGaikwad<br>10.Distributed computer control for industrial automation, PpovikBhatkar, Dekkar Pub | |

# BTINC702 Instrumentation System Design

**Teaching scheme:**
Theory: 3 hrs

Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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|---|---|---|
| Pre requisite | Sensors and Transducers, Electronic Instrumentation | |
| Course Objective | 1. ControlValveSizingconceptsanditsusualtermsforapplications likeliquid, gas, vapour and flashingfluids.<br>2. Control room and Control Paneldetails<br>3. The process of Electronic productdesign | |
| Course Outcome | 1. Design and Analyse CVSizing<br>2. IdentifyvariousControlpanelsandControlRoomdetails<br>3. Design of Electronicproduct.<br>4. Understand Signal Conditioning forTransducers. | |
| Unit | Contents | Contact Hrs |
| 1 | Basic concepts of transducer design: General transducer design consideration, testing of transducer, and selection criteria of transducer.<br>Design of temperature measurement system based on RTD, Thermocouple and thermisters, Design of Displacement measurement system based using LVDT, Potentiometer, Ultrasonic transducer, Complete signal conditioning circuits for above temperature and Displacement transducers. | 6 Hours |
| 2 | Design of orifice, rotameter, venture based flow system and signal conditioning circuits for above system. Design of level sensors and its signal conditioning circuits, design of pressure gauge, diaphragm based pressure gauge, strain gauge cell and its signal conditioning, study of P/I and I/P converters, Design of smart transmitters. | 8 Hours |
| 3 | Concept of reliability definition, Distinction between Quality and reliability, failures, Availability, Maintainability, (MTBF, MTTF, MTTR) Life Cycle and Bathtub curve, Reliability Modeling Exponential, Weibull and Gamma Distribution, Hazard rate and Derivation of MTTF Failure Density Function, Cumulative Distribution Function and Reliability, Importance of documentation in system design. | 8 Hours |
| 4 | Guidelines for enclosure: components and accessories, Grounding and shielding techniques noise in electronic circuits, EMI/ EMC protection against EMI, ESD selection of cables, connectors, types of knobs,; mechanical fixture PCB holders, clamps, control panel layout and control room design. Safe and Hazardous area. | 8 Hours |
| 5 | Printed circuit board design guidelines: general components layout scheme, grid system, PCB size mechanical stress, design rules for analog and digital circuit PCB, single, multi layer and SMD boards, Artwork CAD packages, soldering techniques. | 8 Hours |

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| | **Text/Reference Books**<br>1. Electrostatic Discharge and Electronic Equipment, "Warren Boxleitner" IEEE presses.<br>2. Printed Circuit Boards, "Walter C. Bosshart", CEDT series, TMH.<br>3. Noise Reduction Techniques, "Ott".<br>4. Reliability Engineering, "E. Balguruswamy", PHI.<br>5. Applications of AnalogIntergrated Circuit, "S. Soclof", PHI.<br>6. Process Control, "B.G.Liptak", Chilton.<br>7. National Instruments Catalog.<br>8. Measurement Systems, "E.O.Doebline".<br>9. Process control and Instrumentation technology, "C. D, Johnson", PHI | |

# BTINPE703A Industrial Project Planning and Estimation

**Teaching scheme:**
Theory: 3 hrs

Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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|---|---|---|
| Pre requisite | Basics of Industrial Projects | |
| Course Objective | The objective of the course is to provide students with a firm grasp of the essential principles of project, planning, controlling, estimation and economics. | |
| Course Outcome | 1. Apply the knowledge of the documentation for project execution.<br>2. Able to do the documentation for procurement of instruments/equipment.<br>3. Apply the knowledge for project, planning, controlling, estimation and economics.<br>4. Do higher studies in field of project, planning, controlling, estimation and economic developments. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction:<br>Definition of Project : Purpose, scope, time Quantity, and organization structure Degree of Automation, Manpower considerations, Inter-department and inter organization interactions, Process flow sheets, P & I diagrams, Interlock diagrams, Instrument Index Sheets, Instrumentation standards and practices, Legends and Symbols Instrumentation symbols and Identifications (ANSI/ISA-5.1), Plant layout General arrangement drawing (Plans and Elevations). | 6 Hours |
| 2 | Instrumentation & Control Documentation & Cable Engineering:<br>Instrument specification sheets, Loop diagrams, wiring diagrams isometrics, installation detail drawing bill of material (BOM), control panel drawing, instrument data sheet, document control as per ISA standards, check lists, legend sheets, instrument catalogues test and process reports different classes of conductors and their routines and NEMA Standards Types and specifications of cables, Cable schedule, Routing of cables, Types of glands, Ferruling and terminations | 8 Hours |
| 3 | Procurement Activities and Construction Activities:<br>Vendor registration, Tendering and bidding process, Bid evaluation, Purchase order Vendor documents, Drawing and reports as necessary at above activities, Site conditions and planning, Front availability, Installation and commissioning, Activities and documents, On-site inspection and testing (SAT), Installation sketches Contracting, Cold commissioning and hot commissioning CAT (Customer Acceptance Test Perform trials and final handover Control console, centers, panels and indicators: Types, Design, Inspection, and specification Intelligent operator interface (IOI). Field bus Wiring: Terminator, Power Conditioners, Spurs, Segments, and repeaters | 8 Hours |

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| | Networking: Hubs, routers, LAN cards, and Cat cables. | |
| 4 | Project Management:<br>Process planning and scheduling Management: importance, characteristics, principles and levels of management Controlling, Directing, project authority, responsibility, Accountability Interpersonal influences Standard communication format, project reviews, The statement of work (SOW) Project specifications, milestone schedules, work breakdown structures, cost breakdown structure and the planning cycle Overview planning and execution mode (conceptual focus, design) Implementation, operation and support transition. | 8 Hours |
| 5 | Cost Management, PERT and CPM:<br>Cost and Estimation: Types of Estimates, Pricing process Salary overheads Labour hours, Material and support costs Network fundamentals Slack time network planning Estimating activity time and total program time Total PERT and CPM planning, crash times Software used in project management Software features and classification Evaluation and implementation | 8 Hours |
| | **Text/Reference Books**<br>1. Andrew and Williams, "Applied Instrumentation in Process Industries", Gulf Publishing.<br>2. Liptak , "Process Control Instruments Engineer's Handbook", Chilton.<br>3. HardlodKerzner, "Project Management System Approach To Planning Scheduling and Controlling, 5th edition, Van Nostrand Reinhold Publishing.<br>4. John Bacon, " Management systems," (ISA).<br>5. T.G. Fisher, "Batch Control Systems", (ISA).<br>6. John Bacon, "Instrument installation project management", (ISA). | |

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# BTINPE703B Agriculture Instrumentation

**Teaching scheme:**
Theory: 3 hrs

Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Basics of Sensors and Transducers | |
| Course Objective | Toacquaintandequipwiththeconceptofinstrumentationused in farm power & machinery and measuring devices for force, torque and other parameters. | |
| Course Outcome | 1. Demonstrateknowledgeofdigitalandanalogelectronicsincludingdedicated microcomputersininstrumentationandcontrolsystemsforagricultural<br>2. Evaluatecollecteddatafromaninstrumentationsystem.<br>3. Identifysecurityriskanddeterminestandardprecautionarymeasures.<br>4. Applycorrectpracticetoinstallation,calibrationandmaintenanceof instruments<br>5. Configureinstrumentscorrectlytovendorinstructionsheets.<br>6. Predictandavoidtheproblemswithinstallingmeasurementequipment | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to Agricultural Instrumentation`<br>Necessity of instrumentation & control for agriculture, engineering properties of soil: fundamental definitions & relationships, index properties of soil, permeability & seepage analysis, shear strength, Mohr's circle of stress, active & passive earth pressures, stability &slopes, Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouples, open& close path gas analyzers, brief introduction to various bio-sensors | 6 Hours |
| 2 | Irrigation Systems<br>Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems &it's performance, comparison of different irrigation systems, soil moisture measurement methods: resistance based method, voltage based method, thermal based method, details of gypsum block soil moisture sensor, irrigation scheduling, irrigation efficiencies, design considerations in irrigation channels. | 8 Hours |
| 3 | Batch Processes<br>Flow diagram of sugar plant & instrumentation set up for it, flow diagram of fermenter & control(batch process),flow diagram of dairy industry & instrumentation set up for it, juice extraction control process & instrumentation<br>set up for it | 8 Hours |
| 4 | Automation in Green House<br>Application of SCADA for DAM parameters & control, irrigation control | 8 Hours |

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| | management upstream & down - stream control systems, green houses &instrumentation: ventilation, cooling & heating, wind speed, temperature & humidity, rain gauge carbon dioxide enrichment measurement & control. | |
| 5 | Agro metrological Instrumentation<br>Leaf area length evaporation, transpiration, temperature, wetness & respiration measurement & data logging, electromagnetic radiations photosynthesis, infrared & UV bio sensor methods in agriculture, agro metrological instrumentation weather stations, surface flux measurement, soil water content measurement using time-domain reflectometry (TDR),ground water occurrence confined & unconfined aquifers, evaluation of aquifer properties, ground water recharge. | 8 Hours |
| | **Text/Reference Books**<br>1. Andrew and Williams, "Applied Instrumentation in Process Industries", Gulf Publishing.<br>2. Liptak , "Process Control Instruments Engineer's Handbook", Chilton.<br>3. HardlodKerzner, "Project Management System Approach To Planning Scheduling and Controlling, 5th edition, Van Nostrand Reinhold Publishing.<br>4. John Bacon, " Management systems," (ISA).<br>5. T.G. Fisher, "Batch Control Systems", (ISA).<br>6. John Bacon, "Instrument installation project management", (ISA). | |

## BTINPE703C Environmental Instrumentation

**Teaching scheme:**
Theory: 3 hrs

**Examination Scheme:**
Mid-term test: 20 Marks

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Tutorial: Internal Assessment: 20 Marks

Total credit: 3 End semester exam: 60 Marks

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| Pre requisite | Awareness about environment | |
| Course Objective | 1. To introduce the instrumentation methodologies for environment monitoring.<br>2. To deal with water quality monitoring and waste water treatment<br>3. To discuss the instrumentation required for air pollution monitoring | |
| Course Outcome | 1. design instrumentation systems for environment monitoring.<br>2. develop algorithms for waste water treatment<br>3. measure and analyze air quality and other parameters. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction<br>Necessity of instrumentation & control for environment, Importance of environmental Instrumentation sensor requirement for environment. Instrumentation methodologies: Ultraviolet analyzers, total hydrocarbon analyzers using flame ionization detector, Gas chromatography in environmental analysis, photo ionization, portable & stationary analytical instruments. | 6 Hours |
| 2 | Quality of water<br>Standards of raw & treated water, sources of water & their natural quality, effects of water quality. Water quality parameters: Thermal conductivity, detectors, Opacity monitors, pH analyzers& their application, conductivity analyzers& their application. Water treatment: Requirement of water treatment facilities, process design. | 8 Hours |
| 3 | Sedimentation & flotation<br>General equation for settling or rising of discrete particles, hindered settling, effect of temperature, viscosity, efficiency of an ideal settling basin, reduction in efficiency due to various causes, sludge, storage & removal, design criteria of settling tank, effect of temperature on coagulation. Ground water monitoring: Level measurement in ground water monitoring wells, laboratory analysis of ground water samples, instrumentation in ground water monitoring, instrumentation in assessment of soil & ground water pollution. | 8 Hours |
| 4 | Waste water and Flow monitoring system<br>Automatic waste water sampling, optimum waste water sampling locations, and waste water measurement techniques. Instrumentation set up for waste water treatment plant. Latest methods of waste water treatment plants.<br>Flow monitoring: Non-open channel flow measurement, open channel waste water flow measurement. Rain water harvesting: necessity, methods, role of NGOs & municipal corporation. | 8 Hours |
| 5 | Air Pollution and Sound Monitoring Systems<br>Definitions, energy environment relationship, importance of air pollution, Air sampling methods & equipments, analytical methods for air pollution | 8 Hours |

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| | studies. Control of air pollution. Sound pollution: basics of sound pollution, its effect to environment. Acoustic noise measurement & monitoring. | |
| | **Text/Reference Books**<br>1. Environmental Engineering and Science, Gilber M Masters, Pearson Education , 1997<br>2. Environmental Instrumentation & Analysis Handbook, Randy D. Down & Jay H. Lehr, Wiley.<br>3. Environmental Engineering, Peany Howard S, Donal R Rowe and George TachoBanoylous Teddy.<br>4. Air pollution control technology, Wark& Warner.<br>5. Air pollution engineering, M. N. Rao & H. V. N. Rao<br>6. Environmental noise pollution, Patrick F. Cunniff, Wiley, May-1977.<br>7. Water treatment technology,Walter J. Weber. | |

# BTINOE704A Image Processing

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Digital Signal Processing, Signals and Systems | |
| Course Objective | Thefundamentalsofdigitalimageprocessingandalgorithmsthatareused.Usefulskill basethatwouldallowthemtocarryoutfurtherstudyshouldtheybeinterestedandto work in the field. The students are expected to develop a foundation that can beused as the basis for further study and research in this field. The syllabus gives great emphasis on basic principles as well as more advanced techniques for image enhancement, segmentation, morphological operationsetc | |
| Course Outcome | 1. Acquirethefundamentalconceptsofadigitalimageprocessingsystem<br>2. Identifyandexploitanalogiesbetweenthemathematicaltoolsusedfor1Dand 2D signal analysis andprocessing<br>3. Analyze2DsignalsinthefrequencydomainthroughtheFouriertransform.<br>4. Design and implement with Mat lab algorithms for digital image processing operationssuchashistogramequalization,enhancement,restoration,filtering, anddenoising. | |
| Unit | Contents | Contact Hrs |
| 1 | Digital Image representation, steps in Image processing, Elements of IP system, Frame Grabber, Digital camera, Elements of visual perception, Image model, Sample and Quantization, Basic relationship between pixels, Image Geometry. | 6 Hours |
| 2 | Image Transforms, Introduction to Fourier Transform, DFT, Properties of 2-D fourier transform, FET, Walsh transform, Hazard Transform, Discrete Cosine transform, Harr transform, Wavelet transform. | 8 Hours |
| 3 | Image Enhancement methods by Spatial and Frequency domain methods, point processing, Spatial filtering, Color Image processing, Image Restoration, Degradation model, Digitalization of circulant and block circulant matrices, Algebraic approach, inverse filtering, Least Mean Square filter, constrained Least square restoration, Restoration in spatial domain, geometric Transformation. | 8 Hours |
| 4 | Image Compression by Redundancies, Image compression models, Elements of Information theory, Error-Free compression, Lossy compression, compression standards: JPEG & MPEG. Image Segmentation Detection of Discontinuities, Edge linking and Boundary detection, Thresholding, Region oriented segmentation, use of motion in segmentation. | 8 Hours |

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| 5 | Representation and Description Representation schemes, Boundary descriptors, Regional descriptors, Morphology, Applications of Image Processing in Instrumentation and Control | 8 Hours |
| | **Text/Reference Books**<br>1. Digital Image Processing, "R. C. Gonzalez and R. E. Woods", Addison-Wesley Longman, Inc, 1999<br>2. Digital Image Processing, , "A.K.Jain", PHI<br>3. Image processing, Analysis and Machine vision, "M. Sonka, V. Hlavac, and R. Boyle", Thomson Asia pvt. Ltd, 1999. | |

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# BTINOE704B Internet of Things

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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| Pre requisite | Sensors and Processes | |
| Course Objective | Study different components of IOT.<br>Study different techniques of communication.<br>Study advanced processors | |
| Course Outcome | Students will able to design various applications using IOT. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to Internet of Things :<br>Definition & Characteristics, Physical Design of IOT, Logical Design of IOT, IOT Enabling technologies, IOT Levels & Deployment Templates Domain specific IOTs – Home automation, Cities, Environment, Energy, Retail, Logistics, Agriculture, Industry, Health & Lifestyle IoT and M2M, IoT System Management with NETCONF-YANG | 6 Hours |
| 2 | IOT Platform Design Methodology:<br>Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information model Specification, Service specification, IOT level Specifications, Functional<br>View Specifications, Operational View Specification, device and component integration, application development, case study on IOT system for weather monitoring | 8 Hours |
| 3 | Embedded suite for IoT:<br>Physical device – Arduino / Raspberry Pi Interfaces, Hardware requirement of Arduino / Pi, Connecting remotely to the Arduino /Raspberry Pi , GPIO Basics, Controlling GPIO Outputs Using a Web Interface,– Programming , APIs / Packages, Arduino Interfaces, Integration of Sensors and Actuators with Arduino, Introduction to Python programming – Python data types & data structure,<br>Control flow (if, for, while, range, break/continue, pass), Functions, Modules, packages, file handling, date/time operations, classes, Python packages of interest for IOT | 8 Hours |
| 4 | Connectivity Technologies & Communication Protocols in IOT RFID:<br>Introduction, Principle of RFID, Components of an RFID system, Wireless Sensor Networks: WSN Architecture, the node, Connecting nodes, Networking Nodes, Securing Communication WSN specific IoT applications,<br>Protocols in IOT: CoAP, XMPP, AMQP, MQTT, Communication Protocols: IEEE 802.15.4, Zigbee, 6LoWPAN, Bluetooth, Wireless HART | 8 Hours |
| 5 | IOT Physical Server and Cloud Offerings: | 8 Hours |

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| | Cloud architecture standards and interoperability- Cloud types; IaaS, PaaS, SaaS. Benefits and challenges of cloud computing, public, private clouds community cloud, Fog Computing, SDN Cloud Storage Models & Communication APIs, Web Application Messaging Protocol (WAMP), Python web application framework – Django, Developing Application with Django, Developing REST web services, SkyNetIoT Messaging Platform, Case Studies Illustrating IOT Design – Smart lighting, Home Intrusion Detection, Smart Parking, Weather Monitoring System, Weather Report Bot, Air Pollution Monitoring, Forest fire Detection,Smart Irrigation, IoT Printer | |
| | **Text/Reference Books**<br>1. Pethuru Raj, Anupama C. Raman, The Internet of Things Enabling Technologies, Platforms, and Use Cases, CRC Press Taylor & Francis Group, International Standard Book Number-13: 978-14987-6128-4<br>2. RajkumarBuyya, Amir VahidDastjerdi Internet of Things – Principals and Paradigms, Morgan Kaufmann is an imprint of Elsevier, ISBN: 978-0-12-805395-9 HakimaChaouchi, ― The Internet of Things Connecting Objects to the Web‖ ISBN : 978-1- 84821140-7, Willy Publications<br>3. Olivier Hersent, David Boswarthick, Omar Elloumi, The Internet of Things: Key Applications and Protocols, ISBN: 978-1-119-99435-0, 2 nd Edition, Willy Publications<br>4. Daniel Kellmereit, Daniel Obodovski, ―The Silent Intelligence: The Internet of Things‖,. Publisher: Lightning Source Inc; 1 edition (15 April 2014). ISBN-10: 0989973700, ISBN-13: 978-0989973700.<br>5. Fang Zhaho, Leonidas Guibas, ―Wireless Sensor Network: An information processing approach‖, Elsevier, ISBN: 978-81-8147-642-5.<br>6. Daniel Minoli, ―Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications‖, ISBN: 978-1-118-47347-4, Willy Publications<br>7. Bernd Scholz-Reiter, Florian Michahelles, ―Architecting the Internet of Things‖, ISBN 78-3 | |

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

# BTINOE704C Building Automation

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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|---|---|---|
| Prerequisite | Needs of building automation | |
| Course Objective | Study various systems in building | |
| Course Outcome | After completion of course students will able to design various control systems in building. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction - Introduction, concept and application of Building Management System and Automation. Requirements and design considerations and its effect on functional efficiency of building automation system. | 6 Hours |
| 2 | HVAC system --- Different components of HVAC system like heating, cooling system, chillers, AHUs, compressors and filter units and their types. Design issues in consideration with respect to efficiency and economics. Concept of district cooling. | 8 Hours |
| 3 | Access Control & Security System - Concept of automation in access control system for safety. Manual security system. RFID enabled access control with components like active, passive cards, controllers, antennas. | 8 Hours |
| 4 | Fire &Alarm System-- Different fire sensors, smoke detectors and their types. CO and CO2 sensors. Fire control panels. Design considerations for the FA system. Concept of IP enabled Fire& Alarm system. | 8 Hours |
| 5 | CCTV System & Energy Management System -- Components of CCTV system like cameras, types of lenses, typical types of cables, controlling system. Concept of energy management system, occupancy sensors, fans & lighting controller.<br>PA System & EPBX System-- Components of Public Access System like speakers, Indicators, control panels, switches. Design aspects of PA system. Design consideration of EPBX system and its components. Integration of all the above systems to design a total building management system. | 8 Hours |
| | **Text/Reference Books**<br>1. Jim Sinopoli,' Smart Buildings', fairmont Press (March 8, 2007).<br>2. Barney Capehart, 'Web Based Enterprise Energy and Building Automation<br>Systems', C.E.M, Editor.<br>3. AntoBudiardjo, 'Building Automation Beyond the Simple Web Server', Clasma Events, Inc.<br>4. Paul Ehrlich,'What is an Intelligent Building?',Building Intelligence Group | |

# BTINOE705A Analytical Instrumentation

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

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|---|---|---|
| Pre requisite | Sensors and Transducers | |
| Course Objective | 1.To understand principles of instrumental analysis<br>2.To study the theory and design of analytical instruments<br>3.To develop problem-solving skills applicable to real-world problems | |
| Course Outcome | 1.Summarize and classify capabilities and limitations of analytical instruments.<br>2.Ability to select and use an analytical instrument in the physical, chemical and biological world and appreciate the role of instrumentation.<br>3.Familiarize with the advances in analytical instrumentation. Explain Energy management systems | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to classical and instrumental methods for chemical analysis: comparison of these methods, classification of Instrumental methods (spectral, electroanalytical and separative methods) U.V. Visible and spectroscopy: laws of photometry, Beer and Lambert's law, monochromator design and monochromator performance. Colorimeters, single beam and double beam spectrophotometers, dual wavelength and double monochromatic systems, direct reading multichannel spectrophotometers, diode array rapid scanning spectrophotometers, reverse optics technique. | 6 Hours |
| 2 | IR spectroscopy: Instrumentation, sources, detectors, FTIR. Raman Spectrometry; Raman effect, Raman spectrometer components, LASER Raman spectrophotometer.<br>Flame photometry: Principle, Instrumentation constructional details, fuel gases, atomizer, burner, optical system, Recording system. Interferences in Flame photometry, Applications<br>Atomic Absorption Spectroscopy(AAS): Principle, instrumentation-hollow cathode lamps, burners and flames, plasma excitation sources, optical and electronic systems. Interferences in AAS, Applications | 8 Hours |
| 3 | Nuclear Magnetic Resonance (NMR) spectrometry: Principle ,nuclear spin, nuclear energy levels, resonance condition, NMR absorption spectra, chemical shift, constructional details of NMR spectrometer, sensitivity enhancement techniques, spin decoupler ;Fourier transform NMR Spectroscopy; Electron spin resonance (ESR) spectrometry – principle, constructional details.<br>Fluorimeters and phosphorimeters; principle, single and double beam filter fluorimeter, ratio fluorimeter, spectrofluorimeter, microprocessor-based instruments, phosphorescence spectrometer. | 8 Hours |
| 4 | Mass spectrometr: basic mass spectrometer components, types, magnetic | 8 Hours |

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| | deflection type, time of flight, radio frequency, double focusing, quadrupole type ,Gas chromatograph mass spectro-meter, y GCMS Sy stems; resolution of mass spectrometer, applications.<br>Electron and ion spectroscopy: surface spectroscopic techniques, electron spectroscopy for chemical analysis (ESCA), Auger spectroscopy (AES), Secondary ion mass spectrometry (SIMS) and ion scattering Spectroscopy (ISS), densitometer.<br>Radio chemical instrumentation: Radio chemical methods, radiation detectors – ionization chamber, Geiger Muller counter, proportional counter, Scintillation counter, Semiconductor detectors, pulse height analyzer. X-ray spectrometry: Xray spectrum, instrumentation for X-ray spectrometry, X-ray diffract meters, X-ray absorption meter. | |
| 5 | Gas and liquid chromatography: Classification; basic parts of gas chromatograph – carrier gas, sample injection system, chromatographic column, thermal compartment, temperature programming, dual column system, detectors-thermal conductivity, flame ionization, electron capture, Argon ionization detector, recording instruments; introduction to liquid chromatography and its classification, HPLC , Introduction to optical densitometer, Refractometry.<br>Different types of gas analyzers: oxygen, carbon monoxide, carbon dioxide, Nitrogen analyzer, gas density analyzers. Environment monitoring system. | 8 Hours |
| | **Text/Reference Books**<br>1. 'Handbook of Analytical instruments', R.S. Khandpur, Tata McGraw-Hill.<br>2. 'Instrumental methods of Analysis', Willard, Merrit, Eean,CBS Publishers & distributor, New Delhi.<br>3. 'Instrumental Methods of Chemical Analysis', E.W.Ewing , McGraw-Hill, fifth edition<br>4. 'Introduction to Instrumental Analysis' Robert D. Braun, McGraw-Hill.<br>5. 'Instrumental Methods of Chemical Analysis', B.K.Sharma, goyal publications<br>6. 'Principles of Instrumental Analysis', S.G.Skoog, Thomson | |

# BTINOE705B Adaptive Control System

**Teaching scheme:**
Theory: 3 hrs

**Examination Scheme:**
Mid-term test: 20 Marks

Internal Assessment: 20 Marks

Total credit: 3

End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Control System | |
| Course Objective | To learn Basics of adaptive control systems, types | |
| Course Outcome | After completing this course students are able to apply adaptive control for various processes. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction:<br>Definitions, History of adaptive Control, Essential aspects of adaptive control, Classification of adaptive control system: Feedback adaptive controllers, Feed forward adaptive controllers, Why adaptive control? | 6 Hours |
| 2 | Model Reference Adaptive System:<br>Different configuration of model reference adaptive systems; classification of MRAS, Mathematical description, and Equivalent representation as a nonlinear time-varying system, direct and indirect MRAS | 8 Hours |
| 3 | Analysis and Design of Model Reference Adaptive Systems:<br>Model reference control with local parametric optimization (Gradient method), MIT rule, MRAS for a first order system, MRAS based on Lyapunov stability theory, Design of a first order MRAS based on stability theory, Hyper stability approach, Monopoli's augmented error approach | 8 Hours |
| 4 | Self-Tuning Regulators:<br>Introduction: The basic idea; process models, disturbance models, General linear difference equation models, model simplification, Different approaches to self-tuning, Recursive Parameter Estimation Methods: The RLS method, extended Least squares, Recursive instrumental variable method; U-D factorization, Covariance resulting, variable data forgetting. Estimation accuracy, Direct and Indirect Self-tuning regulators, Clarke and Gawthrop's Self tuning Controller, Pole Placement approach to self-tuning control; Connection between MRAS and STR. | 8 Hours |
| 5 | Gain Scheduling:<br>Introduction, The Principal, Design of Gain Scheduling Regulators, Nonlinear transformations, Applications of gain scheduling. Alternatives to Adaptive Control, Why not Adaptive Control? Robust High gain feedback control, Variable Structure schemes. | 8 Hours |
| | **Text/Reference Books**<br>1. I. B Landau, Adaptive Control - The Model Reference Approach, New York; arcel Dekker, 1979<br>2. K. J. Astrom and B. Wittenmark, Adaptive Control, Addison | |

| | | |
|---|---|---|
| | Wesley Publication Company, 1989.<br>3. B. Roffel, P. J. Vermeer, P. A. Chin, Simulation and Implementation of self-Tuning Controllers, Prentice-Hall, Englewood cliffs, NJ, 1989.<br>4. R. Isermann, K. Lashmann and D. Marko, Adaptive Control Systems, Printice-Hall International (UK) Ltd. 1992.<br>5. K. S. Narendra and A. M. Annaswamy, Stable Adaptive Systems | |

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

# BTINOE705C Automobile Instrumentation

**Teaching scheme:**
Theory: 3 hrs
Tutorial:
Total credit: 3

**Examination Scheme:**
Mid-term test: 20 Marks
Internal Assessment: 20 Marks
End semester exam: 60 Marks

| | | |
|---|---|---|
| Pre requisite | Sensors and Transducers | |
| Course Objective | 1.Know the fundamentals of automotive electronics<br>2.Understand automotive control systems<br>3.Know basics of safety factors in automobile. | |
| Course Outcome | 1.Ability to understand electronic control unit.<br>2.Acquire knowledge of various automotive standards and Protocols.<br>3.Design aspects of measurement and control strategies in automotive application | |
| Unit | Contents | Contact Hrs |
| 1 | Fundamentals of Automotive Electronics:<br>Open loop and closed loop systems, Components for electronic engine management, vehicle motion control, Current trends in modern Automobiles | 6 Hours |
| 2 | Electronic Fuel Injection and ignition systems:<br>Introduction, throttle body ignition and multi-port or point fuel injection, Advantages of electronic ignition system, Types of solid state ignition systems and their principle of operation, electronic spark timing control system, | 8 Hours |
| 3 | Engine control system:<br>Engine cranking and warm up control, Acceleration enrichment – Deceleration leaning and idle speed control, integrated engine control system, exhaust emission control system, Engine performance testing | 8 Hours |
| 4 | Automobile chassis electronic control system:<br>Principle of electronic braking, automatic transmission electronic control circuit, cruise control circuit, the electronic steering control theory, ABS, ASR, ESP, and other electronic control method | 8 Hours |
| 5 | Auto Body Electronic Control Technology:<br>Automotive central locking and anti-theft system control technology, electronically controlled windows and doors and airbag technology, principle of control circuit components and characteristics, Ergonomics and safety: Driver information system, lighting system components, battery monitoring and control, Air conditioning, steering control techniques, Automatic gear control systems, Emission standards. | 8 Hours |
| | **Text/Reference Books**<br>1. William B. Riddens, ―Understanding Automotive Electronics‖, 5th Edition, (Butterworth Heinemann Woburn), (1998).<br>2. Tom Weather Jr and Cland C. Hunter, Automotive Computers and Control System‖,Prentice Hall Inc. ,NewJeresy. | |

| | | |
|---|---|---|
| | 3. Jiri Marek, Hans Peter trah, ―Sensers Applications, Sensers for Automotive Technology‖ 1st Edition , Wiley<br>4. T. Mellard, Automotive Electronic Systems‖1987 by Heinenmann Professional | |

DR. BABASAHEB AMBEDKAR TECHNOLOGICAL UNIVERSITY, LONERE

# BTHM706 Project Engineering and Management — Audit Course

| | | |
|---|---|---|
| Pre requisite | Basics of Management Systems | |
| Course Objective | Study various aspects while developing project | |
| Course Outcome | To understand concepts of project management.<br>To develop a project plan.<br>To understand the project implementation strategy.<br>To analyze post project affects. | |
| Unit | Contents | Contact Hrs |
| 1 | Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization. | 6 Hours |
| 2 | Work definition: Defining work content, Time Estimation Method, Project Cost Estimation and budgeting, Project Risk Management, | 8 Hours |
| 3 | Project scheduling and Planning Tools: Work Breakdown structure, LRC, Gantt charts, CPM/PERT Networks | 8 Hours |
| 4 | Developing Project Plan (Baseline), Project cash flow analysis, Project scheduling with resource constraints: Resource Levelling and Resource Allocation. Time Cost Trade off | 8 Hours |
| 5 | Post-Project Analysis | 8 Hours |
| | Text/Reference Books<br>1. Shtub, Bard and Globerson, Project Management: Engineering, Technology, and Implementation, Prentice Hall, India<br>2. Lock, Gower, Project Management Handbook.<br>3. Cleland and King, VNR Project Management Handbook.<br>4. Wiest and Levy, Management guide to PERT/CPM, Prentice Hall. Ibdia<br>5. HoraldKerzner, Project Management: A Systemic Approach to Planning, Scheduling and Controlling, CBS Publishers, 2002.<br>6. S. Choudhury, Project Scheduling and Monitoring in Practice.<br>7. P. K. Joy, Total Project Management: The Indian Context, Macmillan India Ltd. | |

# BTINL707 Process Instrumentation and Control Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| Expt. No. | List of Experiments: |
|---|---|
| 1 | Study of the time constant of single capacity / Multi-capacity process by graphical methods. |
| 2 | Study of interacting and non-interacting process. |
| 3 | Study the analysis of flow controller control loop. |
| 4 | Study the analysis of Pressure control system |
| 5 | Study of Temperature control using PID |
| 6 | Study of Level control using PID |
| 7 | Study of Cascade control system |
| 8 | Study of ratio control loop. |
| 9 | Study of Split range control |

## BTINL708 Instrumentation System Design Lab

**Teaching scheme:**
Lab work : 4 hrs
Total credit: 1

**Examination Scheme:**
Continuous Assessment (T/W): 60 Marks
Pr/oral: 40 Marks

| Expt. No. | List of Experiments: |
|---|---|
| 1 | Design of signal conditioning RTD (Pt-100) |
| 2 | Design of signal conditioning for thermocouple |
| 3 | Design of signal conditioning for displacement measurement transducer. |
| 4 | Study and Calibration of I/P converter |
| 5 | Study and Calibration of P/I converter |
| 6 | Study of D.P. Transmitter and its application for flow |
| 7 | Study of D.P. Transmitter and its application for level |
| 8 | Study of smart transmitter |
| 9 | Design of signal conditioning for strain gauge. |
| 11 | Study of Enclosure design for circuit and instrument. |

## BTINM709 Project Phase -I 3 Credit

Term work shall consist of detailed report for chosen topic and output of final working proposed. Report shall summarize the literature survey, spell out the scope of work, methodology and results. Viva-voce Examination shall be based on work carried out by the student. In case of students opting for Internship in the eighth semester, the Project may be industry-based.

**BTINM710 Industrial Training / Internship 1 Credit**

Students are expected to undergo industrial training for at least four weeks at factory / design offices or in combination of these after VI semester. Training session shall be guided and certified by qualified engineer / industry expert. A neat detailed report on activities carried out during training is expected. Students should undergo training in Summer Vacation after Semester VI and appear at examination in Semester VII. A brief report of industrial training shall be submitted. Evaluation shall be based on report and power point presentation.

# SEMESTER VIII

## BTINPE801 NPTEL Online Course 3 Credit

NPTEL Course in semester VIII available relevant to branch not covered in previous semester

## BTINP802 Project Phase- II/ Internship 13 Credit

Since Project Stage II is in continuation to Project Stage I, the students are expected to complete the total project by the end of semester VIII. After completion of project work, they are expected to submit the consolidated report including the work done in stage I and stage II.

The report shall be comprehensive and presented typed on A4 size sheets and bound. The number of copies to be submitted is number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

**Dr. Babasaheb Ambedkar Technological University**
**(Established as University of Technology in the State of Maharashtra) (Under Maharashtra Act No. XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103,**
**Maharashtra Telephone and Fax. 02140 - 275142**
**www.dbatu.ac.in**

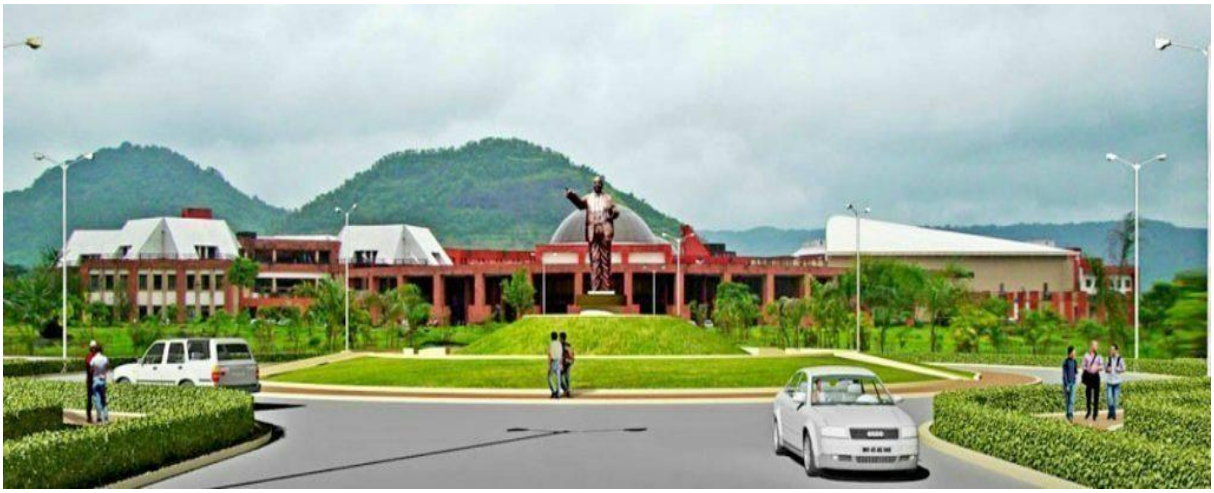
# CURRICULUM

# UNDER GRADUATE PROGRAMME

# B.TECH.

## 2nd and 3rd Year MECHANICAL ENGINEERING/MECHANICAL ENGINEERING(SANDWICH)

## ACADEMIC YEAR 2023-2024



## Abbreviations

***BSC:*** *Basic Science Course*

***ESC:*** *Engineering Science Course*

***PCC:*** *Professional Core Course*

***PEC:*** *Professional Elective Course*

***OEC:*** *Open Elective Course*

***HSSMC:*** *Humanities and Social Science including Management Courses*

***PROJ:*** *Project work, seminar and internship in industry or elsewhere*

## Course Structure for Semester III
## B. Tech in Mechanical Engineering / B. Tech. in Mechanical Engineering (Sandwich) (2022-23)

| Semester III | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | **No. of Credits** |
| | | | **L** | **T** | **P** | **CA** | **MSE** | **ESE** | **Total** | |
| BSC7 | BTBS301 | Engineering Mathematics – III | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC1 | BTMC302 | Fluid Mechanics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC2 | BTMC303 | Thermodynamics | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| ESC10 | BTMES304 | Materials Science and Metallurgy | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC3 | BTMCL305 | Machine Drawing and CAD Lab | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PCC4 | BTMCL306 | Mechanical Engineering Lab – I | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ-2 | BTES209P | IT – 1 Evaluation | - | - | - | - | - | 100 | 100 | 1 |
| | | **Total** | **12** | **4** | **8** | **200** | **80** | **420** | **700** | **21** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course
PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
HSSMC = Humanities and Social Science including Management Courses

## Course Structure for Semester IV
## B. Tech in Mechanical Engineering / B. Tech. in Mechanical Engineering (Sandwich) (2022-23)

| Semester IV | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | **No. of Credits** |
| | | | **L** | **T** | **P** | **CA** | **MSE** | **ESE** | **Total** | |
| PCC 5 | BTMC401 | Manufacturing Processes – I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 6 | BTMC402 | Theory of Machines-I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| HSSMC3 | BTHM403 | Basic Human Rights | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| ESC11 | BTMES404 | Strength of Materials | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 1 | BTMPE405A-C | Elective-I | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC7 | BTMCL406 | Mechanical Engineering Lab-II | - | - | 4 | 60 | - | 40 | 100 | 2 |
| PROJ-3 | BTMI407 | Field Training /Industrial Training (minimum of 4 weeks which can be completed partially in the third and fourth semester or in one semester itself) | - | - | - | - | - | - | - | Credits to be evaluated in Sem V |
| | | **Total** | **15** | **4** | **4** | **160** | **100** | **340** | **600** | **20** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course

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**Elective I**

| Sr. No | Course code | Course Name |
|---|---|---|
| 1 | BTMPE405A | Numerical Methods in Engineering |
| 2 | BTMPE405B | Sheet Metal Engineering |
| 3 | BTMPE405C | Fluid Machinery |

## Course Structure for Semester V
## B. Tech in Mechanical Engineering / B. Tech. in Mechanical Engineering (Sandwich) (2022-23)

| Semester V | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Course Category | Course Code | Course Title | Teaching Scheme | | | Evaluation Scheme | | | | No. of Credits |
| | | | L | T | P | CA | MSE | ESE | Total | |
| PCC 8 | BTMC 501 | Heat Transfer | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 9 | BTMC 502 | Machine Design – I | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC 10 | BTMC 503 | Theory of Machines- II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC 2 | BTMPE 504A-C BTAPE504A,D | Elective-II | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| OEC 1 | BTMOE 505A-D | Open Elective-I | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC 11 | BTMC 506 | Applied Thermodynamics | 3 | | - | 20 | 20 | 60 | 100 | 3 |
| PCC12 | BTMCL 507 | Mechanical Engineering Lab – III | - | - | 6 | 60 | - | 40 | 100 | 3 |
| PROJ-3 | BTMI 408 | IT – 2 Evaluation | - | - | - | - | - | 100 | 100 | 1 |
| | | | | | | | | | | |
| | | **Total** | **18** | **3** | **6** | **180** | **120** | **500** | **800** | **25** |

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PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
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**Elective II**

| Sr. No | Course code | Course Name |
|---|---|---|
| 1 | BTMPE504A | Refrigeration and Air conditioning |
| 2 | BTMPE504B | Steam and Gas Turbines |
| 3 | BTMPE504C | Engineering Tribology |
| 4 | BTAPE504A | Fundamentals of Automobile Design |
| 5 | BTAPE504D | Automobile Engineering |

**Open Elective I**

| Sr.No. | Course code | Course Name |
|---|---|---|
| 1 | BTMOE505A | Solar Energy |
| 2 | BTMOE505B | Renewable Energy Sources |
| 3 | BTMOE505C | Human Resource Management |
| 4 | BTMOE505D | Product Design Engineering |

# Course Structure for Semester VI
# B. Tech in Mechanical Engineering / B. Tech. in Mechanical Engineering (Sandwich) (2022-23)

| Semester VI | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Course Category** | **Course Code** | **Course Title** | **Teaching Scheme** | | | **Evaluation Scheme** | | | | **No. of Credits** |
| | | | **L** | **T** | **P** | **CA** | **MSE** | **ESE** | **Total** | |
| PCC12 | BTMC 601 | Manufacturing Processes-II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PCC13 | BTMC 602 | Machine Design-II | 3 | 1 | - | 20 | 20 | 60 | 100 | 4 |
| PEC3 | BTMPE 603A-C<br>BTAPE 603C,E | Elective-III | 3 | | - | 20 | 20 | 60 | 100 | 3 |
| PEC4 | BTMPE 604A-D<br>BTAPE 604B | Elective-IV | 3 | | - | 20 | 20 | 60 | 100 | 3 |
| OEC2 | BTMOE 605A-E | Open Elective-II | 3 | - | - | 20 | 20 | 60 | 100 | 3 |
| PCC14 | BTMCL 606 | Mechanical Engineering Lab – IV | - | - | 6 | 60 | - | 40 | 100 | 3 |
| PROJ-4 | BTMS607 | B Tech Seminar | - | - | 2 | 60 | | 40 | 100 | 1 |
| PROJ-5 | BTMP 608 | Mini Project (TPCS) | - | - | 2 | 60 | - | 40 | 100 | 1 |
| PROJ-6 | BTMI 609 (IT-3) | Field Training / Industrial Training (minimum of 4 weeks which can be completed partially in fifth semester and sixth semester or in one semester itself). | - | - | - | - | - | - | - | Credits to be evaluated in Sem VII |
| | | **Total** | **15** | **2** | **10** | **280** | **100** | **420** | **800** | **22** |

BSC = Basic Science Course, ESC = Engineering Science Course, PCC = Professional Core Course
PEC = Professional Elective Course, OEC = Open Elective Course, LC = Laboratory Course
HSSMC = Humanities and Social Science including Management Courses

**Elective III:**

| Sr.No | Course code | Course Name |
|---|---|---|
| 1 | BTMPE603A | IC Engines |
| 2 | BTMPE603B | Mechanical Vibrations |
| 3 | BTMPE603C | Machine Tool Design |
| 4 | BTMPE603D | Engineering Metrology and Quality Control |
| 5 | BTAPE603C | Advance Automobile Design |
| 6 | BTAPE603E | E – Vehicles |

**Elective IV:**

| SrNo | Course code | Course Name |
|---|---|---|
| 1 | BTMPE604A | Process Equipment Design |
| 2 | BTMPE604B | Product Life Cycle Management |
| 3 | BTMPE604C | Finite Element Method |
| 4 | BTMPE604D | Robotics |
| 5 | BTAPE604B | Computational Fluid Dynamics |

**Open Elective II:**

| Sr.No | Course code | Course Name |
|---|---|---|
| 1 | BTMOE605A | Quantitative Techniques and Project Management |
| 2 | BTMOE605B | Nanotechnology |
| 3 | BTMOE605C | Energy Conservation and Management |
| 4 | BTMOE605D | Wind Energy |
| 5 | BTMOE605E | Introduction to Probability Theory and Statistics |