

DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT



CURRICULUM

Scheme and Syllabus VII to VIII Semester

Outcome Based Education

(Academic Year 2026-2027)

Department of Mechanical Engineering

7th & 8th Semester B.E

ABOUT THE INSTITUTE

Dayananda Sagar Academy of Technology and Management- DSATM was established in 2011 with 5 UG Programmes and 1 PG Program, the programmes are approved by All India Council for Technical Education (AICTE) New Delhi, Affiliated to Visvesvaraya Technological University (VTU), Belagavi and DSATM is an autonomous institute from 2023-2024.

The Dayananda Sagar Institutions is one of pioneer institutions in India and abroad with six decades of excellence in Academic and Research. The newer campuses were necessary to accommodate the growing need of the technology and innovation.

DSATM nurtures the students in academic, research, sports, cultural and extracurricular activities.

- Creating an academic environment to nurture and develop competent entrepreneurs, leaders and professionals who are socially sensitive and environmentally conscious.
- Integration of Outcome Based Education and cognitive teaching and learning strategies to enhance learning effectiveness.
- Developing necessary infrastructure to cater to the changing needs of Business and Society.
- Optimum utilization of the infrastructure and resources to achieve excellence in all areas of relevance.
- Adopting learning beyond curriculum through outbound activities and creative assignments.
- Imparting contemporary and emerging techno-managerial skills to keep pace with the changing global trends.
- Facilitating greater Industry-Institute Interaction for skill development and employability enhancement.
- Establishing systems and processes to facilitate research, innovation and entrepreneurship for holistic development of students.
- Implementation of Quality Assurance System in all Institutional processes.

VISION OF THE INSTITUTE

To strive at creating the institution a centre of highest calibre of learning, so as to create an overall intellectual atmosphere with each deriving strength from the other to be the best of engineers, scientists with management & design skills.

MISSION OF THE INSTITUTE

- To serve its region, state, the nation and globally by preparing students to make meaningful contributions in an increasing complex global society challenges.
- To encourage, reflection on and evaluation of emerging needs and priorities with state-of-the-art infrastructure at institution.
- To support research and services establishing enhancements in technical, economic, human and cultural development.
- To establish interdisciplinary centre of excellence, supporting/ promoting student's implementation.
- To increase the number of Doctorate holders to promote research culture on campus.
- To establish IIPC, IPR, EDC, innovation cells with functional MOU's supporting student's quality growth.

QUALITY POLICY

Dayananda Sagar Academy of Technology and Management aims at achieving academic excellence through continuous improvement in all spheres of Technical and Management education. In pursuit of excellence cutting – edge and contemporary skills are imparted to the utmost satisfaction of the students and the concerned stakeholders.

ABOUT THE DEPARTMENT: The Department of Mechanical Engineering was established in the year 2011 to impart high quality mechanical skills to the blooming engineers of DSATM under the umbrella of “Dayananda Sagar Institutions”. The Department is committed to well-being and all-round development of its students and faculty. Research and Development center was established in the year 2016 which offers Ph.D. program Affiliated to VTU, Belagavi, facilitating research and consultancy works. The strength of the department lies in its highly qualified and experienced teaching faculty besides its supportive and excellent non-teaching staff, with state-of-the-art laboratory facilities. The department is engaged in sponsored research, consultancy and testing in the areas of advanced material’s development, processing, design, and their characterization and has a dedicated platform called MAKER SPACE where the students can execute their innovative ideas. The focus of our curriculum to the students is to promote technical competence, problem solving skills and innovation of new technologies like such as advanced composites, 3D Printing.

VISION OF THE DEPARTMENT

To endeavor the best quality of teaching and learning in advanced fields of mechanical engineering to cater the industrial demands and social needs.

MISSION OF THE DEPARTMENT

- M1: To provide the students with an academic environment of excellence, leadership, ethical guidelines for a successful career.**
- M2: To empower the students with personality development programs for advancement in their professional career.**
- M3: To impart practical oriented educational programs for the students which tend to promote the intellectual pursuit.**
- M4: To develop alliances with industry and alumni for excellence in teaching, research, and consultancy practices.**

PROGRAM EDUCATION OBJECTIVES (PEO'S):

- PEO 1: The graduates will be able to apply practical knowledge and career-based objectives to survive in advanced technological world
- PEO 2: The graduates are acquired with additional knowledge on interdisciplinary subjects and skills, leadership qualities to become a successful entrepreneur
- PEO 3: The graduates will be able to pursue their higher studies in specialized areas and advances of mechanical engineering & explore possible profession as an researchers, academicians, or self-employment
- PEO 4: All Graduates are made to undergo to do additional certified courses in the field of advanced technologies and interdisciplinary software's

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

ME PSO1

An ability to find out, articulate the local industrial problems and solve with the use of mechanical engineering tools for realistic outcomes.

ME PSO2

Ability to collaborative learning to find out cost-effective, optimal solution for social problems.



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Affiliated to **VTU**
Approved by **AICTE**
Accredited by **NAAC** with **A+** Grade
6 Programs Accredited by **NBA**
(CSE, ISE, ECE, EEE, MECH, CV)

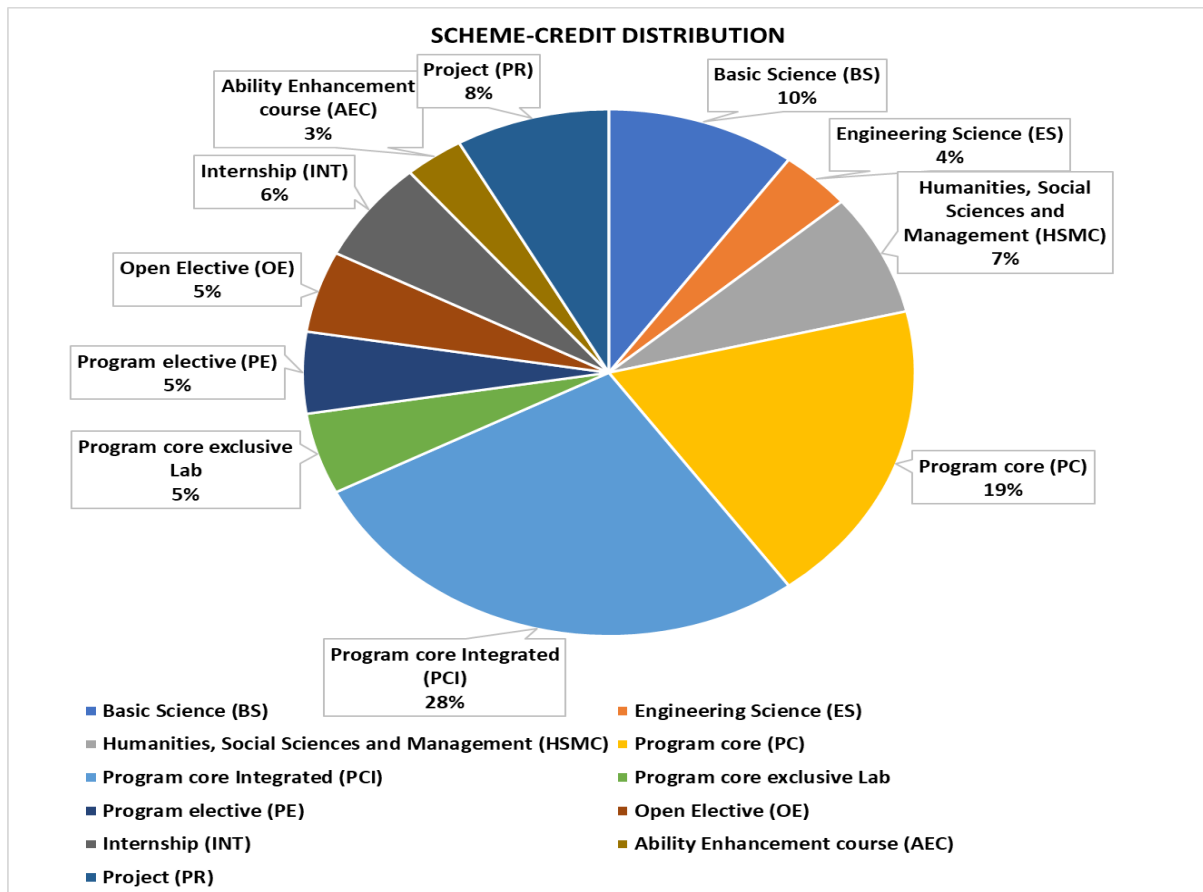
PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

| Sl.No | Semester | No. of Credits |
|--------------|--------------------------|-----------------------|
| 1 | 1 st Semester | 20 |
| 2 | 2 nd Semester | 20 |
| 3 | 3 rd Semester | 21 |
| 4 | 4 th Semester | 21 |
| 5 | 5 th Semester | 22 |
| 6 | 6 th Semester | 22 |
| 7 | 7 th Semester | 20 |
| 8 | 8 th Semester | 14 |
| Total | | 160 |

SCHEME DISTRIBUTION

Department of Mechanical Engineering

| Course Component | Credits | % of Credits |
|---|---------|--------------|
| Basic Science (BS) | 16 | 10 |
| Engineering Science (ES) | 6 | 4 |
| Humanities, Social Sciences and Management (HSMC) | 12 | 8 |
| Program core (PC) | 30 | 18 |
| Program core Integrated (PCI) | 44 | 28 |
| Program core exclusive Lab | 8 | 5 |
| Program elective (PE) | 8 | 5 |
| Open Elective (OE) | 8 | 5 |
| Internship (INT) | 10 | 6 |
| Ability Enhancement course (AEC) | 5 | 3 |
| Project (PR) | 13 | 8 |
| Total | 160 | 100 |



SEMESTER WISE CREDIT BREAKDOWN FOR B.E. DEGREE CURRICULUM

BATCH 2023-2027

| Course Category | Semester | | | | | | | | Total Credits |
|---|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|---------------|
| | 1 st | 2 nd | 3 rd | 4 th | 5 th | 6 th | 7 th | 8 th | |
| Basic Sciences (BSC) | 8 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| Engineering Sciences (ESC) | 3 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| Humanities, Social Sciences and Management (HSMC) | 3 | 3 | 3 | 3 | 0 | 0 | 0 | 0 | 12 |
| Ability Enhancement Course (AEC) | 2 | 2 | 0 | 0 | 3 | 0 | 0 | 0 | 7 |
| Universal Human Values (UHV) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 6 |
| Professional Core Courses (PCC) | 3 | 3 | 9 | 9 | 6 | 6 | 3 | 0 | 39 |
| Integrated Professional core Course (IPCC) | 0 | 0 | 8 | 8 | 4 | 4 | 4 | 0 | 28 |
| Professional Elective Course (PEC) | 0 | 0 | 0 | 0 | 3 | 3 | 3 | 0 | 9 |
| Institutional Open Elective Courses (IOE) | 0 | 0 | 0 | 0 | 3 | 4 | 3 | 0 | 10 |
| Internship (INT) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 14 |
| Project Work (PW) | 0 | 0 | 0 | 0 | 0 | 2 | 7 | 4 | 13 |
| Non-credit Mandatory Courses (NCMC) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total Credits | 20 | 20 | 21 | 21 | 22 | 22 | 20 | 14 | 160 |



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Approved by **AICTE**
Accredited by **NAAC** with **A+** Grade
6 Programs Accredited by **NBA**
(CSE, ISE, ECE, EEE, MECH, CIVIL)

Scheme of Teaching and Examinations – 2024
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2026-27)

7th SEMESTER: MECHANICAL ENGINEERING (ME)

| Sl. No | Course Code | Course Title | Course Category | BOS | TD | Teaching Hours/Week | | | | | Credits | Examination | | | |
|--------|-------------|------------------------------|-----------------|--------------|--------------|--|----------|-----------|---------|-------|-----------|--------------------|-----------|-----------|-------------|
| | | | | | | Lecture | Tutorial | Practical | Project | Total | | SEE Duration (Hrs) | CIE Marks | SEE Marks | Total Marks |
| | | | | | | L | T | P | S | | | | | | |
| 1 | BME701 | Finite Element Methods | IPCC | ME | ME | 3 | 0 | 2 | 0 | 5 | 4 | 3 | 50 | 50 | 100 |
| 2 | BME702 | Control Engineering | PCC | ME | ME | 2 | 2 | 0 | 0 | 4 | 3 | 3 | 50 | 50 | 100 |
| 3 | BME703 | Professional Elective Course | PEC | ME | ME | 3 | 0 | 0 | 0 | 3 | 3 | 3 | 50 | 50 | 100 |
| 4 | BME704 | Open Elective Course | OEC | ME | ME | 3 | 0 | 0 | 0 | 3 | 3 | 3 | 50 | 50 | 100 |
| 5 | BMEP705 | Capstone Project – Phase 2 | PROJ | ME | ME | 0 | 0 | 0 | 7 | 7 | 7 | 3 | 100 | 100 | 200 |
| 6 | BME706 | Indian Knowledge System | NCMC | YOGA TEACHER | | 1 | 0 | 0 | 0 | 1 | -- | -- | 100 | - | 100 |
| 7 | | AICTE Activity Points | | | | Details of 80 AICTE Activity Points Earned | | | | | | | | | |
| | | | | | Total | | | | | | 20 | | | | |

Professional Elective

| | |
|---------|--|
| BME703A | AI Techniques for Modern Mobility |
| BME703B | Data Analytics and Optimization Techniques |
| BME703C | Machine Vision and Robotics |
| BME703D | AI in Smart Manufacturing |

Open Elective

| | |
|---------|--------------------------------------|
| BME704A | AI in Supply Chain Management |
| BME704B | AI in Product Design and Development |

8th SEMESTER: MECHANICAL ENGINEERING (ME)

| Sl. No | Course Code | Course Title | Course Category | BOS | TD | Teaching Hours/Week | | | | | Credits | Examination | | | | |
|--------------|-------------|---|---|-----|----|---------------------|----------|-----------|---------|-------|-----------|--------------------|-----------|-----------|-------------|-----|
| | | | | | | Lecture | Tutorial | Practical | Project | Total | | SEE Duration (Hrs) | CIE Marks | SEE Marks | Total Marks | |
| | | | | | | L | T | P | S | | | | | | | |
| 1 | BMEP801 | Capstone Project – Phase 3 (Publications and Patents) | PROJ | ME | ME | 4 | | | | | 4 | - | 100 | - | 100 | |
| 2 | BMEI802 | Internship | INT | ME | ME | - | | | | | - | 10 | 3 | 50 | 50 | 100 |
| 3 | | AICTE Activity Points | Details of 100 AICTE Activity Points Earned | | | | | | | | | | | | | |
| Total | | | | | | | | | | | 14 | | 150 | 50 | 200 | |

IPCC: Integrated Professional Core Course,

PEC: Professional Elective Course

OEC: Open Elective Course

PROJ: Project Work,

NCMC: Non-Credit Mandatory Course

L: Lecture,

T: Tutorial,

P: Practical

S= SDA: Skill Development Activity,

CIE: Continuous Internal Evaluation,

SEE: Semester End Evaluation.

Integrated Professional Core Course (IPCC): Refers to Integrated Professional Core Course Theory Integrated with practical of the same course. Credit for IPCC can be 04 and its Teaching Learning hours (L : T : P) can be considered as (3 : 0 : 2) or (2 : 2 : 2). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Non Credit Mandatory Course (NCMC) - National Service Scheme /Physical Education/Yoga: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE)(Sports and Athletics), and Yoga(YOG) with the concerned coordinator of the course during the first week of III semesters. Activities shall be carried out between III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. The events shall be appropriately scheduled by the colleges and the same shall be reflected in the calendar prepared for the NSS, PE, and Yoga activities. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Newly introduced subjects in the syllabus

| | | 7th Semester |
|-----------|--|---|
| 1. | List of Existing Elective Courses | Non Conventional Energy Resources Non Traditional Machining Automotive Engineering |
| 2. | List of New Existing Elective Courses | AI Techniques for Modern Mobility Data Analytics and Optimization Techniques Machine Vision and Robotics AI in Smart Manufacturing |
| 3. | List of New Industry Aligned Courses | AI Techniques for Modern Mobility Machine Vision and Robotics |

Percentage of Change in the Syllabus

| 7 th Semester | | | | | | |
|--------------------------|-------------|--|-------------------------------|---|--------------|---|
| Sl.No | Course Code | Course Name | Topics Added | Topics removed | Revised in % | Justification |
| 1 | BME703A | AI Techniques for Modern Mobility | NEW SUBJECT INTRODUCED | ENTIRELY NEW ELECTIVE SUBJECT FOR INDUSTRY STANDARD CURRICULUM | 100 | Required for bridging the gap between Industry and Academia with AI related curriculum |
| 2 | BME703B | Data Analytics and Optimization Techniques | NEW SUBJECT INTRODUCED | ENTIRELY NEW ELECTIVE SUBJECT FOR INDUSTRY STANDARD CURRICULUM | 100 | Required for upskilling the students related to data analytics and its validation |
| 3 | BME703C | Machine Vision and Robotics | NEW SUBJECT INTRODUCED | ENTIRELY NEW ELECTIVE SUBJECT FOR INDUSTRY STANDARD CURRICULUM | 100 | Robotics and Automation linked to Industry 5.0 |
| 4 | BME703D | AI in Smart Manufacturing | NEW SUBJECT INTRODUCED | ENTIRELY NEW ELECTIVE SUBJECT FOR INDUSTRY STANDARD CURRICULUM | 100 | Required for skill development for students to adopt to Smart Manufacturing. |

7th SEMESTER



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| | | | | |
|--|---|------------------------------------|--------------|------------|
| Semester | : | 7 TH SEM | | |
| Course Title | : | FINITE ELEMENT METHODS | | |
| Course Code | : | BME701 | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | |
| Course Category | : | IPCC | | |
| Stream | : | ME | CIE | : 50 Marks |
| Teaching hours/ week (L:T:P:S) | : | 3:0:2:0 | SEE | : 50 Marks |
| Total Hours | : | 40 Hrs (L) +26 Hrs (P) = 66 Hrs | SEE Duration | : 3 Hours |
| Credits | : | 04 | | |

Course Learning Objectives: Students will be able to

| Sl.No | Course Objectives |
|-------|--|
| 1 | Acquire knowledge in finite element methods and analytical procedure. |
| 2 | Solve 1 D, 2 D, 3 D and dynamic problems using Finite Element Analysis approach. |
| 3 | Apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses. |
| 4 | Analyze complex problems using modern simulation tools. |

Teaching-Learning Process

Pedagogy (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.



Scheme of Teaching and Examinations for BE Programme -2023-24
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

DSATM

COURSE SYLLABUS

| Module No. | Contents of the Module | Hours |
|-------------------|--|--------------|
| 1 | <p>Module 1: Introduction to Finite Element Method: General steps of the finite element method. Engineering applications of finite element method. Advantages and Challenges of the Finite Element Method. Potential energy method, Displacement method of finite element formulation. Convergence criteria, Discretization process, Rayleigh Ritz method (Simple numericals), Galerkin's method (Independent study)</p> <p>Types of Elements: 1D, 2D and 3D, Node numbering, Location of nodes. Strain- displacement relations, Stress-strain relations, Plain stress and Plain strain conditions.</p> <p>Interpolation Models: Simplex, complex and multiplex elements, linear interpolation polynomials in terms of global coordinates 1D, 2D, 3D Simplex Elements.</p> | 8 |
| Pedagogy | Problem Solving Technique, Chalk and Talk, PPT, Problem Demonstration using Modern Tool. | |
| 2 | <p>Module 2: Introduction to the Stiffness (Displacement) method: Introduction, One-Dimensional Elements-Analysis of Bars and Trusses, Linear interpolation polynomials in terms of local coordinate's for 1D, 2D elements.</p> <p>Higher order Interpolation functions for 1D quadratic and cubic elements in natural coordinates, Constant strain triangle, Four-Noded Tetrahedral Element (TET 4), Eight-Noded Hexahedral Element (HEXA 3 8), 2D iso-parametric element.</p> <p>Numerical Problems: Solution for displacement, stress and strain in 1D straight bars, stepped bars and tapered bars using elimination approach and penalty approach</p> | 8 |
| Pedagogy | Problem Solving Technique, Chalk and Talk, PPT, Problem Demonstration using Modern Tool | |
| 3 | <p>Module 3: Beams and Shafts: Boundary conditions, Load vector, Hermite shape functions , Beam stiffness matrix based on Euler- Bernoulli beam theory, Numerical problems on simply supported, fixed straight and cantilever beams, propped cantilever beams with concentrated and uniformly distributed load.</p> <p>Torsion of Shafts: Finite element formulation of shafts, determination of stress and twists in circular shafts.</p> | 8 |

| | | |
|-----------------|--|----------|
| Pedagogy | Problem Solving Technique, Chalk and Talk, PPT, Problem Demonstration using Modern Tool | |
| 4 | <p>Module 4: Heat Transfer: Basic equations of heat transfer: Energy balance equation, Rate equation: conduction, convection, radiation, 1D finite element formulation using variational method.</p> <p>Problems with temperature gradient and heat fluxes, heat transfer in composite sections, straight fins.</p> <p>Fluid Flow: Flow through a porous medium, Flow through pipes of uniform and stepped sections, Flow through hydraulic networks.</p> | 8 |
| Pedagogy | Problem Solving Technique, Chalk and Talk, PPT, Problem Demonstration using Modern Tool | |
| 5 | <p>Module 5: Axi-symmetric Solid Elements: Derivation of stiffness matrix of axisymmetric bodies with triangular elements, Numerical solution of axisymmetric triangular element(s) subjected to surface forces, point loads, angular velocity, pressure vessels.</p> <p>Dynamic Considerations: Formulation for point mass and distributed masses, Consistent element mass matrix of one dimensional bar element, truss element, triangular element, beam element. Lumped mass matrix of bar element, truss element.</p> <p>Evaluation of Eigen values and Eigen vectors, Applications to bars, stepped bars, and beams.</p> | 8 |
| Pedagogy | Problem Solving Technique, Chalk and Talk, PPT, Problem Demonstration using Modern Tool | |

| Experiments to be covered | | Hrs. |
|----------------------------------|--|-------------|
| Sl.No. | PART A | |
| 1 | Study of a FEA package, modelling and stress analysis of: Bars of constant cross section area, tapered cross section area and stepped bar | 2 |
| 2 | Trusses-General configuration and Trusses-Cycle frame (2 problems) | 2 |
| 3 | Beams – Cantilever with point load (1 problems) | 2 |
| 4 | Beams –Cantilever with point load and inclined loads(1 problems) | 2 |
| 5 | Beams – Simply supported with point loads and UDL(2 problems) | 2 |
| 6 | Beams – Simply supported with point loads and VDL (2 problems) | 2 |
| 7 | Stress analysis of a rectangular plate with a circular hole and plate with deformities. | 2 |
| | PART B | |
| 8 | Thermal Analysis–1D conduction and convection boundary conditions (2 problems) | 2 |

| Web links and Video Lectures (e-Resources) | |
|---|---|
| 1 | https://nptel.ac.in/courses/112104193 |
| 3 | https://www.coursera.org/learn/finite-element-method |
| 4 | https://ecornell.cornell.edu/certificates/engineering/finite-element-analysis/ |
| 5 | http://icas.bf.rtu.lv/doc/Book.pdf |
| 6 | http://www.adina.com/MITRES2_002S10_linear.pdf |
| 7 | https://www.edx.org/course/finiteelementmethodfemanalysisingshuax70120073x |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | | Practical |
|------------------|-----------------------------|----------|---|----------|----------------|
| | Continuous Assessment Tests | | Continuous Comprehensive Assessment (CCA) | | Practical Test |
| | IAT-1 | IAT-2 | Lab Component | CCA-1 | |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - | - |
| Understand | 10 | 10 | - | - | - |
| Apply | 20 | 20 | - | - | - |
| Analyse | 20 | 20 | - | - | - |
| Evaluate | | | 50 | 50 | - |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|-----------|------------|------------|-----------|-----------|-------------|------------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module-3.5 | Module-3.5 | Module-4 | Module-5 | | |
| CO1 | 05 | 05 | 05 | 05 | 05 | 05 | 30 | 20 |
| CO2 | 10 | 10 | 10 | 10 | 10 | 10 | 60 | 40 |
| CO3 | 10 | 10 | 10 | 10 | 10 | 10 | 60 | 40 |
| CO4 | - | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - | - |
| Total | 25 | 25 | 25 | 25 | 25 | 25 | 150 | 100 |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (80% Problem Solving + 20% Theory) |
|-------------------------|---|
| Remember | - |
| Understand | 20 |
| Apply | 45 |
| Analyse | 35 |
| Evaluate | - |
| Develop | - |

SEE Course Plan

| CO's | Marks Distribution | | | | | Total Marks | Weightage |
|--------------|---------------------------|-----------------|-----------------|-----------------|-----------------|--------------------|------------------|
| | Module-1 | Module-2 | Module-3 | Module-4 | Module-5 | | |
| CO1 | 6 | 6 | 6 | 6 | 6 | 30 | 30 |
| CO2 | 7 | 7 | 7 | 7 | 7 | 35 | 35 |
| CO3 | 7 | 7 | 7 | 7 | 7 | 35 | 35 |
| CO4 | - | - | - | - | - | - | - |
| CO5 | - | - | - | - | - | - | - |
| Total | 20 | 20 | 20 | 20 | 20 | 100 | 100 |



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

| | | | | |
|--|---|------------------------|----------|------------|
| Semester | : | 7 th | | |
| Course Title | : | CONTROL ENGINEERING | | |
| Course Code | : | BME702 | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | |
| Category | : | PCC | | |
| Stream | : | Mechanical Engineering | CIE | : 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : 50 |
| Total Hours | : | 40 Hrs (T) | SEE | : 03 Hours |
| Credits | : | 03 | Duration | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|---|
| 1 | Develop mathematical models of physical systems such as mechanical, electrical, thermal, and hydraulic systems using transfer functions. |
| 2 | Analyze control systems using block diagrams and signal flow graphs , and determine transfer functions using standard techniques. |
| 3 | Evaluate the time response of control systems for standard test inputs and determine transient and steady-state performance. |
| 4 | Assess the stability of control systems using methods such as Routh-Hurwitz criterion and root locus techniques. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt teaching methods using PowerPoint presentation, Video demonstration.
- Use of appropriate software tools to demonstrate the frequency response of the systems.
- Adopt collaborative (Group Learning) learning in the class.
- Adopt problem-based learning which fosters student's analytical skills and develop thinking skills.



DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-------------------|---|--------------|
| 1 | Introduction: Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system. Types of controllers: Proportional, Integral Proportional Integral, Proportional Integral Differential controllers. Mathematical Models: Transfer function models, models of mechanical, electrical circuits, thermal systems and hydraulic systems. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 2 | Block Diagrams and Signal Flow Graphs: Transfer Functions definition, block representation of systems elements, reduction of block diagrams, Signal flow graphs: Mason's gain formula. System Compensation: Series and feedback compensation, Lead compensator, Lag Compensator. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 3 | Transient and Steady State Response Analysis: Introduction, test inputs, first order and second order system response to step, ramp and impulse inputs, concepts of time constant and its importance in speed of response. Steady state error, error constants. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 4 | System stability: Routh's stability Criterion Root Locus Plots: Definition of root loci, General rules for constructing root loci, Analysis using root locus plots. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 5 | Frequency Response Analysis: Polar plots, Nyquist stability criterion, Bode Plots, Determination of phase margin and gain margin using Bode plot. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| | Pedagogical Initiatives (Not limited to): <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process | |

| | |
|--|---|
| | <ul style="list-style-type: none"> • Activity Based Learning (Suggested Activities in Class)/ Practical Based learning: Frequency response of control system using MATLAB/SCILAB or any open-source Software tools. |
|--|---|

| Text Books | |
|-------------------|--|
| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
| 1 | Modern Control Engineering , Katsuhiko Ogata, Pearson Education, Sixth Edition, 2022. |
| 2 | Modern Control Systems , Richard C. Dorf and Robert H. Bishop, Pearson Education, Fourteenth Edition, 2023. |

| Reference Books | |
|------------------------|---|
| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
| 1 | Control Systems: Principles and Design , M. Gopal, McGraw Hill Education (India), Fifth Edition, 2020. |
| 2 | Automatic Control Systems , Benjamin C. Kuo and Farid Golnaraghi, McGraw Hill Education, Ninth Edition, 2009 (Latest widely used edition). |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----------|--|-------------------|----------------------------|
| CO1 | Explain control systems, their types, control actions, and develop governing equations for physical systems (Mechanical, Electrical, Thermal & Hydraulic).equations for physical models (Mechanical, Electrical, Thermal & Hydraulic Systems). | Understand | L2 |
| CO2 | Apply the concepts of time response of control systems for standard test signals and evaluate system performance. | Apply | L3 |
| CO3 | Analyze block diagrams and signal flow graphs to obtain transfer functions and assess system stability in time and frequency domains. | Analyze | L4 |
| CO4 | Evaluate control systems using stability criteria (Routh, Root Locus) and frequency response methods (Bode, Nyquist) for desired performance. | Evaluate | L5 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | | 3 | | | | | | | | | | | |
| CO2 | 3 | 2 | 3 | 2 | 2 | | | | | | | | | |
| CO3 | 3 | 3 | 3 | 3 | 3 | | | | | | | | | |
| CO4 | | | | | | | | | | | | | | |

Web links and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc22_ee31/preview |
| 2 | https://plccoep.vlabs.ac.in/exp/pidcontroller/index.html |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | 40 | - | - | - |
| Apply | 10 | 10 | - | - |
| Analyse | - | 40 | 50 | 50 |

CIE Course Assessment Plan

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | - |
| Understand | 40 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | - |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | - |
| Understand | 40 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | - |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 10 | 10 | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| Total | | | | | | | 100 | 100 |



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

| | | | | | |
|--|---|-----------------------------------|----------|---|----------|
| Semester | : | 7 th | | | |
| Course Title | : | AI TECHNIQUES FOR MODERN MOBILITY | | | |
| Course Code | : | BME703A | | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | | |
| Category | : | PEC | | | |
| Stream | : | Mechanical Engineering | CIE | : | 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : | 50 |
| Total Hours | : | 40 Hrs (T) | SEE | : | 03 Hours |
| Credits | : | 03 | Duration | | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|---|
| 1 | Understand the fundamental concepts and techniques of Artificial Intelligence and their relevance to engineering applications. |
| 2 | Apply Artificial Intelligence techniques in vehicle systems , including automation, control, and intelligent decision-making. |
| 3 | Analyze and solve contemporary problems in vehicle technology using AI-based approaches. |
| 4 | Explore and interpret emerging AI applications in advanced automotive systems and future mobility solutions. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-------------------|--|--------------|
| 1 | <p>Introduction to Artificial Intelligence: Introduction of AI - Importance of AI - Evolution of AI - Applications of AI in mobility – Risks of AI: Trustworthy Artificial Intelligence Framework - Ethical, Regulatory and Social Aspects of AI.</p> <p>Fundamentals of Statistical learning: Introduction to statistical learning - Statistics fundamentals: probability, random variables, description statistics and stochastic processes - Statistical inference: estimation and testing - Evaluation metrics.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 2 | <p>Logic and Automated Reasoning: Introduction to logical representation and reasoning - Logical Agents - Propositional Logic, First-order Logic - Fuzzy Logic Inference Algorithms - Rule based knowledge representation - Expert System-Exercises and case studies.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 3 | <p>IoT Based Battery Management System (BMS) for Hybrid Electric Vehicles (HEV): Introduction, Battery configuration, Type of batteries for HEV and Electric Vehicles (EV), Functional blocks of Battery management systems, IoT based BMS.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 4 | <p>Energy Management of Hybrid Energy Storage System (HESS) in PHEV with various driving mode: Introduction, Problem description and formulation, Modelling of HESS and its analysis.</p> <p>Contemporary Issues: Recent advancements in AI based technology for the future mobility solutions.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 5 | <p>AI Applications in Autonomous vehicle: Technologies of Intelligent Vehicles - Multi-sensor Fusion - Path Planning and Decision-Making - Object Detection - Multi Sensor Fusion (LIDAR, RADAR, IMU, GPS etc.) - Intelligent Transportation System.</p> <p>AI Applications in Electric Vehicle: BLDC motor speed control with ANN - Fuzzy logic control of active magnetic bearing - Intelligent battery management system - Auto tuning fuzzy controller for induction motor - Battery optimization techniques using AI.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |

| | |
|--|--|
| | <p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process |
|--|--|

| Text Books | |
|------------------------|---|
| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
| 1 | Artificial Intelligence: A Modern Approach, S. Russell and P. Norvig, Prentice Hall, Fourth Edition, 2021 |
| 2 | Smart transportation: AI enabled mobility and autonomous driving, Dartmann, Guido, Anke Schmeink, Volker Lücken, Houbing Song, Martina Ziefle, and Giovanni Prestiflippo, eds, CRC Press, 2021. |
| 3 | Artificial Intelligent Techniques for Electric and Hybrid Electric vehicles, Chitra A, P Sanjeev Kumar and S. Himavathi, Wiley, 2020. |
| Reference Books | |
| 1 | Powertrain Development with Artificial Intelligence, Aras Mirfendreski, Springer Berlin, 2022. |
| 2 | Eiza, Mahmoud Hashem, Yue Cao, and Lexi Xu, eds. Toward sustainable and economic smart mobility: shaping the future of smart cities. World Scientific, 2020. |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|------------|---|-------------------|----------------------------|
| CO1 | Recognize the fundamentals and various techniques of Artificial Intelligence related to modern mobility | Understand | L2 |
| CO2 | Demonstrate how to use sensors and IoT connectivity to monitor the voltage and temperature of a hybrid vehicle battery in real-time | Apply | L3 |
| CO3 | Use energy management algorithms to distribute power demands between a battery and a supercapacitor across various PHEV driving cycles. | Apply | L3 |
| CO4 | Analyze how Artificial Intelligence contributor in optimizing automotive applications, powertrain systems and electric vehicles. | Analyze | L4 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | | 3 | | | | | | | | | | | |
| CO2 | 3 | 2 | 3 | 2 | 2 | | | | | | | | | |
| CO3 | 3 | 3 | | | | | | | | | | | | |
| CO4 | 3 | | 3 | 2 | 2 | | | | | | | | | |

Weblinks and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://research.google/blog/introducing-mobility-ai-advancing-urban-transportation/ |
| 2 | https://innovate.ieee.org/innovation-spotlight/using-ai-technologies-to-enhance-mobility/ |
| 3 | https://www.mdpi.com/2673-7590/5/3/122 |
| 4 | https://electrifiedveronika.com/artificial-intelligence-in-the-e-mobility-industry/ |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | 40 | - | - | - |
| Apply | 10 | 10 | - | - |
| Analyse | - | 40 | 50 | 50 |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 10 | 10 | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 100 | 100 |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | - |
| Understand | 40 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | - |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 10 | 10 | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| Total | | | | | | | 100 | 100 |



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

| | | | | |
|--|---|--|----------|------------|
| Semester | : | 7 | | |
| Course Title | : | Data Analytics and Optimization Techniques | | |
| Course Code | : | BME703B | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | |
| Category | : | PEC | | |
| Stream | : | Mechanical Engineering | CIE | : 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : 50 |
| Total Hours | : | 40 | SEE | : 03 Hours |
| Credits | : | 3 | Duration | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|--|
| 1 | Illustrate the core ideas, uses and practical implications of data analytics. |
| 2 | Identify several career pathways, data analyst-hiring sectors and prospects for future advancement. |
| 3 | Analyze how business analytics is essential to data-driven decision-making through business analytics integration. |
| 4 | Evaluate collected data techniques and organize unstructured data types. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-----------------|--|-------|
| 1 | Introduction: Big data definition, classification, characteristics. Scalability and parallel processing. Designing data architecture. Data sources: quality, preprocessing and storing. Data storage and analysis – traditional and big data systems. Application of big data analytics in various areas. | 08 |
| Pedagogy | Case Study, PPT, Videos | |
| 2 | Data Processing: Data types: attributes and measurements, types of data sets. Data preprocessing: aggregation, sampling, dimensionality reduction, discretization and binarization, variable transformation. Proximity measures: similarity and dissimilarity between attributes and data objects, examples of proximity measures, selection of appropriate proximity measures. | 08 |
| Pedagogy | Case Study, PPT, Videos | |
| 3 | Data Visualization: Visualization techniques: bar chart, stacked bar chart, line chart, histogram, pie chart, frequency polygon, box plot, scatter plot, heat map, tree map. Multivariate data visualization: geometric projection techniques, icon-based techniques, pixel-oriented techniques, hierarchical techniques, scatterplot matrix, parallel coordinates. | 08 |
| Pedagogy | Case Study, PPT, Videos | |
| 4 | Big Data Big Data: Evolution of Big data, Best Practices for Big data Analytics - Big data characteristics - Big Data Use Cases, Characteristics of Big Data Applications, Big Data Modelling, HDFS performance and tuning, Map reduce algorithm, Hadoop Eco system Pig: Introduction to PIG, Execution Modes of Pig, Grunt, Pig Latin, User Defined Functions, Data Processing operators. Hive: Hive Shell, Hive Services, HiveQL, Tables, Querying Data and User Defined Functions. Hbase: HBasics, Concepts, Clients, Example, Spark. | 08 |
| Pedagogy | Case Study, PPT, Videos | |
| 5 | Optimization Techniques: Constrained optimization techniques such as direct methods, the complex methods, cutting plane method, exterior penalty function methods for structural engineering problems. Formulation and solution of structural optimization problems by different technique. NoSQL Database: NoSQL Databases - Schema less Models, Increasing Flexibility for Data Manipulation-Key Value Stores, Document Stores, Tabular Stores, Object Data Stores – Graph Databases, Big data for twitter, big data for E-Commerce blogs. | 08 |

| | |
|--|--|
| | <p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process |
|--|--|

Text Books

| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
|---------|--|
| 1 | Advanced Topology Optimization: Methods and Applications, Yun-Fei Fu , MDPI Books, 2026. |
| 2 | Optimization For Data Analysis, Stephen J. Wright, Benjamin Recht, Cambridge University Publication, 2022. |

Reference Books

| | |
|---|---|
| 1 | An Introduction to Optimization: With Applications to Machine Learning, Edwin K. P. Chong, Wu-Sheng Lu, Stanislaw H. Zak, Willey Publication, 2023. |
| 2 | Engineering Design Optimization Joaquim, R. R. A. Martins and Andrew Ning, Cambridge University Press, 2022. |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----|--|-------------------|---------------------|
| CO1 | Illustrate data preprocessing techniques, including dimensionality reduction and variable transformation. | Understand | 2 |
| CO2 | Apply various proximity measures to select the most appropriate metric for specific data object attributes. | Apply | 3 |
| CO3 | Analyze multivariate visualization techniques to determine their effectiveness in representing high-dimensional data. | Analyze | 4 |
| CO4 | Evaluate Big Data pipeline that integrates data sourcing, preprocessing and storage using the Hadoop and Hive ecosystem. | Evaluate | 5 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | 3 | - | - | - | - | - | - | - | - | - | - | 2 | - |
| CO3 | - | - | 3 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | 3 | 2 | - | - | - | - | - | - | - | - | - |

Weblinks and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://www.youtube.com/watch?v=0hW8v8H_B7M - Google Search |
| 2 | https://www.youtube.com/watch?v=NBcAF0ExsXo |
| 3 | https://www.google.com/search?q=https://www.youtube.com/watch%3Fv%3Df7_3XU2mX68 |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 20 | - | 25 | - |
| Analyse | 20 | 10 | 25 | - |
| Evaluate | 10 | 20 | - | 25 |
| Create | - | 20 | - | 25 |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|-----------|-----------------|-----------------|-----------|-----------|-------------|--------------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | | | | | | 20 | 20% |
| CO2 | | 20 | | | | | 20 | 20% |
| CO3 | | | 10 | 10 | 20 | | 40 | 40% |
| CO4 | | | | | | 20 | 20 | 20% |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 20 | 1000% |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | |
| Understand | 20 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|-----------|-----------------|-----------------|-----------|-----------|-------------|-------------|
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | | | | | | 20 | 20% |
| CO2 | | 20 | | | | | 20 | 20% |
| CO3 | | | 10 | 10 | 20 | | 40 | 40% |
| CO4 | | | | | | 20 | 20 | 20% |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 20 | 100% |



Dayananda Sagar Academy of Technology & Management

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| | | | | | |
|--|---|-----------------------------|----------|---|----------|
| Semester | : | 7 | | | |
| Course Title | : | Machine Vision and Robotics | | | |
| Course Code | : | BME703C | | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | | |
| Category | : | PEC | | | |
| Stream | : | Mechanical Engineering | CIE | : | 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : | 50 |
| Total Hours | : | 40 | SEE | : | 03 Hours |
| Credits | : | 3 | Duration | : | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|---|
| 1 | Understand the various sensors, grippers and its selection in robotics. |
| 2 | Apply principles of vision system for different techniques of Object recognition. |
| 3 | Analyze working principle of various drives, actuators and control concepts. |
| 4 | Determine the use of machine vision in industrial application. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-------------------|---|--------------|
| 1 | Introduction to robotics: Brief History, Basic Concepts of Robotics, Three laws, Elements of Robotic Systems - Robot anatomy, DOF, Misunderstood devices, Classification of Robotic systems on the basis of various parameters such as work volume, type of drive, Associated parameters, resolution, accuracy, repeatability, dexterity, compliance, RCC device, Introduction to Principles & Strategies of Automation, Types & Levels of Automations, Need of automation, Industrial applications of robot. | 08 |
| Pedagogy | Case Study on A typical industrial robot often has 6 DOF to mimic human arm movement | |
| 2 | Grippers and Sensors for Robotics: Grippers for Robotics - Types of Grippers, Guidelines for design for robotic gripper, Force analysis for various basic gripper system. Sensors for Robots - Types of Sensors used in Robotics, Classification and applications of sensors, Characteristics of sensing devices, Selections of sensors. Need for sensors and vision system in the working and control of a robot. | 08 |
| Pedagogy | PPT, Videos | |
| 3 | AI Techniques in Robotics: Socio-Economic aspect of robotisation. Economical aspects for robot design, Safety for robot and standards, Introduction to Artificial Intelligence, AI techniques, Need and application of AI, mobile robotics, New trends & recent updates in robotics. Mobile Robot locomotion: Types of locomotion, hopping robots, legged robots, wheeled robots, stability, manoeuvrability, controllability | 08 |
| Pedagogy | Use Problem-Based Learning (PBL) focused on the trade-offs of movement. | |
| 4 | Vision Algorithms: Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours – Image Enhancement : Gray value transformations, image smoothing, Fourier Transform – Geometric Transformation - Image segmentation – Segmentation of contours, lines, circles and ellipses – Camera calibration – Stereo Reconstruction. | 08 |
| Pedagogy | | |
| 5 | Applications: Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements - Vision and Tracking: Following the road, Iconic image processing, Multiscale image processing, Video Tracking - Learning landmarks: Landmark spatiograms, K-means Clustering, EM Clustering. | 08 |

| | |
|--|--|
| | <p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process |
|--|--|

| Text Books | |
|-----------------|---|
| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
| 1 | Kaushik Kumar and B. Sridhar Babu, Industrial Automation and Robotics: Techniques and Applications, Taylor and Francis Publications, 2023. |
| 2 | Introduction to Autonomous Robots: Mechanisms, Sensors, Actuators, and Algorithms, Nikolaus Correll, Bradley Hayes, Christoffer Heckman, MIT Press, 2022. |
| Reference Books | |
| 1 | Recent Advances in Robotics, Factory Automation and Intelligent Networked Systems, Dr Sergey Y Yurish, MDPI, 2025. |
| 2 | Co-Intelligence: Living and Working with AI, Ethan Mollick, Portfolio Publisher, 2024. |
| 3 | Robotics: Control, Sensing, Vision and Intelligence K S Fu, McGraw-Hill Publication, 1987. |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----|---|------------|---------------------|
| CO1 | Explain the concepts of different drives and actuators used in robots | Understand | 2 |
| CO2 | Apply the image capturing and processing techniques | Apply | 3 |
| CO3 | Analyze functions of sensors, grippers used in robots. | Analyze | 4 |
| CO4 | Evaluate the efficacy of multiscale image processing against iconic processing techniques | Evaluate | 5 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 2 | | | | | | | | | | | | 2 | |
| CO2 | | 3 | | | | | | | | | | | | |
| CO3 | | | 2 | | 3 | | | | | | | | | |
| CO4 | | | | 3 | | | | | | | | | | 2 |

Weblinks and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://www.youtube.com/watch?v=0hW8v8H_B7M - Google Search |
| 2 | https://www.youtube.com/watch?v=NBcAF0ExsXo |
| 3 | https://www.google.com/search?q=https://www.youtube.com/watch%3Fv%3Df7_3XU2mX68 |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | - | - | - | - |
| Apply | 20 | - | 25 | - |
| Analyse | 20 | 10 | 25 | - |
| Evaluate | 10 | 20 | - | 25 |
| Create | - | 20 | - | 25 |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|-----------|-----------------|-----------------|-----------|-----------|-------------|--------------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | | | | | | 20 | 20% |
| CO2 | | 20 | | | | | 20 | 20% |
| CO3 | | | 10 | 10 | 20 | | 40 | 40% |
| CO4 | | | | | | 20 | 20 | 20% |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 20 | 1000% |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | |
| Understand | 20 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|-----------|-----------------|-----------------|-----------|-----------|-------------|--------------|
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | | | | | | 20 | 20% |
| CO2 | | 20 | | | | | 20 | 20% |
| CO3 | | | 10 | 10 | 20 | | 40 | 40% |
| CO4 | | | | | | 20 | 20 | 20% |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 20 | 1000% |



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

| | | | |
|--|---|---------------------------|----------------------------|
| Semester | : | 7 th | |
| Course Title | : | AI IN SMART MANUFACTURING | |
| Course Code | : | BME703D | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | |
| Category | : | PEC | |
| Stream | : | Mechanical Engineering | CIE : 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE : 50 |
| Total Hours | : | 40 Hrs (T) | SEE : 03 Hours Duration |
| Credits | : | 03 | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|---|
| 1 | Provide a comprehensive understanding of artificial intelligence methods and techniques applicable to smart manufacturing systems, including machine learning, deep learning, and intelligent automation. |
| 2 | Integrate AI technologies in automated factory environments aligned with Industry 5.0, focusing on human-centric, sustainable, and resilient manufacturing systems. |
| 3 | Develop the ability to identify and solve real-world problems in automated and smart factories using AI-based approaches such as predictive maintenance, quality control, process optimization, and decision support systems. |
| 4 | Evaluate the concepts of AI for the future emerging applications for smart manufacturing. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in Smart Manufacturing.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-------------------|--|--------------|
| 1 | Fundamentals of Industry 5.0 & Smart Factories Introduction to Smart Manufacturing: Evolution from traditional manufacturing, digital transformation, and Industry 5.0 concepts. Cyber-Physical Systems (CPS): Integration of computational algorithms with physical components. IIoT (Industrial Internet of Things): Sensors, actuators, communication protocols, and industrial networks | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 2 | Digital Manufacturing & Modeling Digital Twins and Virtual Factory: Simulating factory environments for optimization before physical implementation. CAD/CAM/CAE Integration: Advanced 3D modeling and product lifecycle management (PLM). Additive Manufacturing (3D Printing): Materials, processes (Vat Photopolymerization, Material Jetting, FDM), and design for additive manufacturing. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 3 | Data Analytics & AI in Production Industrial Data Analytics: Data collection, processing, and visualization for manufacturing optimization. Machine Learning for Manufacturing: Predictive maintenance, quality control, and process optimization. Machine Vision & Image Processing: Automated inspection and robotic vision systems. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| 4 | Advanced Robotics & Automation Industrial Robotics & Automation: Kinematics, dynamics, and control of robotic arms. Intelligent Mobile Robots: Autonomous robots (AGVs/AMRs) for logistics. PLC and HMI: Programmable Logic Controllers, Human Machine Interfaces, and pneumatic/electro-pneumatic systems. | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |

| | | |
|-----------------|--|-----------|
| 5 | <p>Sustainability & Emerging Trends</p> <p>Sustainability & Green Manufacturing: Energy efficiency, circular economy principles, and environmental health.</p> <p>Smart Supply Chain: Digital supply chain management and AI-driven logistics.</p> <p>Cybersecurity in Manufacturing: Protecting industrial control systems.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| | <p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process | |

Text Books

| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
|---------|--|
| 1 | Automation, Production Systems and CIM, Groover M.P., Prentice-Hall, New Delhi, 2020. |
| 2 | A Comprehensive guide to AI and Expert Systems, Robert Levine , McGraw Hill Inc, 2020. |

Reference Books

| | |
|---|--|
| 1 | Intelligent Manufacturing Systems, Andrew Kusiak/Prentice Hall, 2020 |
| 2 | Automated Planning- Theory and Practice, Malik Ghallab Malik, Morgan Kaufmann, 2020. |
| 3 | Machine Learning, Mitchell T, Mc-Graw Hill, 2022 |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----|---|------------|---------------------|
| CO1 | Recognize the fundamentals and types of Artificial Intelligence for Industry 5.0 | Understand | L2 |
| CO2 | Apply the various techniques of Artificial Intelligence related to smart manufacturing. | Apply | L3 |

| | | | |
|------------|--|-----------------|-----------|
| CO3 | Analyze how Artificial Intelligence contributes in optimizing the manufacturing techniques | Analyze | L4 |
| CO4 | Evaluate the sustainability and emerging trends in smart manufacturing. | Evaluate | L5 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | | 3 | | | | | | | | | | | |
| CO2 | | | | | 2 | | | | | | | | | |
| CO3 | | | | | 3 | | | | | | | | | |
| CO4 | | | | | 2 | | | | | 2 | | | | |

Weblinks and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc25_ge44/preview |
| 2 | https://onlinecourses.nptel.ac.in/noc26_ge04/preview |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | 40 | - | - | - |
| Apply | 10 | 10 | - | - |
| Analyse | - | 40 | 50 | 50 |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 10 | 10 | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 100 | 100 |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | - |
| Understand | 40 |
| Apply | 20 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | - |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 10 | 10 | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| Total | | | | | | | 100 | 100 |



Dayananda Sagar Academy of Technology & Management
(Autonomous Institute under VTU)

Affiliated to **VTU**
Approved by **AICTE**
Accredited by **NAAC** with **A+** Grade
6 Programs Accredited by **NBA**
(CSE, ISE, ECE, EEE, MECH, CV)



| | | | | | |
|---|---|--|-----------------|---|-----------------|
| Semester | : | 7th | | | |
| Course Title | : | AI in Supply Chain Management & Introduction to SAP | | | |
| Course Code | : | BME704A | | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | | |
| Category | : | OEC | | | |
| Stream | : | ME | CIE | : | 50 Marks |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : | 50 Marks |
| Total Hours | : | 40 Hours (T) | SEE | : | 3 Hours |
| Credits | : | 03 | Duration | : | |

Course Learning Objectives: Students will be able to

| Sl. No | Course Objectives |
|---------------|---|
| 1 | Discover the key drivers of enterprise resource planning and their interrelationships with strategy. |
| 2 | Develop solutions for a variety of supply chain management & design problems. |
| 3 | Evaluate inter firm and intra firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories, and strategic alliances. |
| 4 | Evaluate the usage of different modules of SAP. |

Teaching-Learning Process

Pedagogical Initiatives:

These are sample strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.



DSATM

Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)

COURSE CURRICULUM

| Module No. | Topics | Hours |
|-----------------|---|-------|
| 1 | <p>Module 1: Introduction: Supply Chain - Fundamentals - Evolution - Role in Economy – Importance - Decision Phases - Supplier Manufacturer - Customer chain. Enablers/ Drivers of Supply Chain Performance. Supply chain strategy - Supply Chain Performance Measures. Introduction to Artificial Intelligence (AI) in Supply Chain Management Strategic Sourcing Outsourcing - Make Vs buy - Identifying core processes - Market Vs Hierarchy - Make Vs buy continuum - Sourcing strategy - Supplier Selection and Contract Negotiation.</p> | 8 |
| Pedagogy | Demonstration, PPT, Video Lectures | |
| 2 | <p>Module 2: Warehouse Management Stores Management - Stores systems and procedures - incoming materials control stores accounting and stock verification, Obsolete, surplus and scrap value analysis - material handling transportation and traffic management - operational efficiency – productivity - cost effectiveness - performance measurement. AI applications in material handling Supply Chain Network Distribution Network Design - Role - Factors Influencing Options, Value Addition - Distribution Strategies - Models for Facility Location and Capacity Allocation. Distribution Center Location Models. Introduction to AI applications in warehouse operations and distribution systems</p> | 8 |
| Pedagogy | Demonstration, PPT, Video Lectures | |
| 3 | <p>Module 3: Introduction to ERP: Enterprise–An Overview, Integrated Management Information, Business Modelling, Integrated Data Model. Introduction to AI enabled ERP systems and intelligent enterprise management ERP Manufacturing Prospective: MRP-Material Requirement Planning, BOM-Bill of Material, MRP-Manufacturing Resource Planning, DRP-Distributed Requirement Planning, PDM-Product Data Management, Role of AI in demand forecasting, material requirement planning and production scheduling. ERP Modules: Plant Maintenance, Quality Management, Materials Management. Application of AI in predictive maintenance under Plant Maintenance module. AI applications in Quality Management for defect prediction and quality analytics.</p> | 8 |
| Pedagogy | Demonstration, PPT, Video Lectures | |
| 4 | Module 4: | 8 |

| | | |
|-----------------|---|---|
| | Introduction to SAP MM: SAP Material Management, Procurement process, Organization structure, Enterprise structure, Master data management, purchase Info record, source list, procurement cycle, purchase requisition, request for quotation, purchase order, inventory management, invoice verification, service management, transaction code. Introduction to AI driven procurement systems. Role of AI in supplier selection and vendor performance analysis. Application of AI in demand forecasting and material requirement | |
| Pedagogy | Demonstration, Hands on Sessions, Experiential Learning | |
| 5 | Module 5: Introduction to SAP EWM: Difference between WM and EWM, Real time warehouse, storage types, and process flow in warehouse, Master data, Product Master, Business partner, Different storage types and configuring storage type search sequence, Storage bins, Different ways to create storage bins in SAP EWM. Introduction to AI enabled smart warehouses and real-time warehouse management. Role of AI in warehouse space optimization and storage bin allocation | 8 |
| Pedagogy | Demonstration, Hands on Sessions, Experiential Learning | |

| | |
|------------------------|--|
| Text Books | |
| 1 | Supply Chain Management: Strategy, Planning, & Operation, Sunil Chopra, Dharam Vir Kalra, Gourav Dwivedi, Pearson, Seventh edition, 2024. |
| 2 | Enterprise Resource Planning, Alexis Leon, McGraw Hill; Fourth edition, 2019. |
| 3 | Materials Management: An Integrated Approach, P. Gopalakrishnan, M. Sundaresan, Prentice Hall India, 2022. |
| Reference Books | |
| 1 | Materials Management with SAP ERP: Functionality and Technical Configuration, Martin Murray & Jawad Akhtar, SAP Press; Fourth edition, 2020. |
| 2 | Warehouse Management with SAP S/4hana: Embedded and Decentralized EWM, Namitha Sachan, Aman Jain, SAP Press; 4th edition, 2024. |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----|--|------------|---------------------|
| CO1 | Describe the framework, drivers and performance measures of Supply Chain Management. | Understand | L2 |
| CO2 | Apply ERP concepts to illustrate the strategic significance and integrated functionalities of Enterprise Resource Planning systems. | Apply | L3 |
| CO3 | Analyze SAP MM components and their influence on procurement and inventory management processes. | Analyze | L4 |
| CO4 | Analyze SAP EWM functionalities for optimizing warehouse operations and distribution efficiency. | Analyze | L4 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | 1 | | | | | | | | | | | | |
| CO2 | 3 | 2 | 1 | | 2 | | | | | | | | | |
| CO3 | 3 | 3 | 1 | | 2 | | | | | | | | | |
| CO4 | 3 | 3 | 2 | | 2 | | | | | | | | | |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | 40 | - | - | - |
| Apply | 10 | 10 | - | - |
| Analyze | - | 40 | 50 | 50 |
| Evaluate | - | - | - | - |
| Create | - | - | - | - |

Weblinks and Video Lectures (e-Resources)

| | |
|---|---|
| 1 | https://onlinecourses.nptel.ac.in/noc21_mg45/preview |
| 2 | https://nptel.ac.in/courses/110106045 |
| 3 | https://nptel.ac.in/courses/110105095 . |
| 4 | https://www.udemy.com/course/sapmmtraining/ |
| 5 | https://www.udemy.com/course/saps4hanammsourcingandprocurement/ |
| 6 | https://www.udemy.com/course/sap-extended-warehouse-management-ewm/ |

CIE Course Assessment Plan

| COs | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | | 40 | 40 |
| CO2 | | | 10 | 10 | | | 20 | 20 |
| CO3 | | | | | 20 | | 20 | 20 |
| CO4 | | | | | | 20 | 20 | 20 |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 100 | 100 |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (100% Theory Questions) |
|------------------|--------------------------------------|
| Remember | - |
| Understand | 40 |
| Apply | 20 |
| Analyze | 20 |
| Evaluate | 20 |
| Create | - |

SEE Course Plan

| COs | Marks Distribution | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|----------|----------|----------|-------------|-----------|
| | Module-1 | Module-2 | Module-3 | Module-4 | Module-5 | | |
| CO1 | 20 | 20 | | | | 40 | 40 |
| CO2 | | | 20 | | | 20 | 20 |
| CO3 | | | | 20 | | 20 | 20 |
| CO4 | | | | | 20 | 20 | 20 |
| Total | 20 | 20 | 20 | 20 | 20 | 100 | 100 |



Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

| | | | | | |
|--|---|--------------------------------------|----------|---|----------|
| Semester | : | 7 th | | | |
| Course Title | : | AI in PRODUCT DESIGN AND DEVELOPMENT | | | |
| Course Code | : | BME704B | | | |
| Course Type (Theory/ Practical/ Integrated) | : | Theory | | | |
| Category | : | PEC | | | |
| Stream | : | Mechanical Engineering | CIE | : | 50 |
| Teaching hours/ week (L:T:P:S) | : | 3:0:0:0 | SEE | : | 50 |
| Total Hours | : | 40 Hrs (T) | SEE | : | 03 Hours |
| Credits | : | 03 | Duration | : | |

Course Learning Objectives: Students will be able to:

| Sl. No | Course Objectives |
|--------|--|
| 1 | Elucidate the fundamental concepts, history, and terminology of Artificial Intelligence specifically within the context of the engineering design lifecycle. |
| 2 | Illustrate various knowledge representation techniques and search strategies used to solve complex, unstructured design problems. |
| 3 | Demonstrate the application of Machine Learning algorithms and Generative AI tools in creating and optimizing product prototypes. |
| 4 | Examine the integration of AI with modern manufacturing paradigms like Digital Twins, IoT, and Industry 4.0 for product monitoring. |
| 5 | Evaluate AI-driven design solutions based on technical feasibility, ethical considerations, and sustainability standards. |

Teaching-Learning Process

Pedagogical Initiatives:

Some sample strategies to accelerate the attainment of various course outcomes are listed below:

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts in C.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Adopt **Problem-Based Learning (PBL)**, which fosters students' analytical skills, and develops thinking skills such as evaluating, generalizing, and analyzing information rather than simply recalling it.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.



DSATM

**Scheme of Teaching and Examinations for BE Programme -2026-27
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2026-27)**

COURSE CURRICULUM

| Module No. | Topics | Hours |
|--|--|-------|
| Module 1: Introduction to AI and Design Thinking | | |
| 1 | <p>Core Concepts: History and evolution of AI in engineering; Strong vs. Weak AI in a design context.</p> <p>Design Frameworks: Integration of AI with the Product Life Cycle (PLC); AI's role in "Need Identification" and "Problem Formulation."</p> <p>Search Strategies: Using Uninformed (BFS/DFS) and Informed (Heuristic, A*) search for design space exploration.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| Module 2: Knowledge Representation in Design | | |
| 2 | <p>Data Models: Semantic nets, Frames, and Ontologies specifically for manufacturing and assembly.</p> <p>Reasoning: Deductive and Inductive reasoning for automating design rules.</p> <p>Case-Based Reasoning (CBR): Utilizing previous design "cases" to solve new design problems (a cornerstone of AI in engineering).</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| Module 3: AI for Generative Design and Optimization | | |
| 3 | <p>Generative AI: Introduction to Variational Autoencoders (VAEs) and GANs for creating 3D CAD models.</p> <p>Optimization: Genetic Algorithms (GA) and Particle Swarm Optimization (PSO) for parameter selection (e.g., minimizing weight while maintaining strength).</p> <p>Simulation: Using AI to accelerate Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD).</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| Module 4: Machine Learning in Product Development | | |
| 4 | <p>Supervised Learning: Regression models for cost estimation and classification for material selection.</p> | 08 |

| | | |
|---|--|-----------|
| | <p>Predictive Maintenance: Using sensor data and ML to design products that predict their own failure.</p> <p>Quality Control: Computer Vision (CNNs) for automated visual inspection during the development phase.</p> | |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| Module 5: Smart Manufacturing and Ethics | | |
| 5 | <p>Industry 4.0: Digital Twins and the Internet of Things (IoT) in the design loop.</p> <p>Collaborative Design: Multi-agent systems in distributed design environments.</p> <p>Ethics: Bias in AI-driven design, data security, and the environmental impact of AI-optimized products.</p> | 08 |
| Pedagogy | Power point presentations, Video lectures, Quiz, Seminar | |
| | <p>Pedagogical Initiatives (Not limited to):</p> <ul style="list-style-type: none"> • Think Pair and Share (Blended Learning): provides an opportunity for students to learn from one another • Problem Solving: encourages cognitive thinking and enables creative problem solving • Poster Presentation: allows students to represent the concepts visually in order to understand the topics easily. • Case studies: maps different domains in real time applications • Demonstration: exhibits the implementation process | |

Text Books

| Sl. No. | Title of the Book/Name of the author/Name of the publisher/Edition and Year |
|---------|--|
| 1 | Product Design and Development: Karl T. Ulrich, Steven D. Eppinger, & Maria C. Yang 7th Edition (2020), McGraw Hill Education |
| 2 | Artificial Intelligence: A Modern Approach: Stuart Russell & Peter Norvig 4th Edition (2021/2022), Pearson Education |
| 3 | Machine Learning: S. Sridhar & M. Vijayalakshmi 1st Edition (2021), Oxford University Press |

Reference Books

| | |
|---|--|
| 1 | Engineering Design: George E. Dieter & Linda C. Schmidt 6th Edition (2021), McGraw Hill |
| 2 | Deep Learning: Ian Good fellow, Yoshua Bengio, & Aaron Courville, (2022), The MIT Press, Massachusetts, USA. |
| 3 | AI for Everyone: A Beginner's Handbook: Saptarsi Goswami, Amit Kumar Das, & Amlan Chakrabarti 1st Edition (2024), Pearson |

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

| CO | Course Outcomes | RBT Level | RBT Level Indicator |
|-----|--|------------|---------------------|
| CO1 | Elucidate the core components of AI and the traditional stages of the Product Development Process (PDP) | Understand | L2 |
| CO2 | Illustrate different AI reasoning methods (Deductive, Inductive, Case-Based) used to automate design rules. | Apply | L2 |
| CO3 | Apply supervised and unsupervised machine learning models to predict product performance and select optimal materials. | Apply | L3 |
| CO4 | Analyze a product's design space using generative algorithms to identify structural or functional improvements. | Analyze | L4 |
| CO5 | Evaluate the use of specific AI technologies in a product's lifecycle, considering ethical bias and environmental impact. | Evaluate | L5 |

Mapping of Course Outcomes to Program Outcomes:

| CO/PO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|
| CO1 | 3 | | 3 | | | | | | | | | | | |
| CO2 | | 2 | | | 2 | | | | | | | | 1 | |
| CO3 | | 3 | | 3 | 3 | | | | | | | | | |
| CO4 | | | | 2 | 1 | | | | | | | | | 2 |
| CO5 | | | 2 | | | | | | | | | | 2 | |

Web links ,Video Lectures and online certification (e-Resources)

| | |
|---|---|
| 1 | https://online.vtu.ac.in/course/1-product-design-and-development |
| 2 | https://nptel.ac.in/courses/110107627 |
| 3 | https://nptel.ac.in/courses/106106139 |
| 4 | https://www.youtube.com/watch?v=uAwh2L2sGAA |

| | |
|---|---|
| 5 | https://www.google.com/search?q=https://vtu.ac.in/en/e-learning/ |
| 6 | https://www.google.com/search?q=https://www.geeksforgeeks.org/artificial-intelligence-tutorial/ |
| 7 | https://www.ibm.com/design/ai/ |
| 8 | https://www.coursera.org/specializations/ai-product-management-duke |

CIE- Continuous Internal Evaluation (50 Marks)

| Bloom's Category | Theory | | | |
|------------------|-----------------------------------|----------|---|----------|
| | Continuous Assessment Tests (IAT) | | Continuous Comprehensive Assessment (CCA) | |
| | IAT-1 | IAT-2 | CCA-1 | CCA-2 |
| | 50 Marks | 50 Marks | 50 Marks | 50 Marks |
| Remember | - | - | - | - |
| Understand | 40 | - | - | - |
| Apply | 10 | 10 | - | - |
| Analyse | - | 40 | 50 | 50 |

CIE Course Assessment Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 10 | 10 | | | | | 20 | 20 |
| CO2 | 10 | 10 | | | | | 20 | 20 |
| CO3 | | | 10 | 10 | | | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| CO5 | | | | | 10 | 10 | 20 | 20 |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 100 | 100 |

SEE- Semester End Examination (50 Marks)

| Bloom's Category | SEE Marks (90% Theory+10% Practical Questions) |
|------------------|---|
| Remember | - |
| Understand | 20 |
| Apply | 40 |
| Analyse | 20 |
| Evaluate | 20 |
| Create | - |

SEE Course Plan

| CO's | Marks Distribution | | | | | | Total Marks | Weightage |
|--------------|--------------------|----------|-----------------|-----------------|----------|----------|-------------|-----------|
| | Test-1 | | | Test-2 | | | | |
| | Module-1 | Module-2 | Module 2 to 2.5 | Module-2.5 to 3 | Module-4 | Module-5 | | |
| CO1 | 10 | 10 | | | | | 20 | 20 |
| CO2 | 10 | 10 | | | | | 20 | 20 |
| CO3 | | | 10 | 10 | | | 20 | 20 |
| CO4 | | | | | 10 | 10 | 20 | 20 |
| CO5 | | | | | 10 | 10 | 20 | 20 |
| Total | 20 | 20 | 10 | 10 | 20 | 20 | 100 | 100 |

CAPSTONE PROJECT
(Phase-2)

CAPSTONE PROJECT (Phase-1 & 2):

Capstone Project – Guidelines & Implementation Framework (UG Engineering Programs)

1. Introduction

The Capstone Project is a comprehensive, year-long project carried out in **two phases during the 6th and 7th semesters** of the undergraduate engineering/technology program. It integrates knowledge and skills acquired from multiple courses and disciplines to address a **complex, real-world problem**.

This project provides students with an opportunity to apply:

- Scientific principles
- Engineering methodologies
- Technological tools

to **conceive, design, implement, and evaluate an engineering solution**.

The Capstone Project serves as a **culminating academic experience** enabling students to demonstrate attainment of program outcomes including:

- Problem-solving ability
- Teamwork
- Communication skills
- Practical application of engineering principles

Students may undertake the project:

- Individually, OR
- In a group **not exceeding four students**

The group may include:

- Students from the same discipline
- Students drawn from different disciplines

2. Types of Capstone Projects

Capstone projects undertaken during the one-year duration may fall into one or more of the following categories:

a) Research-Oriented Projects

- Focus on investigating new concepts, theories, or technologies.

- Aim to generate new knowledge or contribute to academic research.

b) Experimental / Analytical Projects

- Based on laboratory or field experiments to validate a hypothesis or study a phenomenon.
- Include detailed data collection, analysis, and interpretation.

c) Simulation / Modelling Projects

- Use computational tools to model, simulate, and predict system behaviour.
- Reduce the need for physical prototyping in the initial stages.

d) Industrial / Industry-Sponsored Projects

- Carried out in collaboration with an industry partner.
- Address real-world engineering problems faced by the organization.

e) Interdisciplinary / Multidisciplinary Projects

- Combine knowledge and techniques from multiple engineering domains.
- May also involve other fields such as:
 - Management
 - Medicine
 - Environmental sciences

f) Entrepreneurial / Innovation Projects

- Focus on product or service innovation with potential for commercialization.
- Include:
 - Market analysis
 - Cost estimation
 - Business planning

3. Objectives of the Capstone Project

The objectives of the Project Work are:

1. To encourage independent learning and an innovative attitude among students.
2. To develop interactive attitude, communication skills, organization, time management, and presentation skills.
3. To impart flexibility and adaptability.
4. To inspire teamwork.
5. To expand intellectual capacity, credibility, judgment, and intuition.
6. To ensure adherence to punctuality and meeting deadlines.
7. To instill responsibility towards oneself and others.
8. To train students to present project work confidently in seminars, enhance communication skills, and participate in discussions to exchange ideas.

4. Capstone Project – Phase I Evaluation

Capstone Project Phase-I shall have **Continuous Internal Evaluation (CIE) only**.

4.1 Evaluation Committee – Single Discipline Project

The Departmental Project Review Committee shall consist of:

- One Senior Professor
- Project Guide
- One additional faculty member appointed by the Principal

4.2 Evaluation Committee – Interdisciplinary Project

The Project Review Committee shall consist of:

- One Senior Professor
- Department Project Guide
- Interdepartmental Project Guide(s)
- One faculty member from a related department

All members shall be appointed by the Principal.

4.3 Evaluation Criteria

Phase-I evaluation shall be based on:

- Rubrics designed to measure **NBA Graduate Attributes**

Successful completion of Phase-I allows the student to proceed to **Phase-II**.

5. Capstone Project – Phase II Evaluation

5.1 Continuous Internal Evaluation (CIE)

CIE for Phase-II shall be conducted similarly to Phase-I using the designated committee.

5.2 Semester End Examination (SEE)

The SEE shall be conducted by:

- **University-appointed examiners**

Assessment shall be based on:

- Rubrics designed to measure **NBA Graduate Attributes**

6. Continuous Internal Evaluation (CIE) Procedure

6.1 Single Discipline Project

The CIE marks shall be awarded by a committee consisting of:

- Head of the concerned Department
- Two senior faculty members of the Department
- One of the two faculty members shall be the Project Guide

6.2 Distribution of CIE Marks

The CIE marks for the project work shall be based on:

| Component | Weightage |
|----------------------------|------------------|
| Project Report | 50% |
| Project Presentation Skill | 25% |
| Question & Answer Session | 25% |

Non-Credit Mandatory Courses (NMC): are aimed at enhancing students' knowledge, skills, and awareness beyond the core curriculum. Successful completion of the NMC is compulsory for fulfilling the requirements of the academic program. It shall not be considered for the computation of SGPA, CGPA and vertical progression. Each student shall register for the prescribed NMC(s) in the prescribed semester. A student who fails to qualify in the prescribed NMC shall not be eligible for the conferment of the degree.

AICTE Activity Points

Apart from technical knowledge and skills, to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. To match these requirements, AICTE has created a unique mechanism of awarding minimum 100 Activity Points for regular students and 75 Activity Points for Lateral Entry students over and above the academic grades.

The activities can be spread over the entire duration of the programme and will be reflected in the Student's VIII Semester Grade Card. It shall not be considered for computation of SGPA/CGPA and for vertical progression. The total duration of the activities for the entire programme is 320 hours for regular students and 240 hours for lateral entry students.

Break-up of CCE marks for activity points:

Evaluation by the Proctor/Coordinator 50 marks

Evaluation by the Dept. Committee

(i) Report 20 marks

(ii) Presentation 20 marks

(iii) Outcome 10 marks

Total 100 marks

1. No SEE for AICTE Activity Points.

2. Students will be awarded either NP or P grade based on marks obtained.

Students will be awarded 'Degree' only on earning P grade in the Activity Points.

8th SEMESTER

Projects

1. Community Project: A community is a social unit or group of people sharing socially-significant characteristics, such as place, set of norms, culture, religion, values, customs or identity. A community project involves addressing issues or needs within such a community or a network of entities working toward a common purpose. These projects may cover a wide range of areas, including welfare, sustainability, technology integration, and social development. Examples include establishing and maintaining an orphanage, implementing solar power generation and its maintenance, or developing environmental improvement solutions, etc. A community project is an experiential learning activity that encourages students to identify, analyse, and address real-life problems of the community using engineering knowledge. It aims to promote social responsibility and civic engagement, interdisciplinary thinking and collaboration and practical application of theoretical concepts, thereby enabling students to contribute meaningfully to community welfare and sustainable development. Students can take up project individually or in a group not exceeding 4 students.

The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work shall be based on the rubrics. SEE: SEE will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the rubrics.

2. Environmental Science Project:

The Environmental Science Project is an applied learning component designed to develop students' awareness, understanding, and responsibility toward the environment. It provides an opportunity to study real-world environmental issues and apply scientific and engineering principles to design feasible and sustainable solutions. The topics under environment include, but not limited to, climate change, biodiversity, air and water pollution, land use, excess use of natural resources, earthquakes, rise in the earth's temperature, power generation, soil erosion, environment issues related programme, etc. The project involves problem identification, field surveys, case studies, data collection, environmental audits, analysis, and proposal of remedial or preventive measures aimed at improving biodiversity, air quality, and thermal comfort, etc. Students can take up project individually or in a group not exceeding 4 students. Students can opt for Interdisciplinary Project based on their interest.

The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the rubrics. SEE: SEE will be conducted by the two examiners appointed by the University. The SEE marks awarded for the project work shall be based on the rubrics.

3. Hackathon Based Project (Academic):

The term hackathon is derived from the combination of hack (referring to clever problem-solving, not illegal activity) and marathon, which denotes an arduous (i.e., difficult) intellectual task requiring sustained effort, endurance, and mental resilience. The meaning of a hackathon varies depending on the specific context and intent. In an academic context, a hackathon can be considered to involve several concepts, ranging from resourceful, unconventional approaches to problem-solving. Though a hackathon is an event, typically lasting for a few days to address a specific challenge, for academic purposes, it is conducted as a noncompetitive semester-long activity. The evaluation is done as and when the project is completed, by a panel of industry experts. The hackathons not only help participants develop skills like problem-solving, critical thinking, creativity, teamwork, communication and time management, but also foster indigenous technology development, promote innovation and entrepreneurship, and contribute to non-formal learning and skill enhancement. Students can take up a hackathon project individually or in a group of not exceeding 4 students.

The respective BoS will announce the problem statements in the beginning of the 5th semester. The topic selected can be discipline specific, interdepartmental, industrial, social (refers to immediate human relations, interactions, and individual behaviour within a community), societal (describes larger, general issues, institutions, and structures that define society as a whole), environmental, health, financial, or innovative in nature, leading to development of a working prototype, application, or product. Hackathon projects are aligned with the principles of Outcome-Based Education (OBE) and support the objectives of innovation, skill development, and experiential learning in engineering education. Projects shall be evaluated by industry experts, based on creativity, problem-solving approach, teamwork, and possible implementation, as far as possible, as and when the project is completed. The evaluation shall be done as per the following; CIE: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work, shall be based on the rubrics. SEE: SEE will be conducted by the industry experts appointed

by the Head of the Institute/University. The SEE marks awarded for the project work shall be based on the rubrics.

4. Capstone Project :

The Capstone project is a comprehensive, year-long project carried out in two phases during 6th and 7th semesters of the undergraduate engineering/technology program. It integrates knowledge and skills acquired from multiple courses and disciplines to address a complex, real-world problem. This project provides students with an opportunity to apply scientific principles, engineering methodologies, and technological tools to conceive, design, implement and evaluate an engineering solution. It serves as a culminating academic experience to demonstrate program outcomes, including problem-solving ability, teamwork, communication skills, and practical application of engineering principles. Students can take up project individually or in a group not exceeding 4 students. The group may have students from the same discipline and drawn from different disciplines.

Types of Capstone Projects: Capstone projects undertaken for one year may fall into one or more of the following categories:

a) Research-Oriented Projects : • Focus on investigating new concepts, theories, or technologies. • Aim to generate new knowledge or contribute to academic research.

b) Experimental/Analytical Projects • Based on laboratory or field experiments to validate a hypothesis or study a phenomenon. • Including detailed data collection, analysis, and interpretation.

c) Simulation/Modelling Projects

- Use computational tools to model, simulate, and predict system behaviour.

- Reduce the need for physical prototyping in the initial stages.

d) Industrial/Industry-Sponsored Projects

- Carried out in collaboration with an industry partner.

- Address real-world engineering problems faced by the organization.

e) Interdisciplinary/Multidisciplinary Projects

- Combine knowledge and techniques from multiple engineering domains or other fields such as management, medicine, or environmental sciences.

f) Entrepreneurial/Innovation Projects

- Focus on product or service innovation with potential for commercialization.
- Include aspects of market analysis, cost estimation, and business planning.

Phase I Evaluation: Capstone Project Phase-I shall have only Continuous Internal Evaluation (CIE). In case disciplinary capstone project, the CIE shall be conducted by the Departmental Project Review Committee, which consists of a Senior Professor, the Project Guide, and one additional faculty member appointed by the principal for projects within the parent discipline. For Interdisciplinary Projects, the Project Review Committee will consist of one Senior Professor, the department and interdepartmental Project Guides and one faculty member from a department related to the interdisciplinary project. The committee members are appointed by the principal of the college.

Phase-I evaluation shall be based on rubrics designed to measure graduate attributes defined by NBA. Successful completion of Phase-I allows the student to proceed to Phase-II.

Phase II Evaluation: CIE of Phase shall be evaluated as indicated with phase -I evaluation. The SEE shall be conducted by university-appointed examiners. The assessment shall be based on rubrics designed to measure graduate attributes defined by NBA.

Note: One Publication indexed in Scopus or Web of Science is Mandatory from Students Projects

Internship

Internship refers to the position of a student as trainee or a temporary (or unconfirmed) employee, who works in an organization, with or without pay, in order to gain work experience or satisfy requirements for a qualification. It is a structured, supervised professional experience in an industry, research organization, or community setting. Students taking up internship may be with or without stipend. Internships play a vital role in bridging the gap between theoretical education and professional practice. In general, engineering internships serve as a crucial component of professional education by providing experiential learning, industry readiness, and holistic skill development, ultimately producing competent engineers or entrepreneurs. Apart from these, it develops professional ethics, work culture awareness and communication skills. Some of the common types of internships are as follows:

- i. Industry Internship: Carried out in the engineering industry, companies, manufacturing units, startups, business, IT industry. The topic involved may be technical, managerial, production-related tasks, live projects, or innovative activities.
- ii. Research Internship: Carried out at universities, research labs, or R and D departments or organisations. The internship may involve literature review, data analysis, and experimental work leading to publications, prototypes, technical reports or innovations. The research internship may induce students to plan for higher studies or academic careers.
- iii. Academic or Teaching Internship: Carried out at educational institutions. The students assist in academic activities, laboratory sessions or content development, and prepare or present report, presentation and student evaluation. The internship encourages interest in academia and pedagogy, develops new skills, helps to gain a competitive edge on the job market or for post-baccalaureate studies.
- iv. Community or Societal Internship: Carried out with government schemes, or rural development projects, Non-Governmental Organisations (NGOs). The internship focused on social and community development activities promotes social responsibility, sustainable development awareness, encourages civic responsibility and ethical engagement.
- v. Entrepreneurship Internship: Undertaken in association with start-ups, or entrepreneurship cells or launching own idea in Preincubations/Incubation centres. The internship offers exposure to business planning, prototype product development, and promotes innovation, risk-taking, and entrepreneurial mindset.
- vi. Virtual or Remote or Online Internship: Undertaken using online tools and digital collaboration platforms. Such internships are common in content writing, data science, marketing, and software development. It

offers flexible learning environments and access to global opportunities, and allows participation in real projects without being physically present, from anywhere and anytime.

- vii. Government Internship: Ministries, public sector units, or civic bodies offer such internships in policy research, administrative tasks, or public service projects. This internship is for students interested in governance or public administration.
- viii. Post-Placement Internship: Refers to the internship offered to students after they receive a confirmed job offer (placement) from a company, but before formally joining as full-time employees. This internship (on-site, virtual, or hybrid) ensures that students are groomed to be professionally ready, technically competent, and culturally aligned with the organization even before official induction.
- ix. Skill Enhancement Internship: Carried out at reputed organisations in offline or online mode. The aim of the internship is to expose to real-world tools, technologies, and professional environments to improve a student's employability by offering hands-on experience, application of theoretical concepts, and skill development aligned with current industry and technical trends. Skill Enhancement Internships, depending on focus area and scope, can be carried out at various organisations such as, Academic and Research Institutions, Industry and Corporate Settings, Government and Public Sector, NGOs and Social Enterprises. For Skill Enhancement Internship topics refer to <https://online.vtu.ac.in/category/courses/Skill-Enhancement-Course>.

Note on Internship for the Attention of Students and Colleges

- Placement training conducted at the college level, whether by third-party agencies, training institutes, or internal faculty, shall not be considered as internship for either a 15 week or a 30-week period.

The official engagement period of 15-week or 30-week for students selected/recruited by the company/organization only at their premises under the supervision of the company, shall only be considered as an internship.

- The period of training and working of students who have been recruited as employees by organisations at the beginning of the 4th year of the programme, shall also be treated as an internship.
- Students and colleges/institutions shall follow all the guidelines and procedures of the organization and the University's Internship Guidelines, and complete the internship within a period that matches with the VTU Calander and examination timetable.
- The assigned institution faculty mentor/ coordinator/guide should monitor the student's progress, and document offer letters, training reports, attendance, and evaluations for awarding academic credits.

- All students undergoing an internship, should adhere to all the guidelines, reporting protocols, and evaluation procedures prescribed by the University.
- Students must submit the certificate of completion of an internship with the period of internship clearly mentioned, from the respective company/organization.
- Colleges must submit details of students opting for internship during the odd and even semesters, along with a copy of the company selection letter, to the VTU when notified by the University.

Attention: In addition to the internship support provided by the college, students have the option to select internships through the AICTE and VTU Internship Portals. To ensure uniformity, quality, and transparency in the internship process, VTU has developed a dedicated web portal that serves as a single platform where colleges can also register companies offering internships. Every student is required to register on the portal before the commencement of their internship, and their progress will be monitored through the same platform.

As per VTU norms, the CIE shall be conducted based on the students' performance during the training program, assessed through rubrics from the company supervisor. The SEE evaluation shall be conducted by the college as per the examination timetable published by the VTU.

AICTE Activity Points

Apart from technical knowledge and skills, to be successful as professionals, students should have excellent soft skills, leadership qualities and team spirit. They should have entrepreneurial capabilities and societal commitment. To match these requirements, AICTE has created a unique mechanism of awarding minimum 100 Activity Points for regular students and 75 Activity Points for Lateral Entry students over and above the academic grades.

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Evaluation by the Dept. Committee

(i) Report 20 marks

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Total 100 marks

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