# BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

**(Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE New Delhi)**

**Yelahanka, Bengaluru 560064**

## Bachelor of Engineering

## Department of Mechanical Engineering

# III and IV Semester Scheme and Syllabus
# 2022 Scheme
# Effective from the AY 2023-24

**Approved in the BoS meeting held on 13-10-2023**

# Vision and Mission of the Department

## Vision

- To develop technically competent Mechanical Engineering professionals for the benefit of the society

## Mission

- Impart quality education in Mechanical Engineering and allied areas by state- of- the- art- infrastructure and dedicated faculty.
- Provide conducive environment for both students and faculty to pursue higher education & research and to work ethically for the benefit of society.

## Program Educational Objectives (PEOs)

1. Be successful professionals in the field of Mechanical Engineering and allied areas
2. Exhibit skills to work effectively and ethically in multiple domains of engineering as part of a team
3. Excel in higher studies, research and adapt in a world of constantly developing technology

## Program Specific Outcomes (PSOs)

1. Design, Analyze and fabricate the mechanisms.
2. Analyze the fluid and thermal aspects of different mechanical systems and components.
3. Develop materials and components through different manufacturing methods with managerial skills.

**BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT**
(An Autonomous Institution Affiliated to VTU, Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru – 560064

**Date:** 16.10.2023

## CONTINUOUS INTERNAL EVALUATION AND SEMESTER END EXAMINATION PATTERN: 2022 BATCH ONWARDS

All students of 2022 scheme onwards are hereby informed to note the following with reference to Continuous internal evaluation and Semester end examination: The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The Minimum passing mark for the CIE is 40% of the Maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

| **IPCC COURSES: 4 CREDITS AND 3 CREDITS** | | | | | | |
|---|---|---|---|---|---|---|
| **Evaluation Type** | | **Internal Assessments (IAs)** | **Test/ Exam Marks Conducted for** | **Marks to be scale down to** | **Min. Marks to be Scored** | **Evaluation Details** |
| Theory Component | CIE – IA Tests | CIE – Test 1 (1.5 hr) | 40 | 15 | 06 | Average of two internal assessment tests each of 40 marks, scale down the marks scored to 15 marks |
| | | CIE – Test 2 (1.5 hr) | 40 | | | |
| | CIE – CCAs (Comprehensive Continuous Assessment) | CCA -1 | 10 | 10 | 04 | Any two assessment methods as per clause 22OB4.2 of regulations (if assessment is project based, then one assessment method may be adopted) |
| | | CCA-2 | 10 | | | |
| | **Total CIE Theory** | | | **25** | **10** | Scale down marks of tests and CCAs to 25 |
| Practical Component | CIE - Practical | | - | 15 | 06 | Conduction of experiments and preparation of laboratory records etc. |
| | CIE Practical Test | | 50 | 10 | 04 | One test after all experiment's to be conducted for 50 marks |
| | **Total CIE Practical** | | | **25** | **10** | Scale down marks of experiments, record and test to 25 |
| **Total CIE Theory + Practical** | | | | 50 | 20 | |
| **SEE** | | | 100 | 50 | 18 | SEE exam is a theory exam, conducted for 100 marks, scored marks are scaled to 50 marks |
| **CIE + SEE** | | | | **100** | **40** | |

The minimum marks to be secured in CIE to appear for SEE shall be 10 (40% of maximum marks-25) in the theory component and 10 (40% of maximum marks -25) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included in their respective modules only.

| Professional Core Course (PCC) courses: 03 and 02 Credit Courses | | | | | | |
|---|---|---|---|---|---|---|
| **Evaluation Type** | | **Internal Assessments (IAs)** | **Test/ Exam Marks Conducted for** | **Marks to be scale down to** | **Min. Marks to be Scored** | **Evaluation Details** |
| Theory Component | CIE – IA Tests | CIE – Test 1 (1.5 hr) | 40 | 25 | 10 | Average of two internal assessment tests each of 40 marks, scale down the marks scored to 25 marks. |
| | | CIE – Test 2 (1.5 hr) | 40 | | | |
| | CIE - CCAs | CCA -1 | 25 | 25 | 10 | Any two assessment methods as per clause 220B4.2 of regulations (if it is project based, one CCA shall be given ) |
| | | CCA-2 | 25 | | | |
| | **Total CIE Theory** | | | **50** | **20** | |
| **SEE** | | | 100 | 50 | 18 | SEE exam is a theory exam, conducted for 100 marks, scored marks are scaled down to 50 marks |
| **CIE + SEE** | | | | **100** | **40** | |

| NON IPCC COURSES: 01 Credit Courses-MCQ | | | | | | |
|---|---|---|---|---|---|---|
| **Evaluation Type** | | **Internal Assessments (IAs)** | **Test/ Exam Marks Conducted for** | **Marks to be scale down to** | **Min. Marks to be Scored** | **Evaluation Details** |
| Continuous Internal Evaluation Component | CIE – IA Tests (MCQs) | CIE – Test 1 (1 hr) | 40 | 25 | 10 | Average of two internal assessment tests each of 40 marks, scale down the marks scored to 25 marks |
| | | CIE – Test 2 (1 hr) | 40 | | | |
| | CIE - CCAs | CCA -1 | 25 | 25 | 10 | Any two assessment methods as per clause 220B4.2 of regulations |
| | | CCA-2 | 25 | | | |
| | **Total CIE Theory** | | | **50** | **20** | |
| **SEE (MCQ Type)** | | | | 50 | 18 | MCQ-type question papers of 50 questions with each question of 01 mark, examination duration is 01 hour |
| **CIE + SEE** | | | | **100** | **40** | |

| Professional Core Course Laboratory (PCCL) course- 01 credit | | | | | |
|---|---|---|---|---|---|
| **Evaluation Type** | **Internal Assessments (IAs)** | **Test/ Exam Marks Conducted for** | **Marks to be scale down to** | **Min. Marks to be Scored** | **Evaluation Details** |
| Continuous Internal Evaluation | CIE - Practical | - | 30 | - | Each experiment is to be evaluated for conduction with an observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments shall be approved by the PAC and are made known to students at the beginning of the practical session.<br>Record should contain all the specified experiments in the syllabus. Total marks scored by the students are scaled down to 30 marks (60% of maximum marks). |
| | CIE Practical Test | 100 | 20 | - | Department shall conduct a test of 100 marks after the completion of all the experiments listed in the syllabus. In a test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce. The suitable rubrics can be designed to evaluate each student's performance and learning ability by PAC. The marks scored shall be scaled down to 20 marks (40% of the maximum marks). |
| | **Total CIE** | - | **50** | **20** | |
| Semester End Examination | | 100 | **50** | **18** | General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result - 60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (Rubrics shall be approved by the PAC) |
| **CIE+SEE** | | **100** | **50** | **40** | |

| Computer Aided Engineering Drawing (BCEDK103/BCEDK203): 3 credit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Evaluation Type** | | **Topics/Modules** | **Computer Printout** | **Preparatory Sketch** | **Max Marks** | **Total Marks** | **Marks to be Scaled Down to** | **Min Marks to Pass** |
| **CIE** | **Sketchbook and CAD Modelling** | Projection of Points | 10 | 05 | 15 | 200 | 20 | 08 |
| | | Projection of Lines | 10 | 10 | 20 | | | |
| | | Projection of Planes | 20 | 15 | 35 | | | |
| | | Projection of Solids | 40 | 20 | 60 | | | |
| | | Isometric Projections | 20 | 15 | 35 | | | |
| | | Development of lateral surfaces | 20 | 15 | 35 | | | |
| | **Test 1** | Module 1 & 2 | 24 | 06 | 30 | 70 | 20 | 08 |
| | | Module 3 | 32 | 08 | 40 | | | |
| | **Test 2** | Module 3 | 32 | 08 | 40 | 70 | | |
| | | Module 4 | 24 | 06 | 30 | | | |
| | **CCA 1** | Module 5 | 08 | 02 | 10 | 10 | 10 | 04 |
| | **CCA 2** | Module 5 | 08 | 02 | 10 | | | |
| | **CIE Total** | | | | | | **50** | **20** |
| **SEE** | | Module 1 & 2 | 24 | 06 | 30 | **100** | **50** | **20** |
| | | Module 3 | 32 | 08 | 40 | | | |
| | | Module 4 | 24 | 06 | 30 | | | |
| **CIE + SEE** | | | | | | | **100** | **40** |

| Computer Aided Modelling for Manufacturing (BME305): 1 credit | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Evaluation Type** | | **Module** | **Computer Printout** | **Preparatory Calculations / Sketch** | **Max Marks** | **Total Marks** | **Marks to be Scaled Down to** | **Min Marks to Pass** |
| **CIE** | **Sketchbook and CAD Modeling** | Module 1 | 60 | 30 | 90 | 200 | 20 | 08 |
| | | Module 2 | 40 | 20 | 60 | | | |
| | | Module 3 | 40 | 10 | 50 | | | |
| | **Test 1** | Module 1 | 20 | 10 | 30 | 60 | 20 | 08 |
| | | Module 2 | 20 | 10 | 30 | | | |
| | **Test 2** | Module 1 | 20 | 10 | 30 | 60 | | |
| | | Module 3 | 20 | 10 | 30 | | | |
| | **CCA** | Module 1 | 30 | 10 | 40 | 40 | 10 | 04 |
| | **Total CIE** | | | | | | **50** | **20** |
| **SEE** | | Module 1 | 30 | 10 | 40 | 100 | **50** | **20** |
| | | Module 2 | 20 | 10 | 30 | | | |
| | | Module 3 | 20 | 10 | 30 | | | |
| **CIE + SEE** | | | | | | | **100** | **40** |

**220B 4.2 Continuous Internal Evaluation (CIE)**

1) For a theory course, with an L-T-P distribution of L-0-0, the CIE will carry a maximum of 50% weightage of the total marks of a course. Before the start of the Academic session of each Semester, a faculty may choose for his course Internal Assessment Test and a minimum of two of the following assessment methods with suitable weightage for each

i) Assignments (Individual and /or Group)

ii) Seminars

iii) Oral/ Online Quizzes

iv) Group Discussions

v) Case studies/ Case lets

vi) Practical orientation on Design Thinking, Creativity & Innovation

vii) Participatory & Industry – integrated learning

viii) Practical activities/ problem-solving exercises

ix) Class presentations

x) Analysis of Industry/ Technical/ Business Reports

xi) Reports on Guest Lectures/ Webinars/ Industrial Visits

xii) Industrial/ Social/ Rural projects

xiii) Participation in Seminars/ Academic Events/ Symposia, etc.

xiv) Any other academic activity

CoE 18/10/2023

Dean (AA) 18.10.2023

Principal 18/10

# Scheme of IV Semester

BMS Institute of Technology and Management

**B.E. in Mechanical Engineering**

**Scheme of Teaching and Examinations 2022**

Outcome Based Education (OBE) and Choice Based Credit System (CBCS)

(Effective from the academic year 2023-24)

**IV SEMESTER**

| Sl. No | Course and Course Code | | Course Title | Teaching Department (TD) and Question Paper Setting Board (PSB) | Teaching Hours /Week | | | | Examination | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Theory Lecture | Tutorial | Practical/ Drawing | Self - Study | Duration in hours | CIE Marks | SEE Marks | Total Marks | |
| | | | | | L | T | P | S | | | | | |
| 1 | PCC | BME401 | Applied Thermodynamics | TD:ME PSB:ME | 2 | 2 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 2 | IPCC | BME402 | Machining Science & Metrology | | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 3 | IPCC | BME403 | Fluid Mechanics | | 3 | 0 | 2 | | 03 | 50 | 50 | 100 | 4 |
| 4 | PCCL | BME404 | Mechanical Measurements and Metrology lab | | 0 | 0 | 2 | | 03 | 50 | 50 | 100 | 1 |
| 5 | ESC | BME405x | ESC/ETC/PLC | | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 6 | AEC/SEC | BME456x | Ability Enhancement Course/Skill Enhancement Course- IV | | If the course is Theory | | | | 01 | 50 | 50 | 100 | 1 |
| | | | | | 1 | 0 | 0 | | | | | | |
| | | | | | If the course is a lab | | | | 02 | | | | |
| | | | | | 0 | 0 | 2 | | | | | | |
| 7 | BSC | BBOK407 | Biology For Engineers | TD / PSB: BT, CHE, | 3 | 0 | 0 | | 03 | 50 | 50 | 100 | 3 |
| 8 | UHV | BUHK408 | Universal human values course | Any Department | 1 | 0 | 0 | | 01 | 50 | 50 | 100 | 1 |
| 9 | MC | BNSK459 | National Service Scheme (NSS) | NSS coordinator | 0 | 0 | 2 | | | 100 | -- | 100 | 0 |
| | | BPEK459 | Physical Education (PE) (Sports and Athletics) | Physical Education Director | | | | | | | | | |
| | | BYOK459 | Yoga | Yoga Teacher | | | | | | | | | |
| | | BNNK459 | NCC | NCC dept. | | | | | | | | | |
| | | BNMK459 | Music | Music Dept. | | | | | | | | | |
| | | | | | | | | | **Total** | **500** | **400** | **900** | **20** |

**PCC**: Professional Core Course, **PCCL**: Professional Core Course laboratory, **UHV**: Universal Human Value Course, **MC**: Mandatory Course (Non-credit), **AEC**: Ability Enhancement Course, **SEC**: Skill Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical **S= SDA**: Skill Development Activity, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation. K :This letter in the course code indicates common to all the stream of engineering.

| **Engineering Science Course (ESC/ETC/PLC) [L-T-P::3-0-0]** | | | |
|---|---|---|---|
| BME405A | Non Traditional Machining | BME405C | Micro Electro Mechanical Systems |
| BME405B | Environmental Studies | BME405D | Robotics and Automation |
| **Ability Enhancement Course / Skill Enhancement Course - IV** | | | |
| BME456A | Introduction to AI & ML [0-0-2] | BME456C | Introduction to Data Analytics [0-0-2] |
| BME456B | Digital Marketing [0-2-0] | BME456D | Programming in C++ [0-0-2] |

**Professional Core Course (IPCC):** Refers to 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. For more details, the regulation governing the Degree of Bachelor of Engineering /Technology (B.E./B.Tech.) 2022-23.

**National Service Scheme /Physical Education/Yoga/Music/NCC:** 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 and VI semesters (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 courses is mandatory for the award of degree.

# IV Semester Syllabus

**B. E. MECHANICAL ENGINEERING**
Choice Based Credit System (CBCS)

**Applied Thermodynamics** (2:1:0) 3
(Effective from the academic year 2022-23)

| | | | |
|---|---|---|---|
| Course Code | **BME401** | SEMESTER | **IV** |
| Teaching Hours/Week (L: T:P) | 2:2:0 | CIE Marks | 50 |
| Total Number of lecture hours | 40 | SEE Marks | 50 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course Objectives:**

This course will enable students to:

1. Know the fundamental concepts of IC engines and various methods to estimate the Indicated power, Brake power, frictional power
2. Study the combustion phenomenon in SI and CI engines and its controlling factor in order to extract maximum power, use of alternative fuels in SI and CI engines.
3. Acquire the knowledge related to working principle and applications of various gas power cycles, gas turbine cycles and vapour power cycles.
4. Understand various refrigeration systems
5. To study the functioning and applications of air-conditioning and psychrometry.

**Preamble:** Significance of thermodynamic concepts in the present scenario. Outcome of thermodynamic application on societal and renewable solutions.

**Module-1**

**Air standard cycles:** Carnot cycle**,** Otto, Diesel, Dual cycle, P-V and T-S diagrams, description, efficiencies, mean effective pressures, Comparison of Otto, Diesel and Dual cycles. numerical

**Gas power cycles:** Description and analysis of Brayton cycle, Regenerative, intercooling and reheating in gas turbine cycles**,** numerical.

**(08 Hours)**

**Self-Study Component**: Studies on Jet propulsion systems and Atkinson systems

**Module-2**

**Internal Combustion Engines:** Combustion phenomenon in SI and CI engines. Detonation and factors affecting detonation, performance analysis of I.C. engines, heat balance sheet, numerical.

**(08 Hours)**

**Self-Study Component:** Testing of Alternative fuels on IC engines.

**Module-3**

**Vapour Power Cycles:** Carnot vapour power cycle, drawbacks as a reference cycle, Simple Rankine cycle, description, T-S diagram, and analysis for performance, comparison of Carnot cycle and Rankine cycles, effects of temperature and pressure on Rankine cycle performance.

Actual vapour power cycles: Ideal and practical regenerative Rankine cycle, open and closed feed water heaters, reheat Rankine cycle, numerical.

**(08Hours)**

**Self-Study Component:** Innovative ideas/ design features to incorporate in thermal power plant

design for effective performance.

**Module-4**

**Refrigeration Cycles:** Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Any one case study on cold storage or industrial refrigerator. Air cycle refrigeration; reversed Carnot cycle, reversed Brayton cycle, Vapour absorption refrigeration system.

**(08 Hours)**

**Self Study Component:** Studies on Applications of Steam jet refrigeration.

**Module-5**

**Psychrometrics and Air-conditioning Systems:** Psychrometric properties of air, psychrometric chart, analyzing air-conditioning processes: heating, cooling, dehumidification and humidification, evaporative cooling, adiabatic mixing of two moist air streams. cooling towers, numericals.

**(08 Hours)**

**Self Study Component:** Studies on Applications of air conditioning for human comfort.

**Course Outcomes:**

The student will be able to:

**CO1:** Summarize the fundamental concepts of thermodynamics, IC engines, refrigeration Systems, psychrometry and air conditioning.

**CO2:** Apply the concepts of thermodynamics to air standard cycles, gas power cycles, IC engines, vapour power cycles, refrigeration systems, psychrometry and air conditioning.

**CO3:** Analyze air standard cycles, gas power cycles, IC engines and vapour cycles for optimum Performance.

**CO4:** Evaluate the performance parameters of air standard cycles, gas turbines, psychrometry and IC engines.

**CO5**: Evaluate the performance of refrigeration and air conditioning systems.

**Resource learning materials**

**TEXTBOOKS:**

1. P.K. Nag, "Basic and Applied Thermodynamics", Tata McGraw Hill, 6th edition, 2015.
2. PL Bellaney, Thermal engineering, Publisher, McGraw hill, 2017.

**REFERENCES:**

1. Yunus A. Cenegal., Michael A. Boles, "Thermodynamics- An Engineering Approach", Tata McGraw Hill publications, 7th edition, 2001.
3. Ganesan V, "I.C. Engines", Tata McGraw Hill, 4th edition, 2012.
4. M.L.Mathur & Sharma." IC Engines", Dhanpat Rai & sons-India, 8th edition, 2010.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**Machining Science and Metrology (3:0:1) 4**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME402** | SEMESTER | **IV** |
| Teaching Hours/Week (L:T:P) | 3:0:2 | CIE Marks | 50 |
| Total Number of Lecture Hours | 40 hours of theory+ 10 Lab slots | SEE Marks | 50 |
| Examination Pattern (SEE) | Theory | Exam Hours | 03 |

**Course objectives:**

1. To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
2. To introduce students to different machine tools to produce components having different shapes and sizes.
3. To develop the knowledge on mechanics of machining process and effect of various parameters on machining.
4. To understand the basic principles of measurements
5. To enrich the knowledge pertaining to gauge, comparator, and angular measurement.

**Preamble:** Special purpose machines and processes are used to manufacture complex engineering parts with high quality. Delivering innovative technologies that benefit the society.

**Module – 1**

**Basics of Metal cutting**: Orthogonal and oblique cutting. Mechanics of chip formation and its significance. Analysis of orthogonal cutting- Determination of shear angle, shear strain, cutting velocity relationship, forces acting on the cutting tool and their measurement, Merchant circle diagram. Numerical problems.

**Metal cutting machine tools:** Classification of machine tools, types of lathes, major parts of lathe machine and various operations carried out on lathe, calculation of machining time. Turret and capstan lathes. Basic types of cutting tools, geometry of single point cutting tool.

**(08 Hours)**

**Self-study:** Accessories of lathe machine, chip breakers.

**Module – 2**

**Milling Machines:** Up milling & down milling, classification of milling machines, various
Shapes produced on different milling operations, calculation of machining time. Types of milling cutters and milling cutter nomenclature.

Milling indexing: Need of indexing Simple, compound and differential indexing. Numerical problems on indexing.

**Shaping, Slotting and Planning Machines Tools:** Driving mechanisms of shaper, slotter and planer. Parts produced on shaping and planning machines, calculation of machining time on shaping machine.

**Drilling Machines:** Classification, constructional features of radial drilling machine and drilling operations, types of drill bits and drill bit nomenclature.

Abrasive machining: Grinding wheel characteristics, types of grinding operations, grinding wheel specification and selection.

Self-study: Construction of Column and Knee type and Vertical milling machine

**(08 Hours)**

**Self-study:** Studies on Chip breakers.

**Module – 3**

**Finishing Processes:** Principles of honing, lapping, super finishing, polishing and buffing.
Tool wear and Machinability: Temperature distribution in metal cutting, effect of cutting speed on temperatures. Tool wear mechanisms, types of tool wear, tool-life criteria, affect tool life on cutting parameters and factors affecting machinability of materials, numerical problems.

**Cutting tool materials:** Basic requirements of tool materials, major classes of tool materials. High-speed steel, cemented carbide, ceramics, CBN and diamond cutting tools, tool coatings.
Cutting fluids: Functions, properties of cutting fluids and types of cutting fluids.

**(08 Hours)**

**Self-study:** Non-conventional grinding operation.

**Module – 4**

Fundamentals of metrology & measurements, objectives and classification of metrology, standards of length- wavelength standard, subdivision of standards, numerical problems on length calibration.
**Line & End Standards:** Line and end standard, slip gauges, wringing phenomena, numerical problems on slip gauges.
**Angular Measurements:** Bevel protractor, sine bar, angular gauges, numerical on building of angles.

**(08Hours)**

**Self-study Component**: Case studies on static and dynamic characteristics of measuring instruments.

**Module – 5**

**Systems of Limits, Fits & Tolerance:** Definition of tolerance, tolerance specification in assembly, limits of size, Indian standards, concepts of limits of size and tolerances, cost v/s tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation.
**Gauges:** Classification of gauges, Taylor's principle, design of GO, NO GO gauges, wear allowance on gauges, types of gauges- plain plug gauges, ring gauges, snap gauge, limit gauge, simple problems.
**Comparators:** Introduction to comparators, classification, characteristics, systems of displacement amplification in mechanical comparators, Reed type, Sigma comparator, Zeiss ultra-optimeter, Solex air gauge, ultrasonic gauges, LVDT.

**(08 Hours)**

**Self-study Component:** case studies on interchangeability and selective assembly.

**Practical Component of IPCC**

1. Preparation of one model on lathe involving - Plain turning, Facing, Knurling, Drilling, Boring,
2. External/Internal Thread cuts and Eccentric turning.
3. Preparation of one model using a shaper- Cutting of V Groove/ dovetail / Rectangular groove.
4. Cutting of Gear Teeth using Milling Machine.
5. Preparation of one model on the drilling and grinding machine.
6. Study on chip formation in turning of mild steel by HSS tool with different depth of cut, speed, and feed rate.
7. Study & demonstration of power tools like power drill, power hacksaw, portable hand grinding etc., used in Mechanical Engineering.
8. Demonstration/Experimentation of simple programming of CNC machine operations

9. To study the tool geometry of a single point turning tool (SPTT) in the American Standards Association (ASA) system.

**Course outcomes (Course Skill Set):**

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

**CO1**: Apply the various machining processes to produce the variety of engineering products and compute the machining time for specific operation.

**CO2**: Compute the various cutting forces using Merchant's circle diagram.

**CO3**: Analyze effects of the various cutting parameters on the tool life and economics of machining.

**CO4:** Apply the scientific principles involved in length and angular measurements

**CO5:** Determine tolerance and dimensions involved in the design of limit gauges.

**Reference Learning Materials:**

**Textbooks**:


1. David A. Stephenson and John S. Agapiou, "Metal Cutting Theory and Practice" Third Edition, CRC Press, Taylor & Francis Group, Boca Raton, London, NY.
2. R.K. Jain, Engineering Metrology, Khanna Publishers 2009


**Reference Books:**


1. Geoffrey Boothroyd and Winston A. Knight., "Fundamental of Machining and Machine Tools", 3rd Edition, CRC Taylor & Francis, Fourth Indian reprint 2013.
2. Amitabha Ghosh and Asok Kumar Mallik, "Manufacturing Science", Second Edition, East-West press Pvt Ltd, Reprint 2019.
3. P.N. Rao, "Manufacturing Technology: Volume-2 (4e)", McGraw Hill Education, 2019.
4. Beckwith, Mechanical Measurements Marangoni and Lienhard Pearson, Education 6th Edition.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**FLUID MECHANICS (3:0:1) 4**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME403** | SEMESTER | **IV** |
| Teaching Hours/Week (L:T:P) | 3:0:2 | CIE Marks | 50 |
| Total Number of Lecture Hours | 40 hours of theory+ 10 Lab slots | SEE Marks | 50 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course objectives:**

1. To have a working knowledge of the basic properties of fluids and understand the continuum approximation.
2. To calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy.
3. To understand the flow characteristics and dynamics of flow field for various Engineering applications.
4. To discuss properties of laminar and turbulent pipe flow and boundary layer theory.
5. To appreciate the effects of heat transfer on compressible flows.

**Preamble:** Fluid mechanics plays a vital role in all Engineering applications. The properties of fluids and their flow helps in determination of various forces on surfaces. The theoretical concepts of fluid statics, kinematics and dynamics prove useful in various applications.

**Module – 1**

Properties of fluids –mass density, weight density, specific volume, specific gravity, viscosity, surface tension, capillarity, vapor pressure, compressibility and bulk modulus. Concept of continuum, types of fluids, pressure at a point in the static fluid, variation of pressure, Pascal's law, Absolute, gauge, atmospheric and vacuum pressures measurement by simple, differential manometers and mechanical gauges.

**Fluid Statics**: Total pressure and center of pressure for horizontal plane, vertical plane surface and inclined plane surface submerged in static fluid.

**Pressure and its Measurements**: simple monometer – Piezo meter, U tube mano meter. Differential mano meter – U -tube differential nanometer vacuum pressure monometers.

**(08 Hours)**

**Self-study:** Studies on high pressure manometers.

**Module – 2**

**Hydrostatic forces:** Derivation of forces on Horizontal, vertical, and Inclined plate**,** Buoyancy and floatation Buoyancy, center of buoyancy, meta concentric height – analytical method. Conditions of equilibrium of floating and submerged bodies.

**Fluid Kinematics**: Types of flow –steady, unsteady, uniform, non-uniform, laminar, turbulent, one, two and three dimensional, compressible, incompressible, rotational, irrotational, stream lines, pathlines, streak lines, velocity components, convective and local acceleration, 3D continuity equation – cartesian coordinate and numerical problems.

**Laminar and turbulent flow**: Flow through circular pipes, between parallel plates, Poiseuille equation.

(**08 Hours)**

**Self-study:** Case studies on laminar and turbulent flow.

**Module – 3**

**Fluid Dynamics**: Momentum equation, Impact of jets – force on fixed and moving vanes, flat and curved. Numerical problems. Eulers Equation, Integration of Euler's equation to obtain Bernoulli's equation, Bernoullis theorem. Application of Bernoulli's theorem such as venturimeter, orifice meter, triangular notch, pitot tube, orifices. Related Numerical problems.

**Friction in pipes**: Major and minor losses, pipes in series and parallel. Numerical problems.

**(08 Hours)**

**Self-study:** Case studies on pipe flows.

**Module – 4**

**Flow over bodies:** Development of boundary layer, Lift and drag. Boundary layer theory.

**Dimensional analysis:** Derived quantities, dimensions of physical quantities, dimensional homogeneity, Buckingham –Pi theorem, dimensionless numbers, and their importance.

**(08 Hours)**

**Self-study Component**: Case studies on boundary layer theory.

**Module – 5**

**Compressible flows**: Speed of sound, adiabatic and isentropic steady flow, Isentropic flow with area change stagnation and sonic properties, Mach Number, Mach angle, Mach cone. Normal and oblique shocks, Flow through nozzles.

**Self-study Component:** Mach number and its importance in aerospace applications.

**PRACTICAL COMPONENT OF IPCC**

| Sl.No. | Experiments |
|---|---|
| 1 | Determine the viscosity of oil using Redwood viscometer and Saybolt viscometer |
| 2 | Measurement of pressure using different manometers for high and low pressure measurements. |
| 3 | Determination of coefficient of discharge for different flow meters for pipes. |
| 4 | Determination of head loss in pipes and pipe fittings having different diameters, different materials and different roughness. |
| 5 | Determination of Reynolds number of a fluid during its flow through pipe. |
| 6 | Determination of the effect of change in cross section for a fluid flow through a pipe using Bernoulli's equation. |
| 7 | Determination of the effect of fluid flow through a nozzle using Bernoulli's equation. |
| 8 | Determination of coefficient of force on impact of jets using flat and curved plates. |
| 9 | Determination of coefficient of discharge for different flow meters for open channels. |

**Course outcomes (Course Skill Set):**

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

**CO1**: Identify and calculate the key fluid properties used in the analysis of fluid behavior.

**CO2**: Analyze the principles of pressure ,buoyancy and floatation to real time problems

**CO3 :** Apply the knowledge of fluid statics ,kinematics and dynamics while addressing problems on mechanical and chemical Engineering

**CO4:** Enumerate the concept of boundary layer in fluid flow and apply dimensional analysis to form dimensionless numbers in terms of variables.

**CO5:** Illustrate and explain the basic concept of compressible flow and CFD

**Reference learning materials:**

**Textbooks:**


1. Dr R.K Bansal, "A Text Book of Fluid Mechanics and Hydraulic Machines", 10th Edition, Laxmi Publishers, 2018.
2. Victor L Streeter "Fluid mechanics" Mc Graw hill publisher, 2018


**References:**


1. John Douglas, Janul and M.Gasiosek, John A.Swaffield, "Fluid Mechanics", 5th Edition, Pearson Education Asia, 2006.
2. F M White, "Fluid Mechanics", 8th Edition, McGraw Hill Publications, 2016.
3. Yunus A. Cengel John M.Cimbala, "Fluid Mechanics", 3rd Edition. Tata McGraw Hill, 2014.
4. Fluid mechanics and hydraulic machines by Dr. Jagadish Lal, Mc Graw hill, 2018

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**Mechanical Measurements and Metrology lab (0:0:2) 1**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME404** | SEMESTER | **IV** |
| Teaching Hours/Week (L:T:P) | 0:0:2 | CIE Marks | 50 |
| Total Hours of Pedagogy | 10 Sessions | SEE Marks | 50 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 02 |

**Course objectives:**

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools measuring techniques.
3. To understand calibration techniques of various measuring devices.

| **Sl.NO** | **Experiments** |
|---|---|
| | **Part A - MECHANICAL MEASUREMENTS** |
| 1 | Calibration of Pressure Gauge |
| 2 | Calibration of Thermocouple |
| 3 | Calibration of LVDT |
| 4 | Calibration of Load cell |
| 5 | Determination of modulus of elasticity of a mild steel specimen using strain gauges. |
| | **Part B- METROLOGY** |
| 6 | Calibration of Micrometer/Vernier Caliper using slip gauges |
| 7 | Measurements using Optical Projector / Toolmaker Microscope. |
| 8 | Measurement of angle using Sine Centre / Sine bar / bevel protractor |
| 9 | Measurement of alignment using Autocollimator / Roller set |
| 10 | Measurements of Screw thread Parameters using two wire or Three-wire methods. |
| 11 | Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator |
| 12 | Measurement of gear tooth profile using gear tooth Vernier /Gear tooth micrometre |
| **Demonstration Experiments (For CIE )** | |
| 13 | Measurement of cutting tool forces using<br>a) Lathe tool Dynamometer and b) Drill tool Dynamometer. |
| 14 | Measurement using Optical Flats |

**Course outcomes (Course Skill Set):**

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

**CO1**: Demonstrate the calibration procedure for pressure gauge, thermocouple, VDT and load cell.

**CO2**: Build slip gauges for calibrating micrometer and vernier caliper.

**CO3**: Make use of Sine Centre/ Sine Bar/ Bevel Protractor involved in the measurement of an angle.

CO4: Measure screw thread parameters using optical projector/Toolmaker Microscope/ two wire or three wire methods.

**CO5**: Measure gear tooth thickness and surface roughness parameters.

**Reference Learning Material:**

**Textbooks/Manual**

1. Metrology and measurements manual, Developed by Department of Mechanical Engineering. BMSIT
2. Jain Khanna Measurements and Metrology, Publishers 2009
3. Mechanical Measurements Beckwith Marangoni and Lienhard Pearson Education 6th Edition

**B.E MECHANICAL ENIGINEERING**

Choice Based Credit System (CBCS)

SEMESTER - IV

**Non-Traditional Machining (3:0:0) 3**

(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME405A** | SEMESTER | **IV** |
| Teaching Hours/Week (L:T:P) | 3:0:0 | CIE Marks | 50 |
| Total Number of Lecture Hours | 40 | SEE Marks | 50 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course Objectives:**

This course will enable students to:

1. To learn various concepts related to modern machining processes & their applications.
2. To appreciate the differences between conventional and non-conventional machining processes.
3. To acquire a functional understanding of non-traditional manufacturing equipment.
4. To know about various process parameters and their influence on performance and their applications.
5. To impart knowledge on various types of energy involved in non-traditional machining processes.

**Preamble:**

Non-traditional machining refers to a group of manufacturing processes that do not rely on traditional methods such as cutting, drilling, or milling. These processes often utilize advanced technologies and materials to achieve high precision and accuracy in the production of complex parts and components.

**Module – 1**

**Ultrasonic Machining (USM):** Ultrasonic machining system, mechanics of cutting, process parameters, analysis, capability, grain growing model, grain hammering model, advantages, limitations and applications, problems.

**Abrasive Jet Machining (AJM):** Introduction, Equipment and process of material removal, process variables: carrier gas type of abrasive, work material, stand-off distance (SOD).Process characteristics-Material removal rate, Nozzle wear, accuracy & surface finish.

Applications, advantages & limitations of AJM, problems.

**Water Jet Machining (WJM):** Equipment & process, Operation, applications, advantages and limitations of WJM.

**(10 hours)**

**Self Study Component:** Magnetic Abrasive Finishing

**Module – 2**

**Electro Chemical Machining:** Working principle, components and functions, effect of process parameters, material removal rate and mechanism, limitations and applications, problems.

**Chemical Machining (CHM):** Elements of the process: Resists (maskants), Etchants. Types of chemical machining process chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.

**(07 hours)**

**Self Study Component:** Electro polishing

**Module – 3**

**Electrical Discharge Machining (EDM):** Working principle, process parameters, process capabilities, components of system and its functions, flushing techniques, effect of various parameters on material removal rate, application and limitations, electrical discharge wire cutting, wire EDM machine, application and limitations.

**Plasma Arc Machining (PAM):** Working principle, process parameters, process capabilities, components of system and its functions, various plasma arc torches, process capabilities, comparison with oxy fuel cutting, application and limitations.

**(08 hours)**

**Self Study Component:** Electro erosion dissolution process

**Module – 4**

**Laser Beam Machining (LBM):** Types of lasers, process characteristics, working principle, process parameters, process capabilities, components of system and its functions, limitations, application in drilling, cutting, marking and miscellaneous applications.

**Electron Beam Machining (EBM):** Working principle, process parameters, process capabilities, components of system and its functions, application and limitations.

Summary of NTM processes.

**(08 hours)**

**Self Study Component:** Laser-Assisted ECM

**Module – 5**

**Micro- and Nano manufacturing by Focused Ion Beam:** Focused Ion Beam System (Dual Beam), Ion Column, High-Precision Five-Axes Goniometer Sample Stage, Energy-Dispersive Spectroscopy, Nano manipulator, Residual Gas Analyzer Ion–Matter Interaction, Working Principle of Focused Ion Beam, Ion-Beam-Induced Deposition of Various Materials, Fabrication of 3D Micro/Nanostructure.

**Micro- and Nanostructured Surface Development by Nano Plastic Forming and Roller Imprinting:** Nano Plastic Forming, NPF-CRI Technique, Micro- and Nanostructured Surface Development, Application Potentials of Micro- and Nanostructured Surfaces.

**(07 hours)**

**Self Study Component:** Micro moulding technique

**Course outcomes:**

The students will be able to:

CO 1: Categorize the various Non-Traditional Machining process to machine modern materials.

CO 2: Determine an appropriate Non Traditional Machining technique to machine the given material.

CO 3: Identify the Process parameters affecting of various Non- Traditional Machines processes.

CO 4: Interpret the given Non Traditional Machining processes case study material.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous Internal Evaluation:**

- For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
- The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
- Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
- For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.**

**Semester-End Examination:**

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (**duration 03 hours).**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.
4. Marks scored shall be proportionally reduced to 50 marks.

**TEXTBOOKS:**

1. Gary F Benedict., "Non Traditional Manufacturing Processes", Taylor & Francis, 2019.
2. V K Jain, "Micro manufacturing process", CRC press, 2013.

**REFERENCES:**

1. Pandey Shan, "Modern machining process", Tata McGraw Hill, 2013.
2. HMT, "Production Technology", Tata McGraw Hill, 2017.
3. M Adithan, "Unconventional Machining Processes", Atlantic publisher, 2014.

**B. E. MECHANICAL ENGINEERING**
Choice Based Credit System (CBCS)

**ENVIRONMENTAL STUDIES** (3:0:0) 3
(Effective from the academic year 2022-23)

| | | | |
|---|---|---|---|
| Course Code | **BME405B** | Semester | **IV** |
| Teaching Hours/Week (L: T:P: S) | 3:0:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 40 hr. | SEE Marks | 50 |
| Credits | 03 | Total Marks | 100 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course objectives:**

To impart the knowledge and awareness for the environmental protection for real-timecontribution during an execution of engineering practices in the society.

**Teaching-Learning Process (General Instructions)**

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

1. Visit to a local area to document environmental assets/ecosystems-River/forest/grassland/mountain
2. Construction of Food chain/food web of the visited area
3. To identify the sources of air/water/soil/noise pollution of any area.

**Module-1**

**Introduction to Environmental Studies:**

Multidisciplinary nature of environmental studies.

Scope and importance; Concept of sustainability and sustainable development.

Ecosystems: Structure and function of ecosystem; Energy flow in an ecosystem: food chains, food webs and ecological succession. Forest ecosystem, Grassland ecosystem, Desert ecosystem, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

**Module-2**

**Natural Resources: Renewable and Non-Renewable Resources:**

Land resources and land-use change; Land degradation, soil erosion and desertification. Deforestation: Causes and impacts due to mining, dam building on environment, forests,biodiversity and tribal populations.

Water: Use and over-exploitation of surface and ground water, floods, droughts, conflicts overwater (International & Inter-state).

Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources,growing energy needs, case studies.

**Module-3**

**Biodiversity and Conservation:**

Levels of biological diversity: Genetic, species and ecosystem diversity; Biogeographic zones ofIndia; Biodiversity patterns and global biodiversity hotspots.

India as a mega-biodiversity nation; Endangered and endemic species of India.

Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions; Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Ecosystem and biodiversity services: Ecological, economic, social, ethical, aesthetic andInformational

value.

**Environmental Pollution**

Environmental Pollution: Types, causes, effects and controls; Air, water, soil and noise pollution.
Nuclear hazards and human health risks.
Solid waste management, Control measures of urban and industrial waste.

**Module-4**

**Environmental Policies and Practices**

Climate change, global warming, ozone layer depletion, acid rain and impacts on humancommunities and agriculture.
Environment Laws: Environment Protection Act; Air (Prevention & Control of Pollution) Act; Water (Prevention and Control of Pollution) Act; Wildlife (Protection) Act; Forest Conservation Act.
International agreements: Montreal and Kyoto protocols and Convention on Biological Diversity(CBD).
Nature reserves, tribal populations and rights, and human wildlife conflicts in Indian context.

**Module-4**

**Human Communities and the Environment**

Human population growth: Impacts on environment, human health and welfare.Resettlement and Rehabilitation of project affected persons; case studies.
Disaster management: Floods, Earthquake, Cyclones and Landslides. Environmental movements: Chipko, Silent valley, Bishnois of Rajasthan.
Environmental ethics: Role of Indian and other religions and cultures in environmentalconservation.
Environmental communication and public awareness, case studies (e.g., CNG vehicles in cities).

**Course outcome (Course Skill Set)**

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

**CO1**: Illustrate the basic concepts of environmental studies and natural resources.
**CO2**: Explain about the various eco-systems of nature.
**CO3**: Discuss different types of environmental pollutions and their control measures.
**CO4**: Describe the acquired knowledge about the various social aspects related to theenvironment.

**Suggested Learning Resources:**

**Text Books:**


1. Benny Joseph (2005)., *Environmental Studies*, New Delhi, Tata McGraw Hill Publishingco.Ltd
2. Erach Bharucha (2005)., *Textbook of Environmental Studies for Undergraduate Courses*,Hyderabad, Universities Press.


**Reference Books:**


1. Anji Reddy .M (2007), *Textbook of Environmental Sciences and Technology*, Hyderabad, BS Publications.
2. Y Anjaneyulu.(2004), Introduction to *Environmental Sciences*, BS Publications.
3. Climate Change: Science and Politics. (2021). Centre Science and Environment, New Delhi.
4. Gadgil, M., & Guha, R. (1993). This Fissured Land: An Ecological History of India. Univ. of California Press.
5. Gleeson, B. and Low, N. (eds.) (1999). Global Ethics and Environment, London, Routledge.

6. Groom, Martha J., Gary K. Meffe, and Carl Ronald Carroll. (2006). Principles of Conservation Biology. Sunderland: Sinauer Associates.
7. Nandini, N., Sunitha N., & Sucharita Tandon. (2019). A text book on Environmental Studies (AECC). Sapna Book House, Bengaluru.
8. Rosencranz, A., Divan, S., & Noble, M. L. (2001). Environmental law and policy India

**Web link resources**

1. www.eco-prayer.org
2. www.teriin.org
3. www.cpcb.nic.in
4. www.indiaenvironmentportal.org.in
5. www.sustainabledevelopment.un.org
6. www.conserve-energy-future.com

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

1. Study of common plants, insects, birds, and basic principles of identification.
   Study of simple ecosystems – pond, river, etc.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**Micro Electro Mechanical Systems (MEMS) (3:0:0) 3**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME405C** | Semester | **IV** |
| Teaching Hours/Week (L: T:P: S) | 3:0:0:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 40 | SEE Marks | 50 |
| Credits | 03 | Total Marks | 100 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course objectives:**

1. Students are exposed to the MEMS technology & Miniaturization.
2. Students will understand the Process of Micro fabrication Techniques.
3. Students are made to understand the principles of system modelling.
4. Students are made to understand the working principles of Mechanical sensors and actuators.
5. Students are made to understand the working principles of Micro-Opto-Electro Mechanical Systems.

**Teaching-Learning Process (General Instructions)**

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

1. Power Point Presentation,
2. Chalk and Talk are used for Derivations and Correlations (In-general).
3. Video demonstration or Simulations.

**Module-1**

MEMS: Introduction, Production Engineering, Precision Engineering and Ultra- Precision Engineering, Integrated circuits, Micro Electro Mechanical Systems. **08 hours)**

**Module-2**

Micromachining: Introduction, Photo Lithography, Structural and Sacrificial Materials, Etching, Surface Micromachining, Bulk versus Surface Micromachining, Wafer Bonding, LIGA. **(08 hours)**

**Module-3**

System Modelling: Introduction, Need for Modelling, System types, Basic Modelling Elements In Mechanical System, Basic Modelling Elements In Electrical Systems, Basic Modelling Elements In Fluid Systems and Thermal Systems. **(08 hours)**

**Module-4**

Mechanical sensors and actuators: Introduction, Principles of Sensing and Actuation, Beam and Cantilever, Micro Plates, Capacitive Effects, Piezo Electric Material as Sensing and Actuating Elements. **(08 hours)**

**Module-5**

Micro-Opto-Electro Mechanical Systems: Introduction, Fundamental Principles of MOEMS Technology, Review on Properties of Light, Light Modulators, Micro mirrors, Digital Micro mirror Device. **(08 hours)**

**Course outcome (Course Skill Set):**

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

1. Understand the working of MEMS technology & Miniaturization.
2. Explain the Process of Micro fabrication Techniques.
3. Explain the principles of system modelling.
4. Understand the working principles of Mechanical sensors and actuators.
5. Describe the working principles of Micro-Opto-Electro Mechanical Systems

**Suggested Learning Resources:**

**Books**


1. MEMS- Nitaigour Premchand Mahalik, TMH 2007.
2. G.K.Ananthasuresh, K.J.Vinoy, S.Gopalakrishnan, K.N.Bhat,V.K.Aatre,Micro and Smart Systems:Wiley India 2010.
3. V. Varadan, K. J. Vinoy, S. Goplakrishnan Design and Development Methodogies, Smart Material Systems and MEMS: K. J. Vinoy, S. Goplakrishnan, Wiley.
   Tai-Ran Hsu, Tata Mc-Graw-Hill MEMS & Microsystems: Design and Manufacture,


**Web links and Video Lectures (e-Resources):**

1. VTU e-Shikshana Program
2. VTU EDUSAT Program.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

1. Gaining hands on Knowledge to work on ANSYS Tool
2. Simulation of Cantilever Beam For Different Loads On ANSYS Tool.


**Web links and Video Lectures (e-Resources):**

1. VTU e-Shikshana Program
2. VTU EDUSAT Program.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

1. Gaining hands on Knowledge to work on ANSYS Tool
2. Simulation of Cantilever Beam For Different Loads On ANSYS Tool.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**Automation and Robotics (3:0:0) 3**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME405D** | Semester | **IV** |
| Teaching Hours/Week (L: T:P: S) | 3:0:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 40 | SEE Marks | 50 |
| Credits | 03 | Total Marks | 100 |
| Examination Pattern (SEE) | **Theory** | Exam Hours | 03 |

**Course objectives:** students will be able **to**

1. Gain knowledge of Robotics and automation.
2. Comprehend the working methodology of robotics and automation.
3. Understand the application various types of automation
4. Acquire knowledge on kinematics of robotics
5. Importance of Machine vision sensors in robot for various applications.

**Teaching-Learning Process (General Instructions)**

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

1. Through Power Point Presentations and Video demonstrations or Simulations.
2. Chalk and Talk method for Problem Solving.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three higher order Thinking questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students Analytical skills, develop thinking skillssuch as the ability to evaluate, generalize, and analyze information rather than simply recall it.

**Preamble:**

Automation is anything that replaces human labor with a machine. That machine usually includes mechanical, electrical, and electronic components. Controls, on the other hand, are the electrical and electronic components that link the mechanical machines together using a common software program or an integrated collection of programs.

**Module-1**

**Basics of automation:** Basic elements of an automated system, Types of automation, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control,

Sensors: Classification of transducers and sensor, Difference between transducer and sensor, Principle of working and applications of sensors: Tactile sensors proximity and rain sensors miscellaneous sensors censor based system

**(09 hours)**

**Self -study**: Application of sensors in Automation

**Module-2**

**Automated production lines:** Fundamentals of automated production lines, application of automated production lines, analysis of transfer lines Numerical problem, automated assembly systems, fundamentals of automated assembly systems, quantitative analysis of assembly systems.

**(08 hours)**

**Self -study**: Analysis of Automation in packing industries and textile industries

Module - 3

**Material Handling:** Identification System Selection and of Precision Motion Components,Material Transport Equipment, Analysis of Material Transport System, Storage System Performance and location Strategies, Automated Storage system , Engineering Analysis of storage system,

LM Guide ways, Ball screws, bearings, Types, Selection, from the manufacturer 's catalogue based on the applications, fixing arrangements and assembly automatic identification methods, barcode technology, radio frequency identification, other.

**(07 hours)**

**Self -study**: AIDC technologies in warehouse operations

Module-4

**Robotics:** origin of robotics, different types of robotics, various generations of robots, degrees of freedom and Asimov's laws of robotics.

**Robot motion analysis and contro**l: Position representation, adding orientations: A 3 degree of Freedom of Arm in two dimension and 4 degree freedom manipulator in three dimensions homogeneous transformations and robot kinematics kinematic equation using homogeneous transformations.

**(08 hours)**

**Self -study**: Solving kinematic equations manipulate a path control

Module-5

**Mission vision:** The sensing and digitizing function in Mission Vision: Immediately lighting techniques, analogue to digital signal conversions, sampling, quantization encoding and image storage. events Image processing and analysis: Image data reduction, and training vision system**.**

**(09 hours)**

**Self -study**: Analysis of Mission vision system in BIN picking applications

**Course outcome (Course Skill Set)**

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

**CO 1:** Illustrate various types of Robotics and Automation.

**CO 2:** Apply the fundamentals of various motion sensors and control systems in automation.

**CO 3:** Identify the different material handling systems used in Automation.

**CO 4:** Analyze the various applications of controllers in automation and robotics.

**CO 5**: Evaluate kinematic equations manipulate a path control.

**Suggested Learning Resources:**

**Textbooks**


1. Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G. Odrey and Ashish Dutta, "Industrial Robotics: Technology, Programming and Applications", 2nd Edition, Tata McGraw Hill, 2012.
2. Roland Siegwart, Illah R. Nourbakhsh, and Davide Scaramuzza, "Introduction to Autonomous Mobile Robots", 2nd Edition, PHI, 2011.

**References**


1. John J. Craig, "Introduction to Robotics", 3rd Edition, Pearson publication, 2009.
2. Ashitava Ghosal "Robotics, Fundamental concepts and Analysis", Oxford Publication, 2011.


**Web links and Video Lectures (e-Resources):**

- NPTEL course on Industrial Robotics.
- Videos on Industrial Automation.

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

Visit any automated production Industry understand the importance and applications ofRobots in Automated Industry.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**INTRODUCTION TO AI & ML 0:0:2:0**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME456A** | Semester | **IV** |
| Teaching Hours/Week (L:T:P: S) | 0:0:2:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 15 sessions | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination type (SEE) | **PRACTICAL** | Exam Hours | 03 |

**Course objectives:**

- Make use of Data sets in implementing the machine learning algorithms
- Implement the machine learning concepts and algorithms in any suitable language of choice.
- Analyse the working of various documents like PDF, Word file

| **Sl.NO** | **Experiments** |
|---|---|
| 1 | Implement A* Search algorithm. |
| 2 | Implement AO* Search algorithm. |
| 3 | Write a program to implement Water jug program using AI. |
| 4 | The probability that it is Friday and that a student is absent is 3 %. Since there are 5 school days in a week, the probability that it is Friday is 20 %. What is the probability that a student is absent given that today is Friday? Apply Baye's rule in python to get the result. |
| 5 | Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file. |
| 6 | For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples. |
| 7 | Build an Artificial Neural Network by implementing the Backpropagation algorithm and test the same using appropriate data sets. |
| 8 | Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API |
| | **Demonstration Experiments ( For CIE )** |
| 9 | Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample. |

**Course outcomes (Course Skill Set):**

1. Understand the implementation procedures for the machine learning algorithms
2. Design Java/Python programs for various Learning algorithms.
3. Apply appropriate data sets to the Machine Learning algorithms
4. Identify and apply Machine Learning algorithms to solve real world problems
5. Examine working of PDF and word file formats

**Suggested Learning Resources:**

1. Tom M Mitchell,"Machine Lerning",1 st Edition, McGraw Hill Education, 2017.

**2.** Elaine Rich, Kevin K and S B Nair, “Artificial Inteligence”, 3rd Edition, McGraw Hill Education, 2017.

**B.E MECHANICAL ENIGINEERING**
Choice Based Credit System (CBCS)

**Digital Marketing (1:0:0) 1**
(Effective from the academic year 2022-2023)

| | | | |
|---|---|---|---|
| Course Code | **BME456B** | Semester | **IV** |
| Teaching Hours/Week (L: T:P: S) | 1:0:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 15 | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination type (SEE) | **Theory** | Exam Hours | 01 |

**Course objectives:**

1. To focuses on the importance of digital marketing and its applications and to introduce current and core practices of Digital and Social Media Marketing that will allow learners toanalyse, plan, execute and evaluate a digital marketing strategy.

**Teaching-Learning Process (General Instructions)**

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

1. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations.
2. Adopt flipped classroom teaching method.
3. Adopt collaborative (Group Learning) learning in the class.

**Module-1**

Introduction to Digital Marketing (DM)-Meaning, Definition, Need of DM, Scope of DM, History of DM, Concept and approaches to DM, Examples of good practices in DM. Email Marketing-Need for Emails, Types of Emails, options in Email advertising, Mobile Marketing.

**(03hours)**

**Module-2**

Social Media Marketing -Introduction to Blogging. Introduction to Face book, Twitter, Google +,LinkedIn, YouTube, Instagram and Pinterest; their channel advertising and campaigns.

**(03hours)**

**Module-3**

Acquiring & Engaging Users through Digital Channels: Understanding the relationship betweencontent and branding and its impact on sales, search engine marketing, mobile marketing, video marketing, and social-media marketing.

**(03hours)**

**Module-4**

Designing Organization for Digital Success: Digital transformation, digital leadership principles, online P.R. and reputation management. ROI of digital strategies, how digital marketing is adding value to business, and evaluating cost effectiveness of digital strategies

**(03hours)**

**Module-5**

Digital Innovation and Trends: The contemporary digital revolution, digital transformation framework; security and privatization issues with digital marketing, Understanding trends in digital marketing – Indian and global context, online communities and co-creation.

**(03hours)**

**Suggested Learning Resources:**

**Books**


1. Fundamentals of Digital Marketing by Puneet Singh Bhatia, Pearson
2. Moutsy Maiti: Internet Marketing, Oxford University Press India
3. Vandana, Ahuja; Digital Marketing, Oxford University Press India (November, 2015).
4. Eric Greenberg, and Kates, Alexander; Strategic Digital Marketing: Top Digital Experts
5. Share the Formula for Tangible Returns on Your Marketing Investment; McGraw-Hill
6. Professional (October, 2013).
7. Ryan, Damian; Understanding Digital Marketing: marketing strategies for engaging the
8. digital generation; Kogan Page (3rd Edition, 2014).
9. Tracy L. Tuten & Michael R. Solomon: Social Media Marketing (Sage Publication)


**Web links and Video Lectures (e-Resources):**

**Activity Based Learning (Suggested Activities in Class)/ Practical Based learning**

**B.E MECHANICAL ENGINEERING**
**(Choice Based Credit System (CBCS)**

**INTRODUCTION TO DATA ANALYTICS** (0:0:1) 1
(Effective from the academic year 2022-23)

| | | | |
|---|---|---|---|
| Course Code | **BME456C** | SEMESTER | **IV** |
| Teaching Hours/Week (L: T:P) | 0:0:2 | CIE Marks | 50 |
| Total Number of Contact Hours | 10 lab slots | SEE Marks | 50 |
| Examination type (SEE) | **PRACTICAL** | Exam Hours | 03 |

**Course Objectives:**

This course will enable students to:

1. To understand NumPy, Pandas and Mat plot library
2. To understand basics of statistics
3. To learn the basic of decision tree algorithm.
4. To understand random forest algorithm and Anova
5. To use Python data structures.

**Preamble:** Introduction to python programming, python data structures.

## PART A

1. Numpy library in python:
   a) Create single dimensional array and perform various operations using Python.
   b) Create multi-dimensional array and perform various operations using Python.
2. Pandas library in python:
   a) Data set cleaning, merging, and joining using python
   b) Data analysis using python.
3. Matplot library in python:
   a) Plot 2D line graph for data visualization using Python.
   b) Plot 2D contour plots for data visualization using Python.
   c) Plot 3D contour plots for data visualization using Python.
4. Probability distribution using python
   a) Determine simple probabilities using python
   b) Determine frequency distribution using python
   c) Draw the normal curve using python

## PART B

5. Basic statistics using python
   a) Determine sampling and sampling distribution using python.
   b) *Calculate* the *average*, *variance* and *standard deviation using* Python.
6. Discrete statistics using python:
   a) Draw the correlation and correlation coefficient and scatter plots using python.
   b) Draw the scatter plots using python
7. Regression analysis
   a) Implement and analyze Linear regression in Python (Single variable & Multivariable).
   b) Implement and analyze Logistic regression in Python
8. Algorithm in Python
   a) Implement and analyze Decision tree algorithm in Python.
   b) Implement and analyze Random Forest algorithm in Python

**Course Outcomes:**

The student will be able to:

**CO1:** Analyze data using different libraries of python.

**CO2:** Develop Python programs to plot for data visualization.

**CO3:** Develop Python programs to carry out the probability distribution.

**CO4:** Develop Python programs to implement various statistical methods.

**CO5:** Develop Python programs for analysis of data algorithms.

**REFERENCES :**


1. McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and IPython. " O'Reilly Media, Inc.".
2. Swaroop, C. H. (2003). A Byte of Python. Python Tutorial.
3. Ken Black, sixth Editing. Business Statistics for Contemporary Decision Making. “John Wiley & Sons, Inc”

**B.E MECHANICAL ENGINEERING**
**(Choice Based Credit System (CBCS)**

**Programming in C++** (0:0:1) 1
(Effective from the academic year 2022-23)

| | | | |
|---|---|---|---|
| Course Code | **BME456D** | Semester | **IV** |
| Teaching Hours/Week (L:T:P: S) | 0:0:2:0 | CIE Marks | 50 |
| Total Hours of Pedagogy | 15 sessions | SEE Marks | 50 |
| Credits | 01 | Total Marks | 100 |
| Examination type (SEE) | **Practical** | Exam Hours | 03 |

**Course objectives:**

1. To learn object-oriented programming concepts using the C++ language.
2. To apply the principles of data abstraction, inheritance and polymorphism;
3. To use the principles of virtual functions and polymorphism
4. To learn how to handle formatted I/O and unformatted I/O

| **Sl.NO** | **Experiments** |
|---|---|
| 1 | Write a C++ Program to display Names, Roll No., and grades of 3 students who have appeared inthe examination. Declare the class of name, Roll No. and grade. Create an array of class objects.<br>Read and display the contents of the array. |
| 2 | Write a C++ program to declare Struct. Initialize and display contents of member variables. |
| 3 | Write a C++ program to declare a class. Declare pointer to class. Initialize and display the contents of the class member. |
| 4 | Given that an EMPLOYEE class contains following members: data members: Employee number, Employee name, Basic, DA, IT, Net Salary and print data members. |
| 5 | Write a C++ program to read the data of N employee and compute Net salary of each employee<br>(DA=52% of Basic and Income Tax (IT) =30% of the gross salary)**.** |
| 6 | Write a C++ to illustrate the concepts of console I/O operations. |
| 7 | Write a C++ program to use scope resolution operator. Display the various values of the same |
| 8 | Write a C++ program to create an array of pointers. Invoke functions using array objects. |
| | **Demonstration Experiments ( For CIE )** |
| 9 | Write a C++ program for Vehicle reservation system |
| 10 | Write a C++ program to Create a Modern Periodic Table |
| 11 | Write a C++ program to Develop a Bookshop inventory |
| 12 | Write a C++ program for Credit Card Validation System |

**Course outcomes (Course Skill Set):**

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

**CO1:** Apply Object Oriented Programming concepts in C++

**CO2:** Write a C++ program by applying knowledge of mathematics, science, and engineering.

**CO3:** Function on multi-disciplinary teams.

**CO4:** Identify, formulate, and solve engineering problems.

**Suggested Learning Resources:**

1. The C++ Programming Language, 3rd Edition, B. Stroutstrup, Pearson Education.
2. OOP in C++, 3rd Edition, T. Gaddis, J. Walters and G. Muganda, Wiley Dream Tech Press.
   Object Oriented Programming in C++, 3rd Edition, R. Lafore, Galigotia Publications Pvt Ltd.

**B.E MECHANICAL ENGINEERING**
(Choice Based Credit System (CBCS)

**BIOLOGY FOR ENGINEERS** (3:0:0)3
(Effective from the academic year 2022-23)

| | | | |
|---|---|---|---|
| Course Code | **BBOK407** | Semester | **IV** |
| Teaching Hours/Week (L:T:P) | 3:0:0 | CIE Marks | 50 |
| Total Number of Contact Hours | 40 | SEE Marks | 50 |
| Examination type (SEE) | **Theory** | Exam Hours | 03 |

**Course Objectives:**

This course will enable students to:

1. Understand the biological concepts from an engineering perspective and applications.
2. Acquire knowledge on biomolecules and human organ system.
3. Impart knowledge about spectroscopy and clinical imaging system for biological study.
4. Gain knowledge on Nature-Bioinspired mechanisms and materials can be substitute.
5. Learn about recent developments and trends in Bioengineering

**Module – 1**

**Introduction to Biology**

Importance of Biology for Engineers, need to study Biology, Life Science studies significance. The cell: the basic unit of life, Structure and functions of a cell. Prokaryotic and Eukaryotic cell,

carbohydrates nucleic acids: Classification, salient features, functions. Enzymes: Classification, properties and functions. plant based proteins and protein as food, Lipids: functions, biodiesel, cleaning agents/detergents.

**Spectroscopy and Microscopy techniques for Biology**

Basic principle and biological applications of infrared spectroscopy, Case studies on Raman spectroscopy and its use in biological studies**.** **(08 Hours)**

**Module – 2**

**Biomolecules and Applications**

Carbohydrates: cellulose-based water filters, PHA and PLA as bioplastics, Nucleic acids Forensics: DNA fingerprinting, Proteins: Proteins as food.

**Biological Mechanisms**

Skeletal muscles in the body, the structure of muscles, passive muscles, activating muscles, Gecko - Gecko tape, Whale fins - Turbine blades, Termite/ ant hill-passive cooling, Namib beetle- Water collection. Ventilators, Kidney as a filtration system: mechanism of filtration. Case studies on Biological Neural Network: Principles and importance. **(08 Hours)**

**Module – 3**

**Human Organ Systems and Bio Designs: Brain** as a CPU system: signal transmission and EEG, Robotic arms for prosthetics. Eye as a Camera system (architecture of rod and cone cells, lens materials, bionic eye). Heart as a pump system and electrocardiography (ECG). artificial heart, Lungs as purification system: gas exchange mechanisms, spirometry.

**Clinical Imaging System** Basic principle and biological uses of Computerized Tomography (CT), Magnetic Resonance Imaging (MRI). Case studies on X-ray Imaging techniques and biological applications**.** **(08 Hours)**

**Module – 4**

**Nature-Bioinspired Mechanisms:** Echolocation: ultrasonography/ultrasound Imaging, sonars Photosynthesis: bionic leaf, Birds and insects: flight aerodynamics. Lotus leaf effect: super hydrophobic and self-cleaning surfaces, Mosquito inspired micro needle, Plant burrs: Velcro, Shark skin: Friction

reducing swim suits, Kingfisher beak: Bullet train.

**Nature-Bioinspired Materials**: Bio filter, biochips and their applications in health. Physiological Assist Device: Artificial Skin, artificial limbs. Case studies on Bio-composites. **(08 Hours)**

**Module – 5**

**Trends in Bioengineering**

Introduction to regenerative medicine: Muscular and Skeletal Systems as scaffolds (architecture, mechanisms,), scaffolds and tissue engineering,3D printing of ear, bone and skin, 3D printed foods. Artificial Self-healing Bioconcrete based on bacillus spores and calcium lactate nutrients, Biosensors for personal diabetes management, Biopolymers, Bio fertilizer, Artificial kidney, immunological biosensors: types and applications. DNA bio sensor. Case study on Bio printing techniques and materials.

**(08 Hours)**

**Course Outcomes:**

The students will be able to:

1. Describe the concept of Biology from an engineering perspectives and applications.
2. Summarize biomolecules and human organ systems.
3. Discuss microscopy techniques and clinical imaging system for biological study.
4. Illustrate Nature-Bioinspired materials and mechanisms.
5. Elaborate principles and applications of bioengineering.

**Textbooks:**


1. Biology for Engineers, Thyagarajan S., Selvamurugan N., Rajesh M.P., Nazeer R.A., Thilagaraj W., Barathi S., and Jaganthan M.K., Tata McGraw-Hill, New Delhi, 2012.
2. Biology for Engineers, Rajendra Singh C and Rathnakar Rao N, Rajendra Singh C and Rathnakar Rao, N Publishing, Bengaluru, 2023.


**References:**


1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011
2. Wilson and Walker- Principles and Techniques of Biochemistry and Molecular Biology, by Andreas Hofmann, Samuel Clokie. 2018 Edition.
3. Biology for Engineers, Sohini Singh and Tanu Allen, Vayu Education of India, New Delhi, 2014.
4. 3D Bioprinting: Fundamentals, Principles and Applications by Ibrahim Ozbolat, Academic Press, 2016.


**Web links and Video Lectures (e-Resources):**

1. https://nptel.ac.in/courses/121106008
2. https://freevideolectures.com/course/4877/nptel-biology-engineers-other-non-biologists
3. https://ocw.mit.edu/courses/20-020-introduction-to-biological-engineering-design-spring-2009
4. https://ocw.mit.edu/courses/20-010j-introduction-to-bioengineering-be-010j-spring-2006
5. https://www.coursera.org/courses?query=biology
6. https://onlinecourses.nptel.ac.in/noc19_ge31/preview
7. https://www.classcentral.com/subject/biology
8. https://www.futurelearn.com/courses/biology-basic-concepts

**ASSESSMENT METHODS:**

**CIE Components** (50 Marks)

**Continuous Internal Evaluation:**

1. For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment

2. Test component, there are 25 marks. The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned.
4. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
5. For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

**Semester-End Examination:**

1. Theory SEE will be conducted with common question papers for the course (duration 03 hours). The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 2 sub-questions), should have a mix of topics under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored shall be proportionally reduced to 50 marks.

**Assessment Details** (both CIE and SEE):

- The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%.
- The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50).
- The minimum passing mark for the SEE is 35% of the maximum marks (18 marks out of 50).
- A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50) in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

## Department of Humanities and Social Sciences

Choice Based Credit System (CBCS)

**Universal Human Values (UHV)**

(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BUHK408** | Semester | **IV** |
| Teaching Hours/Week (L: T:P:S) | 1:0:0:1 | CIE Marks | 50 |
| Total Number of Contact Hours | 15-hour Theory Session +15 hour Self study | SEE Marks | 50 |
| Credits | 01 | Exam Hours | 01 |

**Course Objectives:**

This course is intended to:

1. To help the students appreciate the essential complementarity between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement towards value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature.
4. This course is intended to provide a much-needed orientation input in value education to the young enquiring minds

Teaching-Learning Process (General Instructions)

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

1. The methodology of this course is explorational and thus universally adaptable. It involves a systematic and rational study of the human being vis-à-vis the rest of existence.
2. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the activities will develop students' theoretical and applied skills.
3. State the need for UHV activities and its present relevance in the society and provide real-life examples.
4. Support and guide the students for self-study activities.
5. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress in real activities in the field.
6. This process of self-exploration takes the form of a dialogue between the teacher and the students to begin with, and then to continue within the student in every activity, leading to continuous self-evolution.
7. Encourage the students for group work to improve their creative and analytical skills.

**Module – 1**

**Introduction to Value Education:**

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations **(03 Hours)**

**Module – 2**

**Harmony in the Human Being:**

Understanding Human being as the Co-existence of the Self and the Body, distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

**(03 Hours)**

**Module – 3**

**Harmony in the Family and Society**:
Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

**(03 hours)**

**Module – 4**

**Harmony in the Nature/Existence:**
Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence

**(03 hours)**

**Module – 5**

**Implications of the Holistic Understanding – a Look at Professional Ethics:**
Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession

**(03 hours)**

**Course outcome (Course Skill Set)**

At the end of the course, students are expected to become more aware of themselves, and their surroundings (family, society, nature);

1.They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.  They would have better critical ability.

2. They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).

3. It is hoped that they would be able to apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction.

Expected to positively impact common graduate attributes like:

1. Ethical human conduct
2. Socially responsible behaviour
3. Holistic vision of life
4. Environmentally responsible work
5. Having Competence and Capabilities for Maintaining Health and Hygiene
6. Appreciation and aspiration for excellence (merit) and gratitude for all

**Assessment Details (both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50) and for the SEE minimum passing mark is 35% of the maximum marks (18 out of 50 marks). The student is declared as a pass in the course if he/she secures a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

**Continuous internal Examination (CIE)**

1. For the Assignment component of the CIE, there are 25 marks and for the Internal Assessment Test component, there are 25 marks.
2. The first test will be administered after 40-50% of the syllabus has been covered, and the second test will be administered after 85-90% of the syllabus has been covered
3. Any two assignment methods mentioned in the 22OB2.4, if an assignment is project-based then only one assignment for the course shall be planned. The teacher should not conduct two assignments at the end of the semester if two assignments are planned.
4. For the course, CIE marks will be based on a scaled-down sum of two tests and other methods of assessment.

The sum of two tests, two assignments, will be out of 100 marks and will be scaled down to 50 marks.

Internal Assessment Test question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

**Semester End Examinations (SEE)**

SEE paper shall be set for 50 questions, each of the 01 marks. **The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is 01 hour**. The student has to secure a minimum of 35% of the maximum marks meant for SEE

**Textbooks and Teachers Manual**

1.The Textbook A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G P Bagaria, 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 97893-87034- 47-1

2.The Teacher"s Manual for A Foundation Course in Human Values and Professional Ethics, R R Gaur, R Asthana, G

**References**

1.Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amar kantak, 1999

2.Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004

3.The Story of Stuff (Book).

4.SThe Story of My Experiments with Truth - by Mohandas Karamchand Gandhi

5.Small is Beautiful - E. F Schumacher

6. Slow is Beautiful - Cecile Andrews

7.Economy of Permanence - J C Kumarappa.

8.Bharat Mein Angreji Raj – Pandit Sunderlal

9.Rediscovering India - by Dharampal

10.Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi

11.India Wins Freedom - Maulana Abdul Kalam Azad

12.Vivekananda - Romain Rolland (English)

13.Gandhi - Romain Rolland (English)

14.Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991

15.Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.

16.A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

17.P L Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers

18.A N Tripathy, 2003, Human Values, New Age International Publishers.

19.Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) KrishiTantraShodh, Amravati.

20.E G Seebauer & Robert L. Berry, 2000, Fundamentals of Ethics for Scientists & Engineers, Oxford University Press

21.M Govindrajran, S Natrajan & V.S. Senthil Kumar, Engineering Ethics (including Human Values), Eastern Economy Edition, Prentice Hall of India Ltd.

22.B P Banerjee, 2005, Foundations of Ethics and Management, Excel Books

23.B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

Web links and Video Lectures (e-Resources):

2. Value Education websites
3. https://www.uhv.org.in/uhv-ii
4. http://uhv.ac.in
5. http://www.uptu.ac.in

6. Story of Stuff
7. http://www.storyofstuff.com
8. Al Gore, An Inconvenient Truth, Paramount Classics, USA

9. Charlie Chaplin, Modern Times, United Artists, USA
10. IIT Delhi, Modern Technology – the Untold Story
11. Gandhi A., Right Here Right Now, Cyclewala Productions
12. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
13. https://fdp-si.aicte-india.org/8dayUHV_download.php
14. https://www.youtube.com/watch?v=8ovkLRYXIjE
15. https://www.youtube.com/watch?v=OgdNx0X923I
16. https://www.youtube.com/watch?v=nGRcbRpvGoU
17. https://www.youtube.com/watch?v=sDxGXOgYEKM

## Department of Humanities and Social Sciences

**Choice Based Credit System (CBCS)**

National Service Scheme (NSS)

(Common to all branches)

(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BNSK359/459/559/659** | Semester | III to IV |
| Teaching Hours/Week (L:T:P) | 0:0:2 | CIE Marks | 100 |
| Total Number of Contact Hours | 26 | SEE Marks | - |
| Examination pattern (CIE) | Theory + Practical | Exam Hours | - |

Mandatory Course (Non-Credit)

(Completion of the course shall be mandatory for the award of degree)

**Course Objectives: National Service Scheme (NSS) will enable the students to:**

11. Understand the community in general in which they work.
12. Identify the needs and problems of the community and involve them in problem solving.
13. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
14. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
15. Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

### Module – 1

**Introduction to NSS**

History and growth of NSS, Philosophy of NSS, Objectives of NSS, Meaning of NSS Logo, NSS Programs and activities, administrative structure of NSS, Planning of programs / activities, implementation of NSS programs / activities, National & State Awards for NSS College / Program Officer / Volunteers. **(04 Hours)**

### Module – 2

**Overview of NSS Programs**

Objectives, special camping – Environment enrichment and conservation, Health, Family, Welfare and Nutrition program. Awareness for improvement of the status of women, Social Service program, production-oriented programs, Relief & Rehabilitation work during natural calamities, education and recreations, Selection of the problem to be addressed. (**04 Hours)**

### Module – 3

**NSS Activities - Group Contributions to Society / community (Activity based Learning)**

Organic Farming, Indian agriculture (Past, Present, Future) Connectivity for marketing, Waste management– Public, Private and Govt. organization, 5 R's. Water conservation techniques – role of different stakeholders – implementation, preparing an actionable business proposal for enhancing the village income and approach for implementation. Helping local schools to achieve good results and enhance their enrolment in Higher/ technical/ vocational education.

**(06 Hours)**

### Module – 4

**NSS National Level Activities for Society / Community at large (Activity based Learning)**

Developing Sustainable Water management system for rural areas and implementation approaches. Contribution to any national level initiative of Government of India. Foreg. Digital India, Skill India, Swachh Bharat, Atmanirbhar Bharath, Make in India, Mudra scheme, Skill development programs etc

**(06 Hours)**

### Module – 5

**NSS Individual Activities for Local Voice (Activity based learning)**

Govt. school Rejuvenation and helping them to achieve good infrastructure, Plantation and adoption of plants. Know your plants. Spreading public awareness under rural outreach programs, National integration and social harmony events. **(06 Hours)**

**Course outcomes (Course Skill Set):**

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

CO1: Understand the importance of his / her responsibilities towards society.

CO2: Analyse the environmental and societal problems/issues and will be able to design solutions for the same.

CO3: Evaluate the existing system and to propose practical solutions for the same for sustainable development.

CO4: Implement government or self-driven projects effectively in the field.

CO5: Develop capacity to meet emergencies and natural disasters & practice national integration and social harmony in general.

**Teaching Practice:**

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

**Assessment Details**

| **Weightage** | **CIE – 100%** |
|---|---|
| Presentation -1<br>Selection of topic, PHASE-1 | 20 Marks |
| Commencement of activity and its progress – PHASE – 2 | 20 Marks |
| Case Study based Assessment – Individual performance | 20 Marks |
| Sector wise study and its consolidation | 20 Marks |
| Video based seminar for 10 minutes by each student at the end of the course with Report | 20 Marks |

**Suggested Learning Resources:**

**Books:**

1. NSS Course Manual**,** Published by NSS Cell, VTU Belagavi.
2. Government of Karnataka, NSS cell, activities reports and its manual.
3. Government of India, NSS cell, Activities reports and its manual.

**DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES**
**Choice Based Credit System (CBCS)**

**Sports**
(Common to all Branches)
(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | BPEK359/459/559/659 | Semester | III to IV |
| Teaching Hours/Week (L: T:P) | 0:0:2 | CIE Marks | 100 |
| Total Number of Contact Hours | 26 | SEE Marks | -- |
| Examination pattern (CIE) | Theory + Practical | Exam Hours | -- |

**Mandatory Course (Non-Credit)**

(Completion of the course shall be mandatory for the award of degree)

**Course Objectives:** The course will enable students to

1. Develop a healthy life style.
2. Acquire Knowledge about various stages of sports and games.
3. Focus on modern technology in sports.

**Module – 1**

**Introduction of the game:** Aim of sports and games, Brief history of the game, Nature of the game, Terminology & Modern trends of the game, Fitness & Skill tests along with Game Performance.

**(06 Hours)**

**Module – 2**

**Offensive and Defensive Techno Tactical Abilities:** Fitness, Fundamentals & Techniques of the game with the implementation of Biomechanics, Tactics- Drills for the Techno Tactical abilities, Individual and Group, Miner games- to implement the Techniques, Tactics and Motor abilities.

**(05 Hours)**

**Module – 3**

**Team tactics and Rules of the Game:** Rules and Regulations of the Game: Game rules as well as sequence of officiating, Team tactics: Offensive and Defensive team strategies and scrimmages, Practice Matches: among the group, Analysis of Techno Tactical abilities: Correction and implementation of skills and Sports Injuries and rehabilitation: First aid, PRICE treatment,

**(05 Hours)**

**Module – 4**

**Sports Training:** Introduction of Sports Training, Principles of Sports performance, how to increase and sustain the sports performance, Training Load & Recovery- How to increase the training load (volume/Intensity) and means and methods for Recovery, Periodization: Shorts, Medium and Long term, Physiological changes: Changes in Lung capacity, heart beats etc…

**(05 Hours)**

**Module – 5**

**Organization of Sports Event:** Tournament system, Planning and preparation for the competition, Ground preparation and Equipment's, Organizing an event among the group.

**(05 Hours)**

The above 5 modules are common to all the sports events / games, we are offering the following games**: 1. Baseball, 2. Kabaddi, 3. Table Tennis, and 4. Volleyball.**

**Course outcomes:**

The students will be able to:

6 Understand the importance of sports and games, inculcate healthy habits of daily exercise & fitness, Self-hygiene, good food habits, Create awareness of Self-assessment of fitness.

7 Develops individual and group techno tactical abilities of the game.

8 Increases the team combination and plan the strategies to play against opponents.

| | |
|---|---|
| 9 | Outline the concept of sports training and how to adopt technology to attain high level performance. |
| 10 | Summarize the basic principles of organising sports events and concept of technology implemented to organise competitions in an unbiased manner. |

Teaching Practice:

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation and video analysing.
- Practical classes in outdoor and indoor as per requirement.

**CIE: 100 Marks**

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student has to give fitness and skill tests and his performance in game will be assessed.

**Textbooks**


1. Barbara Bushman, "ACSM's complete guide to Fitness & Health", 2011, Human Kinetics USA
2. **Pankaj Vinayak Pathak, *"Sports and Games - Rules and Regulation"*, 2019, Khel Sahitya Kendra.**
3. Hardayal Singh, *"Sports Training, General Theory & Methods"*, 1984 "Netaji Subhas, National Institute of Sports".
4. Keith A. Brown, "International Handbook of Physical Education and Sports Science", 2018, (5 Volumes) Hardcover.


**References**


1. Tudor O Bompa,*" Periodization Training for Sports*", 1999, Human Kinetics, USA
2. Michael Boyle, "New Functional Training for Sports" 2016, Human Kinetics USA
3. Michael Kjaer, Michael Rogsgaard, Peter Magnusson, Lars Engebretsen & 3 more, "Text book of Sports Medicine: Basic Science and Clinical Aspects of Sports Injury and Physical Activity", 2002, Wiley Blackwell.
4. Scott L. Delp and Thomas K. Uchida, "Biomechanics of Movement: The Science of Sports, Robotics, and Rehabilitation", 2021, The MIT Press
5. MCARDLE W.D. "Exercise Physiology Nutrition Energy And Human Performance" 2015, LWW IE (50)

## Department of Humanities and Social Sciences

**Choice Based Credit System (CBCS)**

**Yoga**

(Common to all Branches)

(Effective for the 2022 scheme)

| | | | |
|---|---|---|---|
| Course Code | **BYOK359/459/559/659** | Semester | III to IV |
| Teaching Hours/Week (L:T:P) | 0:0:2 | CIE Marks | 100 |
| Total Number of Contact Hours | 26 | SEE Marks | - |
| Examination pattern (CIE) | Theory + Practical | Exam Hours | - |

**Course Objectives:**

This course will enable students to:

16. Understand the importance of practicing yoga in day-to-day life.
17. Be aware of therapeutic and preventive value of Yoga.
18. Have a focussed, joyful and peaceful life.
19. Maintain physical, mental and spiritual fitness.
20. Develop self-confidence to take up initiatives in their lives.

**Module – 1**

**Introduction to Yoga:** Introduction, classical and scientific aspects of yoga, Importance, Types, Healthy Lifestyle, Food Habits, Brief Rules, Sithalikarana Practical classes. **(04 Hours)**

**Module – 2**

**Physical Health:** Introduction, Pre-requisites, Asana-Standing, Sitting, Supine and Prone, Practical classes. **(06 Hours)**

**Module – 3**

**Psychological Health:** Introduction Thought Forms, Kriya (Kapalabhati), Preparation to Meditation, Practical classes. **(06 Hours)**

**Module – 4**

**Therapeutic Yoga:** Mudra Forms, Acupressure therapy, Relaxation techniques Practical classes. **(06 Hours)**

**Module – 5**

**Spirituality & Universal Mantra:** Introduction, Being Human, Universal Mantra, Universal LOVE, Benefits of practice of Spirituality in day-to-day life, practical classes. **(04 Hours)**

**Course Outcomes:**

Students will be able to:

6. Understand the requirement of practicing yoga in their day-to-day life.
7. Apply the yogic postures in therapy of psychosomatic diseases
8. Train themselves to have a focussed, joyful and peaceful life.
9. Demonstrate the fitness of Physical, Mental and Spiritual practices.
10. Develops self-confidence to take up initiatives in their lives.

**Teaching Practice:**

- Classroom teaching (Chalk and Talk)
- ICT – Power Point Presentation
- Audio & Video Visualization Tools

**CIE: 100 Marks**

- CIE 1 for 40 marks – A theory paper which is MCQ / Descriptive conducted during the semester.
- CIE 2 for 60 marks – A practical test conducted at the end of the semester in which the student have to perform asanas.

**Textbooks**

**1. George Feuerstein: The yoga Tradition (Its history, literature, philosophy and practice.)**
**2. Sri Ananda: The complete Book of yoga Harmony of Body and Mind. (Orient paper Backs: vision Books Pvt.Ltd., 1982.**
**3. B.K.S Iyenkar: Light on the Yoga sutras of patanjali (Haper Collins Publications India Pvt.,Ltd., New Delhi.)**
**4. Science of Divinity and Realization of Self – Vethathiri Publication, (6-11) WCSC, Erode**

**References**

**1. Principles and Practice of Yoga in Health Care, Publisher: Handspring Publishing Limited, ISBN: 9781909141209, 9781909141209**
**2. Basavaraddi I V: Yoga in School Health, MDNIY New Delhi, 2009**
**3. Dr. HR. Nagendra: Yoga Research and applications (Vivekanda Kendra Yoga Prakashana Bangalore)**
**4. Dr. Shirley Telles: Glimpses of Human Body (Vivekanda Kendra Yoga Prakashana Bangalore)**

**Web resources**

**Web links and Video Lectures (e-Resources): Refer links**

**1. https://youtu.be/KB-TYlgd1wE**
**2. https://youtu.be/aa-TG0Wg1Ls**

**DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES**
**Choice Based Credit System (CBCS)**

**Course: Music**
(Common to all Branches)
(Effective for the 2022 Scheme)

| | | | |
|---|---|---|---|
| Course Code | BMUK359/459/559/659 | Semester | III to VI |
| Teaching Hours/Week (L: T:P) | 0:0:2 | CIE Marks | 100 |
| Total Number of Contact Hours | 26 | SEE Marks | - |
| Examination pattern (CIE) | Theory + Practical | Exam Hours | - |

**Mandatory Course (Non-Credit)**
(Completion of the course shall be mandatory for the award of the Degree)

**Course Objectives:**

The course will enable the students to:

4. Identify the major traditions of Indian music, both through notations andaurally.
5. Analyze the compositions with respect to musical and lyrical content.
6. Demonstrate an ability to use music technology appropriately in a variety ofsettings.

**Module – 1**

**Preamble:** Contents of the curriculum intend to promote music as a language to developan analytical, creative, and intuitive understanding. For this the student must experiencemusic through study and direct participation in improvisation and composition.

**Origin of the Indian Music:** Evolution of the Indian music system, Understanding of Shruthi, Nada, Swara, Laya, Raga, Tala, Mela. **(03 Hours)**

**Module – 2**

**Compositions:** Introduction to the types of compositions in Carnatic Music - Geethe, JathiSwara, Swarajathi, Varna, Krithi, and Thillana, Notation system.

**(03 Hours)**

**Module – 3**

**Composers:** Biography and contributions of Purandaradasa, Thyagaraja, Mysore Vasudevacharya. **(03 Hours)**

**Module – 4**

**Music Instruments:** Classification and construction of string instruments, wind instruments, percussion instruments, Idiophones (Ghana Vaadya), Examples of each class of Instruments

**(03 Hours)**

**Module – 5**

**Abhyasa Gana:** Singing the swara exercises (Sarale Varase Only), Notation writing for Sarale Varase and Suladi Saptha Tala (Only in Mayamalavagowla Raga), Singing 4 Geethein Malahari, and one Jathi Swara, One Nottu Swara OR One krithi in a Mela raga, a patriotic song

**(14 Hours)**

**Course Outcomes (COs):**

The students will be able to:

CO1: Discuss the Indian system of music and relate it to other genres (CognitiveDomain)
CO2: Experience the emotions of the composer and develop empathy (AffectiveDomain)
CO3: Respond to queries on various patterns in a composition (Psycho-Motor Domain)

**Teaching Practice:**

- Classroom teaching
- ICT – PowerPoint Presentation
- Audio & Video Visualization Tools

**CIE: 100 Marks**

- **CIE 1** for 40 marks – A theory paper which is MCQ / Descriptive conductedduring the semester
- **CIE 2** for 60 marks – A practical test conducted at the end of the semester in which the student has to recite one Sarale Varase mentioned by the examiner inthree speeds. Sing / Play the Geethe in Malahari. Singing / Playing Jathi Swara /Krithi.

**Textbooks**


3. Vidushi Vasantha Madhavi, "Theory of Music", Prism Publication, 2007.
4. T Sachidevi and T Sharadha (Thirumalai Sisters), Karnataka Sangeetha Dharpana - Vol. 1 (English), Shreenivaasa Prakaashana, 2018.


**References**


5. Lakshminarayana Subramaniam, Viji Subramaniam, "Classical Music of India: APractical Guide", Tranquebar 2018.
6. R. Rangaramanuja Ayyangar, "History of South Indian (Carnatic) Music", Vipanci Charitable Trust; Third edition, 2019.
7. Ethel Rosenthal, "The Story of Indian Music and Its Instruments: A Study of thePresent and a Record of the Past", Pilgrims Publishing, 2007.
8. Carnatic Music, National Institute of Open Schooling, 2019.