BMS INSTITUTE OF TECHNOLOGY AND MANAGEMENT

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

Yelahanka, Bengaluru 560119

Bachelor of Engineering

Department of Mechanical Engineering

V Semester Scheme and Syllabus
2022 Scheme
Effective from the AY 2025-26
2023 Batch

Approved in the BoS meeting held on 14.08.2025

Vision and Mission of the Department

Vision

To establish a hub of excellence in diverse field of Mechanical Engineering for research and innovation to meet the industrial and societal challenges.

Mission

Impart quality education in mechanical engineering and allied areas through effective teaching-learning process and state-of-the-art infrastructure.

Provide a conducive environment to excel in research and innovation for sustainable solutions through industrial collaboration, co-curricular and extracurricular activities.

Program Educational Objectives (PEOs)

PEO1: Be successful professionals in the field of Mechanical Engineering and allied areas.

PEO2: Exhibit skills to work effectively and ethically in multiple domains of engineering as part of a team.

PEO3: Excel in higher studies, research and adapt in a world of constantly developing technology.

Program Specific Outcomes (PSOs)

PSO1: Design and analyse the mechanical components and systems.

PSO2: Ansalyse the fluid and thermal aspects of different mechanical systems and components.

PSO3: Manufacture mechanical components and systems adopting effective managerial techniques.

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BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

Ref.: BMSIT&M/Exam/2023-24/ 104 **Date:** 21.09.2024

CONTINUOUS INTERNAL EVALUATION (CIE) AND SEMESTER END EXAMINATION (SEE) PATTERN

(Applicable to UG students admitted from the 2022 batch, effective from the Academic year 2024-25 onwards)

The UG students admitted from the 2022 batch onwards are hereby informed to note the following regarding Continuous Internal Evaluation and Semester End Examination pattern:

- The Weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Examination (SEE) is 50%.
- The Minimum passing mark for the CIE is 40% of the Maximum marks (i.e. 20 marks out of 50) and for the SEE minimum passing mark is 35% of the Maximum marks (i.e. 18 out of 50 marks).
- A student will be declared to have passed the course if they secure a minimum of 40% (i.e. 40 marks out of 100) in the combined total of the CIE and SEE.

The following tables summarize the CIE and SEE Patterns for the courses of various credits:

INTEGRATED PROFESSIONAL COMPETENCE COURSE (IPCC) COURSES **4 OR 3 CREDITS**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE - Internal Assessment (IA) Tests	CIE – Test 1 (1.5 hr)	40	20	-	The sum of the two internal assessment tests will be **80 Marks** and the same shall be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	10	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**30**	**12**	
Practical Component	CIE - Practical		30	10	-	Each laboratory experiment is to be

NON-IPCC COURSES **01 CREDIT – MULTIPLE CHOICE QUESTION TYPE**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation Component	CIE – IA Tests (MCQs)	CIE – Test 1 (1 hr)	40	40	-	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on a higher Bloom's level. The sum of the two internal assessment tests will be **80 Marks**, and the same will be scaled down to **40 Marks**.
		CIE – Test 2 (1 hr)	40			
	CIE - CCAs	CCA	10	10	-	Any One Assessment method can be used from the list provided below.
	Total CIE			**50**	**20**	
SEE (MCQ Type)				50	18	The question paper pattern for this course shall be an **MCQ** of **1 or 2 Marks (s).** The questions with 2 Marks can be framed based on higher Bloom's level. MCQ-type question papers of 50 questions with each question of a **01 Mark**, the examination duration is 01 hour.
CIE + SEE				**100**	**40**	

					assessed for **30 Marks** using appropriate rubrics.
	CIE Practical Test	20	10	-	One test after all experiments to be conducted for **20 Marks**
	Total CIE Practical		**20**	**08**	
Total CIE Theory + Practical			**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**	
Note: The assessment of the laboratory component for the IPCC courses shall be restricted to CIE only.					

PROFESSIONAL CORE COURSES (PCC) / ENGINEERING SCIENCE COURSES (ESC) 03 OR 02 CREDITS						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	
SEE			100	50	18	SEE is a theory exam, conducted for **100 Marks**, scored marks are scaled down to **50 Marks.**
CIE + SEE				**100**	**40**	

PROFESSIONAL CORE COURSE LABORATORY (PCCL) /ABILITY ENHANCEMENT COURSE LABORATORY (AEC) **01 CREDIT**					
Evaluation Type	**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Continuous Internal Evaluation	CIE - Practical	30	30		Each laboratory experiment is to be evaluated for **30 Marks** using appropriate rubrics.
	CIE - Practical Test	50	20		One test after all experiments is to be conducted for **50 Marks** and to be scaled down to **20 Marks**.
	Total CIE	-	**50**	**20**	
Semester End Examination		100	50	18	SEE to be conducted for **100 Marks**.
CIE+SEE		**100**		**40**	

NON-IPCC / ABILITY ENHANCEMENT COURSE (AEC) **01 CREDIT – DESCRIPTIVE TYPE**						
Evaluation Type		**Internal Assessments (IAs)**	**Test/ Exam Marks Conducted for**	**Marks to be scaled down to**	**Min. Marks to be Scored**	**Evaluation Details**
Theory Component	CIE – IA Tests	CIE – Test 1 (1.5 hr)	40	30	-	The sum of the two internal assessment tests will be **80 Marks** and the same will be scaled down to **30 Marks**.
		CIE – Test 2 (1.5 hr)	40			
	CIE - CCAs	CCA	20	20	-	Any Two assessment methods can be used from the list. If it is project-based, one CCA shall be given.
	Total CIE Theory			**50**	**20**	

SEE	100	50	18	SEE is a theory exam, conducted for **100 Marks for 02 Hours duration**, scored marks are scaled down to **50 Marks.**
CIE + SEE		**100**	**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	**Sketch Book and CAD Modelling**	Projection of Points	10	05	15	200	20	-
		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	-
		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	-
	CCA 2	Module 5	08	02	10			
CIE Total							**50**	**20**
SEE		Module 1 & 2	24	06	30	100	**50**	**18**
		Module 3	32	08	40			
		Module 4	24	06	30			
CIE + SEE							**100**	**40**

COMPUTER AIDED MODELLING FOR MANUFACTURING (BME305) **1 CREDIT**								
Evaluation Type		**Topics/ Modules**	**Computer Printout**	**Preparatory Calculations / Sketch**	**Max Marks**	**Total Marks**	**Marks to be Scaled Down to**	**Min Marks to Pass**
CIE	**Sketch Book and CAD Modelling**	Module 1	60	30	90	200	20	
		Module 2	40	20	60			
		Module 3	40	10	50			
	Test 1	Module 1	20	10	30	60	20	-
		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	-
CIE Total							**50**	**20**
SEE		Module 1	30	10	40	100	**50**	**18**
		Module 2	20	10	30			
		Module 3	20	10	30			
CIE + SEE							**100**	**40**

Learning Activities for CCAs:

A faculty member may choose the following CCAs based on the needs of the course:

1. Course project
2. Literature review
3. MOOC
4. Case studies
5. Tool exploration
6. GATE-based aptitude test
7. Open book tests
8. Industry integrated learning
9. Analysis of Industry / Technical / Business reports
10. Programming assignments with higher Bloom level
11. Group discussions
12. Industrial / Social / Rural projects

CoE 21/09/2024

Dean - AA 21/09/24

21/9/2024

Principal

Copy To:

1. The Vice-Principal, Deans, HoDs, and Associate HoDs
2. All faculty members and students of 2022, 2023, and 2024 batch.
3. Examination Section

BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

(Autonomous Institution Affiliated to VTU, Belagavi)

B. E. in Mechanical Engineering

Scheme of Teaching and Examinations – 2022 Scheme

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

V Semester

Sl. No.	Course Category	Course Code	Course Title	Teaching Department (TD) and Question Paper Setting Board (PSB)	Credits Distribution				Examination				Contact Hours/week
					L	T	P	Total	CIE Marks	SEE Marks	Total Marks	SEE Duration (H)	
1	HSMC	BME501	Engineering Economics & Industrial Management	TD: ME PSB: ME	3	0	0	3	50	50	100	3	3
2	IPCC	BME502	Turbo Machinery		2	1	1	4	50	50	100	3	6
3	PCC	BME503	Elements of Machine Design		4	0	0	4	50	50	100	3	5
4	PCCL	BMEL504	Energy Conversion Lab		0	0	1	1	50	50	100	3	2
5	PEC	BME505X	Professional Elective Course I		3	0	0	3	50	50	100	3	3
6	PW	BME506	Mini Project		0	0	3	3	50	50	100	3	6
7	AEC	BRMK507	Research Methodology and IPR	Any Department	2	0	0	2	50	50	100	3	2
8	MC	BESK508	Environmental Studies	TD: CV PSB: CV	1	0	0	1	50	50	100	1	1
9	NCMC	BNSK509	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	100	-	100	-	2
		BPEK509	Physical Education (Sports and Athletics)	PED									
		BYOK509	Yoga	Yoga Teacher									
		BNCK509	National Cadet Corps (NCC)	NCC officer									
		BMUK609	Music	Music Techer									
TOTAL					**15**	**1**	**5**	**21**	**500**	**400**	**900**	**-**	30

HSMC: Humanities, Social Sciences and Management Course, **IPCC**: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PCCL**: Professional Core Course laboratory, **PEC:** Professional Elective Course, **PW:** Project Work, **AEC**: Ability Enhancement Course, **MC:** Mandatory Course, **NCMC**: Non Credit Mandatory Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course - I			
Course Code	**Course Name**	**Course Code**	**Course Name**
BME505A	Mechanics of Composite Materials	BME505C	Operation Research
BME505B	Mechanical Vibrations	BME505D	Design for manufacturing
BME505E	Automotive System Design		

Integrated Professional Core Course (IPCC): Refers to Professional Core Course Theory Integrated with practical's 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.

National Service Scheme /Physical Education/Yoga/NCC/Music: All students have to register for any one of the courses namely National Service Scheme (NSS), Physical Education (PE) (Sports and Athletics), Yoga (YOG), National Cadet Corps (NCC) and Music with the concerned coordinator of the course during the beginning of each semester starting from III semester to VII semester. In every semester, students should choose any one mandatory course among the available 5 courses without repeating the course again. Activities shall be carried out in each of the semesters from III semester to the VI semester (for 4 semesters). Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree. These courses shall not be considered for vertical progression as well as for the calculation of SGPA and CGPA, but completion of the course is mandatory for the award of degree.

Professional Elective Courses (PEC): A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in the Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course. The minimum number of students' strengths for offering a professional elective is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Mini Project: The Mini Project Work is a part of the curriculum in the pre-final year. Mini Project is a course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a Mini- project can be assigned to a group having not more than 4 students. A comprehensive report is to be prepared after completion of the project work.

B.E MECHANICAL ENIGINEERING

Choice Based Credit System (CBCS)

Humanity, Social Science and Management Course (HSMC)

Engineering Economics and Industrial Management (3:0:0)3

(Effective from the academic year 2022-2023)

Course Code	**BME501**	Semester	**V**
Teaching Hours/Week (L:T:P)	**3:0:0**	CIE Marks	**50**
Total Number of Lecture Hours	**40**	SEE Marks	**50**
Examination nature (SEE)	**Descriptive**	Exam Hours	**03**

Course Objectives:

1. To understand the fundamental concepts of engineering economics, time value of money and cash flow analysis
2. To understand the principles of engineering economics and industrial management to achieve organizational goals.
3. To understand the economic analysis techniques to evaluate engineering projects and decisions.

5. To understand the industrial management issues in organization.

Preamble: This course is designed to equip students with the knowledge and skills necessary to make decisions about economic and managerial aspects of engineering projects and industrial operations. Exploring the principles of engineering economics as well as the fundamentals of the industrial management. Through this course, students will understand the relationship between technical, economic, and managerial factors in engineering and industrial contexts, preparing them to excel in their future careers as engineering professional and managers.

Module – 1

Engineering and Economics: Problem solving and decision making process, Laws of demand and supply, Difference between Microeconomics and Macroeconomics, equilibrium between demand and supply, elasticity of demand, price elasticity, income elasticity. Law of Returns.

Interest and interest factors: simple and compound interest, Cash flow diagrams, numerical problems **(08 hours)**

Module-2

Present, future and annual worth: Basic present worth comparisons, Present worth-equivalence, Assets with unequal lives and infinites lives, future worth comparisons, payback comparisons, Equivalent annual worth comparisons, situations for annual worth comparisons. Asset life. numerical problems

Rate of return: minimum acceptable rate of return, comparisons of all present future and annual worth with IRR, numerical problems. **(08 hours)**

Module-3

Costing: Components of costs, estimation of selling price, marginal cost, first cost, all kinds of overheads, indirect cost estimation with depreciation, estimation of material cost, cost estimation of mechanical process, numerical problems

Depreciation: Causes of depreciation, methods of computing depreciation charges, straight line method, declining balance method, sum of years method, sinking fund method, service output methods, numerical problems. **(08 hours)**

Module-4

Industrial Management: Nature and characteristics of Management, Scope and Functional areas of management, contribution of Taylor, Henry Fayol, Gilbert, Henry Gantt to the evolution of management science,

Management Functions: Planning: nature, importance, Steps in planning, Decision making process. Principles of organization, Types of organization, Leadership types ,Quality of good leader, Motivation, Maslow's Theory of Motivation, Communication, Process of Communication,

Barriers for effective communication, Controlling, steps in controlling, Essentials of a sound control system.

Production Planning and Control (PPC): Functions of PPC, planning, routing, scheduling, dispatching and Inspection, Basics of CPM and PERT , Comparison of CPM and PERT. Simple numerical Problems. **(08 hours)**

Module-5

Work Study: Motion study and Method time study, principles of motion economy, charts and diagrams, Job evaluation systems, Wage payment and plans, Incentive schemes, Training and Development, Safety Regulations and safe practices. Simple numerical problems on work study.

Logistics: Functions of materials management, stores management, Concepts of Enterprise resource planning, Material Requirement Planning (MRP), Just in Time (JIT), Supply chain management. **(08 hours)**

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

1. Choose the concepts of engineering economics and industrial management in decision making.
2. Select the best economic model from various available alternatives
3. Apply the concepts of costing and depreciation estimation.
4. Recognize the importance of planning, Decision making, Organizing, Directing and Controlling
5. Simplify the organization process using the concepts of production planning, work study , and the logistics management

Textbooks:

1. James L. Riggs, David D. Bedworth, Sabah U. Randhawa, "Engineering Economy", 4th edition, McGraw-Hill publishers,1996.
2. A P Varma, N Mohan," Industrial Management", 8th edition, S K Kataria & Sons,2013.

Reference Books:

1. P. C. Tripathi., P. N. Reddy., "Principles of Management." 6th Edition, McGraw-Hill Education, 2017.
2. R Panneerselvam, "Engineering Economics", 3rd edition, McGraw-Hill Education, 2013.
3. O.P.Khanna: " Industrial Engineering and Management", Dhanpat Rai Publishers.

B.E MECHANICAL ENIGINEERING
Choice Based Credit System (CBCS)
Integrated Program Core Couse (IPCC)

Turbomachinery (2:1:1) 4
(Effective from the academic year 2022-2023)

Course Code	**BME502**	Semester	**V**
Teaching Hours/Week (L:T:P)	**2:2:2**	CIE Marks	**50**
Total Number of Lecture Hours	**50**	SEE Marks	**50**
Examination nature (SEE)	**Descriptive**	Exam Hours	**03**

Course Objectives:

The students will be able to understand:

1. The design of turbo machines and compare homologous machines by using dimensional analysis.
2. The suitable turbomachines and Apply Euler's equation.
3. The use of Virtual Lab experiments, Model demonstration and flip class to determine the performance of turbomachines.
4. The energy output and energy consumption by turbomachines.

Preamble: Turbomachines are energy conversion devices in which energy is transferred either to or from a continuously flowing fluid by dynamic action of rotor. This course deals with the study of construction, working, energy transfer and performance calculations of both compressible and incompressible flow machines like turbines, compressors and pumps.

Module – 1

Turbomachines: Classification, Comparison with positive displacement machines, Dimensionless parameters and their significance, Unit and specific quantities, Model studies and numerical problems.

Thermodynamics of Fluid Flow: Efficiencies of turbo machines, Static and Stagnation states, Overall isentropic efficiency, Stage efficiency, Numerical problems. **(10 hours)**

Module-2

Energy Exchange in Turbo Machines: Euler's turbine equation, Alternate form of Euler's turbine equation, Components of energy transfer, Degree of Reaction, Utilization factor, Relation between degree of reaction and utilization factor, Numerical problems.

General Analysis of Turbo Machines: Radial flow pumps – general analysis, Expression for degree of reaction, Velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, Numerical problems.

(10 hours)

Module-3

Steam Turbines: Single stage impulse turbine, Condition for maximum blade efficiency, Stage efficiency, Need and methods of compounding, Multi-stage impulse turbine, Numerical problems.

Reaction Turbine: Parsons's turbine, Condition for maximum utilization factor, Reaction staging, Numerical problems.

(10 hours)

Module-4

Pelton wheel turbine: Principle of working, Velocity triangles, Design parameters, Maximum efficiency, and Numerical problems.

Francis and Kaplan turbines: Principle of working, Draft tubes types, Velocity triangles, Design parameters, and Numerical problems. **(10 hours)**

Module-5

Centrifugal pumps: Parts, Different heads and efficiencies of centrifugal pump, Theoretical head – capacity relationship, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel, and Numerical problems.

Centrifugal compressors: Parts, Stage velocity triangles, Slip factor, Power input factor, Stage work, Pressure developed, Stage efficiency, Surging, stalling and Numerical problems.

(10 hours)

Practical Component of IPCC

1. To determine the overall efficiency and also to draw the main characteristic curves and operating characteristic curves for Pelton wheel
2. To determine the overall efficiency and also to draw the main characteristic curves and operating characteristic curves for Francis Turbine
3. To determine the overall efficiency and also to draw the main characteristic curves and operating characteristic curves for Kaplan Turbine
4. To determine the overall efficiency of Centrifugal Pump
5. To determine the overall efficiency of Reciprocating Pump
6. To determine the mechanical efficiency and volumetric efficiency of two stage reciprocating air compressor.
7. To determine the efficiency of an air blower.

Course Outcomes:

The students will be able to:

CO 1: Classify typical designs of turbo machines and Compare homologous machines by using dimensional analysis.

CO 2: Apply Euler's equation for turbomachines.

CO 3: Analyze the energy transfer in pumps, compressors, turbines on a 1-D basis with the use of velocity triangles and conduction of Flip class / Quiz / Model demonstration / Virtual Lab experiments.

CO4: Examine the performance of turbomachines using different techniques, operating under various conditions

Textbooks:

1. V. Kadambi and Manohar Prasad, “An Introduction to Energy Conversion”, Volume III, New Age International Publishers, reprint 2008.
2. S. M. Yahya, “Turbines, Compressors & Fans”, 2nd Ed, Tata-McGraw Hill Co., 2002.

Reference Books:

1. S. Dixon, “Fluid Mechanics and Thermodynamics of Turbomachinery”, 7th Ed, Butterworth-Heinemann, 2014.
2. P. W. William, “Fundamentals of Turbomachinery”, 1st Ed, John Wiley & Sons, 2008.
3. Shankar Nag. G. L., Keerthi Kumar. N., “Turbomachines”, Cengage Publications, 2018.

B.E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)
Program Core Course (PCC)

ELEMENTS OF MACHINE DESIGN (3:1:0) 4
(Effective from the academic year 2022-23)

Course Code	**BME503**	Semester	**V**
Teaching Hours/Week (L:T:P)	**4:0:0**	CIE Marks	**50**
Total Number of Contact Hours	**50**	SEE Marks	**50**
Examination nature (SEE)	**Descriptive**	Exam Hours	**3**

Course objectives:

1. Understand mechanical design procedure, materials, codes and standards
2. Design machine components for static, impact and fatigue strength
3. Design fasteners, shafts, joints, power screws

Preamble: This course will enable students to design mechanical components subjected to various types of loads such as static, impact and fatigue loads keeping in view of real world applications.

Module – 1

Phases of design process: Normal, shear, biaxial and tri axial stresses, stress tensor, principal stresses, engineering materials and their mechanical properties, stress analysis, design considerations, codes and standards. Stress concentrations, determination of stress concentration factor. **(10 Hours)**

Module – 2

Design for impact loads: Design of machine components under impact stresses due to axial, bending and torsional loads.

Design for Fatigue loads: S-N diagram, Low cycle fatigue, high cycle fatigue, Goodman and Soderberg relationship, endurance limit, endurance limit modifying factors; size effect, surface, stress concentration effects, fluctuating stresses, stresses due to combined loading. **(10 Hours)**

Module – 3

Design of Shafts
Design of shafts for torsion, strength and rigidity with steady loading, ASME codes for power transmission shafting, shafts under combinedloads. **(10 Hours)**

Module – 4

Riveted joints: Types of Riveted joints, Failures of riveted joints, joint efficiency, boiler joints, designof eccentricallyloaded rivetedjoints

Welded joints: Types of welded joints, strength of lap and butt fillet welds, eccentrically loaded welded joints. **(10 Hours)**

Module – 5

Threaded fasteners and Power screws: Stresses in threaded fasteners, effect of initial tension, design of threaded fasteners under static loading. Types of power screws, efficiency and self-locking, design of power screw. **(10 Hours)**

CO 1:	Apply the concept of safe machine design for static loading taking stress concentration into account.
CO 2:	Solve for stresses of machine components subjected to impact and fatigue strength
CO 3:	Select design parameters for welded joints, riveted joints, fasteners and power screws
CO 4:	Analyse and design the shafts as per ASTM standards

Textbooks:

1. Joseph. E. Shigley., Charles. R. Mischke., "Mechanical Engineering Design", 6th Edition, McGraw Hill International, 2009.
2. C. S. Sharma., Kamalesh Purohit., "Design of Machine Elements", 7th Edition, Prentice Hall of India Private Limited, 2006.

References:

1. Robert. L. Norton., "Machine Design – An Integrated Approach", 3rd Edition, Pearson Education, 2001.
2. George. E. Dieter., Linda. Schmidt., "Engineering Design", Indian Edition, McGraw Hill Education, 2003.
3. Hall., Holowenko., "Engineering Design", Special Indian Edition, Laughlin (Schaum's Outline series), 2008.
4. V. B. Bhandari., "Design of Machine Elements", 2nd Edition Tata McGraw Hill Publishing Company Ltd, 2007.

Design Data Handbook

1. K. Mahadevan., Balaveera Reddy., "Design Data Handbook", 4th Edition, CBS publication, 2001.

B.E MECHANICAL ENIGINEERING

Choice Based Credit System (CBCS)

Professional Core Course Laboratory (PCCL)

Energy Conversion Lab (0:0:1) 1

(Effective from the academic year 2022-2023)

Course Code	**BME504**	Semester	**V**
Teaching Hours/Week (L:T:P)	**0:0:2**	CIE Marks	**50**
Total Number of Lecture Hours	**20**	SEE Marks	**50**
Examination nature (SEE)	**Practical Exam**	Exam Hours	**03**

Course Objectives:

1. This course will provide a basic understanding of fuel properties and its measurements using various types of measuring devices
2. Energy conversion principles, analysis and understanding of I C Engines will be discussed. Application of these concepts for these machines will be demonstrated. Performance analysis will be carried out using characteristic curves.
3. Exhaust emissions of I C Engines will be measured and compared with the standards.

List of experiments:

1. Lab layout, calibration of instruments and standards.
2. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleveland's (Open Cup) Apparatus.
3. Determination of Calorific value of liquid and gaseous fuels.
4. Determination of Viscosity of lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
5. Valve Timing/port opening diagram of an I.C. Engine (4-S Diesel engine).
6. Performance Tests on I.C. Engines, Calculations of IP, BP, Thermal efficiency, Volumetric efficiency, Mechanical efficiency, SFC, FP, A:F Ratio, heat balance sheet for:
   a. Single cylinder four stroke Diesel Engine.
   b. Single cylinder four stroke Petrol Engine.
   c. Multi Cylinder Petrol Engine, (Morse test).
   d. Single cylinder four stroke Variable Compression Ratio Engine
7. Measurements of Exhaust Emissions of Diesel engine.
8. Demonstration of pp. pv plots using Computerized IC engine test rig. **(20 hours)**

Course Outcomes:

The students will be able to:

1. Perform experiments to determine the properties of fuels and oils.
2. Determine the energy flow pattern through the I C Engine, and conduct experiments and draw characteristic curves.
3. Identify emission, factors affecting them and report the remedies.

B.E MECHANICAL ENGINEERING

(Choice Based Credit System (CBCS)

SEMESTER - V

Mechanics of Composite Materials (3:0:0) 3

(Effective from the academic year 2022-23)

Course Code	**BME505A**	Semester	**V**
Teaching Hours/Week (L: T:P)	3:0:0	CIE Marks	50
Total Number of Contact Hours	40	SEE Marks	50
Examination nature (SEE)	Descriptive	Exam Hours	3 Hours

Course Objectives:

This course will enable students to:

1. To know the behaviour of constituents in the composite materials.
2. To Enlighten on different types of reinforcement and matrices.
3. To illuminate the knowledge and analysis skills in applying basic laws in mechanics to the composite materials.
4. To understand the various machining techniques used in composite fabrication.
5. To Enlighten on maintenance of composites using various types of inspection and repair operations.

Preamble: Composite materials, classification and development of different types of composite materials, Important properties and applications of composite materials

Module – 1

Introduction to Composite Materials: Function of the matrix and reinforcement in composites, classification of composite materials, Types of matrices & reinforcements, characteristics & selection, Fiber composites, laminated composites, particulate composites, Advantages and application of composites.

Metal Matrix Composites (MMCs): Reinforcement materials: types, Characteristics & Selection, base metals-selection, applications. Processing of MMCs: Liquid state process, solid state process. Properties & Applications of MMCs.

(08 Hours)

Module – 2

Polymer Matrix Composites (PMC): Polymer matrix materials, Thermoset Matrix Composites, Thermoplastic Matrix Composites, prepregs, Advantages and disadvantages. Applications of Polymer matrix composites,

Manufacturing methods: Thermoset Composite manufacturing- Layup processes, Spray up process, Resin transfer moulding, Vacuum moulding, Compression moulding process, Filament winding. Thermoplastic Composite manufacturing- Sheet moulding, Injection moulding, rotational moulding,

(08 Hours)

Module – 3

Ceramic Matrix Composites (CMCs): Matrix and reinforcement materials of CMCs, properties and applications of CMC's. Processing of CMC's: Sintering, Hot Pressing, Infiltration, In Situ Chemical Reaction Technique, Sol-Gel Polymer Infiltration & Pyrolysis.

Carbon-Carbon Composites: Advantages and limitations of carbon-carbon composites, processing of carbon-carbon composites, oxidation protection of carbon-carbon composites, properties and application of carbon-carbon composites.

(08 Hours)

Module – 4

Micromechanics of Composites: Density, Mechanical Properties; Prediction of Elastic Constants, Micromechanical Approaches, Halpin-Tsai Equations, Transverse Stresses, Thermal properties. Numerical Problems.

Macro mechanics of Composites: Introduction, Elastic constants of an isotropic material, elastic constants of a lamina, relationship between engineering constants and reduced stiffnesses and compliances.

(08 Hours)

Module – 5

Machining of composites: Machining of PMCs: Drilling, milling, Waterjet machining, Electric discharge Machining.

Maintenance of Composites: Damage assessment, Inspection Methodology, Repair operation, Repair procedures. Types of Repairs – Repair failures, Typical repair procedures, Delamination, Damage to laminate structures, Repair to sandwich structures, Repair to Honeycomb structures.

(08 Hours)

Course outcomes:

The students will be able to:

CO1: Identify the types of composite materials and their characteristic features.
CO2: Understand the methods employed in composite fabrication.
CO3: Analyze the micro and micromechanical behavior of composites.
CO4: Illustrate the machining process used in composites
CO5: Apply the different procedures to inspect and repair the damaged composites.

TEXTBOOKS:

1. Krishan K. Chawla, Composite Material Science and Engineering, Springer, Third Edition First Indian Reprint 2015.
2. P.K. Mallick, Fibre-Reinforced Composites, Materials, Manufacturing, and Design, CRC Press, Taylor & Francis Group, Third Edition.

REFERENCES:

1. Autar K. Kaw, Mechanics of Composite materials, CRC Taylor & Francis, 2nd Ed, 2005.
2. Michael W, Hyer, Stress analysis of fiber Reinforced Composites Materials, Mc-Graw Hill International, 2009

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

MECHANICAL VIBRATIONS (3:1:0) 4
(Effective from the academic year 2022-23)

Course Code	**BME505B**	Semester	**V**
Teaching Hours/Week (L:T:P)	**3:2:0**	CIE Marks	**50**
Total Number of Contact Hours	**40**	SEE Marks	**50**
Examination nature	**Descriptive**	Exam Hours	**03**

Course objectives:

1. Calculate natural frequencies of various systems subjected to free vibrations and forced vibrations
2. Analyze multi degree freedom systems by applying various numerical methods

Preamble: This course will enable the students to understand the importance and impact of vibrations in component design, environment and economy

Module – 1

Simple Harmonic motion: Types of vibtaions, simple harmonic motions, work done by harmonic force, principle of superposition applied to SHM, Beats, Fourier theorem and simple problems

Undamped free vibrations: Derivations for spring mass systems, methods of analysis, natural frequency of simple systems, springs in series and parallel, torsional and transverse vibrations, effect of mass of spring and problems **(08 Hours)**

Module – 2

Forced Vibrations (1DOF): Analysis of forced vibration with constant harmonic excitation – magnification factor, rotating and reciprocating unbalances, excitation of support (relative and absolute amplitudes) force and motion transmissibility, energy dissipated due to damping and problems **(08 Hours)**

Module – 3

Vibration Measuring Instruments: Vibrometer and accelerometer. Frequency measuring instruments and problems.
Whirling of shafts: Whirling of shafts with and without damping. Discussion of speeds above and below critical speeds and problems **(08 Hours)**

Module – 4

Numerical Methods for Multi Degree Freedom Systems: Maxwell's reciprocal theorem, influence coefficients, Rayleigh's method, Dunkerley's method. Stodola method, Holzer's method, Orthogonality of principal modes, method of matrix iteration and problems **(08 Hours)**

Module – 5

Modal Analysis and Condition Monitoring: Signal analysis, dynamic testing of machines and structures, experimental modal analysis, Machine condition monitoring and diagnosis (**08 Hours)**

Course outcomes:
The students will be able to:
CO 1: Analyze the given wave forms through Fourier series
CO 2: Compute the natural frequency of various undamped mechanical systems during their operation and explain signal & modal analysis
CO 3: Model the given mechanical system into stiffness, mass and damper system and compute the natural frequency of the given system
CO 4: Calculate the critical speed of shaft and identify the vibration measuring techniques for seismic applications.
CO 5: Analyzing the natural frequency of multi degree freedom systems for damped and undamped vibration systems and understand condition monitoring and diagnosis

Textbooks:

1. Singiresu S Rao.,"Mechanical Vibrations",6th Edition, Pearson, 2018
2. V P Singh.," Mechanical Vibrations",3rdEdition, Dhanpat Rai & Co., 2006.

References:

1. S. Graham Kelly., "Mechanical Vibrations: Theory and Applications", 2nd Edition, Pearson Education Asia, 2023.
2. Shashidhar K Kudari.," Mechanical Vibrations", McGrawHill Education, Indian edition, 2015.
3. J.S.Rao, K.Gupta," Theory and Practice of Mechanical Vibrations", New Age International Publishers, Revised 2nd edition, 2023.
4. Grover G.K.," Mechanical Vibrations",2nd Edition, Nem chand and Bros., Roorkee, 2003.

B.E MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)
Professional Elective Course - I

Operations Research (3:0:0) 3
(Effective from the academic year 2022-2023)

Course Code	**BME505C**	Semester	**V**
Teaching Hours/Week (L:T:P)	**3:0:0**	CIE Marks	**50**
Total Number of Lecture Hours	**40**	SEE Marks	**50**
Descriptive	**Descriptive**	Exam Hours	**03**

Course Objectives:

Students will be able to:

1. Impart knowledge in concepts and tools of Operations Research.
2. Understand mathematical models used in Operations Research.
3. Apply operations research techniques constructively to make effective business decisions.

Preamble: Operations Research (OR) is a discipline that helps to make better decisions in complex scenarios by the application of a set of advanced analytical methods. It couples theories, results and theorems of mathematics, statistics and probability with its own theories and algorithms for problem solving

Module – 1

Fundamentals: Evolution of OR, significance and scope of OR, Phases in OR study. Characteristics and limitations of OR, Linear Programming Problem (LPP), Generalized LPP- Formulation of L.P.P graphical method (Two Variables), Types of solution. **(08 Hours)**

Module – 2

Simplex method, Big-M Method, Two-Phase Simplex Method, Concept of Duality, writing Dual of given LPP and Dual Simplex method problems. **(08 Hours)**

Module – 3

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using North-West Corner rule, Vogel's Approximation method. Optimality in Transportation problem by Modified Distribution (MODI) method. Unbalanced T.P. Maximization T.P. Degeneracy in transportation problems, application of transportation problem

Assignment Problem- Formulation, Solutions to assignment problems by Hungarian method, Special cases in assignment problems, unbalanced, Maximization assignment problems.. Difference between assignment and T.S.P, Finding best route by Little's method. Numerical Problems.
(08 Hours)

Module – 4

Network analysis: Introduction, Construction of networks, Fulkerson's rule for numbering the nodes; Critical path method to find the expected completion time of a project determination of floats in networks, PERT networks, determining the probability of completing a project, predicting the completion time of project; Cost analysis in networks. Crashing of networks- Problems.

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), Kendall & Lee's notation of Queuing, empirical queuing models – Numerical on M/M/1 models **(08 Hours)**

Module – 5

Game Theory: Definition, Pure Strategy problems, Saddle point, Max-Min and Min-Max criteria, Principle of Dominance, Solution of games with Saddle point. Mixed Strategy problems. Solution of 2X2 games by Arithmetic method, Solution of 2Xn m and mX2 games by graphical method. Formulation of games.

Sequencing: Introduction, basic assumptions, sequencing "n" jobs on single machine using priority rules, sequencing using Johnson's rule-"n" jobs on 2 machines, "n" jobs on 3 machines, "n" jobs on "m" machines. Sequencing 2 jobs on "m" machines using graphical method. **(08 Hours)**

Course Outcomes:

The students will be able to:

1. Develop mathematical representations from the verbal description of the Real Systems.
2. Analyze appropriate techniques to optimize the results.
3. Asses the solving techniques and propose recommendations to the decision-making process.

Textbooks:

1. S. D Sharma Operations Research 21th edition VISIONIAS publisher 2024
2. P. K. Gupta., D. S. Hira., "Operations Research", 7th Edition, S. Chand and Company Ltd, 2007.
3. Hamdy. A. Taha., "Operations Research: An Introduction", 10th Edition, Pearson, 2016.

Reference Books:

1. J. K. Sharma., "Operations Research: Theory and Applications", 6th Edition, Trinity Press, Laxmi Publications Pvt. Ltd, 2016.
2. Paneerselvan., "Operations Research", 2nd Edition, PHI, 20015.
   A. M. Natarajan., P. Balasubramani., "Operations Research", 2nd Edition, Pearson Education, 2014.

B.E MECHANICAL ENIGINEERING
Choice Based Credit System (CBCS)
Professional Elective Course - I

Design for Manufacture (3:0:0) 3
(Effective from the academic year 2022-23)

Course Code	**BME505D**	Semester	**V**
Teaching Hours/Week (L:T:P)	**3:0:0**	CIE Marks	**50**
Total Number of Lecture Hours	**40**	SEE Marks	**50**
Examination Nature (SEE)	**Descriptive**	Exam Hours	**03**

Course Objectives:
This course enables the students to

1. Understand the concepts of Geometric dimensioning and Tolerances in Engineering drawing.
2. Understand the process capabilities and datum features in various components
3. Evaluate the design considerations of casting, injection moulding, die casting and powder metallurgical components
4. Estimate the assembly limits, machining sequence and process parameters

Preamble: This course will introduce methods that can provide guidance in simplifying product structure to reduce manufacturing and assembly costs, quantify improvements and design concepts can be used for ensuring quality.

Module – 1

Selection of materials for processes: Advantages of applying DFMA, General requirements of early materials and process selection, Selection of Manufacturing processes, Process capabilities, shape attributes, material selection by Membership function modification and dimensionless ranking, computer based primary process/material selection. **(08Hours)**

Module-2

Engineering Design features. – Dimensioning, General Tolerance, Assembly limits, achieving larger machining tolerances, Screw threads, Ground surfaces, holes. Numerical Problems**.**

Datum features – Functional datum, machining sequence, manufacturing datum, changing the datum. Examples. **(08 Hours)**

Module-3

Component Design- Machining Considerations: Design features to facilitate machining: drills, milling cutters, keyways, Doweling procedures, counter sunk screws, Reduction of machined area, simplification by separation, simplification by amalgamation, Numerical Problems

Design for Powder metal Processing: Design principles, Powder metallurgy processing, stages, compaction characteristics, Tooling, Sintering, Design guidelines. **(08 Hours)**

Module-4

Component Design - Casting considerations: Pattern, mould, and parting line. Cored holes and machined holes. Identifying the possible and probable parting lines. Castings requiring special sand cores. Designing to obviate sand cores.

Design for Injection Molding – Injection molding materials, Molding cycle, Systems, machine size, cycle time, cost estimation, Insert molding, Design guidelines.

(08 Hours)

Module-5

GD&T: Symbols, three datum concepts of dimensioning, Straightness, concentricity, Run-out, Location Tolerance, Assembly of parts having concentric cylinders, Control of feature location by true position, Body of revolution, Roundness, Profile dimensioning, Tapers, Shaft of two diameters. Examples**.** **(08 Hours)**

Course Outcomes:

At the end of the course, students will be able to

CO1: Explain the design principles related to various manufacturing processes.

CO2: Apply the concepts of Geometrical dimensioning, selection of materials and tolerance for engineering products**.**

CO3: Evaluate the assembly limits, general tolerances, and process parameters.

CO4: Select the appropriate materials and machining sequence for manufacturing processes.

Textbooks:

1. Harry Peck," Designing for Manufacturing", Pitman Publications,1983,
2. Geofferry Boothroyod, Peter Dew Hurst and Winston Knight - Product Design for Manufacture and Assembly, 3rdEdition, Taylor & Francis Group,2011
3. Merhyle F Spotts, Englewood Cliffs, "Dimensioning and Tolerance for Quantity Production" Prentice Hall, 5th edition,

Reference Books:

1. Bralla, James G, "Handbook of Products Design for Manufacturing: A Practical Guide to Low-cost Production", McGraw Hill, New York,1986.
2. R.K.Jain, "Engineering Metrology", 20th Edition, Khanna Publishers, 2008.

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

Automotive Systems Design (2:1:0) 3
(Effective from the academic year 2022-

Course Code	**BME505E**	Semester	**V**
Teaching Hours/Week (L: T:P: S)	2:1:0	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. Acquire knowledge on forward vehicle dynamics
2. Gain knowledge of engine dynamics, kinematics of suspension and steering.
3. Understand the application various principles to anlyze the braking and steering mechanisms.
4. Practice various system dynamics analysis applied for passenger and sports cars.

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 derivations and problem solving.
3. Encourage collaborative (Group) Learning in the class through Tutorial sessions.
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 skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.

Preamble: Vehicle is a complex machine made of various systems and subsystems. This course will deal with kinematics and dynamics of various automotive systems to synthesize automotive system design and to analyze the forces and moments during vehicle operation..

Module-1

Fundamentals of Motor Vehicle: Vehicle Evolution**,** Simple layout of mechanical systems, Layout of light passenger car: Rear wheel drive layout and Front wheel drive layout, body of light passenger car, Requirements of the vehicle structure, Chassis frame construction, Different frame structure.

Vehicle Dynamics: Symmetric consideration of motor vehicles, Reference frames. Parked car on a level road, Longitudinal mass center of a car, Later mass center of a car, Height of mass center. Parked car on an inclined road, Maximum inclination angle, Front wheel braking, Four wheel braking, Accelerating car on level road, maximum acceleration on level road. Problems related to Vehicle Dynamics. **(08 hours)**

Module-2

Suspension System: Role of suspension system, Vehicle axis terminology, Wheel orientation, Suspension types, Kinematic Analysis of Suspension, Roll center analysis, Suspension Springs, vehicle response to road excitation (Quarter vehicle model), types of suspensions **(08 hours)**

Module-3

Braking System: Function and conditions of braking system, Components and configuration, brake layouts. Kinematics of braking vehicles. Problems on brake force and stopping distance, Braking efficiency. **(08 hours)**

Module-4

Steering Kinematics: Ackerman condition and expression, Front wheel steering 4Wheel System, Turning circle radius, equivalent steering angle, Equivalent bicycle model for front wheel steering, Required space for turning. Trapezoidal steering mechanism and expression, relationship between inner and outer steering angle. Race car steering mechanism. **(08 hours)**

Module-5

Driveline dynamics: Maximum engine power, power performance curves, Fuel consumption at constant speed. Driveline efficiency, Stability condition for transmission. Problems on Powertrain dynamics. **(08 hours)**

Course Outcomes:

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

CO 1. Explain the constructional feature of various systems and subsystems of a passenger car.

CO 2. Analyze the forces, moment and displacement experienced by the vehicle under braking, suspension and steering.

CO 3. Estimate the center of mass for various vehicle designs and analyze the forces developed in a vehicle moving forward using forward vehicle dynamics for both level and inclined road

Suggested Learning Resources:

Textbooks

1. Reza N. Jazar, (2018), Vehicle Dynamics: Theory and Application, 3rd Edition, Springer International Publishing AG
2. Julian Happian-Smith, (2001), An Introduction to Modern Vehicle Design, 1st Edition, Reed Educational and Professional Publishing Ltd

References

1. V.A.W. Hillier & Peter Coombes, (2004), Hillier's Fundamentals of Motor Vehicle Technology – Book 1, 5th Edition, Stanley Thornes (Publishers) Ltd
2. Giancarlo Genta and Lorenzo Morello, (2009), The Automotive Chassis Vol. 2: System Design, Springer Science+Business Media B.V

Web links and Video Lectures (e-Resources)

1. Vehicle Dynamics by Dr. R. Krishnakumar Department of Engineering Design IIT Madras
   Link: https://archive.nptel.ac.in/courses/107/106/107106080/

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

Mini Project (0:0:3) 3
(Effective from the academic year 2022-2023)

Course Code	**BME506**	Semester	**V**
Teaching Hours/Week (L:T:P)	**0:0:9**	CIE Marks	**50**
Examination Nature (CIE)	Presentation, Skill and Viva	SEE Marks	**50**
Examination Nature (SEE)	Presentation, Skill and Viva	Exam Hours	**03**

Preamble: Mini Project: The Mini Project Work is a part of the curriculum in the pre-final year. Mini Project is a course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications. Based on the ability/abilities of the student/s and recommendations of the mentor, a Mini- project can be assigned to a group having not more than 4 students. A comprehensive report is to be prepared after completion of the project work.

Mini Project:

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini project:

(i) Single discipline:

The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25.

The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary:

Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates. SEE for Mini-project.

SEE procedure for Mini project:

Single discipline:

Contribution to the Mini-project and the performance of each group member shall be assessed individually in the semester end examination (SEE) conducted at the department

Interdisciplinary: Contribution to the Mini-project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belongs to.

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Choice Based Credit System (CBCS)

Research Methodology and IPR (2:0:0) 2

Common to all Branches

(Effective from the academic year 2024-25 for 2022 Scheme)

Course Code	**BRMK507**	Semester	**V**
Teaching Hours/Week (L:T:P)	2:0:0	CIE Marks	50
Total Number of Contact Hours	26	SEE Marks	50
Examination Nature (SEE)	Descriptive	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Explain research process and research problem.
2. Gain knowledge on research design, sampling survey and data collection.
3. Familiarized with Interpretation and report writing.
4. Understand the concept of IP, patent and copy right.
5. Enhance their knowledge on trademarks, industrial and IC layout design.

Module – 1

Research Methodology: Meaning of Research, Objectives of research, types of research, research approaches, Significance of research, Research Process: Formulating research problem, Research methods verses methodology, Research and scientific method. Criteria of good research.

Defining the Research Problem: What is a Research Problem? Selecting the Research Problem, Necessity of Defining the Problem, Techniques Involved in Defining a problem. **(06 Hours)**

Module – 2

Research Design: Meaning of Research Design, Need for Research design, Feature of a Good Design. Research Design in case of exploratory research studies, descriptive and diagnostic research studies. Basic Principles of Experimental Designs.

Design of sampling survey: Sample Design: Objective, size of sample, parameter of interest, selection of proper sample design. Sampling errors, non-sampling errors.

Data Collection: Experiments and Surveys, collection of primary data: observation method. Collection of secondary data. Selection of appropriate method for data collection. **(05 Hours)**

Module – 3

Interpretation and Report writing: Meaning of Interpretation, Techniques of Interpretation, Precautions in interpretation, Significance of report writing, Different steps in report writing, layout of the research report, Types of reports, Oral presentation, Mechanics of writing research report, Precautions for writing a research reports. **(05 Hours)**

Module – 4

Introduction to IP: Various forms of IP, Importance of intellectual property, Trade policy reviews, Agreement on trips.

Patent: What is patent, condition for grant of patent, Temporal and spatial aspects of patent, right of patentee, Patent office and register of patent.

Copyright: Copyright and classes of work, meaning of publication, ownership of copyright, license of copyright, term of copyright, Internet and copyright issues. **(05 Hours)**

Module – 5

Trademarks: Introduction to trademark, term of trademark, collective marks, certification trademarks.
Industrial Design: Registration of Design: Non-registrable designs under The Design Act 2000, Condition for registration of Industrial Designs. Term of Industrial Designs
IC Layout Design: Integrated Circuits Layout Design, Grant of registration of IC Layout Design.

(05 Hours)

Course Outcomes:
The students will be able to:
CO1: Illustrate research process and research problem.
CO2: Describe research design, sampling survey and data collection.
CO3: Explain the techniques of Interpretation and report writing.
CO4: Summarize the concept of IP, patent and copy right.
CO5: Discuss trademarks, industrial and IC layout design.

TEXTBOOKS:

1. CR Kothari and Gaurav Garg, Research Methodology, New Age International Publishers, 2020.
2. Neeraj Pandey, Khushdeep Dharni, "Intellectual Property Rights", PHI Learning, 2014.

REFERENCES:

1. Dinakar Deb, Rajdeep Dey, Valentina, Engineering Research Methodology, Springer, 2019.
2. David V. Thiel, Research method for engineers, Cambridge University Press, 2014.
3. Prabhuddha Ganguli, "Intellectual Property Rights", Tata Mc-Graw –Hill, 2017.

ASSESSMENT METHODS

CIE Components (50 Marks)
Two Unit Tests each of 40 Marks. Sum of the two Internal Assessments Tests Marks will be out of 80 Marks and scaled down to 25 Marks.

CCA 1 : 25 Marks
CCA 2 : 25 Marks
Sum of the CCA's will be out of 50 Marks and scaled down to 25 Marks.

Internal Assessments Tests	: 25 Marks
CCA	: 25 Marks
Total CIE Marks	: 50 Marks

SEE Component (50 Marks)
- SEE examination is conducted for 100 Marks and scaled down to 50 Marks.
- The question paper will have ten full questions carrying equal marks.
- Each full question will be for 20 marks.
- There will be two full questions (with a maximum of three sub- questions) from each module.

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 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.

B.E. MECHANICAL ENGINEERING
Choice Based Credit System (CBCS)
Mandatory Course (MD)

Environmental Studies (1:0:0) 1

Common to all Branches
(Effective from the academic year 2024-25 for 2022 Scheme)

Course Code	**BESK508**	Semester	**V**
Teaching Hours/Week (L:T:P)	**1:0:0**	CIE Marks	**50**
Total Number of Lecture Hours	**15**	SEE Marks	**50**
Examination Nature (SEE)	**MCQ**	Exam Hours	**01**

Course Objectives:

This course will enable students to

1. Recognize the ecological basis for regional and global Environmental issues, and lead by example as an environmental steward.
2. Apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
3. Analyze the trans-national character of environmental problems and ways of addressing them, including interactions across local to global scales.
4. Demonstrate proficiency in quantitative methods, qualitative analysis, critical thinking, and written and oral communication needed to conduct high-level work as environmentalists.

Module – 1

Biodiversity: Types, Value, Hot spots and Threats
***Field work:** Visit to a local area to document environmental assets: River / Forest / Grassland / Hill **(03 Hours)**

Module – 2

Environmental Pollution & Abatement & Relevant Acts: Water, Soil and Air Pollution.

***Field work:** Visit to a local polluted Site-Urban/Rural/Industrial/Agricultural, followed by observation and documentation of environmental pollution and recommendation of remedial measures. **(03 Hours)**

Module – 3

Waste Management & Public Health Aspects & Relevant Acts: E-waste, Bio-medical & Hazardous wastes.
***Field work:** Visit to a Resource Management Facility or Waste Treatment Facility, followed by understanding of process and its brief documentation. **(03 Hours)**

Module – 4

Global Environmental Concerns: Ground water depletion, Climate Change and Carbon Trading.
*Field work: Visit to a Green Building, followed by understanding of process and its brief documentation. **(03 Hours)**

Module – 5

Latest Developments in Environmental Pollution Mitigation: E.I.A., E.M.S., SDG.
*Field work: Visit to Environmental NGOs, followed by brief documentation.
(03 Hours)

*** Any one Field Work is to be successfully accomplished. The same will be assessed for AAT.**

Course Outcomes:

The students will be able to:

CO 1: Appraise the significance of ecological systems under the ambit of environment.

CO 2: Analyze for the consequences owing from anthropogenic interactions on the environmental processes.

CO 3: Recommend solutions in the Anthropocene Epoch, with an in-depth understanding of the interdisciplinary facets of environmental issues.

CO 4: Elucidate the trans-national character of environmental problems and ways of addressing them.

CO 5: Appraise latest developments, concerns and ethical challenges associated with Environmental Protection.

Textbooks:

1. Rajesh Gopinath and N. Balasubramanya, "Environmental science and Engineering", 1st Edition, Cengage Learning India Private Limited, 2018.
2. J. S. Singh, S. P. Singh and S. R. Gupta, "Ecology, Environmental Science and Conservation", India, S. Chand Publishing, 2017.

Reference Books:

1. M. Gadgil and R. Guha, "This Fissured Land: An Ecological History of India", Univ. of California Press, 1993.
2. E. P. Odum and H. T. Odum, "Fundamentals of Ecology", Philadelphia: Saunders Publisher, 1971.
3. M. L. Mckinney, "Environmental Science systems & Solutions", Web enhanced Edition, City of Publisher, R. M. Publisher, 1996

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	**BNSK509**	Semester	V 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 degree)

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

1. Understand the community in general in which they work.
2. Identify the needs and problems of the community and involve them in problem solving.
3. Develop among themselves a sense of social & civic responsibility & utilize their knowledge in finding practical solutions to individual and community problems.
4. Develop competence required for group-living and sharing of responsibilities & gain skills in mobilizing community participation to acquire leadership qualities and democratic attitudes.
5. 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 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	**BPEK509**	Semester	**V 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 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:

1 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.

2	Develops individual and group techno tactical abilities of the game.
3	Increases the team combination and plan the strategies to play against opponents.
4	Outline the concept of sports training and how to adopt technology to attain high level performance.
5	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	**BYOK509**	Semester	**V 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	**-**

Course Objectives:

This course will enable students to:

6. Understand the importance of practicing yoga in day-to-day life.
7. Be aware of therapeutic and preventive value of Yoga.
8. Have a focussed, joyful and peaceful life.
9. Maintain physical, mental and spiritual fitness.
10. 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:

1. Understand the requirement of practicing yoga in their day-to-day life.
2. Apply the yogic postures in therapy of psychosomatic diseases
3. Train themselves to have a focussed, joyful and peaceful life.
4. Demonstrate the fitness of Physical, Mental and Spiritual practices.
5. 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

BMS Institute of Technology and Management

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
Choice Based Credit System (CBCS)
SEMESTER – III to VI

NCC (Common to all Branches)
(Effective for the 2022 scheme)

Course Code	**BNCK509**	CIE Marks	100
Teaching Hours/Week (L: T:P)	0:0:2	SEE Marks	-
Total Number of Contact Hours	26	Exam Hours	-

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

Course Objectives:
This course will enable students to:

- Understand the vision of NCC and its functioning.
- Understand the security set up and management of Border/Coastal areas.
- Acquire knowledge about the Armed forces and general awareness.

Module– 1

Introduction to National Cadet Corp: What is NCC, who can join NCC, benefits, Establishment, history, 3 wings, motto, core values, Aims, flag, song, pledge, cardinals, Organization, Director General NCC, Directorates, Uniform and Cadet ranks, Camps, Certificate exams, Basic aspects of drill.

National Integration: Importance of national integration**,** Factors affecting national integration, Unity in diversity**,** Role of NCC in nation building.

Disaster Management: What is a Disaster**,** Natural and Man-made disasters**,** Earthquake, Floods.

(04 Hours)

Module– 2

Indian Army: Introduction to Indian Army, Command and control, Fighting & supporting arms**,** Rank structure, Major Regiments of the Army**,** Major Wars and Battles**,** Entry to the Indian Army, Renowned leaders and Gallantry Awardees. **(02 Hours)**

Module– 3

Indian Air Force: Introduction to Indian Air Force, Command and control**,** Rank structure**,** Major Aircrafts, Entry to the Indian Air Force, Renowned leaders.

Indian Navy: Introduction to Indian Navy, Command and control, Rank structure, Major Ships and Submarines**,** Entry to the Indian Navy, Renowned leaders. **(02 Hours)**

Module– 4

Health and Hygiene: First Aid Protocols - CPR, Understanding Types of Bandages, Fire Fighting
Field & Battle Crafts: Field Signals using hands, Judging distance -Types of Judging Distance, Section formations-types of Section Formation. **(10 Hours)**

Module– 5

Drill Practicals: Savdhan, Vishram, Salute, Turning, Marching. **(08 Hours)**

Course outcomes:

The students will be able to:

CO1: Develop qualities like character, comradeship, discipline, leadership, secular outlook, spirit of adventure, ethics and ideals of selfless service.

CO2: Get motivated and trained to exhibit leadership qualities in all walks of life and be always available for the service of the nation.

CO3: Familiarize on the issues related to social & community development and disaster management and equip themselves to provide solutions.

CO4: Get an insight of the defense forces and further motivate them to join the defense forces.

Teaching Practice:

- Blackboard/Multimedia Assisted Teaching.
- Class Room Discussions, Brainstorming Sessions, Debates.
- Activity: Organizing/Participation in Social Service Programs.
- On Ground: Drill training.

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.

Textbooks:

1. NCC Cadets Handbook –Common Directorate General of NCC, New Delhi.
2. NCC Cadets Handbook –Special(A), Directorate General of NCC, New Delhi.

References:

- Chandra B. Khanduri, "Field Marshal KM Cariappa: a biographical sketch", Dev Publications,2000.
- Gautam Sharma, "Valour and Sacrifice: Famous Regiments of the Indian Army", Allied Publishers,1990.

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

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

Course Code	**BMUK509**	Semester	**V 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:

1. Identify the major traditions of Indian music, both through notations and aurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. Demonstrate an ability to use music technology appropriately in a variety of settings.

Module – 1

Preamble: Contents of the curriculum intend to promote music as a language to develop an analytical, creative, and intuitive understanding. For this the student must experience music 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 - Geetha, 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

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

References

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