BMS INSTITUTE OF TECHNOLOGY & MANAGEMENT

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

Yelahanka, Bengaluru 560064

Bachelor of Engineering

Department of Mechanical Engineering

VI Semester Scheme and Syllabus
2022 Scheme
Effective from the AY 2024-25

2022 BATCH

Approved in the BoS meeting held on 01.03.2025

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.

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮತ್ತು ವ್ಯವಸ್ಥಾಪನಾ ಮಹಾವಿದ್ಯಾಲಯ
BMS Institute of Technology and Management
(An Autonomous Institution, Affiliated to VTU Belagavi)
Avalahalli, Doddaballapur Main Road, Bengaluru, Karnataka – 560064

REVISED

Date: 18-12-2024

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:

IPCC COURSES: 4 CREDITS 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 – 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 will be scaled down to **20 Marks**.
		CIE – Test 2 (1.5 hr)	40			

	CIE – CCA (Comprehensive Continuous Assessment)	CCA	10	05	-	Any one assessment method can be used from the list appended below.
	Total CIE Theory			**25**	**10**	
Practical Component	CIE - Practical		30	15	-	Each laboratory experiment is to be evaluated 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			**25**	**10**	
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**	
The laboratory component of the IPCC shall be for CIE only.						

Professional Core Courses (PCC) / Engineering Science Courses (ESC): 03 and 02 Credit						
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**	

NON-IPCC COURSES: 01 Credit Course - MCQ						
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**, examination duration is 01 hour.
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**	

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 18/12/2024

Dean AA 18.12.24

Principal 18/12/24

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)

VI 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	IPCC	BME601	Heat Transfer	TD: ME PSB: ME	2	1	1	4	50	50	100	3	6
2	PCC	BME602	Advanced Machine Design		4	0	0	4	50	50	100	3	4
3	PCC	BME603	Theory of Machines		3	0	0	3	50	50	100	3	3
4	PEC	BME604X	Professional Elective Course II		3	0	0	3	50	50	100	3	3
5	OEC	BME605X	Open Elective Course I		3	0	0	3	50	50	100	3	3
6	PW	BME606	Major Project Phase-1		0	0	3	3	100	-	100	-	6
7	PCCL	BMEL607	Automation Lab		0	0	1	1	50	50	100	3	2
8	AEC	BME608X	Ability Enhancement Course		For Theory course				50	50	100	1	1
					1	0	0	1					
					For Practical course							2	2
					0	0	1	1					
9	NCMC	BNSK609	National Service Scheme (NSS)	NSS Coordinator	0	0	0	0	100	-	100	-	2
		BPEK609	Physical Education (Sports and Athletics)	PED									
		BYOK609	Yoga	Yoga Teacher									
		BNCK609	National Cadet Corps (NCC)	NCC officer									
		BMUK609	Music	Music Teacher									
10	NCMC	BIKS610	Indian Knowledge System	Any Department	0	0	0	0	100	-	100	-	1
TOTAL					**16**	**1**	**5**	**22**	**650**	**350**	**1000**	**-**	**33**

IPCC: Integrated Professional Core Course, **PCC**: Professional Core Courses, **PEC**: Professional Elective Course, **OEC**: Open Elective Course, **PCCL**: Professional Core Course laboratory, **NCMC**: Non Credit Mandatory Course, **ESC**: Engineering Science Course, **AEC**: Ability Enhancement Course, **L:** Lecture, **T**: Tutorial, **P**: Practical, **CIE**: Continuous Internal Evaluation, **SEE**: Semester End Evaluation.

Professional Elective Course II		**Open Elective Course I**		**Ability Enhancement Course**	
Course Code	**Course Name**	**Course Code**	**Course Name**	**Course Code**	**Course Name**
BME604A	Control Engineering	BME605A	Digital Transformation in Industry	BME608A	Electric Vehicle Laboratory
BME604B	Design for Manufacturing and Assembly	BME605B	Intellectual Property Management	BME608B	Internet of Things Lab
BME604C	Mechatronics	BME605C	Energy Storage System	BME608C	Programming and Simulation lab
BME604D	Automotive Electronics	BME605D	Product Design and Development	BME608D	Advanced Python Programming Lab.
BME604E	Innovative Product Development				

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 VI 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.

Open Elective Courses (OEC): Students belonging to a particular stream of Engineering and Technology are not entitled to the open electives offered by their parent Department. However, they can opt for an elective offered by other Departments, provided they satisfy the prerequisite condition if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the program.
- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the program.
- The minimum students' strength for offering open electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

Project Phase-I: Students have to discuss with the mentor /guide and with their help he/she has to complete the literature survey and prepare the report and finally define the problem statement for the project work.

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

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

Course Code	**BME601**	Semester	**VI**
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:

1. Use the concept of modes of heat transfer to solve real life problmes.
2. Learn how to formulate and solve 1-D steady and unsteady heat conduction problems.
3. Apply empirical correlations for fully-developed laminar, turbulent internal flows and external boundary layer convective flow problems.
4. Study the basic principles of heat exchanger analysis and thermal design.
5. Analyze the principles of boiling and condensation including radiation heat transfer related engineering problems.

Preamble: Heat transfer is the exchange of thermal energy between physical systems due to temperature and pressure differences. This course deals with study of different modes of heat transfer and also heat transfer in steady and unsteady condition.

Module – 1

Modes of Heat Transfer: Governing Laws of conduction, Convection, and Radiation heat transfer; Electrical Analogy, Combined mechanisms of heat transfer, Types of boundary conditions. General three dimensional heat conduction equation: Derivation of the equation in Cartesian coordinate. Numerical problems.

Steady-State One-Dimensional Heat Conduction: Steady-state one-dimensional heat conduction problems in Cartesian System: Without heat generation, Constant thermal conductivity - in Cartesian system, Thermal resistances in series and in parallel. Numerical problems. **(10 hours)**

Module-2

Extended Surfaces or Fins: Straight rectangular and circular fins, Temperature distribution and heat transfer calculations, Fin efficiency and effectiveness, Applications, Numerical problems.

Transient Heat Conduction: Definition, Different cases - Negligible internal thermal resistance, Negligible surface resistance, Comparable internal thermal and surface resistance, Lumped body, Infinite Body and Semi-infinite Body, Numerical Problems. **(10 hours)**

Module-3

Thermal Radiation: Principles - Gray, White, Opaque, Transparent and Black bodies, Spectral emissive power, Stefan-Boltzmann law for the total emissive power of a black body, View factor, Net radiation exchange between parallel plates, Radiation Shield, Numerical problems. **(10 hours)**

Module-4

Forced Convection: Boundary layer theory, Velocity and Thermal boundary layers, Prandtl number, Turbulent flow, Various empirical solutions, Forced convection flow over cylinders and spheres, Laminar and turbulent flow solutions, Numerical problems.

Free convection: Laminar and turbulent flows, Vertical plates, Horizontal plates, Vertical tubes and horizontal Tubes, Numerical problems. **(10 hours)**

Module-5

Heat Exchangers: LMTD method, Effectiveness - NTU method, Fouling factors, Chart solution procedures for solving heat exchanger problems: Correction factor charts and effectiveness-NTU Charts, Numerical problems.

Boiling and Condensation: Pool boiling, Bubble growth mechanisms, Nucleate pool boiling, Critical heat flux in Nucleate pool boiling, Pool film boiling, Critical heat flux, film wise and dropwise Condensation, Numerical problems. **(10 hours)**

PRACTICAL COMPONENT OF IPCC

1. To determine the thermal conductivity of metal rod (Aluminum).
2. To determine the overall thermal conductivity of a composite wall.
3. To determine the effectiveness and efficiency and heat transfer through Pin fin.
4. To determine the convective heat transfer coefficient and heat transfer, theoretically and experimentally in natural convection.
5. To determine the convective heat transfer coefficient and heat transfer, theoretically and experimentally in forced convection.
6. To determine the emissivity of a given surface.
7. To determine LMTD and the rate of heat transfer for Parallel flow and Counter flow heat exchangers.
8. To determine the heat transfer and to draw the temperature time graph for cylinder using un steady state heat conduction equipment.

For Demonstration only

1. To determine the rate of heat transfer by Drop wise and film wise condensation apparatus.
2. To find the critical temperature of a given wire using critical heat flux apparatus.

Course outcomes:

The students will be able to:

CO 1: Apply the governing laws of heat transfer to compute rate of heat transfer, effectiveness and efficiency in a given thermal system.

CO 2: Analyse the study and transient behavior for thermal components and compute heat flow pattern.

CO 3: Assess the performance of different thermal systems

CO 4: Conduct the thermal analysis through simulation / experimentation for different thermal components and prepare the report.

Textbooks :

1. F. P. Incropera and D. P. Dewitt, “Fundamentals of Heat and Mass Transfer”, John Wiley and Sons, 2009.
2. J. P. Holman, “Heat Transfer”, McGraw Hill, 2007.

References

1. M. N. Ozisik, “Heat Transfer-A Basic Approach”, McGraw Hill, 1985.
2. A. Bejan, “Convective Heat Transfer”, John Wiley and Sons, 2004.
3. F. Kreith and M. S. Von, “Principles of Heat Transfer”, Brook and Cole Publication, 2001.

Data Hand Books:

1. C P Kothandaraman and S Subramanyan “ Heat and Mass Transfer Data Book” , New age International Publishers, 11th edition. 2024.

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

Advanced Design of Machine Elements (4:0:0) 4
(Effective from the academic year 2022-23)

Course Code	**BME602**	Semester	**VI**
Teaching Hours/Week (L:T:P)	4:0:0	CIE Marks	50
Total Number of Contact Hours	50	SEE Marks	50
Examination nature	Descriptive	Exam Hours	03

Course objectives:

1. Design of crane hooks and frames of punch presses of various cross sections
2. Selection of belts and bearings from manufacturer's catalogue
3. Analyze the characteristics of journal bearings
4. Design machine components such as gears, springs, clutches and brakes.

Preamble: This course will enable students to select and design various components of automotive transmission such as gears, bearings, gears, clutches and brakes considering its impact on economy, environment and customer satisfaction

Module – 1

Curved Beams: Difference between straight and curved beams, Assumptions in analysis of curved beams, Stresses in curved beams of standard cross sections used in crane hook, frames of punching presses and clamps. **(10 Hours)**

Module – 2

Belts: Construction of flat and V belts and materials of belts, power rating of belts, concept of slip and creep, initial tension, effect of centrifugal tension, maximum power condition.
Design of Springs: Types of springs-stresses in Helical coil springs of circular and non circular cross sections. **Leaf Springs**: Stresses in leaf springs. Equalized stresses and nipping of leaf springs. Design of Belleville springs. **(10 Hours)**

Module – 3

Gear drives: Classification of gears, materials for gears, standard systems of gear tooth, gear tooth failure modes and lubrication ofgears.
Spur Gears: Definitions, stresses in gear tooth: Lewis equation and form factor, Design for strength, Dynamic load and wear load.
Bevel Gears: Bevel Gears: Definitions, formative number of teeth, Design based on strength, dynamic and wear loads. **(10 Hours)**

Module – 4

Design of Clutches: Types of clutches and their applications**,** cone clutch, Single plate and multi plate clutches.
Design of Brakes: Types of brakes, Block and Band brakes: Self locking of brakes and heat generation in Brakes.
Internal expanding brakes and disc brakes (Theoretical treatment only). **(10 Hours)**

Module – 5

Lubrication and Bearings: Lubricants and their properties, Bearing Materials and properties, Mechanisms of Lubrication, hydrodynamic lubrication and, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, Heat Generated, Heat dissipated.
Anti friction bearings: Types of rolling contact bearings and their applications, static and dynamic load carrying capacities, equivalent bearing load, load life relationship, selection of deep groove ball bearings from manufacturer's catalogue, Summary of the course

(10 Hours)

Course outcomes:

The students will be able to:

CO 1: Develop various curved beams and springs under loadings, select V-belts,

CO 2: Develop various types of gears.

CO 3: Analyze the characteristics of Journal bearing, select bearings from manufacturer's catalogue.

CO 4: Solve for the dimensions of clutches and Brakes.

Textbooks:

1. Joseph.E.Shigley.,Charles.R.Mischke.,"MechanicalEngineeringDesign",6th Edition, McGraw Hill International, 2009.
2. C.S. Sharma., KamaleshPurohit.,"DesignofMachineElements",7th Edition, Prentice Hall of India Private Limited,2006.

References:

1. Robert. L. Norton., "Machine Design – An Integrated Approach, 3rd Edition, Pearson Education Asia,2001.
2. George.E.Dieter.,LindaSchmidt.,"EngineeringDesign",McGrawHillEducation,Indian
    a. edition, 2003.
3. Hall.,Holowenko.,"EngineeringDesign",Laughlin(schaum'sOutlineseries),Special Indian edition,2008.
4. V.B.Bhandari.,"Design of MachineElements",2nd Edition, TataMcGrawHill Publishing Company,2007.

Design Data Handbook:

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

B.E MECHANICAL ENGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

THEORY OF MACHINES (3:0:0) 3

(Effective from the academic year 2022-23)

Course Code	**BME603**	Semester	**VI**
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 understand the concept of machines, mechanisms and related terminologies.
2. To analyse working cams, gears and gear trains.
3. To understand the working of gyroscope and governors.
4. To know the concepts of vibration mechanical systems using spring, mass and damper elements.

Preamble: Working of various machines and machine components, application of mechanisms in various fields based on the requirement.

Module – 1

Mechanisms: Structures, Machines, mechanisms, static, kinetic, mechanisms and Mechanism terminologies, degrees of freedom, Classification links and pairs, Groshoff's law, Inversions of Slider crank and four bar mechanisms.

Mechanisms: Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Oldham's coupling, Intermittent Motion mechanisms: Geneva wheel mechanism, Ratchet and Pawl mechanism. **(08 Hours)**

Module – 2

Velocity and Acceleration Analysis: Velocity and Acceleration Analysis of Four bar mechanism and Single slider crank mechanisms.

Static and Dynamic force analysis: Static equilibrium, analysis of four bar mechanism, slider crank mechanism, shaper mechanism, numerical problems, D'Alembert's principle, analysis of four bar and slider crank mechanism. **(08 Hours)**

Module – 3

Cams: Types of cams, Types of followers, Follower displacement programming, Derivatives of follower Motion, Motions of follower, Layout of cam profiles.

Spur Gears: Gear terminology, law of gearing, path of contact, arc of contact, contact ratio of spur gear. Interference in involute gears, methods of avoiding interference, back lash, numericals.

Gear Trains: Simple gear trains, compound gear trains. Epicyclic gear trains:Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains, numerical problems.

(08 Hours)

Module – 4

Governors: Types of governors, force analysis of Porter and Hartnell governors. Controlling force, Stability, Sensitiveness, Isochronism, Effort and Power, numerical problems. Modern electronic governors.

Gyroscope: Vectorial representation of angular motion, Gyroscopic couple. Effect of gyroscopic couple on plane disc, aeroplane, ship, stability of two wheelers and four wheelers, numerical problems. **(08 Hours)**

Module – 5

Vibration: Introduction, Basic elements of vibrating system.

Free vibration: Types of free vibration, Longitudinal Vibrations-Equilibrium method, Energy method, Rayleigh's method.

Damped free vibrations: Under damped, over damped and critically damped systems. Logarithmic decrement.

Forced vibration: Undamped forced vibration of spring mass system, damped forced vibrations, Vibration isolation. **(08 Hours)**

Course outcomes:

The students will be able to:

CO1: Apply acquired knowledge of basic mechanisms to study the working of different mechanisms.

CO2: Analyze the velocity, acceleration and forces of mechanisms.

CO3: Illustrate the motion of cams, gears and gear trains.

CO4: Analyze the governors, and gyroscopes.

CO5: Classify the vibrational characteristics of various machine components.

CO6: Conduct the velocity and force analysis through simulation / experimentation for different machine components and prepare the report.

TEXTBOOKS:

1. Rattan S.S, Theory of Machines, Tata McGraw Hill Publishing Company Ltd., New Delhi, 5th Edition, 2019.
2. Sadhu Singh, Theory of Machines, Pearson Education, 4th Edition. 2009.
3. A. G. Ambekar, Mechanism and Machine Theory, PHI, 2007

REFERENCES:

1. Michael M Stanisic, Mechanisms and Machines-Kinematics, Dynamics and Synthesis, Cengage Learning, 4th Edition 2016.
2. J.J. Uicker, G.R. Pennock, J.E. Shigley, Theory of Machines & Mechanisms, Oxford University Press, New York, 5th Edition 2017.

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

Control Engineering (3:0:0) 3
(Effective from the academic year 2022-2023)

Course Code	**BME604A**	Semester	**VI**
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 identify the needs of different types of controllers
2. To understand the concepts of mathematical modeling, feedback control
3. To understand the transfer function using block diagram and signal flowgraphs
4. To understand the time response of the system for standard input functions
5. To understand the nature of stability of the system

Preamble: This course is designed to understand the fundamental principles of control systems essential for various engineering fields. Through this course students will gain the knowledge necessary to analyze, and implement control systems that ensure the stability, performance, and efficiency of various engineering applications and preparing them to solve real-world problems in fields such as robotics, process control and automation.

Module – 1

Automatic Control:: Significance and Scope of control engineering , Importance of the control engineering , Recent trends in control system, Concept of automatic controls, Open loop and closed loop systems, Concepts of feedback, requirements of an ideal control system.

Controllers: Types of controllers, Proportional, Integral, Differential, Proportional and Integral, Proportional Differential and Proportional Integral Differential controllers**.** **(08 hours)**

Module-2

Modeling of Physical Systems: Mathematical Models of Mechanical, Electrical, Thermal systems.

Analogous Systems: Direct and inverse analogous for mechanical systems. **(08 hours)**

Module-3

Block Diagram Representation: General representation of a feedback control system, transfer functions, rules of block diagram, reduction of block diagram to obtain closed loop transfer function.

Signal Flow Graphs : Transfer function using Mason's gain formula. **(08 hours)**

Module-4

Time Response Analysis: First order and second order system response to step, ramp and impulse inputs, concepts of time constant, Routh's stability criterion for a control system.

Root Locus Plots: Significance of Root locus, construction of Root locus using general rules and steps and stability analysis using Root Locus. **(08 hours)**

Module-5

Frequency Domain Analysis: Relationship between time and frequency response, Polar plot, Bode's Plot, Nyquist plot and Nyquist stability criterion, Relative Stability, Phase and Gain Margins. **(08 hours)**

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

1. Describe the elements of control systems and controllers.
2. Determine the system governing equations for physical models.
3. Find the transfer function using the block diagram reduction rules and Mason's gain formulae.
4. Analyze the time response of first and second order system.
5. Evaluate the stability of the control system using Root locus, Bode plots & Nyquist plots.

Text Books:

1. Katsuhiko Ogatta, "Modern Control Engineering", 4th edition, , Pearson Education Publishers,2002.
2. B.C.Kuo, F.Golnaraghi, "Automatic Control Systems", 9th edition, Wiley publishers,2014.

Reference Books:

1. Norman S. Nise, "Engineering control systems", India Edition, Wiley publishers, 2018.
2. Schaum's Series, "Feedback Control System", 3rd edition, McGraw-Hill Education,2013.
3. Nagrath & Gopal, "Control Systems Engineering", 6th Edition, New Age International Publishers, 2018

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

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

Course Code	**BME604B**	Semester	**VI**
Teaching Hours/Week (L:T:P)	3:0:0	CIE Marks	50
Total Number of Lecture Hours	40 hours	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 and 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. **(08 Hours)**

Module-2

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

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

Design for Assembly: Design guidelines for manual assembly, large assemblies, analysis of an assembly, rules for product design for automation, design for robot assembly **(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.

TEXT BOOKS

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,

REFERENCES:

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 ENGINEERING
Choice Based Credit System (CBCS)

Mechatronics (3:0:0) 3
(Effective from the academic year 2022-23)

Course Code	**BME604C**	Semester	**VI**
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	03

Course objectives:

This course will enable students to:

1. Understand the evolution and development of Mechatronics as a discipline.
2. Substantiate the need for interdisciplinary study in technology education.
3. Comprehend the applications of microprocessors in various systems and to know the functions of each element.

Preamble System in the current scenario, Industrial /defense application, research in the field of ME, Impact of Mechatronics on society and sustainable solutions

Module – 1

Fundamentals of mechatronics: Multidisciplinary Scenario, Evolution of Mechatronics, Design of Mechatronics system, Objectives, advantages and disadvantages of Mechatronics.
Transducers and sensors: Classification of transducers, Difference between transducer and sensor, Definition and classification of sensors, Principle of working and applications of light sensors, proximity sensors and Hall Effect sensors. Nano sensors and Types. **(08 Hours)**

Module – 2

Signal Conditioning: Digital I/O, Digital number system, Binary number system, Hexadecimal number system, Binary addition, Boolean Algebra, Logic function, Universal gates, flip- flop, Registers counters. Analog to digital conversions, Registers, capacitors, amplifying signals using OP amps. Digital Signal Processing – Digital to Analog conversion, filters. Data acquisition systems (DAQS), Multiplexers, PWM's – Pulse Width Modulation. **(08 Hours)**

Module – 3

Microprocessor & Microcontrollers: Microprocessor systems, Basic elements of control systems, 8085 Architecture. Bus structure, Pin Instructions, Types of registers, Microcontrollers, Difference between Microprocessor and Microcontrollers. **(08 Hours)**

Module – 4

Programmable logic controller: basic structure PLC's, Principle of operation, Programming and concept of ladder diagram, concept of latching &selection of a PLC.
Integration: Introduction & background, Advanced actuators, Pneumatic actuators, Industrial Robot, different parts of a Robot-Controller, Drive, Arm, End Effectors, Sensor & Functional requirements of robot **(08 Hours)**

Module – 5

MEMS and Microsystems: MEMS and Microsystem, Typical MEMS and Microsystems Products, Evolution of Microfabrication, Microsystems and Microelectronics, Multidisciplinary Nature of Microsystems, Miniaturization. Applications. **(08 Hours)**

Course outcomes:

This course will enable students to:

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Analyse the fundamentals of programmable logic controllers (PLCs) and Integration
4. Analyse the technologies related to Micro Electro Mechanical Systems

Textbooks:

1. W. Bolton., “Mechatronics – Electronic Control Systems in Mechanical and Electrical Engineering”, 6th Edition, Pearson Education, 2011.

2. Tai-Ran Hsu, MEMS and Micro systems: Design, Manufacture and Nanoscale Engineering, 2nd Ed, Wiley

References:

1. HMT, “Mechatronics”, 1st Edition, Tata Mc Graw Hill, 2010.
2. Hans H. Gatzen, Volker Saile, Jurg Leuthold, Micro and Nano Fabrication: Tools and Processes, Springer, 2015.

B.E MECHANICAL ENIGINEERING

Choice Based Credit System (CBCS)

Professional Elective Course - II

Automotive Electronics (3:0:0) 3

(Effective from the academic year 2022-23)

Course Code	**BME604D**	Semester	**VI**
Teaching Hours/Week (L: T:P: S)	3:0:0	CIE Marks	50
Total Hours of Pedagogy	40	SEE Marks	50
Examination Pattern (SEE)	Descriptive	Exam Hours	03

Course objectives: students will be able to

1. Gain knowledge on automotive wiring, multiplexing and CAN Bus
2. Comprehend the construction and working of starting, charging, ignition system and fuel supply system used in modern vehicles.
3. Acquire knowledge on engine management system that could enhance the overall engine performance
4. Demonstrate the working of chassis electronics (ABS, TCS, ESC, EPS), Active suspension, airbag ,lane deviation ,night vision, lighting and auxiliary systems for improved vehicle performance.

Preamble:

The automotive industry is today the sixth largest economy in the world. As for other industries, significant improvements in functionalities, performance, comfort, safety, etc. are provided to the automobiles by electronic and software technologies which is known as embedded systems. Indeed, the surge for the development of electronic control systems for automotive systems came through the regulation concerning air pollution. This course will deal with the advanced electronics and embedded systems that are part of modern automobiles.

Module-1

Electrical Wiring: Wiring Harness design, Temperature, Pressure and Inertia switches. **Multiplexing:** Limits of conventional wiring, Multiplex data bus, Control Area Network (CAN), Fast controller area network, Local interconnected network (LIN), FlexRay, Media oriented system transport (MOST)

Automotive Sensor: Thermistor, Thermocouple, Inductive Sensor, Hall effect sensor, Strain Gauge, Variable Capacitance, Variable Resistance, Engine Knock sensor (Accelerometer), LVDT, Airflow sensor: Hot Wire, Vortex, Pitot tube, Turbine flow, Optical sensor, Oxygen sensor, Rain fall sensor. Sensor and their levels.

Actuators: Solenoid actuator: Fuel injector and EGR valve**,** Motorized actuators: Rotary idle actuator, Stepper motors, **(09 hours)**

Module-2

Charging System: Working principal, charging circuit, Rectification processes, Voltage regulation, Smart charging system

Starting System: System configuration, DC Motor characteristics, Permanent magnet starter, Speed/Torque and Power of a motor. Engine start – stop system

Conventional Engine Support System: Functional requirements, generation of high-tension voltage, Components of Ignition system. Type of Ignition: Electronics, Hall effect pulse generator, Inductive pulse generator, Capacitor ignition, Spark plug, Fuel Injection System, single-point injection, multipoint injection,

(08 hours)

Module-3

Embedded System: Definition and importance, Programmed Ignition system, Distributorless Ignition System (DIS), Electric Spark Advance. Fuel Supply: Control layout of fuel injection system, inputs and outputs for fuel injection system. Fuel and idle speed flow diagram, Jetronic System Layout (L-Jetronic to LH-Jetronic). Diesel common rail injection system. Air-fuel ratio calculation for various fuels.

Engine Management System (EMS): General block diagram of EMS, Variable length inlet manifold, Air shrouding injection system, Closed loop fuel monitoring. DI-Motronic and ME-Motronic systems, Switching between Stratified to Homogeneous modes, Lean burn engine graph. Spark ignition engine trends. **(08 hours)**

Module-4

Embedded system with chassis electronics:

Anti-lock braking system (ABS), BAS requirements, ABS block diagram and working

Traction control system (TCS), TCS block diagram and working, Traction control functions

Electronic Stability Control (ESC), importance of ESC, components and block diagram.

Electronic Power Steering (EPS) components and block diagram **(08 hours)**

Module-5

Active Suspension: Components and block diagram, Magneto-Rheological (MR) fluid suspension,

Adaptive Cruise Control System: Components and block diagram, Automatic Braking Application

Other Embedded Systems: Vision enhancement system, Tyre pressure monitoring system, Electronic limited slip differential, Steer-by-wire, Brake-by-wire, Automotive Telematics. **(07 hours)**

Course outcome (Course Skill Set)

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

CO 1. Describe the salient features of wiring, networking, sensors and actuators used in automobiles.

CO 2. Identify the latest technological trends implemented in basic vehicle electrical systems like charging, starting and ignition systems and discuss their benefits.

CO 3. Compare and contrast various Fuel supply and Engine Management modules.

CO4. Appraise the importance of computation and embedded systems in improving the vehicle .performance.

Textbooks

1. Tom Denton, (2018), Automobile Electrical and Electronic Systems, 5th Ed, Taylor and Francis Group.
2. David A. Crolla, (2009), Automotive Engineering - Powertrain, Chassis System and Vehicle Body 1st Ed, Butterworth-Heinemann.

Reference Books

Alan Bonnick, (2001) Automotive Computer Controlled Systems, 1st Edition, Routledge Publication

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

Innovative Product Development (3:0:0) 3
(Effective from the academic year 2022-23)

Course Code	**BME604E**	Semester	**VI**
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 will enable students to:

Understand innovation and innovation portfolio.

1. Develop innovative culture and critical thinking.
2. Gain knowledge on problems analysis and creative process.
3. Explain synthesis and design process.
4. Illustrate product development and prototype.

Preamble: This course provides an insight into innovation, critical thinking, Problems analysis, synthesis, product design and development process.

Module – 1

Innovation: Concepts and importance of innovations, innovation strategy, A framework for innovation strategy. Types of innovations: disruptive, radical, Architectural, incremental, product and process innovations.

Creating Innovation Portfolio: Value creation: unmet customer needs, existing technology paradigm improvement, building complementary technological capabilities. Creative Constructive Leader**:** Outward looking, view innovation as the competitive weapon, Embrace being different.

(08 Hours)

Module – 2

Innovative Cultures: The Paradox of innovation culture: Tolerance for failure, collaboration, willingness to experiment and flat but with strong leadership.

Critical Thinking: The basics of critical thinking, Creative critical thinking, benefits of critical thinking, Elements of critical thinking, how to develop critical thinking skills. Barriers to critical thinking. **(08 Hours)**

Module – 3

Problem Analysis: Understanding of the problem**:** Blind spot knowledge and awareness. Problem Analysis: Ishikawa diagram. Discovering Novel Problems and Solutions: Innovation as hunt for problems and solutions, Mix the Gene pool workforce, learn through analogies.

Creative Process: Preparation, incubation, illumination and ideation. Intuitive creative techniques: semantic intuition. Walt-Disney method, Six thinking Hats, Mind mapping. Inventive problem solving: increasing the degree of ideality, resource analysis. **(08 Hours)**

Module – 4

Synthesis: Innovation as synthesis, building a capacity for synthesis, Develop and retain the synthesis, Processes: design for exploration and experimentation, Organizational structure. Evolution of Ideas: PPCO method.

Design Process and Management: Engineering Design Process, Pahl and Beitz's model of the design process, Engineering design interface. Design Management: Technical Management structure, Engineering Design Management Process, Engineering design management principle.

(08 Hours)

Module – 5

Product Development: Characteristics of successful product development, who designs and develops of products. Industrial Design: ergonomics and aesthetics. Agility in product development, The Scrum Guide for product development.

Building Prototype: Understanding, types of prototypes, purpose of prototypes: Learning, communication, integration and milestones. Prototyping technologies: 3D CAD modelling, Free-form fabrication. **(08 Hours)**

Course outcomes: The students will be able to:
CO 1: Summarize innovation and innovation portfolio.
CO2: Develop innovative culture and critical thinking.
CO 3: Discuss problems analysis and creative process.
CO4: Identify process of synthesis and design.
CO 5: Illustrate product development and prototype.

Textbooks:

1. Gary P. Pisano, Creative Construction: DNA of Sustained Innovation, BBS Public Affairs, New York, 2019
2. Karl T. Ulrich, Steven D. Eppinger, Product Design and Development, McGraw-Hill Higher Education, 2016.

References:

1. Steven Schuster, The Critical Thinker, Jaico Publishing House, 2022
2. Ken S. Hurst, Engineering Design Principles, Elsevier Ltd, 2010.
3. Christian Mueller-Rotorberg, Handbook of Design Thinking, Copyright© 2018 Christian Mueller-Rotorberg.

B.E MECHANICAL ENIGINEERING

Choice Based Credit System (CBCS)

Digital Transformation in Industry (3:0:0) 3

(Effective from the academic year 2022-2023)

Course Code	**BME605A**	Semester	**VI**
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 will enable students:

1. To get acquainted with the basic aspects of Industry 4.0.
2. To comprehend predictive analytics and IoT for value creation.
3. To understand supportive technologies in industry 4.0 their interactions and functions.
4. To impart knowledge of cyber security and smart factories to know its importance in digital transformation.

Preamble: The emergence of Industry 4.0 stands as a beacon of innovation and efficiency. This revolutionary concept represents the fusion of traditional manufacturing processes with cutting-edge digital technologies, creating interconnected systems that drive unprecedented levels of automation, data exchange, and real-time decision-making. Industry 4.0 encapsulates the convergence of cyber- physical systems, the Internet of Things (IoT), cloud computing and cognitive computing, reshaping every facet of industrial production and management.

Module – 1

A Conceptual Framework for Industry 4.0: Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0.

Technology Roadmap for Industry 4.0: Introduction, Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.

(08 hours)

Module – 2

Data Analytics in Manufacturing: Introduction, Power Consumption in Manufacturing, Anomaly Detection in Air Conditioning, Smart Remote Machinery Maintenance Systems with Komatsu, Quality Prediction in Steel Manufacturing, Predicting Drilling Efficiency, Estimation

Internet of Things and New Value Proposition: Introduction, Internet of Things (IoTs), Examples for IoTs Value Creation in Different Industries, IoTs Value Creation Barriers: Standards, Security, Privacy Concerns, Basics of Cyber security . **(08 hours)**

Module – 3

Additive Manufacturing Technologies and Applications: Introduction, Additive Manufacturing (AM) Technologies, Application Areas of Additive Manufacturing, Impact of Additive Manufacturing Techniques on Society

Advances in Robotics in the Era of Industry 4.0: Introduction, Recent Technological Components of Robots- Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly. **(08 hours)**

Module – 4

The Role of Augmented Reality in the Age of Industry 4.0: AR Hardware and Software Technology, Industrial Applications of AR, Maintenance, Assembly, Collaborative Operations, Training.

Digital Traceability Through Production Value Chain: Digital Traceability Technologies, Applications, Project Management in Digital Traceability (08 hours)

Module – 5

Overview of Cyber Security in the Industry 4.0 Era: Introduction, Security Threats and Vulnerabilities of IoT, Industrial Challenges, Evolution of Cyber Attacks, Cases (Cyber-Attacks and Solutions), Strategic Principles of Cyber Security, Cyber Security Measures.

Smart Factories: Introducing the Smart Factory, Smart Factories in Action, Why Smart Manufacturing Is Important, Winners and Losers? Real-World Smart Factories.

(08 hours)

Course Outcomes: The students will be able to:

CO 1: Understand the fundamentals of industry 4.0
CO 2: Apply data analytics and IoT to enhance manufacturing efficiency.
CO 3: Analyse industry 4.0 systems to deliver better productivity.
CO 4: Analyse the impact of cyber security and smart factories.

Textbooks:

1. Alp Ustundag, Emre Cevikcan, "Industry 4.0: Managing The Digital Transformation", 1st Edition, Springer, 2018.
2. Alasdair Gilchrist, "Industry 4.0-The Industrial Internet of Things", 1st Edition, Apress, 2016.

References:

Christoph Jan Bartodziej, "The Concept Industry 4.0", 1st Edition, Springer Gabler, 2017. UNIDO team members, "Industry 4.0- Opportunities Behind The Challenge", UNIDO, UNIDO General conference, 2017.

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

Intellectual Property Management (3:0:0)3
(Effective from the academic year 2022 -23)

Course Code	**BME605B**	Semester	**VI**
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	03

Course Objectives:

This course will enable students to:

1. Give an overview on creation IP and management.
2. Demonstrate patent search and specification.
3. Illustrate Patent claim drafting for invention.
4. Familiarize international treaties and agreement on IP.
5. Gain knowledge on National and International patent filing process.

Preamble: Importance of intellectual property(IP): patents Need for patents, objectives of patent law and IP management.

Module – 1

Creation of IP: Rights, kinds of rights, property rights, intellectual property rights. Need for creating Intellectual property. Characteristics of innovation organisations.

Project Management and IPR: The knowledge canopy**,** Incorporating IPR in Project Management: check posts on the innovation highway. IPR as part of Project Management.

Patent: Invention, inventive step, applicant, inventor, controller, process patent, product patent. Patentability of invention: Novelty, non-obviousness and industrial applicability. **(08 Hours)**

Module – 2

Prior art searches: The need and role of prior art search. International(IPC) and cooperation patent (CPC) classification, Novelty search, Boolean search, validity/invalidity search, freedom to operate search, strategies for patent search.

Search databases: InPASS, Espacenet, Google patents, PATENTSCOP and Lens.

Patent Specification: Provisional and complete specification. Content of the specification: title, field, background of the invention. Objectives of invention, summary of invention. drawing, detailed description of the invention, claim and abstract. **(08 Hours)**

Module – 3

Claim Drafting: Introduction to patent claim**,** basic structure of claims: preamble, transitional phrase and body of the claims. independent and dependent claims, product claim, process claim. Patent Claim Design**:** Scope, important characteristics, unity of invention.

Filing process: Ordinary patent application, Patent of addition, patent of division, Procedure for grant of patent, Publication of application, Pre grant opposition, Examination of application, Grant of patent, grant of patent to be subjected to certain condition. **(08 Hours)**

Module -4

WTO and WIPO: Basic principles of trading system under WTO (World Trade organisation), Objects, function and organs of WIPO (World Intellectual Property organisation), Structure of WTO agreement.

Patent Cooperation Treaty (PCT): Need, feature, advantages. PCT Terminologies: IB, RO, DO and EO, Content of PCT applications.

TRIPS: Need and objectives of TRIPS, Structure of TRIPS: Minimum standard, Enforcement of IP standard, Dispute settlement. Most favoured nation treatment. Most favoured nation treatment. **(08 Hours)**

Module -5

International application: Conventional application, PCT applications, PCT Timelines, Indian international search authority, International search report, Indian international preliminary examination authority, International preliminary examination report.

IP Management: Definition of IP management, Need and importance of IP Management, Major IP management Activities: Undertaking IP Intelligence, Managing IP Portfolio, valuation of IP and carrying out IP audits, standards and patents. (0**8 Hours)**

Course Outcomes:

The students will be able to:

CO1: Explain IP creation and management.

CO2: Demonstrate the process of prior art search.

CO3: Develop Patent specification and drafting process.

CO4: Summarise international treaties and agreement on IP.

CO5: Illustrate National and International patent filing process.

Textbooks:

1. Neeraj Pandey, Khushdeep Dharani, "Intellectual Property Rights", PHI Learning, 2014.
2. Dr. S R Myneni, "Patent Drafting & Specification Writing", New Era Law Publication, 2020.

Reference Books:

1. Prabhuddha Ganguli, "Intellectual Property Rights", Tata Mc-Graw –Hill, 2017.
2. M. Ashok Kumar, Mohd. Iqbal Ali, "Intellectual Property Rights", Serials Publications, 2008.

Deborah E. Bouchoux, "Intellectual Property Rights", Cengage Learning, 2011.

B.E MECHANICAL ENIGINEERING

Choice Based Credit Syste(CBCS)

Open Elective Course - I

Energy Storage Systems (3:0:0) 3

(Effective from the academic year 2022-23)

Course Code	**BME605C**	Semester	**VI**
Teaching Hours/Week (L: T: P)	3:0:0	CIE Marks	50
Number of Lecturer Hours	40	SEE Marks	50
Examination Pattern (SEE)	Descriptive	Exam Hours	03

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

1. Acquire knowledge on energy demand and supply with respect to variations in the energy cycle.
2. Gain knowledge of various energy storage systems.
3. Understand the power conversion systems for various energy applications.
4. Evaluate the energy conversion through windmills and Photovoltaic panels and design flywheel as energy storage system.

Preamble:

Energy sector is facing various challenges due to highly fluctuated demand and supply. Most of the renewable energy systems are with variable conversion rates throughout the day and throughout the year causing loss of energy while power transmission. This course will highlight the necessity for various type of energy storage systems.

Module-1

Fundamentals of Energy Storage: Major sources and uses of Energy, storage in distribution system, Periodic Storage, Problem of load leveling and variation in energy demand. The catalog of storage technologies.

Power Conversion Systems for Electrical Storage: Normal topology for power conversion systems, Energy storage technologies are key in the field of electromobility. **(08 hours)**

Module-2

Energy Storage in Organics Fuels: Solar energy in Biomass, Storage via animals, Synthetic liquid fuels, Gaseous fuel in liquid form, other materials used as energy storage.

Thermal energy storage: Sensible Heat, Latent Heat, Inorganic Phase Change material, Organic Phase Change materials, Molten Salts as a Thermal Storage Medium, solar power plant coupled with molten salt storage system. **(08 hours)**

Module-3

Mechanical Energy Storage: Potential energy storage, principle of compressed air energy storage, Hydroelectric storage: Pumped hydro storage, Kinetic Energy (KE) in moving water. KE in Mechanical System, Linear KE, Rotational KE, Shape factor on disk shapes, Flywheel Characteristics, Superconducting Magnetic Energy Storage. **(08 hours)**

Module-4

Hydrogen Energy Storage: Power to Gas Concept, general concept of the ideal hydrogen economy, Gaseous Hydrogen in High-Pressure Tanks, Liquid Hydrogen in Insulated Tanks, Hydrogen as Protons in Solids: Metal Hydrides, concept of the Regenerative Fuel Cell.

(08 hours)

Module-5

Electrochemical Energy Storage: Energy Storage in (Parallel Plate) Capacitors, topology of a supercapacitor, Types of Reaction Mechanisms in Electrochemical Cells, Design of battery cell, Charge Storage in batteries, Comparison of the variation of the potential, Lead acid, Nickel-Cadmium, Sodium–Sulfur, Lithium-Ion Batteries, operating principle of flow batteries. Thermal management of battery cell. **(08 hours)**

Course outcome (Course Skill Set)

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

CO 1. Explain the requirement for energy storage and power conversion systems in terms of load leveling and variation in energy demand.

CO 2. Appraise various energy conversion techniques to store the renewable energy in the form of mechanical, thermal, electrochemical energy.

CO 3. Analyze the energy conversion rate for windmills and solar power plants.

Textbooks:

Robert A. Huggins, (2016), Energy Storage - Fundamentals, Materials and Applications, 2nd Edition, Springer Cham Heidelberg New York

Reference Books:

1. Francisco D´ıaz-Gonzalez , Andreas Sumper, Oriol Gomis-Bellmunt, (2016), Energy Storage in Power Systems, 1st Edition, John Wiley & Sons Ltd.

B.E MECHANICAL ENIGINEERING

Choice Based Credit System (CBCS)

SEMESTER - VI

Product Design and Development (3:0:0) 3

(Effective from the academic year 2022-2023)

Course Code	BME605D	CIE Marks	50
Teaching Hours/Week (L:T:P)	3:0:0	SEE Marks	50
Total Number of Lecture Hours	40	Exam Hours	03

Course Learning Objectives:

1. Students should develop a comprehensive understanding of the professional practice of product design and development.
2. Students will understand the concept of design for manufacture and prototyping.

Preamble: Product design and development encompasses the entire life cycle of a product from initial concept to final manufacturing and market launch. The primary objective is to create the products that innovative, functional and desirable to consumers while being economically feasible and sustainable for the business.

Module – 1

Introduction: Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

Development Processes and Organizations: A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations.

Product Planning: The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **(08 hours)**

Module-2

Identifying Customer Needs: Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

Product Specifications: What are specifications, when are specifications established, establishing target specifications, setting the final specifications. **(08 hours)**

Module-3

Concept Generation: The activities of concept generation clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process.

Concept Selection: Overview of methodology, concept screening, and concept scoring,

Concept Testing: Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, reflect on the results and the process. **(08 hours)**

Module-4

Product Architecture: What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning.

Industrial Design: Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assess the quality of industrial design. **(08 hours)**

Module-5
Design for Manufacturing: Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production. **Prototyping**: Prototyping basics, principles of prototyping, technologies, planning for prototypes. **Robust Design**: Robust design process. **(08 hours)**
At the end of the course, the student will be able to: CO1: Describe the fundamentals of new product development process and planning. CO2: Establish product specifications identifying customer needs. CO3: Generate and select various concepts for a product. CO4: Apply the concept of Product Architecture and Industrial Design in product development. CO5: Appraise the concept of Design for Manufacturing and Prototyping.

TEXTBOOKS:

1. Product Design and Development - Karl. T. Ulrich, Steven D Eppinger – Fifth Edition, Irwin McGraw-Hill- 2000.

REFERENCES:

1. Product Design and Manufacturing - A C Chitale and R C Gupta, PH1, - 3rd Edition,2003.
2. Product Design for Manufacture and Assembly - Geoffery Boothroyd, Peter Dewhurst, and Winston Knight – 2002

B.E MECHANICAL ENGINEERING

(Choice Based Credit System (CBCS)

Automation Lab (0:0:1) 1

(Effective from the academic year 2022-23)

Course Code	**BMEL607**	Semester	**VI**
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	50
Total Number of Contact Hours	20	SEE Marks	50
Examination nature (SEE)	Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To understand the basic knowledge of different types of drives systems with respect to automation. s.
2. To understand the selection of pneumatic, electro pneumatic and electro pneumatic drive systems with PLC components for relevant applications.
3. To make students familiar with the advanced electrical drives.

Preamble: Understand the drive systems for robotics gain hands-on experience in Automation studio for solving the various Mechanical engineering problems.

List of Experiments

Part-A

1. Experimental study on direct operation of Single/Double acting cylinder.
2. Study of controlling the speed of a double acting cylinder using METERING IN/METERING OUT flow control valve.
3. Time delay operation of a double acting cylinder in forward and return stroke.
4. Operation of single /double acting cylinder using solenoid valve (direct actuation of solenoid).
5. Apply AND logic using two manual controls for return/forward stroke of a double acting cylinder (direct actuation of solenoid).
6. Apply OR logic using two manual controls for return/forward stroke of a double acting cylinder (direct actuation of solenoid).

Part-B

7. Single cycle on delay operation of a single acting cylinder using single solenoid valve (use on delay timer for solenoid actuation).
8. Single cycle off delay operation of a single acting cylinder using single solenoid valve (use off delay timer for solenoid actuation).
9. Single cycle on & off delay operation of a double acting cylinder using double solenoid valve (use on & off delay timer for solenoid actuation).
10. Operation of a double acting cylinders using a double solenoid valve. Forward stroke should be manual and return stroke should be automatic as it reaches the forward end.
11. Sequential control of double acting cylinders A+B+A-B- using double pilot valves.
12. Exercise on PLC drives system with simple case studies or applications (Lamp Circuits, Push button switch, control relay, Conveyor controller applications, Lift control applications, Logic gates, alarm systems, PLC integrated to Hydraulic, Pneumatic drives etc.)

COURSE OUTCOMES:

After completion of the course, students should be able to:

CO1: To familiarize the Pneumatic drive mechanism, circuit designs and its advantages.

CO2: To understand the importance of electrical drive systems, implementations of electro pneumatic drive.

CO3: To interpret the electro pneumatic drive characteristics with PLC applications and supervisory control systems.

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

Electrical Vehicle Laboratory (0:0:1) 1
(Effective from the academic year 2022-23)

Course Code	**BME608A**	Semester	**VI**
Teaching Hours/Week (L:T:P)	0:0:2	CIE Marks	50
Total Number of Contact Hours	20	SEE Marks	50
Nature of examination	Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To acquire practical training, EV Internship, research and development to support a wide array of EV technology.
2. The learning facility is dedicated to accelerating the pace of research and development in EV Design & Development, motor & motor control,
3. To learn EV battery and battery management systems, charging and discharges behaviour of various battery.
4. To understand the behaviour of 2 wheeler dynamometer by considering RPM, torque, maximum speed validation, acceleration and deceleration, vehicle coast down test.

List of Experiments

Part-A

1. Measurement of Open circuit voltage for a battery.
2. Measurement of Discharge capacity at standard discharge C-rate for a cell chemistry at ambient temperature.
3. Measurement of Discharge capacity at ambient temperature for 0.5C and 1C discharge c-rates for a battery.
4. Measurement of Charge capacity at standard charging c-rate a cell chemistry at ambient temperature.
5. Analysing Charging and discharging efficiency for a cell.
6. Performance characterization of Hub motors

Part-B

7. Measurement of RPM and torque on wheel for a two-wheeler using Chassis Dynamometer.
8. Performance characterization of two-wheeler Acceleration and deceleration using Chassis Dynamometer.
9. Measurement of Vehicle coast down for a two-wheeler using Chassis Dynamometer
10. Measurement of Endurance under Steady state condition for a two-wheeler using Chassis Dynamometer.

Course Outcomes:

The students will be able to:

CO1: To analyse the electrical characters of various battery used in electrical and hybrid vehicles.

CO2: The estimate characters of battery management systems, motor & motor control.

CO3: To evaluate 2-wheeler characters by considering various parameters RPM, torque, acceleration and deceleration.

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

Internet of Things Lab (0:0:1) 1
(Effective from the academic year 2022-2023)

Course Code	**BME608**	Semester	**VI**
Teaching Hours/Week (L: T:P: S)	0:0:1	CIE Marks	50
Total Number of Contact Hours	20	SEE Marks	50
Examination Pattern (SEE)	Practical	Exam Hours	03

Course objectives: students will be able to

1. Acquire basic knowledge on Internet of Things
2. Gain hands-on exposure on physical computing devices, sensors and actuators.
   Practice the process of connecting things to internet and exchange data and information

List of Experiments

Part -A

1. Interfacing the RGB LED with the Arduino
2. Controlling the LED blink rate with the potentiometer interfacing with Arduino
3. Interfacing of temperature sensor LM35 with Arduino
4. Interfacing Servo Motor with the Arduino
5. Interfacing of the relay with Arduino.

Part-B

1. Building Intrusion Detection System with Arduino and Ultrasonic Sensor
2. Directional Control of the DC motor using Arduino
3. Upload humidity & temperature data to Thing Speak, periodically logging ambient light level to Thing Speak
4. Displaying various sensor readings on a simple web page hosted on the ESP32
5. Controlling LEDs/Motors from an Android/Web app, Controlling AC Appliances from an android/web app with the help of relay.

Course Outcome:

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

CO 1. Build the circuits with physical computing boards, sensor and actuators and program them to perform a given task

CO 2. Exchange the data and information between the connected devices through the internet and control IoT devices by remote systems.

CO 3. Apply concept of IoT on real-time applications to solve the problems/enhance the functionality.

B.E MECHANICAL ENGINEERING

(Choice Based Credit System (CBCS)

PROGRAMMING AND SIMULATION LAB (0:0:1) 1

(Effective from the academic year 2022-23)

Course Code	**BME608C**	Semester	**VI**
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	50
Total Number of Contact Hours	20	SEE Marks	50
Examination nature (SEE)	Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. To know about fundamentals of MATLAB tool.
2. Implement the MATLAB tool to draw the 2D and 3D dimensional plots.
3. To provide an overview to Logical and Selection functions in MATLAB.
4. Implement the MATLAB tool for simulation of stress, strain and vibration characteristics.

List of Experiments

Part-A

1. Array operations in MATLAB, loops and execution of control
2. 2D and 3D dimensional plots using MATLAB.
3. Logical functions in MATLAB.
4. Selection functions in MATLAB.

Part-B

5. Invariants, Principal stresses and strains with directions.
6. Maximum shear stresses and strains and planes, Von-Mises stress
7. Stress analysis of rectangular plate with circular hole under uniform Tension.
8. Vibration Characteristics of a Spring Mass Damper System.

Course outcomes:

The students will be able to:

CO1: Demonstrate expertise in handling the MATLAB tool.

CO2: Apply the MATLAB tool expertise to draw the 2D and 3D dimensional plots.

CO3: Solve the stress, strain problems using MAT Lab.

CO4: Simulate the vibration characteristics using MAT Lab.

B.E MECHANICAL ENGINEERING

(Choice Based Credit System (CBCS)

SEMESTER - VI

ADVANCED PYTHON PROGRAMMING LAB (0:0:1) 1

(Effective from the academic year 2022-23)

Course Code	**BME608D**	Semester	**VI**
Teaching Hours/Week (L: T:P)	0:0:2	CIE Marks	50
Total Number of Contact Hours	20	SEE Marks	50
Examination nature (SEE)	Practical	Exam Hours	03

Course Objectives:

This course will enable students to:

1. Learn the syntax and semantics of the Python programming language.
2. Appraise the need for working with various documents like Excel, PDF and Others.
3. Demonstrate regular expression using python programming.
4. Implement the python Programming concepts in draw the graphs in the field of Mechanical engineering.
5. Implement the python Programming concepts in the analysis of mechanical components in various aspects.
6. Implement the python Programming concepts in the vibration and thermal analysis of mechanical components.

List of Experiments

PART-A

1. Matplot library for plotting the data in the field of Mechanical engineering:
   a) Plot 2D line graph to implement figure and axis.
   b) Plot 2D line graph to implement subplots and grid specifications.
   c) Plot 2D contour plots for data visualization.
2. Generate SFD and BMD of Beams:
   a) SFD and BMD of simply supported beam with point load and UDL.
   b) SFD and BMD of cantilever beam with point load and UDL.
3. Kinematic analysis of mechanisms:
   a) Displacement analysis of slider crank mechanism.
   b) Velocity analysis of slider crank mechanism.
   c) Acceleration analysis of slider crank mechanism.
4. Fatigue analysis of machine components:
   a) Fatigue analysis of machine components using Soderberg criteria.
   b) Fatigue analysis of machine components using Goodman criteria.
   c) Fatigue analysis of machine components using Gerber criteria.

PART-B

5. Vibration analysis of single degree of freedom:
   a) Analyse the simple spring mass system.
   b) Plot the frequency response of the spring mass system.
6. Fluid flow analysis:
   a) Plot velocity stream lines of flowing fluid.
   b) Flow plot for fluid flow over the cylinder
7. Thermal analysis:
   a) Temperature distribution in 1D heat transfer.
   b) Temperature distribution in 2D heat transfer.
8. Analysis of IC engines:

a) Plot pressure volume diagram for engine.
b) Plot pressure Turning moment diagram for engine.

Course outcomes:

The students will be able to:

CO1: Understand and remember the Python programming skills in the field of Mechanical engineering.

CO2: Demonstrate expertise in handling various Python programming constructs.

CO3: Apply the appropriate libraries to develop the python programs in the field of Mechanical engineering.

CO4: Develop Python scripts to analyze various components in the field of Mechanical engineering.

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	**BNSK609**	Semester	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)

Physical Education (Sports and Athletics)

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

Course Code	**BPEK609**	Semester	**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	**BYOK609**	Semester	**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

National Cadet Corps (NCC)

(Common to all Branches)

(Effective for the 2022 scheme)

Course Code	**BNCK609**	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	**BMUK609**	Semester	**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 andaurally.
2. Analyze the compositions with respect to musical and lyrical content.
3. 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

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.

SEMESTER – VI

INDIAN KNOWLEDGE SYSTEM
(Common to All UG Programs)
Applicable for the Academic Year 2024-25 for 2022 scheme onwards

Course Code	**BIKS610**	CIE Marks	100
Teaching Hours/Week (L: T:P)	1:0:0- NCMC	SEE Marks	-
Total Number of Lecture Hours	13	Total marks	100

Course objectives:

1. To facilitate the students with the concepts of Indian traditional knowledge and to makethem understand the importance of roots of knowledge system.
2. To make the students understand the traditional knowledge and analyse it and apply it to their day-to-day life.

Module – 1

Introduction to Indian Knowledge Systems (IKS): Overview, Vedic Corpus, Philosophy, Character, scope and importance, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge vs. western knowledge. (05**Hours)**

Module – 2

Traditional Knowledge in Humanities and Sciences: Linguistics, Number and measurements- Mathematics, Chemistry, Physics, Art, Astronomy, Astrology, Crafts and Tradein India and Engineering and Technology. (0**4 Hours)**

Module – 3

Traditional Knowledge in Professional domain: Town planning and architecture-Construction, Health, wellness and Psychology-Medicine, Agriculture, Governance and public administration, United Nations Sustainable development goals. (0**4 Hours)**

Course Outcomes: After completing the course, the students will be able to	
CO1:	Provide an overview of the concept of the Indian Knowledge System and its importance.
CO2:	Appreciate the need and importance of protecting traditional knowledge.
CO3:	Recognize the relevance of Traditional knowledge in different domains.
CO4:	Establish the significance of Indian Knowledge systems in the contemporary world.

Reference Books:

1	**Introduction to Indian Knowledge System- concepts and applications**, B Mahadevan, Vinayak Rajat Bhat, Nagendra Pavana R N, 2022, PHI Learning Private Ltd, ISBN-978-93-91818-21-0
	Traditional Knowledge System in India, Amit Jha, 2009, Atlantic Publishers and Distributors (P) Ltd., ISBN-13: 978-8126912230,
2	**Knowledge Traditions and Practices of India**, Kapil Kapoor, Avadesh Kumar Singh, Vol. 1,2005, DK Print World (P) Ltd., ISBN 81-246-0334,

Suggested Web Links:

1.	**https://www.youtube.com/watch?v=LZP1StpYEPM**
2.	**http://nptel.ac.in/courses/121106003/**
3.	http://www.iitkgp.ac.in/department/KS;jsessionid=C5042785F727F6EB46CBF432D7683B63 (Centre of Excellence for Indian Knowledge System, IIT Kharagpur)
4.	https://www.wipo.int/pressroom/en/briefs/tk_ip.html
5.	https://unctad.org/system/files/official-document/ditcted10_en.pdf
6.	http://nbaindia.org/uploaded/docs/traditionalknowledge_190707.pdf
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