DAYANANDA SAGAR ACADEMY OF TECHNOLOGY & MANAGEMENT

CURRICULUM

Scheme and Syllabus V to VI Semester

Outcome Based Education

(Academic Year 2025-2026)

Department of Mechanical Engineering

5th & 6th Semester B.E

ABOUT THE INSTITUTE

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

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

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

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

VISION OF THE INSTITUTE

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

MISSION OF THE INSTITUTE

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

QUALITY POLICY

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

ABOUT THE DEPARTMENT

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

VISION OF THE DEPARTMENT

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

MISSION OF THE DEPARTMENT

M1: To provide the students with an academic environment of excellence, leadership, ethical guidelines for a successful career.

M2: To empower the students with personality development programs for advancement in their professional career.

M3: To impart practical oriented educational programs for the students which tend to promote the intellectual pursuit.

M4: To develop alliances with industry and alumni for excellence in teaching, research, and consultancy practices.

PROGRAM EDUCATION OBJECTIVES (PEO'S):

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

PROGRAM OUTCOMES (PO's)

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES (PSO's)

ME PSO1	An ability to find out, articulate the local industrial problems and solve with the use of mechanical engineering tools for realistic outcomes.
ME PSO2	Ability to collaborative learning to find out cost-effective, optimal solution for social problems.

PROPOSED UG CREDIT STRUCTURE IN ALIGNMENT WITH VTU

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

PROPOSED UG SCHEME

Sl. No	Course Category	BOS	TD	Teaching Hours/Week					Credits
				Lecture	Tutorial	Practical	Project	Total	
				L	T	P	S	(Hrs/week)	
1	IPCC	ME	ME	3	0	2	0	5	4
2	PCC	ME	ME	2	2	0	0	4	3
3	PEC-1/2	ME	ME	3	0	0	0	3	3
4	HSMS/OEC-1	ME	ME	3	0	0	0	3	3
5	PCCL	ME	ME	0	1	2	0	3	2
6	Proj	ME	ME	0	0	0	6	6	3
7	AEC	ME	ME	0	0	0	2	2	1
8	MC	ME	ME	3	0	0	0	3	3
9	NCMC	NSS / YOGA / PED							22
10	AICTE Activity Points								
								Total	**22**

Percentage of Mapping– Theory & Practical - Scheme & Syllabus- 5th & 6th Sem

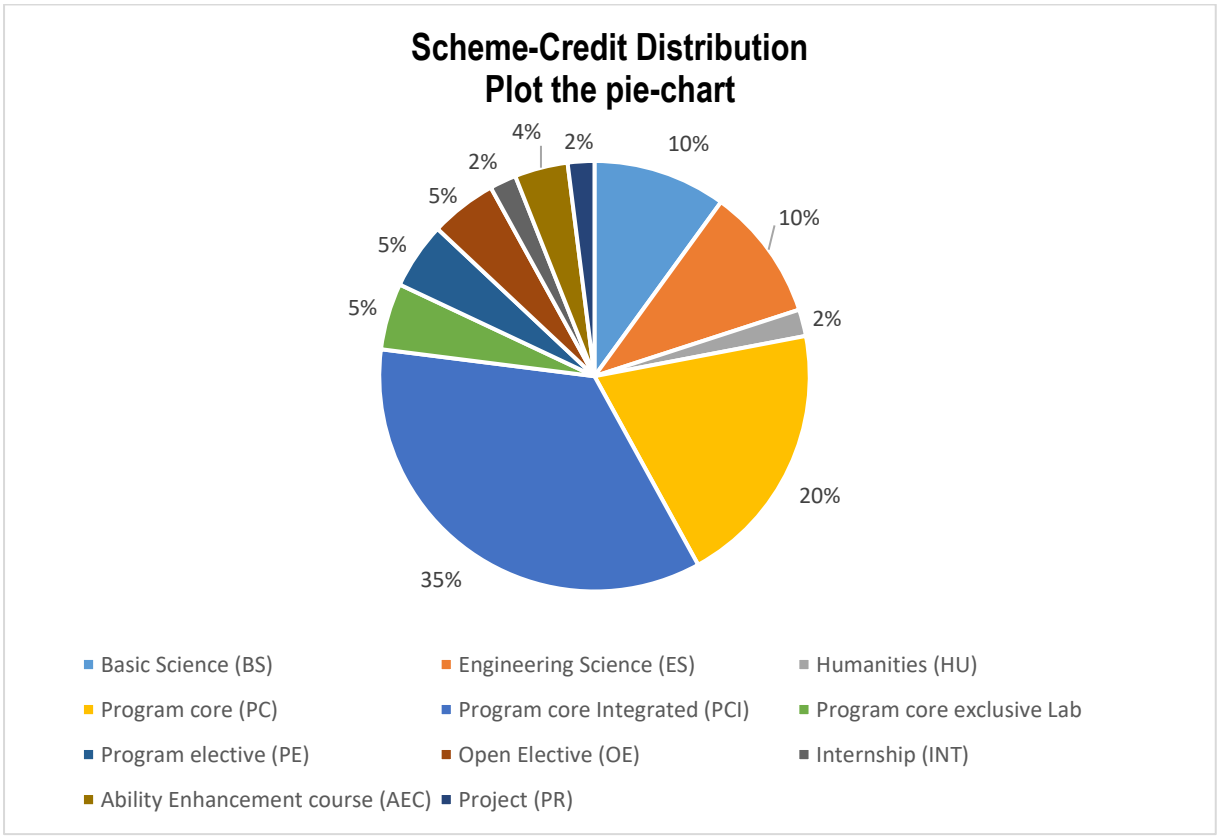
5th Sem & 6th Sem

Sl. No	Course Category	Component			
		Theory	Practical	Outreach	YOGA/SPORTS
1	IPCC	60%	40%	--	--
2	PCC	100%	--	--	--
3	PEC-1/2	100%	--	--	--
4	HSMS/OEC-1	100%	--	--	--
5	PCCL	--	100%	--	--
6	Proj	--	100%	--	--
7	AEC	--	100%	--	--
8	MC	100%	--	--	--
9	NCMC	--	--	--	100%

Scheme Distribution

Department of Mechanical & Engineering

Course Component	Credits	% of Credits
Basic Science (BS)	16	10
Engineering Science (ES)	16	10
Humanities (HU)	2	2
Program core (PC)	35	20
Program core Integrated (PCI)	55	35
Program core exclusive Lab	8	5
Program elective (PE)	8	5
Open Elective (OE)	8	5
Internship (INT)	4	2
Ability Enhancement course (AEC)	5	4
Project (PR)	4	2
Total	**160**	**100**



SEMESTER WISE CREDIT BREAKDOWN FOR B.E. DEGREE CURRICULUM

BATCH 2023-2027

Course Category	Semester								Total Credits
	1st	2nd	3rd	4th	5th	6th	7th	8th	
Basic Sciences (BSC)	8	8	0	0	0	0			
Engineering Sciences (ESC)	3	3	0	0	0	0			
Engineering Technological Course (ETC)	3	3	3	3	0	0			
Humanities, Social Sciences and Management (HSMC)	2	2	0	0	3	0			
Ability Enhancement Course (AEC)	1	1	1	1	1	1			
Core Engineering Course (CEC)	3	3	0	0	3	3			
Universal Human Values (UHV)	0	0	0	1	0	0			
Professional Core Courses (PCC)	0	0	6	6	3	3			
Integrated Professional core Course (IPCC)	0	0	8	8	4	4			
Professional Core Course Lab (PCCL)	0	0	2	2	2	2			
Social Connect and Responsibility (SCR)	0	0	1	0	0	0			
Professional Elective Course (PEC)	0	0	0	0	3	3			
Institutional Open Elective Courses (IOE)	0	0	0	0	0	3			
Internship (INT)	0	0	0	0	0	0			
Mini Project / Project Work (PW)	0	0	0	0	3	3			
Non-credit Mandatory Courses (NCMC)	0	0	0	0	0	0			
Total Credits	20	20	21	21	22	22			

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

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

Scheme of Teaching and Examinations – 2025
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from 2025-26)

5th SEMESTER: Mechanical Engineering (ME)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BME501	Metal Cutting and Forming	IPCC	ME	ME	3	0	2	0	5	4	3	50	50	100
2	BME502	Turbomachines	PCC	ME	ME	2	2	0	0	4	3	3	50	50	100
3	BME503	PEC-1	PEC-1	ME	ME	3	0	0	0	3	3	3	50	50	100
4	BME504	Industrial Management & Entrepreneurship	HSMS	ME	ME	3	0	0	0	3	3	3	50	50	100
5	BME505	CNC Programming and 3D Printing Lab	PCCL	ME	ME	0	1	2	0	3	2	3	50	50	100
6	BME506	Mini Project	Proj	ME	ME	0	0	0	6	6	3	3	50	50	100
7	BME507	Extended Reality	AEC	ME	ME	0	0	0	2	2	1	3	50	50	100
8	BME508	RM & IPR	MC	ME	ME	3	0	0	0	3	3	1	50	50	100
9		National Service Scheme (NSS (Sports and Athletics))	NCMC	NSS/ PE/YO	NSS/ PE/YO	0	0	2	0	2	0	0	100	0	100
		Physical Education (PE)													
		Yoga													
					Total						22				900

6th SEMESTER: Mechanical Engineering (ME)

Sl. No	Course Code	Course Title	Course Category	BOS	TD	Teaching Hours/Week					Credits	Examination			
						Lecture	Tutorial	Practical	Project	Total		SEE Duration (Hrs)	CIE Marks	SEE Marks	Total Marks
						L	T	P	S						
1	BME601	Heat Transfer	IPCC	ME	ME	3	0	2	0	5	4	3	50	50	100
2	BME602	Machine Design	PCC	ME	ME	2	2	0	0	4	3	3	50	50	100
3	BME603	PEC-2	PEC-2	ME	ME	3	0	0	0	3	3	3	50	50	100
4	BME604	OEC-1	OEC-1	ME	ME	3	0	0	0	3	3	3	50	50	100
5	BME605	Design Lab	PCCL	ME	ME	0	1	2	0	3	2	3	50	50	100

6	BME606	Project Phase-1	Proj	ME	ME	0	0	0	6	6	3	3	50	50	100
7	BME607	Critical Thinking Skills	AEC	ME	ME	1	0	0	0	1	1	3	50	50	100
8	BME608	Environmental Studies	MC	ME	ME	3	0	0	0	3	3	3	50	50	100
9		National Service Scheme (NSS (Sports and Athletics))	NCMC	NSS/ PE/YO	NSS/ PE/YO	0	0	2	0	2	0	0	100	0	100
		Physical Education (PE)													
		Yoga													
22											**22**				**900**

IPCC: Integrated Professional Core Course,

PCC: Professional Core Course

PBL: Project Based Learning

AEC: Ability Enhancement Course,

NCMC: Non-Credit Mandatory Course

L: Lecture,

T: Tutorial,

P: Practical

S= SDA: Skill Development Activity,

CIE: Continuous Internal Evaluation,

SEE: Semester End Evaluation.

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

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

Newly introduced Courses in the syllabus

	List of Courses	5th Semester	6th Semester
1.	List of Existing Elective Courses	-	-
2.	List of New Existing Elective Courses	1. Reverse Engineering (PEC)	1. SCM & ERP
3.	List of New Industry Aligned Courses	1. Extended Reality	-
4.	Others		1. Analytical and Logical Reasoning

Percentage of Change in the Syllabus

5th Semester						
Sl.No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BME501	Metal Cutting and Forming	Nil	Nil	-	Included from Previous Semester
2	BME502	Turbomachines	-	-	-	-
3	BME503	PEC-1	-		25%	New Course Added (Reverse Engineering)
4	BME504	Industrial Management & Entrepreneurship	-	-	-	-
5	BME505	CNC Programming and 3D Printing Lab	-	-	-	-
6	BME506	Mini Project	-	-	-	-
7	BME507	Extended Reality	-	-	-	New Course added
8	BME508	RM & IPR	-	-	-	-

6th Semester						
Sl.No	**Course Code**	**Course Name**	**Topics Added**	**Topics removed**	**Revised in %**	**Justification**
1	BME601	Heat Transfer	-	-	-	-
2	BME602	Machine Design	-	-	-	-
3	BME603	PEC-2	-	-	-	New Course Added (SCM & ERP)
4	BME604	OEC-1	-	-	-	-
5	BME605	Design Lab	-	-	-	-
6	BME606	Project Phase-1	-	-	-	-
7	BME607	Critical Thinking Skills	-	-	-	New Course Added
8	BME608	Environmental Studies	-	-	-	-

3rd Year

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**METAL CUTTING AND FORMING**				
Course Code	:	**BME501**				
Course Type (Theory/ Practical/ Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L: T:P:S)	:	**3:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**60 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**04**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To enrich the knowledge pertaining to relative motion and mechanics required for various machine tools.
2	To introduce students to different machine tools to produce components having different shapes and sizes.
3	To develop the knowledge on mechanics of machining process and effect of various parameters on machining.
4	To acquaint with the basic knowledge on fundamentals of metal forming processes
5	To study various metal forming processes

Teaching-Learning Process

Pedagogical Initiatives:

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

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

DSATM

Teaching-Learning Process (TLP).
Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Module 1: Introduction to Metal cutting** **Orthogonal and oblique cutting.** Classification of cutting tools: single, and multipoint; tool signature for single point cutting tool. Mechanics of orthogonal cutting; chip formation, shear angle and its significance, Merchant circle diagram. Numerical problems. Cutting tool materials and applications.	9
Pedagogy	**Demonstration, PPT, Experimental Learning**	
2	**Module 2:** **Introduction to basic metal cutting machine tools:** **Lathe**- Parts of lathe machine, accessories of lathe Machine and various operations carried out on lathe. Kinematics of lathe. Turret and Capstan lathe. **Milling Machines:** up milling & down milling, classification of milling machines, constructional features (Column and Knee and vertical milling machine), milling cutter nomenclature, various milling operations, calculation of machining time.	9
Pedagogy	**Demonstration, PPT. Video Lectures**	
3	**Module 3:** **Grinding:** Types of abrasives, bonding processes, Creep feed grinding, Designation and selection of grinding wheel, Surface Finishing Processes: Lapping, Honing, Polishing. **Drilling Machines:** Constructional features (Radial & Bench drilling Machines), operations, types of drill & drill bit nomenclature. Grinding: Grinding operation, classification of grinding processes: cylindrical, surface &centerless grinding	9
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4:** **Advanced Machining Process;** Importance and classification of advanced machining process; Process principal, process parameters, and application of: - Abrasive Jet Machining (AJW), Water Jet Machining (WJM), Ultrasonic Machining (USM); Electrical Discharge Machining (EDM); Electro Chemical Machining (ECM). Laser Beam Machining (LBM), Electron Beam Machining (EBM), and Plasma Arc Machining (PAM).	9
Pedagogy	**Demonstration, Experimental Learning, Video Lectures**	

5	**Module 5** **METAL FORMING PROCESSES** **Introduction of metal forming process:** Mechanical behaviour of metals in elastic and plastic deformation, stress-strain relationships, Yield criteria, Application to tensile testing, strain rate and temperature in metal working; Hot deformation, Cold working and annealing. **Metal Working Processes:** Fundamentals of metal working, Analysis of bulk forming processes like forging, rolling, extrusion, wire drawing by slab method, other sheet metal processes: Sheet metal forming processes, High Energy rate forming processes.	9
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

List of Programs:

Sl. No	List of the Experiment
	PART-A: Lathe operations
1.	Facing, plain turning, Step turning
2.	Taper turning and calculation
3.	Thread cutting and calculation
4.	Drilling, Boring
5.	Knurling
	PART-B: Milling and Shaper operations
1.	Cutting of V Groove/ dovetail / Rectangular groove on shaper
2.	Milling Machine operations
	Open ended Experiments
1.	Different Taper turning operations
2.	Cutting of Gear Teeth using Milling Machine and calculation

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	Shaw, M C, (2014), Metal Cutting Principles, Oxford University Press.
2	Boothroyd, G., and Knight, W. A., Fundamentals of Machining and Machine Tools, CRC Press.
3	Mikell P. Groover, (2019), Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, Wiley Publications.
4	Rao P. N., Manufacturing Technology II, Tata McGraw Hill
Reference Books	
1	Manufacturing process, H.N Gupta, New Age International Publisher, Second,2009
2	Manufacturing process, H.S. Shan, Cambridge University Press, India, Second,2017
3	Manufacturing Engineering and Technology Serope Kalpakjian and Steven R. Schmid Prentice Hall, 7th Edition, 2013

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understand** the concept of temperature in metal cutting, forms of wear in metal cutting process	**L 2**	**Understand**
CO2	**Apply** skills in selecting metal cutting techniques and optimizing machining processes;	**L 3**	**Apply**
CO3	**Analyze** various cutting parameters in metal cutting	**L 4**	**Analyze**
CO4	**Evaluate** the Quality and Integrity of metal cutting Components Design and develop adequate tooling linked with turning, milling and shaping operations	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-			-
CO2	3	-	-	-	-	-	3	-	-	-	-	-			3
CO3	-	3	-	-	-	-	-	-	-	-	-	-			-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	2	2	-

Weblinks and Video Lectures (e-Resources)	
1	1. V. K. Jain, Advanced Machining Processes, NPTEL Course Department of Mechanical Engineering, IIT Kanpur, Link: http://nptel.ac.in/courses/112104028/.
2	2. U. S. Dixit, Mechanics of Machining, NPTEL Course Department of Mechanical Engineering Guwahati, Link: http://nptel.ac.in/courses/112103248/.
3	3. A. B. Chattopadhyay, Manufacturing Processes II, NPTEL Course of Department of Mechanical
4	https://onlinecourses.nptel.ac.in/noc23_me48/preview
5	MOOCs: http://nptel.ac.in/courses/112105126/

Dayananda Sagar Academy of Technology & Management
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Semester	:	**5th**				
Course Title	:	**TURBOMACHINES**				
Course Code	:	**BME502**				
Course Type (Theory/ Practical/ Integrated)	:	**Integrated**				
Course Category	:	**IPCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**50 Hrs (40 hours Theory + 8-10 Lab slots)**		**SEE Duration**	:	**3 Hours**
Credits	:	**04**				

Course Learning Objectives: **Students will be taught to**

Sl. No	Course Objectives
1	Understand typical design of Turbo machine, their working principle, application and thermodynamics process involved
2	Study the conversion of fluid energy to mechanical energy in Turbo machine with utilization factor and degree of reaction.
3	Analyse various designs of steam turbine and their working principle.
4	Study the various designs of hydraulic turbine based on the working principle.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**MODULE 1:** **Introduction:** Definition of turbo machine, parts of turbo machines, Comparison with positive displacement machines, Classification, Dimensionless parameters and their significance, Unit and specific quantities, model studies and its numerical. (Note: Since dimensional analysis is covered in Fluid Mechanics subject, the questions on dimensional analysis should not be given. However, dimensionless parameters and model studies may be given more weightage.) **Thermodynamics of fluid flow:** Application of first and second law of thermodynamics to turbo machines, Efficiencies of turbo machines, Static and Stagnation states, overall isentropic efficiency, stage efficiency (their comparison) and polytropic efficiency for both compression and expansion processes. Reheat factor for expansion process. Simple Numerical on-stage efficiency and polytropic efficiency.	8
Pedagogy	**Chalk and talk, Video animation**	
2	**MODULE 2:** **Energy exchange in Turbo machines:** Euler's turbine equation, Alternate form of Euler's turbine equation, Velocity triangles for different values of degree of reaction, Components of energy transfer, Degree of Reaction, utilization factor, Relation between degree of reaction and Utilization factor, Problems. **General Analysis of Turbo machines:** Radial flow compressors and pumps – general analysis, Expression for degree of reaction, velocity triangles, Effect of blade discharge angle on energy transfer and degree of reaction, Effect of blade discharge angle on performance, General analysis of axial flow pumps and compressors, degree of reaction, velocity triangles, Numerical Problems.	8
Pedagogy	**Chalk and talk, Video animation**	
3	**MODULE 3:** **Steam Turbines:** Classification, Single stage impulse turbine, condition for maximum blade efficiency, stage efficiency, Need and methods of compounding, Multistage impulse turbine, expression for maximum utilization factor, Numerical. **Reaction turbine:** Parsons's turbine, condition for maximum utilization factor, reaction staging. Numerical.	8
Pedagogy	**Chalk and talk, PPT**	
4	**MODULE 4:** **Hydraulic Turbines:** Classification, various efficiencies. Pelton Wheel – Principle of working, velocity triangles, design parameters, maximum efficiency, and numerical.	8

	Franci's turbine – Principle of working, velocity triangles, design parameters, and numerical problems. **Kaplan and Propeller turbines:** Principle of working, velocity triangles, design parameters and Numerical. Theory and types of Draft tubes.	
Pedagogy	**Chalk and talk, PPT**	
5	**MODULE 5:** **Centrifugal Pumps:** Classification and parts of centrifugal pump, different heads and efficiencies of centrifugal pump, Theoretical head – capacity relationship, Minimum speed for starting the flow, Maximum suction lift, Net positive suction head, Cavitation, Need for priming, Pumps in series and parallel. Problems. **Centrifugal Compressors:** Stage velocity triangles, slip factor, power input factor, Stage work, Pressure developed, stage efficiency and surging and problems.	**8**
Pedagogy	**Chalk and talk, PPT**	

PRACTICAL COMPONENT OF IPCC (May cover all / major modules)

Sl.No	Experiments
1	Performance analysis of Pelton Wheel
2	Performance analysis of Francis turbine
3	Performance analysis of Kaplan turbine
4	Performance analysis of Centrifugal Air blower
5	Performance analysis of Single Stage Centrifugal pump
6	Performance analysis of Multistage Stage Centrifugal pump
7	Performance analysis of Reciprocating Air Compressor
8	Performance analysis of Reciprocating Pump

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the basics of Energy exchange in Turbo machines	L 2	UNDERSTAND
CO2	Apply thermodynamic concepts and Energy exchange principles in Turbo machines.	L 3	APPLY
CO3	Analyse the energy transfers in different power generating and power absorbing Turbo machines.	L 4	ANALYSE
CO4	Evaluate the performance of power generating and power absorbing Turbo machines.	L 5	EVALUATE

Mapping of Course Outcomes to Program Outcomes:

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

Test Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	V. Kadambi and Manohar Prasad, An Introduction to Energy Conversion, Volume III, Turbo machinery, New Age International Publishers, reprint 2008
2	M. S. Govinde Gowda, A Text of Turbo machines, 1st Edition, 2024, Iterative International Publishers (IIP), ISBN: 9789362528841.

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Principals of Turbo machines, D. G. Shepherd, The Macmillan Company (1964).
2	Fluid Mechanics & Thermodynamics of Turbo machines, S. L. Dixon, Elsevier (2005).
3	Turbines, Compressors & Fans, S. M. Yahya, Tata McGraw Hill Co. Ltd., 2nd edition, 2002.
4	B.K Venkanna, Fundamentals of Turbo Machinery, PHI Publishers
5	Yahya S. M. "Turbines, Fans and Compressors",4/e,Tata McGraw Hill Publishing Company Limited ,2011.

Web links and Video Lectures (e-Resources)	
1	https://youtu.be/_6FLj3Zpumo
2	https://youtu.be/GIvV6XWaGA
3	https://nptel.ac.in/courses/112106200
4	https://nptel.ac.in/courses/101101058

CIE- Continuous Internal Evaluation (50 Marks)

	Continuous Assessment Tests		Continuous Comprehensive Assessment (CCA)		Lab Component
	IAT-1	IAT-2	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	25 Marks
Remember	-	-			
Understand	10	10	10	10	
Apply	20	20	20	20	
Analyse	20	20	20	20	
Evaluate	-	-			25

CIE Course Assessment Plan

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

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	-
Understand	20
Apply	40
Analyse	40
Evaluate	-0
Develop	-

SEE Course Plan

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

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**Industrial Management and Entrepreneurship**				
Course Code	:	**BME503**				
Course Type (Theory/Practical/Integrated)	:	**Theory**				
Course Category	:	**PCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45Hrs (T)**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Understand the basic concepts of management, planning, organizing, staffing and Hierarchy of plans
2	To learn the organizational theory in a professional organization and Management: Concept of Change.
3	Identify various types of supporting agencies and financing available for an entrepreneur
4	To learn the principles of productivity and modern concepts in management in a professional organization.
5	Prepare project report and decide selection of industrial ownership.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Management & Planning Process** **Management;** Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, Development of Management Thought early management approaches–Modern management approaches. **Planning;** Nature, importance and purpose of planning process Objectives Types of plans(Meaning only)-Decision making Importance of planning-steps in planning & planning premises - Hierarchy of plans.	9
Pedagogy	**PPT, Video Lectures**	
2	**Module 2: Organization Theory and Vroom's valence-expectancy theory** **Organizational Conflict;** Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory. **Vroom's valence-expectancy theory;** Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.	9
Pedagogy	**PPT, Video Lectures**	
3	**Module 3: Entrepreneur and Development of Entrepreneurship** **Entrepreneur;** Meaning of Entrepreneur; Evolution of the Concept; Function so fan Entrepreneur, Types of Entrepreneurs, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship. **Development of Entrepreneurship;** Stages in entrepreneurial process; Role of entrepreneurs in Economic Development; Entrepreneurship in India; Entrepreneurship–its Barriers.	9

Pedagogy	**PPT, Video Lectures Case Studies**	
4	**Module 4: Small Scale Industries and Policies of SSI** **Small Scale Industries:** Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; **Different Policies of SSI;** Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GATT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry.	**9**
Pedagogy	**PPT, Video Lectures**	
5	**Module 5: Institutional Support and Preparation of Project** **Institutional Support;** Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC. Preparation of Project; Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; **Guidelines by Planning Commission for Project report;** Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.	**9**
Pedagogy	**PPT, Video Lectures**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Principles of Management, P.C.Tripathi, P.N.Reddy,TataMcGrawHill
2	Dynamics of Entrepreneurial Development & Management, Vasant Desai, Publishing House.
3	Entrepreneurship Development, Poornima.M.Charantimath,SmallBusinessEnterprises–Pearson, 2006 (2 & 4)
4	Management Fundamentals- Concepts, Application, Skill, Robers Lusier –Thomson
5	Entrepreneurship Development, S. S. Khanka, S. Chand &Co
6	Management, Stephen Robbins, Pearson Education/PHI, 17thEdition, 2003

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the about the management and planning.	**L 2**	**Understand**
CO2	Apply the knowledge on Management planning & Concept of Change.	**L 3**	**Apply**
CO3	**Analyze** the various Government schemes for institutional support and market feasibility study.	**L 4**	**Analyze**
CO4	**Evaluate** the requirements towards the small-scale industries and project preparation.	**L 5**	**Evaluate**

Web links and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc22_me28/preview
2	https://archive.nptel.ac.in/courses/112/107/112107219/
3	https://nptel.ac.in/courses/112101098

Mapping of Course Outcomes to Program Outcomes:

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

CIE- Continuous Internal Evaluation (50 Marks)

Bloom's Category	Theory					Practical
	Continuous Assessment Tests			Continuous Comprehensive Assessment (CCA)		Practical Test
	IAT-1	IAT-2	IAT-3	CCA-1	CCA-2	
	50 Marks	50 Marks	50 Marks	50 Marks	50 Marks	50 Marks
Remember	-	-	-	-	-	-
Understand	10	10	-	-	-	-
Apply	20	20	-	-	-	-
Analyse	20	20	-	-	-	-
Evaluate	-	-	-	50	50	-

CIE Course Assessment Plan

CO's	Marks Distribution					Total Marks	Weightage
	Test-1		Test-2		-		
	Module-1	Module-2	Module-3	Module-4	Module-5		
CO1	05	05	05	05	10	30	20
CO2	10	10	10	10	20	60	40
CO3	10	10	10	10	20	60	40
CO4	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-
Total	25	25	25	25	50	150	100

SEE- Semester End Examination (50 Marks)

Bloom's Category	SEE Marks (90% Theory+10% Practical Questions)
Remember	--
Understand	30
Apply	35
Analyse	35
Evaluate	--
Develop	--

SEE Course Plan

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

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

Semester	:	**5th**				
Course Title	:	**Operations Management**				
Course Code	:	**BME504A**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PEC-1**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L: T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Get acquainted with the basic aspects of Operation Management such as planning, organizing, and controlling
2	Identify and solve different operational issues in manufacturing and services organizations
3	To discriminate or select relevant decisions at various stages of Operation
4	To improve the efficiency and effectiveness of organizational operations using various strategic tools

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module-1** **Introduction:** Introduction, Production and Operation Management, Functions within business organizations, the operation management function, Classification of production systems, Productivity, factors affecting productivity. **Decision Making:** Introduction, the decision process, characteristics of operations decisions, use of models, decision making environments, graphical linear programming, analysis and trade-offs.	9
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module-2** **Forecasting:** Introduction, Steps in forecasting process, approaches to forecasting, forecasts based on judgment and opinion, analysis of time series data, accuracy, and control of forecasts, choosing a forecasting techniques, elements of a good forecast.	9
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module-3** **Capacity & Location Planning:** Introduction, Importance of capacity decisions, defining and measuring capacity, determinants of effective capacity, determining capacity requirement, developing capacity alternatives, evaluating alternatives, Need for location decisions, nature of locations decisions, general procedure for making locations decisions, evaluating locations decisions, facilities layout – need for layout decisions, types of processing.	9
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module-4** **Aggregate Planning & Master Scheduling:** Introduction, Aggregate planning – Nature and scope of aggregate planning, strategies of aggregate planning, techniques for aggregate	9

	planning – graphical and charting techniques, mathematical techniques. The master production schedule, Master scheduling process, Master scheduling methods. **Inventory Management:** Introduction, types of inventories, Objectives of Inventory Control, Inventory control models	
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module-5** **Material Requirement Planning (MRP):** Dependent versus independent demand, an overview of MRP – MRP inputs and outputs, MRP processing, ERP capacity requirement planning, benefits and limitations of MRP. **Purchasing and Supply Chain Management (SCM):** Introduction, Importance of purchasing and SCM, the procurement process, Concept of tenders, Approaches to SCM, Vendor development.	**9**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Textbooks:	
1	"Operation Management, Author- Joseph G Monks McGrew Hill Publication, International Edition-1987.
2	"Production and Operation Management," Author - Pannerselvam R. PHI publications, 2nd edition
3	"An Introductory book on lean System, TPS Yasuhiro Modern.
Reference Books:	
1	"Production and Operation Management" Chary S. N. TataMcGrew Hill 3rd edition.
2	"Production and Operations Management", Everett E. Adams, Ronald J. Ebert, Prentice Hall of India Publications, Fourth Edition.
3	Modern Production/Operations Management, Buffia, Wiely India Ltd 4th Edition.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Explain the **core concepts, strategies, and techniques of operations management** and their role within a business	L 2	Understand
CO2	Apply **quantitative methods** to address and solve practical business problems	L 3	Apply
CO3	Analyze complex **operational data** to find opportunities for process improvement	L 4	Analyze
CO4	Design a **Plan/Schedule** for an effective Production/Operation based on given data, including supply, demand, costs, and inventory	L6	Design

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://nptel.ac.in/courses/112107238
2	https://nptel.ac.in/courses/110106045
3	https://onlinecourses.nptel.ac.in/noc25_mg126/preview

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**Applied Mechatronics**				
Course Code	:	**BME504B**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
2	To understand the evolution and development of Mechatronics as a discipline.
3	To understand the applications of microprocessors in various systems and to know the functions of each element.
4	To demonstrate the integration philosophy in view of Mechatronics technology
5	To be able to work efficiently in multidisciplinary teams.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1:** **Basic System Models:** Mathematical Models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks. **System Models:** Engineering systems, Rotational-translational systems, Electromechanical systems, Hydraulic-mechanical systems.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2:** **Dynamic Responses of systems:** Modelling dynamic systems, First order systems, Second order systems, Systems in series, Systems with feedback loops, Effect of pole location on transient response. **Frequency Response:** Sinusoidal input, Phasors, Frequency response, Bode plots, Performance specifications, Stability.	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3:** **Input/Output systems:** Interfacing, Input/output addressing, Interface requirements, Peripheral interface adapters, Serial communication interface, Examples of Interfacing. **Communication Systems:** Digital communications, Centralized, hierarchical and distributed control, Networks, Protocols, Open systems interconnection communication model, Communication interfaces.	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4:** **Programmable Logic Controller:** Introduction to PLCs, Basic structure of PLC, Principle of operation, input and output processing, PLC programming language, ladder diagram, ladder diagrams circuits, timer counters, internal relays, master control, jump control, shift registers, data handling, and manipulations, analogue input and output, selection of PLC for application. **Application of PLC control:** Extending and retracting a pneumatic piston using latches, control of two pneumatic pistons, control of process motor, control of vibrating machine, control of process tank, control of conveyer motor etc.	8
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5:** **Mechatronics in Computer Numerical Control (CNC) machines:** Design of modern CNC machines – Machine Elements: Different types of guide ways, Linear Motion guide ways. Bearings: antifriction bearings, hydrostatic bearing and hydrodynamic bearing. Recirculating ball screws. Typical elements of open and closed loop control systems. Adaptive controllers for machine tools.	8

	Mechatronics Design process: Stages of design process – Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Automatic car park barrier.	
Pedagogy	**Hands on Sessions, Experimental Learning**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Mechatronics–Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Pearson Education, 7th Edition, 2018.
2	Mechatronics, HMT Ltd., Mc Graw Hill, July 2017 Edition. ISBN:978007 4636435
3	Mechatronics System Design by Devdas Shetty and Richard A Kolk, Second edition, Thomson Learning Publishing Company, Vikas publishing house, 2001.
4	Mechatronics: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram, Wiley India Pvt. Ltd., New Delhi, 2008.
5	Mechatronics - Principles Concepts and Applications, Nitaigour Premchand Mahalik, McGraw Hill Education, July 2017 Edition.
6	Shetty and Kolk "Mechatronics System Design", Cengage Learning, 2010

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Illustrate various components of Mechatronics systems.	**L2**	**Understand**
CO2	Apply the principles of Mechatronics design to product design.	**L3**	**Apply**
CO3	Assess various control systems used in automation.	**L3**	**Analyze**
CO4	Design and conduct experiments to evaluate the performance of a Mechatronics system or Component with respect to specifications, as well as to analyse and interpret data.	**L4**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/112/107/112107298
2	https://archive.nptel.ac.in/courses/112/101/112101304/
3	http://engineering.nyu.edu/mechatronics/smart/html/resources/onlineResources.html

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**Automation in Manufacturing**				
Course Code	:	**BME504C**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PEC – 1B**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Explain the basics of productions, automation system and manufacturing operations.
2	Solve the simple problems on mathematical model.
3	Explain CAPP and MRP system and analyze the AGVS.
4	Understand the inspection technologies and shop floor control.
5	Explain the modern trends in additive manufacturing and automated factory

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Introduction** Introduction: Production system facilities, Manufacturing support systems, Automation in production systems, Automation principles &strategies. Manufacturing Operations: Manufacturing operations, Product/production relationship, Production concepts and Mathematical models &costs of manufacturing operations. Problems on mathematical models.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: Line Balancing** Methods of line balancing, Numerical problems on largest candidate rule, Kilbridge's and Wester's method, and ranked positional weights method, computerized line balancing methods. Automated Assembly System: Design for automated assembly, types of automated assembly system, Parts feeding devices, Analysis of single and multi station assembly machines.	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: Computerized Manufacture Planning and AGVS** Computer aided process planning (CAPP), Retrieval and Generative systems, and benefits of CAPP. Material requirement planning, Inputs to MRP system, working of MRP, Outputs and benefits. Automated Guided Vehicles System: Applications, Guidance and routing, Industrial Robotics: Definition, Robot anatomy, Joints and links, Robot configurations, Robot control systems, Accuracy and repeatability, End effectors, Sensors in robotics. Industrial robot applications: Material handling, Processing, assembly and inspection.	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	

4	**Module 4: Inspection Technologies** Automated inspection, coordinate measuring machines construction, Operation &programming, Software, application &benefits, Flexible inspection system, Inspection probes on machine tools, Machine vision, Optical inspection techniques & Noncontact Nonoptical inspection technologies. Shop Floor Control and Automatic Identification Techniques: Shop floor control, Factory data collection system, Automatic identification methods, Bar code technology, Automatic data collection systems. An Introduction to QR Code Technology.	**8**
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5: Additive Manufacturing Systems** Basic principles of additive manufacturing, Slicing CAD models for AM, Advantages and limitations of AM technologies, Recent trends in manufacturing, Hybrid manufacturing. Future of Automated Factory: Trends in manufacturing, the future automated factory, Human workers in future automated factory, Social impact.	**8**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P Groover, 3rd Edition, 2009, PHI Learning.
2	Automation, Production Systems and Computer Integrated Manufacturing, by Mikell P Groover, 1999, PrenticeHall of India.
3	CAD / CAM Principles and Applications by P N Rao, 3rd Edition, 2015, Tata Mc Graw Hill.
4	Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 2nd Ed. (2015), Ian Gibson, David W. Rosen, Brent Stucker 98
5	"Understanding Additive Manufacturing", Andreas Gebhardt, Hanser Publishers, 2011.
6	Systems Approach to Computer Integrated Design and Manufacturing by Dr. Nanua Singh,Wiley, 1996.
7	CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U. Raju, New Age International Publication Revised Third Edition 2007. Delhi.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model.	L 2	Understand
CO2	**Apply** the concepts of CAPP and MRP system for planning and controlling production.	L 3	Apply
CO3	**Analyze** the modern trends in additive manufacturing and automated factory.	L 4	Analyze
CO4	**Evaluate** shop floor control with the inspection technologies.	L 5	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	http://lavalle.pl/vr/book.html
2	https://nptel.ac.in/courses/106/106/106106138/
3	https://www.coursera.org/learn/introduction-virtual-reality.

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

Semester	:	**5th**				
Course Title	:	**Energy Engineering**				
Course Code	:	**BME504D**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	Understand energy scenario, energy sources and their utilization
2	Learn about energy conversion methods
3	Study the principles of renewable energy conversion systems.
4	To get exposed to concepts of energy production through different conventional & non - conventional methods

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

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Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Steam Generators**: Generation of steam using forced circulation, high and supercritical pressures, LaMount, Benson, Velox, Loeffer, Schmidt steam generators, Cooling towers and Ponds, Accessories such as Super heaters, Desuper heater, Economizers, Air pre heaters. **Diesel Engine Power System:** Applications of Diesel Engines in Power field. Method of starting Diesel engines. Auxiliaries like cooling and lubrication system, filters, centrifuges, Oil heaters, intake and exhaust system, Layout of diesel power plant.	9
Pedagogy	**Demonstration, PPT, Case studies**	
2	**Module 2: Solar Energy:** Introduction, Solar radiation at the earth's surface, Solar radiation measurements, Flat plate collectors, Solar Pond, Solar electric power generation Solar photo voltaic. **Biomass Energy:** Photosynthesis, photosynthetic oxygen production, energy plantation. **Biochemical Route:** Biogas production from organic wastes by anaerobic fermentation, Biogas plants KVIC, Janta, Deenbhandu models, factors affecting bio gas generation. Thermal gasification of biomass, updraft and downdraft	9
Pedagogy	**Demonstration, PPT, Case studies**	
3	**Module 3: Geothermal Energy:** Forms of geothermal energy, Dry steam, wet steam, hot dry rock and magmatic chamber systems. **Tidal Energy:** Tidal power, Site selection, Single basin and double basin systems, Advantages and disadvantages of tidal energy. **Wind Energy:** Wind energy Advantages and limitations, wind velocity and wind power, Basic components of wind energy conversion systems, horizontal and vertical axis wind mills, coefficient of performance of a wind mill rotor, Applications of wind energy.	9
Pedagogy	**Demonstration, PPT, Video Lectures**	
4	**Module 4: Hydroelectric plants:** Advantages & disadvantages of water power, Hydrographs and flow duration curves numerical, Storage and pondage, General layout of hydel power plants components such as Penstock, surge tanks, spill way and draft tube and their applications, pumped storage plants, Detailed classification of hydroelectric plants, water hammer. **Ocean Thermal Energy:** Ocean thermal energy conversion, Principle and working of Rankine cycle, Problems associated with OTEC.	9
Pedagogy	**Demonstration, PPT, Case studies**	

5	**Module 5: Nuclear Energy:** Principles of release of nuclear energy Fusion and fission reactions. Nuclear fuels used in the reactors, Chain reaction, Moderation, breeding, Multiplication and thermal utilization factors. General components of a nuclear reactor and materials, Brief description Pressurized water reactor, Boiling water reactor, Sodium graphite reactor, Fast Breeder reactor, Homogeneous graphite reactor and gas cooled reactor, Radiation hazards, Shielding, Nuclear waste, Radioactive waste disposal.	**9**
Pedagogy	**Demonstration, PPT, Case Studies**	

Text Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	G.D. Rai, Non-conventional energy resources, 5th Edition, Khanna Publishers, New Delhi
2	B H Khan, Non-conventional energy resources, 3rd Edition, McGraw Hill Education
3	Principles of Energy conversion, A. W. Culp Jr., McGraw Hill. 1996
Reference Books	
1	S.P. Sukhatme, Solar Energy: principles of Thermal Collection and Storage, Tata McGraw-Hill (1984).
2	C.S Solanki – Solar photo voltaics: Fundamental applications and technologies, prentice Hall of India 2009
3	L.L. Freris, Wind Energy Conversion Systems, Prentice Hall, 1990.

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

CO	**Course Outcomes**	**RBT Level**	**Level Indicator**
CO1	**Understand** the construction and working of steam generators and their accessories.	**L 2**	**Understand**
CO2	**Apply** the knowledge of identifying renewable energy sources and their utilization.	**L 3**	**Apply**
CO3	**Analyze** the principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass ,nuclear hydel and tidal.	**L 4**	**Analyze**
CO4	**Evaluate** by investigating the performance of various water turbines in hydroelectric power plant like, Pelton, Francis and Kaplan Turbine.	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://www.tlv.com/global/TI/steamtheory/principalapplicationsforsteam.html
2	https://youtu.be/IdPTuwKEfmA
3	https://youtu.be/6FMLm5WCad
4	https://youtu.be/utjf7US_cK
5	https://youtu.be/Z1ur09_SLVo
6	https://youtu.be/Z1ur09_SLVo
7	https://youtu.be/AMXxXoHtMo

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**Mini Project**				
Course Code	:	**BME505**				
Course Type (Theory/ Practical/ Integrated)	:	**Project Work**				
Course Category	:	**Mini Project**				
Stream	:	**ME**		**CIE**	:	**100 Marks**
Teaching hours/ week (L: T:P:S)	:	**3:0:0:0**		**SEE**	:	
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	To encourage independent learning and the innovative attitude of the students.
2	To develop interactive attitude, communication skills, organization, time management, and presentation skills.
3	To expand intellectual capacity, credibility, judgment, and intuition.
4	To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

Course Outcome: Students will be able to

CO	Course Outcome
CO1	**Apply** the knowledge of Engineering Fundamentals and Modern tool techniques for the defined project work.
CO2	**Analyze** data to produce useful information and draw conclusions in a systematic manner.
CO3	**Evaluate** their skills and the knowledge acquired by Communicating the results, concepts and ideas in written and oral form.
CO4	**Create** new products or generate new ideas with innovative thinking.

Mini-project work: Mini Project is a laboratory-oriented/hands on course that will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications etc. Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of the project report, project presentation skill, and question

and answer session in the ratio of 50:25:25. The marks awarded for the project report shall be the same for all the batches mates.

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

No SEE component for Mini-Project.

Mapping of Course Outcomes to Program Outcomes:

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

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**5th**				
Course Title	:	**Reverse Engineering**				
Course Code	:	**BME506**				
Course Type (Theory/ Practical/ Integrated)	:	**Practical**				
Course Category	:	**PCCL**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**0:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**30 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	Understand the foundational concepts, scope, and ethical aspects of reverse engineering.
2	Apply systematic disassembly techniques to extract product functionality.
3	Analyze component geometry using modeling tools.
4	Evaluate material properties and manufacturing processes from existing products.
5	Design and develop improved prototypes based on reverse engineered data.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Introduction to Reverse Engineering** Definition and scope of reverse engineering, Historical background and significance in mechanical engineering, Applications across industries: Automotive, Aerospace, Biomedical, etc., Legal and ethical aspects of reverse engineering, Reverse engineering vs. forward engineering. **Practical Component:** • Case study discussion on successful reverse engineering projects • Group activity: Identify reverse engineering opportunities in common products	9
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: Product Disassembly and Documentation** Disassembly techniques and safety procedures, Functional decomposition of products, Identifying components, materials, and mechanisms, Measurement tools and techniques (calipers, micrometers, CMM, etc.), Documentation standards: sketches, exploded views, BoM. **Practical Component**: • Hands-on disassembly of simple mechanical devices (e.g., gearbox, fan) • Creating an exploded view and basic BoM using hand sketches or CAD	9
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: Modeling Techniques** Introduction to mesh generation and surface reconstruction CAD modeling, Reverse modeling techniques in software (SolidWorks, Fusion 360, Geomagic, etc.) **Practical Component:**	9

	• Creating Solid model of components from the drawing	
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4: Material and Manufacturing Process Identification** Material identification techniques (visual, density, hardness tests), Use of spectroscopy, SEM, etc. (conceptual overview), Manufacturing process identification (casting, forging, machining, AM), Cost estimation and DFM (Design for Manufacturing) principles. **Practical Component:** • Identification of materials and processes in selected components • Use of test kits or simulation software to analyze material properties	**9**
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5: Introduction to Product Redesign and Prototyping** Rapid prototyping using 3D printing, Integration with FEA and simulation tools, Capstone mini-project: reverse engineer and improve a product **Practical Component:** • Redesign and 3D print an improved version of a component (DEMO) • Group presentations on redesign ideas and justifications	**9**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	**Reverse Engineering: Technology of Reinvention – W. Ahmad, CRC Press, 1st Edition, 2010.**
2	**Product Design and Development** – Karl T. Ulrich and Steven D. Eppinger, McGraw-Hill Education, 7th Edition, 2019.
3	**Engineering Design: A Systematic Approach** – Gerhard Pahl, Wolfgang Beitz, Springer, 3rd Edition, 2007.
4	**Rapid Prototyping: Principles and Applications – Chua C. K., Leong K. F., World Scientific Publishing, 3rd Edition, 2010.**
5	**Design for Manufacturability and Concurrent Engineering** – David M. Anderson, CRC Press, 2nd Edition, 2014.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Explain the relevance and ethical implications of reverse engineering. *(Understand)*	L 2	Understand
CO2	Apply hands-on techniques to disassemble and document mechanical components. *(Apply)*	L 3	Apply
CO3	Analyze geometric data and reconstruct accurate CAD models. *(Analyze)*	L 4	Analyze
CO4	Evaluate materials and manufacturing processes from real-world products. *(Evaluate)*	L 5	Evaluate
CO5	Design and prototype enhanced mechanical products using reverse engineering methods. *(Create)*	L6	Create

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	NPTEL Reverse Engineering Course (IIT Madras): https://nptel.ac.in/courses/112104222
2	MIT OpenCourseWare - Product Dissection: https://ocw.mit.edu
3	Autodesk Fusion 360 Official Tutorials: https://www.youtube.com/c/AutodeskFusion360
4	3D Scanning Basics (YouTube - 3D Printing Nerd): https://www.youtube.com/watch?v=9A5oME1uvQM
5	Introduction to Manufacturing Processes - NPTEL: https://nptel.ac.in/courses/112107145
6	Granta EduPack Materials Tutorials: https://www.ansys.com/academic/tools/granta-edupack
7	Additive Manufacturing - NPTEL: https://nptel.ac.in/courses/112105299
8	3D Printing Tutorial Series (Simplify3D): https://www.simplify3d.com/support/tutorials/
9	Engineering Ethics (NPTEL): https://nptel.ac.in/courses/109104068

Dayananda Sagar Academy of Technology & Management

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Semester	:	**5th Sem**				
Course Title	:	**EXTENDED REALITY**				
Course Code	:	**BME507**				
Course Type (Theory/ Practical/ Integrated)	:	**Project Based Learning**				
Course Category	:	**AEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**0:0:0:2**		**SEE**	:	**50 Marks**
Total Hours	:	**30 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**01**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	To equip students with the foundational knowledge of XR principles, hardware, and software, enabling them to comprehend the underlying technological landscape and human perception factors critical for designing effective immersive experiences.
2	To develop students' practical skills in 3D content creation, optimization, and the utilization of industry-standard XR development platforms (e.g., Unity/Unreal Engine), empowering them to design, develop, and iterate functional XR applications.
3	To foster an understanding of advanced XR concepts, spatial computing, and the ethical implications of immersive technologies, preparing students to critically analyze emerging trends, tackle complex challenges, and contribute responsibly to the evolving XR ecosystem.

Teaching-Learning Process

Pedagogy (General Instructions):

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

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.

7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.

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Scheme of Teaching and Examinations for BE Programme -2023-24
Outcome Based Education and Choice Based Credit System (CBCS)
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COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Foundations of Extended Reality** Definitions and distinctions of AR, VR, MR, and XR, History and evolution of immersive technologies, Human visual system, depth perception, and stereoscopy, Auditory perception, spatial audio, and haptics, Overview of current XR hardware (headsets, trackers, input devices), XR software ecosystem (game engines like Unity/Unreal, SDKs, APIs), Industry applications (healthcare, manufacturing, design, education, entertainment).	2
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: 3D Graphics, Modeling, and Asset Pipeline for XR** Introduction to 3D graphics pipelines, 3D modeling software (e.g., Blender, Autodesk Maya/3ds Max) for XR assets, Mesh optimization, LOD (Level of Detail), and polygon reduction, Texturing, materials, and PBR (Physically Based Rendering), Lighting techniques for real-time rendering in XR, Basic 3D animation principles and rigging, Asset import, export, and integration into XR development platforms (Unity/Unreal).	2
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: XR Development Platforms & Interaction Design** Introduction to Unity/Unreal Engine for XR development, setting up XR projects and device integration (e.g., OpenXR, SteamVR, ARCore, ARKit), XR input systems and controllers (e.g., Oculus Touch, Valve Index controllers, HoloLens gestures), Locomotion techniques (teleportation, smooth movement, comfort modes), User Interface (UI) design for 3D environments, User Experience (UX) design for XR: usability, accessibility, presence, and avoiding motion sickness,	2

	Building simple interactive AR experiences (e.g., object placement, image tracking). Developing basic VR environments and interactions.	
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4: Ethical Considerations and Future of XR** Ethical implications of XR (privacy, data security, addiction, psychological effects), Research frontiers and future challenges in XR. Accessibility and inclusive design in XR, XR's role in the Metaverse: interoperability, digital identity, virtual economies, Integration of AI/Machine Learning with XR (e.g., intelligent agents, procedural content generation), IoT and XR: connecting the physical and digital worlds.	**2**
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5: Capstone Project** Planning, design, development, testing, and presentation of a significant XR application, Project execution, Project Presentation, Demonstration of the Project, Poster Presentation, Preparation of Project Report.	**22**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	**Creating Augmented and Virtual Realities: Theory and Practice for Next-Generation Spatial Computing**, Erin Pangilinan, Steve Lukas, Vasanth Mohan, O'Reilly Media, 2019
2	**Introduction to Extended Reality (XR) Technologies**, Manisha Vohra, Wiley-Scrivener, February 2025
3	**Spatial Computing: An AI-Driven Business Revolution**, Cathy Hackl, Irena Cronin, Wiley, May 2024
4	**The Metaverse: And How It Will Revolutionize Everything, Matthew Ball, W. W. Norton & Company, 2022**

5	**The VR Book: Human-Centered Design for Virtual Reality**, Jason Jerald, ACM Books / Morgan & Claypool Publishers, 2015
6	**Handbook of Virtual Environments: Design, Implementation, and Applications, Second Edition**, Kelly S. Hale and Kay M. Stanney (Editors), CRC Press / Routledge, 2014

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the fundamental concepts and theories of Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR), and articulate their unique characteristics and underlying technological principles.	L 2	Understand
CO2	**Apply** theoretical knowledge and established methodologies to select appropriate XR hardware, software development kits (SDKs), and programming paradigms for specific immersive application requirements.	L 3	Apply
CO3	**Develop** functional and optimized XR applications or digital environment using industry-standard tools, integrating 3D assets, and implementing interactive behaviours for real-time immersive experiences.	L 6	Develop
CO4	Present and defend their Project on XR applications or digital environment solution, **evaluating** its efficacy, usability, and ethical implications while providing a clear and reasoned conclusion	L 5	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	http://lavalle.pl/vr/book.html
2	https://nptel.ac.in/courses/106/106/106106138/
3	https://www.coursera.org/learn/introduction-virtual-reality.
4	https://elearn.nptel.ac.in/shop/completed-courses/short-term-programs-completed/foundation-course-on-virtual-reality-and-augmented-reality/?v=c86ee0d9d7ed
5	https://www.classcentral.com/course/swayam-extended-reality-technologies-293410

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Scheme of Teaching and Examinations for BE Programme -2024-25

Outcome Based Education and Choice Based Credit System (CBCS)

(Effective from the Academic Year 2024-25)

Semester	:	**5th Semester**				
Course Title	:	**Environmental Studies**				
Course Code	:	**BESK508**				
Course Type (Theory/ Practical/ Integrated)	:	**THEORY**				
Category	:	**MC**				
Stream	:	**Common Course**		**CIE**	:	**50**
Teaching hours/ week (L:T:P:S)	:	**2:0:0:0**		**SEE**	:	**50**
Total Hours	:	**15**		**SEE Duration**	:	**1 Hr**
Credits	:	**2**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	**To introduce** students to the fundamental concepts of the environment, ecosystems, and biodiversity, emphasizing their interdependence and significance in sustaining life.
2	To identify the causes, effects, control measures major challenges of pollution of environmental problems and e-waste management.
3	To provide guidance on developing skills, and demonstrate socio-economic skills for Environmental protection e-waste management.

Teaching-Learning Process

Pedagogical Initiatives:

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

- Adopt different teaching methods to attain the course outcomes.
- Include videos to demonstrate various concepts.
- Encourage collaborative (Group) Learning to encourage team building.
- Ask at least three **HOTS (Higher-order Thinking Skills)** module-wise questions to promote critical thinking.
- Show different ways to solve a problem and encourage the students to come up with creative and optimal solutions.
- Discuss various case studies to map with real-world scenarios and improve the understanding.
- Devise innovative pedagogy to improve **Teaching-Learning Process (TLP)**.

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Scheme of Teaching and Examinations for BE Programme -2024-25
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Environment and Sustainability**: **Environment & Ecosystem:** Components of the environment, Ecosystems: Structure and Function, Types: Forest, Wetlands, River, Oceanic and Lake ecosystem. **Sustainability**: 17SDG targets and possible actions. Self-Study Component (SSC): Biodiversity: Types, Values, and Conservation of biodiversity.	3
Pedagogy	Chalk and talk, PowerPoint presentation and animation tools	
2	**Natural resources and Energy:** Natural Resources: Water resources – Availability & Quality aspects, Water borne diseases & Fluoride problem in drinking water. Energy: Different types of energy, Wind Energy, Hydrogen as an alternative energy. Self-Study Component (SSC): Conventional sources & non-conventional sources of Energy, Solar energy	3
Pedagogy	Chalk and talk, PowerPoint presentation, Videos, Case studies	
3	**Environmental Pollution and Global Environmental Issues** Environmental Pollution: Water Pollution, Noise pollution, Air pollution (Sources, Impacts, Preventive measures, Case studies, Relevant Environmental Acts) Global Environmental Issues: Acid Rain, Ozone Depletion, Global warming and Ground water depletion. Self-Study Component (SSC): Case studies of air pollution episodes.	3
Pedagogy	PowerPoint presentation, Videos and Case studies.	
4	**Waste management & Environmental Legislation:** Waste management: Solid Waste Management, types and sources, Biomedical Waste Management - Sources, Characteristics, Environmental Legislation: Water Act 1974, Air Act 1981, Environmental Protection Act 1984 Solid Waste Management Rules,2016, Biomedical Waste Management Rules, 2016. Self-Study Component (SSC): Case studies on waste management options	3
Pedagogy	PowerPoint presentation, Seminar, Demonstration Videos	
5	**E - Waste Management** E- waste: Composition and generation, Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment. Component of E waste management. E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2022 - Salient Features and its implications. Self-Study Component (SSC): E-Waste (Management) Amendment Rules, 2023, 2024	3

Pedagogy	Power Point presentation, Demonstration videos and Poster presentation	
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process	

Text Books	
Sl. No.	**Title of the Book/Name of the author/Name of the publisher/Edition and Year**
1	S M Prakash – Environmental Studies,3rd Edition Elite Publishers, Mangalore, 2018.
2	Hester R.E., and Harrison R.M, Electronic Waste Management. Science, 2009.
3	Benny Joseph- Environmental studies, Tata McGraw-Hill 2nd edition 2012.
Reference Books	
1	R Geetha Balakrishna & K G Lakshminarayanana Bhatta- Environmental Studies, S M Publications, 2006-2007.
2	M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007
3	Johri R., E-waste: implications, regulations, and management in India and current global best practices, TERI Press, New Delhi.
4	Dr. B.S Chauhan- Environmental studies, university of science press 1st edition
5	M.Ayi Reddy Textbook of environmental science and Technology, BS publications 2007

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	To understand the principles of ecology and environmental issues that apply to air, land and water issues along with e-waste management on a global scale.	Understand/ Remember	L1
CO2	To evaluate the societal complex issues related to environment and e-waste management.	Design	L4
CO3	To develop sustainable solution for environmental issues and e-waste management issues	Create	L5

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1													2		
CO2									2	2				2	1
CO3								3		3					

Weblinks and Video Lectures (e-Resources)	
1	https://youtu.be/I_bnGkviWOUhttps://youtu.be/Ar04qG1P8Es
2	https://sdgs.un.org/goals
3	https://kspcb.karnataka.gov.in/waste-management/biomedical-waste
4	https://archive.nptel.ac.in/courses/109/105/109105190/
5	https://youtu.be/I_bnGkviWOUhttps://youtu.be/Ar04qG1P8Es

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	**:**	**6th**				
Course Title	**:**	**Heat Transfer**				
Course Code	**:**	**BME601**				
Course Type (Theory/ Practical/ Integrated)	**:**	**Integrated**				
Course Category	**:**	**IPCC**				
Stream	**:**	**ME**		**CIE**	**:**	**50 Marks**
Teaching hours/ week (L:T:P:S)	**:**	**3:0:2:0**		**SEE**	**:**	**50 Marks**
Total Hours	**:**	**40 Hrs T+8 to 10 lab slots**		**SEE Duration**	**:**	**3 Hours**
Credits	**:**	**03**				

Course Learning Objectives: Student will be able to learn

Sl.No	Course Objectives
1	Principles of heat transfer
2	Steady and transient heat transfer, obtain the differential equation of heat conduction in various coordinate system.
3	Physical mechanism of convection and visualize the development of velocity and thermal boundary layers during flow over a surface
4	Radiation heat transfer mechanism
5	The mechanisms of boiling and condensation and understand performance parameters of heat exchangers

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Introductory Concepts and definition:** Review of basics of Modes of Heat Transfer. **Conduction-Basic Equations:** General form of one-dimensional heat conduction equation. Boundary conditions of first, second and third kinds **One dimensional Steady state conduction with and without heat generation**: Steady state conduction in slab, cylinder and sphere with engineering applications. **Steady state conduction:** Overall heat transfer coefficient for a composite medium; thermal contact resistance; critical thickness of insulation, Discussion on engineering applications.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**One dimensional Transient conduction:** Conduction in solids with negligible internal temperature gradients (lumped system analysis) Use of transient temperature charts (Heisler's charts) for Transient conduction in slab, long cylinder and sphere; Discussion on engineering applications. **Extended surfaces;** Steady state conduction in fins of uniform cross section long fin, fin with insulated tip and fin with convection at the tip; fin efficiency & effectiveness, Discussion on engineering applications.	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Free or Natural Convection:** Physical significance of dimensionless numbers. Use of correlations for free convection from or to vertical, horizontal and inclined flat plates, vertical and inclined cylinder. **Concepts and Basic Relations in Boundary layers**: Flow over a flat plate -Velocity boundary layer, Thermal boundary layer; Prandtl number; general expression for local heat transfer coefficient; Average heat transfer coefficient. **Forced Convection:** Physical significance of Dimensionless numbers. Use of various Correlations for hydro dynamically and thermally developed flows; Use of correlations for flow over a flat plate, cylinder, sphere and flow inside the duct.	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	

4	**Heat Exchangers:** Classification of heat exchangers; Overall heat transfer coefficient, Fouling, Scaling factors; LMTD and NTU methods of analysis of heat exchangers. **Boiling and Condensation;** Pool boiling regimes. Basics of Film and dropwise condensation, Use of correlations for film and dropwise condensation on tubes.	**8**
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Radiation Heat transfer:** Review of basic laws of thermal radiation, Intensity of radiation and solid angle; Concept of thermal radiation resistance, Radiation network, view factor, Radiation heat exchange between two parallel infinite black surfaces, between two parallel infinite gray surfaces; Effect of radiation shield; Discussion on engineering applications **Numerical Analysis of Heat Conduction:** Introduction, one-dimensional steady conduction and one-Dimensional unsteady conduction, boundary conditions, and solution methods.	**8**
Pedagogy	**Hands on Sessions, PPT ,Video Lectures**	

PRACTICAL COMPONENT OF IPCC	
	Experiments
1	Determination of Thermal Conductivity of a Metal Rod.
2	Determination of Overall Heat Transfer Coefficient of a Composite wall.
3	Determination of Effectiveness on a Metallic fin.
4	Determination of Heat Transfer Coefficient in free Convection
5	Determination of Heat Transfer Coefficient in a Forced Convention
6	Determination of Emissivity of a Surface and Determination of Stefan Boltzmann Constant.
7	Determination of LMDT and Effectiveness in a Parallel Flow and Counter Flow Heat Exchangers.
8	Experiments on Boiling of Liquid and Condensation of Vapour.
9	Experiment on Transient Conduction Heat Transfer.
10	Use of CFD for demonstrating heat transfer mechanism considering practical applications, Minimum two exercises
11	Determination of efficiency of refrigeration system
12	Using one dimensional transient conduction, experimentally demonstrate estimation of thermal conductivity and thermal diffusivity

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Principals of heat transfer Frank Kreith, Raj M. Manglik, Mark S. Bohn Cengage learning Seventh Edition 2011
2	Heat transfer, a practical approach Yunus A. Cengel Tata Mc Graw Hill Fifth edition
3	Fundamentals of Heat and Mass Transfer Incropera, F. P. and De Witt, D. P John Wiley and Sons, New York 5thEdition 2006
4	Heat Transfer A Basic Approach M. Necati Ozisik McGraw Hill, New York 2005
5	Heat Transfer Holman, J. P. Tata McGraw Hill, New York 9th Edition 2008
6	Heat and mass transfer Kurt C, Rolle Cengage learning second edition

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the principles and modes of heat transfer.	**L 2**	**Understand**
CO2	**Apply** the modes of heat transfer to different environments.	**L 3**	**Apply**
CO3	**Analyze** the rate of heat transfer and	**L 4**	**Analyze**
CO4	**Evaluate** the Performance of Various heat transfer Systems under specific conditions	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=rxTK_SvSmvs&list=PL1gyM10tgL1hK9666oGndGlWDQdpQzkY9
2	https://www.kochheattransfer.com/products/twisted-tube-bundle-technology?gad=1&gclid=Cj0KCQjwmtGjBhDhARIsAEqfDEdG22TY7OHa8PBzHX1Yo_DKQcheV46aZxtDRvDIhCe1Gfpr5obDMLoaArSXEALw_wcB
3	https://www.hightemp-furnaces.com/

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**ADVANCED MANUFACTURING**				
Course Code	:	**BME602**				
Course Type (Theory/ Practical/ Integrated)	:	**Integrated**				
Category	:	**IPCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**60 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**04**				

Course Learning Objectives: Students will be able to:

Sl. No	Course Objectives
1	To impart knowledge on the principles, classifications, and applications of various non-traditional machining (NTM) processes.
2	To enable students to select appropriate NTM methods for machining advanced, hard, and complex materials with high precision.
3	To introduce the fundamentals, techniques, and materials used in additive manufacturing processes.
4	To develop the ability to design and fabricate complex components using 3D printing technologies for industrial applications.
5	To provide knowledge on the working principles, programming, and operation of CNC machines.
6	To introduce the fundamentals of robotics and automation systems, including kinematics, dynamics, and control.

Teaching-Learning Process

Pedagogical Initiatives:

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2024-25)

COURSE CURRICULUM

Module No.	Topics	Hours
1	**Module-1 Introduction to Advance machining** Introduction to Non-traditional machining, Need for Non-traditional machining process, Comparison between traditional and non-traditional machining, general classification Non-traditional machining processes, classification based on nature of energy employed in machining. **Ultrasonic Machining (USM)** Introduction, Equipment and material process, Effect of process parameters: Effect of amplitude and frequency, Effect of abrasive grain diameter, effect of slurry, tool & work material. Process characteristics: Material removal rate, tool wear, accuracy, surface finish, applications, advantages & limitations of USM. **Abrasive Jet Machining (AJM)** Introduction, Equipment and process of material removal, process variables: carrier gas, type of abrasive, work material, stand-off distance (SOD). Process characteristics-Material removal rate, Nozzle wear, accuracy & surface finish. Applications, advantages & limitations of AJM.	**9**
Pedagogy	**Demonstration, PPT, Experimental Learning**	
2	**Module-2 Electrochemical & chemical Machining** **Electrochemical Machining (ECM)** Introduction, Principle of electro chemical machining, ECM equipment, elements of ECM operation, Chemistry of ECM. ECM Process characteristics: Material removal rate, accuracy, surface finish. Process parameters: Current density, Tool feed rate, Gap between tool & work piece, velocity of electrolyte flow, type of electrolyte, its concentration temperature, and choice of electrolytes. **Chemical Machining (CHM)** Elements of the process, Resists (maskants), Etchants. Types of chemical machining process-chemical blanking process, chemical milling process. Process characteristics of CHM: material removal rate, accuracy, surface finish, advantages, limitations and applications of chemical machining process.	**9**
Pedagogy	**Demonstration, PPT. Video Lectures**	
3	**Module-3 Additive Manufacturing** **Introduction and basic principles**	**9**

	Need for Additive Manufacturing, Generic AM process, stereolithography or 3dprinting, rapid proto typing, the benefits of AM, distinction between AM and CNC machining, other related technologies- reverse engineering technology. **Development of Additive Manufacturing Technology** Introduction, computers, computer-aided design technology, other associated technologies, the use of layers, classification of AM processes, metal systems, hybrid systems, milestones in AM development. **Additive Manufacturing Process chain** Introduction, the eight steps in additive manufacture, variations from one AM machine to another, metal systems, maintenance of equipment, materials handling issues, design for AM, and application areas.	
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module-4 CNC Machine Tools** **Introduction to CNC** Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection. **CNC Programming** Coordinate system, structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, manual part programming for machining centre and turning centre.	**9**
Pedagogy	**Demonstration, Experimental Learning, Video Lectures**	
5	**Module-5 Robotics & Automation** **Introduction to automation** Basic elements of an automated system, advanced automation functions, levels of automation, process industries versus discrete manufacturing industries, continuous versus discrete control, computer process control. Hardware components for automation and process control, sensors, actuators, analog to digital converters, digital to analog converters, input/output devices for discrete data **Industrial Robotics** Robotic configuration, robot anatomy and related attributes, robot control systems, end effectors, sensors in robotics, industrial robot applications, robot accuracy and repeatability, different types of robots, various generations of robots, degrees of freedom – Asimov's laws of robotics, dynamic stabilization of robots	**9**
	Pedagogical Initiatives (Not limited to): • **Think Pair and Share (Blended Learning):** provides an opportunity for students to learn	

	from one another • **Problem Solving**: encourages cognitive thinking and enables creative problem solving • **Poster Presentation:** allows students to represent the concepts visually in order to understand the topics easily. • **Case studies:** maps different domains in real time applications • **Demonstration:** exhibits the implementation process

List of Programs:

Sl. No	List of the Experiment
	PART-A: CNC Lab
1.	**Manual CNC part programming** using ISO Format G/M codes for 2 turning parts
2.	Using ISO Format G/M codes for 2 milling parts.
3.	Selection and assignment of tools, correction of syntax and logical errors, and verification of tool path using CNC program verification software.
4.	Simulation of Turning operations. 3 typical simulations to be carried out using simulation packages like: Cadem CAMLab-Pro, Mastercam.
5.	Simulation of Drilling operations. 3 typical simulations to be carried out using simulation packages like: Cadem CAMLab-Pro, Mastercam.
6.	Simulation of Milling operations. 3 typical simulations to be carried out using simulation packages like: Cadem CAMLab-Pro, Mastercam.
	PART-B: Additive Manufacturing Lab
1.	Conversion of 3D Part drawings to stereolithography (stl) format.
2.	Generation of Additive Manufacturing Machine Specific Code. Fabrication of model using Rapid Prototyping Machine

Text Books

Sl. No.	Title of the Book/Name of the author/Name of the publisher/Edition and Year
1	Modern Machining Process by P.C Pandey and H S Shah McGraw Hill Education India Pvt. Ltd. 2000
2	Production technology HMT McGraw Hill Education India Pvt. Ltd 2001
3	Rapid Prototyping: Principles & Applications Chua Chee Kai, Leong Kah Fai World Scientific 2003
4	Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling" D.T. Pham, S.S. Dimov Springer 2001

5	Computer Numerical Control Machines Radhakrishnan P New Central Book Agency 2002
6	Introduction to robotics mechanics and control John J. Craig Pearson 3rd edition, 2009
Reference Books	
1	New Technology Dr. Amitabha Bhattacharyya, The Institute of Engineers (India) 2000
2	Rapid Prototyping: Principles and Applications in Manufacturing Rafiq Nooran John Wiley & Sons 2006
3	CAD/CAM Rao P.N. Tata McGraw-Hill Publishing Company Limited 2002
4	Industrial Robotics Weiss, Nagel McGraw Hill International 2nd edition, 2012

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

CO	Course Outcomes	RBT Level	RBT Level Indicator
CO1	**Understanding** the basic concept of advance manufacturing process and constructional feature of the equipment, process parameters, process characteristics, applications, advantages and limitations	**L 2**	**Understand**
CO2	**Apply** the concepts of additive manufacturing to design and create components that satisfy product development/prototyping requirements, using advanced/additive manufacturing devices and processes.	**L 3**	**Apply**
CO3	**Analyze** and select tooling and work holding devices for different components to be machined on CNC machine tools.	**L 4**	**Analyze**
CO4	**Evaluate** components manufactured by AM with Conventional method	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	-	-	-	-	-	-	-			-
CO2	3	-	-	-	-	-	3	-	-	-	-	-			3
CO3	-	3	-	-	-	-	-	-	-	-	-	-			-
CO4	-	-	-	2	-	-	-	-	-	-	-	-	2	2	-

Weblinks and Video Lectures (e-Resources)	
1	https://www.youtube.com/watch?v=B-JraFrOuQA
2	https://www.youtube.com/watch?v=Wu4QSdPPyN0
3	https://onlinecourses.nptel.ac.in/noc25_mm02/preview
4	https://onlinecourses.nptel.ac.in/noc23_me112/preview
5	https://www.udemy.com/topic/cnc/?srsltid=AfmBOorthH7RsqMeurcrlN4bG18i_JzDditCeCkIduD9GhhxRXh-fKl0
6	https://www.udemy.com/topic/robotics/?srsltid=AfmBOopAx0CQ1xHgiTE2xkQhQTEzz5xSlujRL_Br2A-

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

Semester	:	**6st**				
Course Title	:	**MACHINE DESIGN**				
Course Code	:	**BME603**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:2:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**50 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**04**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	Understand the fundamental properties of engineering materials, standard manufacturing processes, and relevant codes and standards for selecting appropriate machine elements and preferred sizes.
2	Apply the concepts of static and fatigue loading, including theories of failure and stress concentration, to design safe and reliable machine components under various loading conditions.
3	Apply the concepts of static and fatigue loading, including theories of failure and stress concentration, to design safe and reliable machine components under various loading conditions.
4	Apply analytical techniques to the design of permanent joints such as riveted and welded connections, assessing their strength, joint efficiency, and failure mechanisms in practical applications.
5	Understand the working principles and design parameters of gears, clutches, brakes, and bearings, and analyse their performance considering factors like strength, wear, dynamic load, lubrication, and thermal behavior.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Design for static and dynamic loading** **Introduction and Review**: Review of engineering materials and their properties and manufacturing processes; use of codes and standards, selection of preferred sizes. Review of axial, bending, shear and torsion loading on machine components, combined loading. **Design for static strength**: Factor of safety and service factor. Failure mode: definition and types., Failure of brittle and ductile materials; even and uneven materials; Stress concentration, stress concentration factor, Theories of failure: maximum normal stress theory, maximum shear stress theory, distortion energy theory, strain energy theory, Columba –Mohr theory and modified Mohr's theory **Fatigue loading**: Introduction to fatigue failure, Mechanism of fatigue failure, types of fatigue loading, SN Diagram, Low cycle fatigue, High cycle fatigue, Endurance limit.	**10**
Pedagogy	**Problem Solving Technique ,Chalk and Talk, Demonstration, PPT, collaborative (Group Learning) learning in the class**	
2	**Module 2: Design of shafts, keys & coupling** **Design of shafts**: Torsion of shafts, solid and hollow shaft design with steady loading based on strength and rigidity, ASME and BIS codes for power transmission shafting, design of shafts subjected to combined bending, torsion and axial loading, Discussion on engineering applications. **Design of keys**: Keys: Types of keys and their applications, design considerations in parallel and tapered sunk keys, Design of square and rectangular sunk keys. **Couplings**: Rigid and flexible coupling types and applications, design of Flange coupling, and Bush and Pin type coupling.	**10**
Pedagogy	**Problem Solving Technique ,Chalk and Talk, Demonstration, PPT, collaborative (Group Learning) learning in the class**	
	Module 3: Design of Riveted joints, welded joints & Spur gears	**10**

3	**Riveted joints:** Types of rivets, rivet materials, Caulking and fullering, analysis of riveted joints, joint efficiency, failures of riveted joints, boiler joints, riveted brackets, Discussion on engineering applications. **Welded joints:** Types, strength of butt and fillet welds, eccentrically loaded welded joints, Discussion on engineering applications. **Spur Gears:** Definitions and Terminology, stresses in gear tooth: Lewis equation and form factor, design for strength, dynamic load and wear.	
Pedagogy	**Problem Solving Technique ,Chalk and Talk, Demonstration, PPT, collaborative (Group Learning) learning in the class**	
4	**Module 4: Design of Helical Gears, Bevel Gears & Worm Gears** **Helical Gears:** Definitions, transverse and normal module, formative number of teeth, design based on strength, dynamic load and wear. **Bevel Gears:** Definitions, formative number of teeth, design based on strength, dynamic load and wear. **Worm Gears:** Definitions, types of worm and worm gears, and materials for worm and worm wheel. Design based on strength, dynamic, wear loads and efficiency of worm gear drives. Use any analysis tool to design and evaluate the static strength of one type of the gears mentioned above **(Students may take up in Continuous Comprehensive Assessment (CCA- as a Pedagogical Initiatives).**	**10**
Pedagogy	**Problem Solving Technique ,Chalk and Talk, Demonstration, PPT, collaborative (Group Learning) learning in the class**	
5	**Module 5: Design of Clutches, Brakes and Mechanism of Lubrication and bearing** **Design of Clutches and Brakes**: Design of single plate based on uniform pressure and uniform wear theories. Design of band brakes, block brakes. **Lubrication and Bearings**: Lubricants and their properties, bearing materials and properties; mechanisms of lubrication, hydrodynamic lubrication, pressure development in oil film, bearing modulus, coefficient of friction, minimum oil film thickness, heat generated, and heat dissipated.	**10**
Pedagogy	**Problem Solving Technique ,Chalk and Talk, Demonstration, PPT, collaborative (Group Learning) learning in the class**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Machine Design Data Handbook,Dr.K.Lingaiah,Suma Publisher,4rth Edition,2006
2	Shigley's Mechanical Engineering Design Richard G. Budynas, and J. Keith Nisbett McGrawHill Education 10th Edition, 2015
3	Fundamentals of Machine Component Design Juvinall R.C, and Marshek K.M John Wiley & Sons Third Edition 2007 Wiley student edition
4	Design of Machine Elements V. B. Bhandari Tata Mcgraw Hill 4th Ed 2016.
5	Design Data Handbook for Mechanical Engineering, K. Mahadevan and Balaveera Reddy, CBS Publisher, Fourth Edition, 2024.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the essential concepts of Machine Design	**L 2**	**Understand**
CO2	Apply codes and standards in the design of machine elements and select an element based on the Manufacturer's catalogue.	**L 3**	**Apply**
CO3	Analyze the performance and failure modes of mechanical components subjected to combined loading and fatigue loading using the concepts of theories of failure.	**L 4**	**Analyze**
CO4	Use design data handbooks and modern tools to model and evaluate the Performance Parameters of Gears, Coupling, Shafts, Weld joints, Riveted joints, Clutch, Gears, and Bearing.	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://en.wikipedia.org/wiki/Machine_element
2	www.nptel.ac.in
3	https://cosmolearning.org
4	www.vtu.ac.in
5	http://nevonprojects.com/miniprojectsformechanicalengineering/

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

Semester	:	**6th**				
Course Title	:	**Total Quality Management**				
Course Code	:	**BME604A**				
Course Type (Theory/Practical/Integrated)	:	**Theory**				
Course Category	:	**PCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45Hrs (T)**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Understand various approaches to TQM
2	Understand the characteristics of quality leader and his role.
3	Develop feedback and suggestion systems for quality management.
4	Enhance the knowledge in Tools and Techniques of quality management
5	Acquire knowledge in Total Productive Maintenance and Quality by Design

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme 2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Management Principles & Systems** **Principles and Practice;** Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, and benefits of TQM. **Quality Management Systems:** Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.	9
Pedagogy	**PPT, Video Lectures**	
2	**Module 2: Organization Theory and Vroom's valence-expectancy theory** **Leadership;** Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, **Role of TQM leaders;** Implementation, core values, concepts and framework, strategic planning communication, decision making.	9
Pedagogy	**PPT, Video Lectures**	
3	**Module 3: Customer Satisfaction and Employee Involvement** **Customer Satisfaction;** customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies. **Employee Involvement;** Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, performance appraisal, unions and employee involvement, case studies.	9
Pedagogy	**PPT, Video Lectures Case Studies**	

4	**Module 4: Continuous Process Improvement and Process Control** **Continuous Process Improvement;** The Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem- solving methods, Kaizen, reengineering, six sigma, and case studies. **Statistical Process Control;** Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.	**9**
Pedagogy	**PPT, Video Lectures**	
5	**Module 5: Total Productive Maintenance (TPM) and Quality by Design** **Total Productive Maintenance;** Definition, Types of Maintenance, Steps in introduction of TPM in an organization, Pillars of TPM – 5S, Jishu Hozen, Quality Maintenance, Planned Maintenance. **Quality by Design (QbD);** Definition, Key components of QbD, Role of QbD in Pharmaceutical Industry, Benefits and Challenges of QbD. Environmental Management Systems (EMS): Definition, Basic EMS, EMS under ISO 14001, Costs and Benefits of EMS.	**9**
Pedagogy	**PPT, Video Lectures**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Total Quality Management Dale H. Besterfield Pearson Education India, Edition 03. ISBN: 8129702606
2	Total Quality Management for Engineers M. Zairi Wood head Publishing ISBN:185573024
3	Managing for Quality and Performance Excellence James R. Evans and William M Lindsay Cengage Learning. 9th edition
4	Four revolutions in management Shoji Shiba, Alan Graham, David Walden Oregon 1990
5	Organizational Excellence through TQM H. Lal New age Publications 200864 Engineering
6	Introduction to Operations Research- Concepts and Cases F.S. Hillier. G.J. Lieberman Tata McGraw Hill 9th Edition, 2010

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Explain the various approaches of TQM	L 2	Understand
CO2	Infer the customer perception of quality	L 3	Apply
CO3	Apply statistical tools for continuous improvement of systems	L 4	Analyze
CO4	Apply the tools and technique for effective implementation of TQM.	L 5	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc22_me28/preview
2	https://archive.nptel.ac.in/courses/112/107/112107219/
3	https://nptel.ac.in/courses/112101098

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

Semester	:	**6th**				
Course Title	:	**Refrigeration and Air conditioning**				
Course Code	:	**BME604B**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: **Students will be taught to**

Sl.No	Course Objectives
1	To Illustrate the principles, nomenclature, and applications of refrigeration systems.
2	Explain vapour compression refrigeration system and identify methods for performance improvement
3	Study the working principles of air, vapour absorption, thermoelectric and steam-jet and thermoacoustic refrigeration systems.
4	Estimate the performance of air-conditioning systems using the principles of psychrometry.
5	Compute and Interpret cooling and heating loads in an air-conditioning system.
6	Identify suitable refrigerant for various refrigerating systems.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**MODULE 1:** **Introduction to Refrigeration:** Basic Definitions, ASHRAE Nomenclature, Air Refrigeration Cycles-reversed Carnot cycle, Bell-Coleman cycle analysis, Air Refrigeration systems-merits and demerits and applications: Aircraft refrigeration cycles, Joule Thompson coefficient and Inversion Temperature, Linde, Claude and Stirling cycles for liquefaction of air. **Industrial Refrigeration:** Chemical and process industries, Dairy plants, Petroleum refineries, Food processing, and food chain, Miscellaneous	8
Pedagogy	**Chalk and talk, Video animation**	
2	**MODULE 2:** **Vapour Compression Refrigeration System(VCRS):** Comparison of Vapour Compression Cycle and Gas cycle, Vapour Compression Refrigeration system Working and analysis, Limitations, Superheat horn and throttling loss for various refrigerants, efficiency, Modifications to standard cycle – liquid-suction heat exchangers, Grindlay cycle and Lorenz cycle, Optimum suction condition for optimum COP Actual cycles with pressure drops, Complete Vapour Compression Refrigeration System, Multi-Pressure, Multi-evaporator systems or Compound Vapour Compression Refrigeration Systems – Methods like Flash Gas removal, Flash inter cooling and water Inter cooling.	8
Pedagogy	**Chalk and talk, Video animation**	
3	**MODULE 3:** **Vapour Absorption Refrigeration Systems:** Absorbent – Refrigerant combinations, Water-Ammonia Systems, Practical problems, Lithium- Bromide System, Contrast between the two systems, Modified Version of Aqua-Ammonia System with Rectifier and Analyser Assembly. Practical problems – crystallization and air leakage, Commercial systems **Other types of Refrigeration systems:** (i) Steam-Jet refrigeration system and (ii) Thermoelectric refrigeration, pulse tube refrigeration, thermoacoustic refrigeration systems	8
Pedagogy	**Chalk and talk, PPT**	
4	**MODULE 4:** **Refrigerants:** Primary and secondary refrigerants, Designation of Refrigerants, Desirable properties of refrigerants including solubility in water and lubricating oil, material compatibility, toxicity, flammability, leak detection, cost, environment and performance issues Thermodynamic properties of refrigerants, Synthetic and natural refrigerants, Comparison between different refrigerants vis a vis applications, Special issues and practical implications Refrigerant mixtures – zeotropic and azeotropic mixtures	8

	Refrigeration systems Equipment: Compressors, Condensers, Expansion Devices and Evaporators, A brief look at other components of the system.	
Pedagogy	**Chalk and talk, PPT**	
5	**MODULE 5:** **Air-Conditioning:** Introduction to Air-Conditioning, Basic Definition, Classification, power rating, Mathematical Analysis of Air-Conditioning Loads, Related Aspects, Different Air-Conditioning Systems-Central – Station Air-Conditioning System, Unitary Air-Conditioning System, Window Air-Conditioner and Packaged Air-Conditioner, Components related to Air-Conditioning Systems. **Transport air conditioning Systems:** Air conditioning systems for automobiles (cars, buses etc.), Air conditioning systems for trains, Air conditioning systems for ships	**8**
Pedagogy	**Chalk and talk, PPT**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Refrigeration and Airconditioning Arora C.P Tata Mc Graw –Hill, New Delhi 2 ndEdition, 2001
2	Principles of Refrigeration Roy J. Dossat Wiley Limited
3	Refrigeration and Airconditioning Stoecker W.F., and Jones J.W., Mc Graw - Hill, New Delhi 2nd edition, 1982.
4	Heating, Ventilation and Air Conditioning McQuistion Wiley Students edition 5 th edition2000.
5	Air conditioning PITA Pearson 4th edition 2005
6	Refrigeration and AirConditioning S C Arora& S Domkundwar Dhanpat Rai Publication
7	Principles of Refrigeration Dossat Pearson 2006

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the basics of Refrigeration	L 2	Understand
CO2	Apply thermodynamic concepts in vapour compression refrigeration system	L 3	Apply
CO3	Analyse the suitable refrigerant for various refrigerating systems	L 4	Analyse
CO4	Evaluate the performance of performance improvement for various refrigeration system	L 3	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/112/105/112105129/
2	https://www.youtube.com/watch?v=nlsNmhiID74&ab_channel=Refrigerationandair-conditioning

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

Semester	:	**6th**				
Course Title	:	**ERP & SAP**				
Course Code	:	**BME604C**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**PEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	To acquaint with key drivers of enterprise resource planning and their interrelationships with strategy.
2	To impart analytical and problem-solving skills necessary to develop solutions for a variety of supply chain management & design problems.
3	To study the complexity of inter firm and intra firm coordination in implementing programs such as e-collaboration, quick response, jointly managed inventories, and strategic alliances.
4	To understand the usage of different modules of SAP.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1:** **Introduction to ERP:** Enterprise–An Overview, Integrated Management Information, Business Modeling, Integrated Data Model **ERP and Related Technologies:** Business Processing Reengineering (BPR), Data Warehousing, Data Mining, On-line Analytical Processing (OLAP), Supply Chain Management (SCM), Customer Relationship Management (CRM), MIS-Management Information System, DSS-Decision Support System, EIS-Executive Information System.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2:** **ERP Manufacturing Prospective:** MRP-Material Requirement Planning, BOM-Bill Of Material, MRP-Manufacturing Resource Planning, DRP-Distributed Requirement Planning, PDM-Product Data Management **ERP Modules:** Finance, Plant Maintenance, Quality Management, Materials Management	8
Pedagogy		
3	**Module 3:** **Introduction to SAP MM:** SAP Material Management, Procurement process, Organization structure, Enterprise structure, Master data management, purchase Info record, source list, procurement cycle, purchase requisition, request for quotation, purchase order, inventory management, invoice verification, service management, transaction code	8
Pedagogy	**Demonstration, Hands on Sessions, Experimental Learning**	
4	**Module 4:** **Introduction to SAP EWM:** Difference between WM and EWM, Real time warehouse, storage types, and process flow in warehouse, Master data, Product Master, Business partner, Different storage types and configuring storage type search sequence, Storage bins, Different ways to create storage bins in SAP EWM.	8
Pedagogy	**Demonstration, Hands on Sessions, Experimental Learning**	
5	**Module 5:** **Warehouse Process Type** (WPT) and its configuration, Process codes and their functionalities, Simple putaway, Door and SA Determination, Pallet storage type configuration, Bulk storage type configuration. **Warehouse Order Creation Rule** (WOCR), Outbound simple picking and Storage type search sequence for picking, Outbound Goods issue.	8
Pedagogy	**Demonstration, Hands on Sessions, Experimental Learning**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Enterprise Resource Planning, Alexis Leon, McGraw Hill; Fourth edition, 2019.
2	Materials Management: An Integrated Approach, P. Gopalakrishnan, M. Sundaresan, Prentice Hall India
3	Materials Management with SAP ERP: Functionality and Technical Configuration, Martin Murray & Jawad Akhtar, SAP Press; Fourth edition, 2020.
4	Warehouse Management with SAP S/4hana: Embedded and Decentralized EWM, Namitha Sachan, Aman Jain, SAP Press; 4th edition, 2024.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	to comprehend various components of Enterprise Resource Planning (ERP)	**L2**	**Understand**
CO2	to assess the strategic significance and integrated functionalities of Enterprise Resource Planning (ERP) and its related technologies	**L3**	**Apply**
CO3	to examine, break down, and figure out the connections between various SAP MM components and their influence on core business processes.	**L4**	**Analyse**
CO4	to determine how SAP EWM functionalities contribute to optimizing warehouse operations and supply chain efficiency.	**L4**	**Analyse**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://www.udemy.com/course/simplify-your-processes-with-erp/
2	https://www.udemy.com/course/sapmmtraining/
3	https://www.udemy.com/course/saps4hanammsourcingandprocurement/
4	https://www.udemy.com/course/sap-extended-warehouse-management-ewm/

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

Semester	:	**6th**				
Course Title	:	**Design for Manufacture and Assembly**				
Course Code	:	**BME604D**				
Course Type (Theory/Practical/Integrated)	:	**Theory**				
Course Category	:	**PCC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45Hrs (T)**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Understand the concepts of Geometric dimensioning and Tolerances in Engineering drawing
2	Analyse 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
5	Describe design for environmental energy efficiency and life cycle assessment

Teaching-Learning Process
Pedagogy (General Instructions):
These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in theprinciple.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come upwith their own creative ways to solve them.

8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.

DSATM

Scheme of Teaching and Examinations for BE Programme 2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Introduction to Design for Manufacturing** **Introduction:** History of DFM, Design philosophy steps in Design process - General Design rules for manufacturability basic principles of designing for economical production - **Creativity in design and materials;** Evaluation method, and Process capability. Selection of Materials for design Developments in Material technology - criteria for material selection.	9
Pedagogy	**PPT, Video Lectures**	
2	**Module 2: Components design for Manufacturing** **Component Design- I:** Machining Consideration: Design features to facilitate machining: drills, Doweling procedures, Design for machinability, Design for economy, Design for capability, Design for accessibility, Design for assembly. **Component Design- II:** Casting Consideration: Redesign of castings based on parting line considerations, Minimizing core requirements, machined holes, redesign of cast members to obviate cores. group technology, Computer Applications for DFMA	9
Pedagogy	**PPT, Video Lectures**	
3	**Module 3: Assembly** **Assemble advantages:** Development of the assemble process, choice of assemble method assemble advantages social effects of automation. **Automatic assembly transfer systems:** Continuous transfer, intermittent transfer, transfer machine GD&T.	9

	Automatic assembly transfer systems GD &T – Symbols, Three datum concept of dimensioning, Straightness, concentricity, Run-out, Location Tolerance, Assembly of parts having concentric cylinders, Roundness, Profile dimensioning, Tapers, Shaft of two diameters. Examples.	
Pedagogy	**PPT, Video Lectures Case Studies**	
4	**Module 4: Manual Assembly** **Design of manual assembly:** Design for assembly fits in the design process, general design guidelines for manual assembly, development of the systematic DFA methodology, classification system for manual handling. **Classification system for manual:** Insertion and fastening, effect of part symmetry on handling time, effect of weight on handling time, effect of symmetry effect of chamfer design on insertion operations, estimation of insertion time	**9**
Pedagogy	**PPT, Video Lectures**	
5	**Module 5: Design for Environment** **Design for the Environment:** Introduction, Environmental objectives, Global issues, Regional and local issues, Basic DFE methods, Design guidelines, Example application, Life Cycle assessment, Basic method, Weighted sum assessment method. **Life Cycle assessment method**: Techniques to reduce environmental impact, Design to minimize material usage, Design for disassembly, Design for remanufacture, Design for energy efficiency, Design to regulations and standard.	**9**
Pedagogy	**PPT, Video Lectures**	

Reference Books
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)

1	Designing for Manufacture, Peck H, Pitman Publications, 1983
2	Engineering Design: A Materials and processing Approach, Dieter, G.E. McGraw Hill Co.Ltd, 2000
3	Engineering Metrology, R K Jain, Khanna Publications, 2000.
4	ASM Hand book, Vol.20. Material selection & Design
5	Handbook of Products Design for Manufacturing: A Practical Guide to Low-cost Production Bralla, James G. McGraw Hill, New York, 1986.
6	Product Design for Manufacture and Assembly, Geoffery Boothroyed et al, Mercel Dekker Inc.New York.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Develop the appropriate material and machining sequence for manufacturing processes	L 2	Understand
CO2	Select a suitable manufacturing system considering environmental factors	L 3	Apply
CO3	Apply the concepts of Geometrical dimensioning, selection of materials and tolerance for engineering products	L 4	Analyze
CO4	Analyse the design principles related to various manufacturing processes and assembly method	L 5	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://onlinecourses.nptel.ac.in/noc22_me28/preview
2	https://archive.nptel.ac.in/courses/112/107/112107219/
3	https://nptel.ac.in/courses/112101098

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**PROJECT MANAGEMENT**				
Course Code	:	**BME605A**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**OEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	To understand how to break down a complex project into manageable segments and use of effective project management tools and techniques to arrive at solution and ensure that the project meets its deliverables and is completed within budget and on schedule.
2	To impart knowledge on various components, phases, and attributes of a project.
3	To prepare students to plan, develop, lead, manage, and successfully implement and deliver projects within their chosen practice area.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Introduction** Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles Project Selection and Prioritization – Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: Project Planning** Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organisation, coding the WBS for the information system. Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: Resourcing Projects** Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project team composition issues, Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning, Project Quality Planning and Project Kick off: Development of quality concepts, project quality management plan, project quality tools, kicks off project, baseline and communicate project management plan, using Microsoft Project for project baselines.	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4: Performing Projects**	8

	Performing Projects: Project supply chain management: Plan purchasing and acquisitions, plan contracting, contact types, project partnering and collaborations, project supply chain management. Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues, Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.	
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5:** Network Analysis Introduction, network construction rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; PERT for finding expected duration of an activity and project, determining the probability of completing a project, predicting the completion time of project; crashing of simple projects.	**8**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Project Management, Timothy J Kloppenborg, Cengage Learning, Edition 2009.
2	Project Management, A systems approach to planning scheduling and controlling by Harold kerzner, CBS publication.
3	Project Management by S Choudhury, Mc Graw Hill Education (India) Pvt. Ltd. New Delhi, 2016.
4	Project Management, Pennington Lawrence, Mc Graw hill.
5	Project Management, A Moder Joseph and Phillips New Yark Van Nostrand, Reinhold.
6	Project Management, Bhavesh M. Patal, Vikas publishing House.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the selection, prioritization and initiation of individual projects and strategic role of project management.	L 2	Understand
CO2	**Apply** the concept of breakdown structure, scheduling and uncertainty in projects.by integrating it with organization.	L 3	Apply
CO3	**Analyze** the activities like purchasing, acquisitions, contracting, partnering and elaborations related to performing projects.	L 4	Analyze
CO4	**Evaluate** the project progress and results through balanced scorecard approach.	L 5	Evaluate

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	http://lavalle.pl/vr/book.html
2	https://nptel.ac.in/courses/106/106/106106138/
3	https://www.coursera.org/learn/introduction-virtual-reality.

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

Semester	:	**6th**				
Course Title	:	**Renewable Energy Power Plants**				
Course Code	:	**BME605B**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**OEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**45 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	To explore society's present needs and future energy demands.
2	To introduce the concepts of solar energy
3	To introduce the concepts and applications of Wind energy, Biomass energy, geothermal energy and Ocean energy as alternative energy sources.
4	To get exposed to energy conservation methods.

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

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Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module: 01 Introduction to Renewable Energy:** Overview of global energy demand and the need for renewable energy, Comparison of renewable and nonrenewable energy sources, Environmental benefits and challenges of renewable energy. **Solar Radiation:** Extraterrestrial radiation, spectral distribution of extraterrestrial radiation, solar constant, solar radiation at the earth's surface, beam, diffuse and global radiation	9
Pedagogy	**Demonstration, PPT, Case studies**	
2	**Module 2: Solar Power Plants:** **Measurement of Solar Radiation:** Pyrometer, shading ring pyrheliometer, sunshine recorder, schematic diagrams and principle of working. Solar Thermal Conversion: Collection and storage, thermal collection devices. **Fundamentals of solar energy and photovoltaic (PV) technology**, Types of solar power plants: grid tied, offgrid, and hybrid systems, Design considerations for solar power plants: site selection, orientation, and shading analysis, PV system components and their functionalities, Operation, maintenance, and performance monitoring of solar power plants	9
Pedagogy	**Demonstration, PPT, Case studies**	
3	**Module: 03 Wind Power Plants:** Basics of wind energy and wind turbine technology, Types of wind turbines: horizontal axis and vertical axis; Wind resource assessment and site selection for wind power plants, Wind farm layout optimization and wake effects, Grid integration and power system considerations for wind power plants **Geothermal Energy Conversion:** Principle of working, types of geothermal station with schematic diagram, geothermal plants in the world, problems associated with geothermal conversion, scope of geothermal energy.	9
Pedagogy	**Demonstration, PPT, Video Lectures**	
4	**Module: 04 Tidal Power:** Tides and waves as energy suppliers and their mechanics; fundamental characteristics of tidal power, harnessing tidal energy, advantages and limitations. **Ocean Thermal Energy Conversion:** Principle of working, OTEC power stations in the world, problems associated with OTEC.	9
Pedagogy	**Demonstration, PPT, Case studies**	
5	**Biomass Power Plants:** Biomass as a renewable energy source: types and characteristics, Conversion technologies: combustion, gasification, and anaerobic digestion, biomass	9

	feedstock selection and availability, Environmental impacts and sustainability of biomass power plants, Integration of biomass power plants with other energy systems **Hydrogen Energy:** Properties of Hydrogen with respected to its utilization as a renewable form of energy, sources of hydrogen, production of hydrogen, electrolysis of water, thermal decomposition of water, thermos Chemical production biochemical production.	
Pedagogy	**Demonstration, PPT, Case Studies**	

Suggested Learning Resources:	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Nonconventional Energy sources, G D Rai, Khanna Publication, Fourth Edition,
2	Energy Technology, S.Rao and Dr. B.B. Parulekar, Khanna Publication. Solar energy, Subhas P Sukhatme, TataMcGrawHill, 2ndEdition,1996
3	Principles of Energy conversion, A.W.Culp Jr. McGraw Hill, 1996
4	Non Convention Energy Resources, ShobhNath Singh, Pearson, 2018

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the need of renewable energy resources, historical and latest developments	**L 2**	**Understand**
CO2	**Apply** by describing the use of solar energy and the various components used in the energy production	**L 3**	**Apply**
CO3	**Analyze** by Appreciating the need of Wind Energy and the various components used in energy generation and the classifications.	**L 4**	**Analyze**
CO4	**Evaluate** by Acquiring the knowledge of fuel cells, wave power, tidal power and geothermal principles and Applications, concept of Biomass energy resources and their classification, types of biogas Plants application	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://www. Investopedia.com/terms/i/internet-energy
2	Ebook URL: https://www.pdfdrive.com/nonconventionalenergysourcese10086374.html
3	Ebook URL: https://www.pdfdrive.com/nonconventionalenergysystemsnptel d17376903.html
4	Ebook URL: https://www.pdfdrive.com/renewableenergysourcesandtheirapplications e33423592.html
5	Ebook URL: https://www.pdfdrive.com/lecturenotesonrenewableenergysources e34339149.
6	html https://onlinecourses.nptel.ac.in/noc18_ge09/preview

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**Introduction to Mechatronics**				
Course Code	:	**BME605C**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**OEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	Key elements of Mechatronics system, representation into block diagram
2	Principles of sensors, its characteristics, interfacing with DAQ microcontroller
3	Concepts of PLC system and its ladder programming, and significance of PLC systems in industrial application
4	The system modeling and analysis in time domain and frequency domain.
5	Control actions such as Proportional, derivative, and integral and study its significance in industrial applications

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Mechatronics systems** Introduction to Mechatronics, Elements of mechatronics system, Evolution of Mechatronics, Design process of Mechatronics system, Modelling of a Mechatronics System, Measurement System. Control systems, Open- and Closed-loop System, analogue and digital control systems, sequential controllers, programmable logic controllers, case studies on mechatronics and microprocessor-based applications	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: Signal Conditioning** Introduction to Signal conditioning, Signal Conditioning processes, The operational amplifier, Protection, Filtering, Wheatstone bridge, Pulse modulation. Introduction to Digital Signals, comparison between analog and digital signals, Digital-to-analogue and Analogue to digital converters, and Data Acquisition, Digital Signal Processing	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: Transducers and Sensors** Introduction to Transducers, Performance terminology, static and dynamic characteristics of Transducers. Introduction to Sensors, classifications, displacement, position and proximity sensors, velocity and motion sensors, force sensor, fluid pressure sensors, Temperature sensors, Light Sensors, selection of sensors	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4: Actuation Systems** Introduction to Mechanical actuation system, kinematic chains, Cams, Gears, Introduction to hydraulic and pneumatic actuation systems, directional control valves, pressure control valves, Cylinders. Introduction to electrical actuation systems, Switching devices, Solenoid-type devices, Drive systems	8
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5: Microprocessors**	8

	Introduction to Digital Logic, Boolean algebra, De morgan theorem, Digital Logic Gates, Logic gate networks, Logic Functions, Truth Table. Introduction to Microprocessor Systems, Evolution of Microprocessor, Internal architecture of a microprocessor, Microcontrollers, Programming, Programmable Logic Controllers	
Pedagogy	**Hands on Sessions, Experimental Learning**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Mechatronics, HMT Ltd., Mc Graw Hill, July 2017 Edition. ISBN:978007 4636435
2	Mechatronics: Integrated Mechanical Electronic Systems, K.P. Ramachandran, G.K. Vijayaraghavan, M.S. Balasundaram, Wiley India Pvt. Ltd., New Delhi, 2008.
3	Mechatronics - Principles Concepts and Applications, Nitaigour Premchand Mahalik, McGraw Hill Education, July 2017 Edition.
4	Mechatronics–Electronic Control Systems in Mechanical and Electrical Engineering, William Bolton, Pearson Education, 7th Edition, 2018.

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Understand the core principles of mechatronics, including the integration of mechanical engineering, electronics, control systems and computer science.	**L2**	**Understand**
CO2	Apply mechatronic principles to choose and combine the right mechanical parts, electronic controls, and computational elements for effective automation and smart systems.	**L3**	**Apply**
CO3	Analyze the performance and functionality of mechatronic systems consisting mechanical, electronic, and software components, and issues related to system integration and operation.	**L3**	**Analyze**
CO4	Evaluate the efficiency and effectiveness of mechatronic systems and propose improvements to enhance system capabilities and functionality in the context of technological change.	**L4**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/112/107/112107298
2	https://archive.nptel.ac.in/courses/112/101/112101304/
3	http://engineering.nyu.edu/mechatronics/smart/html/resources/onlineResources.html

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**MODERN MOBILITY**				
Course Code	:	**BME605D**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**OEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	To understand the different chassis design & main components of automobile
2	To Accomplish the working of transmission and control system employed in automobiles
3	To understand the automotive pollution and alternative automotive technologies under trail
4	To provide insights on the upcoming electric vehicle technology

Teaching-Learning Process

Pedagogy (General Instructions):

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

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

DSATM

Scheme of Teaching and Examinations for BE Programme -2025-26
Outcome Based Education and Choice Based Credit System (CBCS)
(Effective from the Academic Year 2025-26)

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module:1 Mobility Systems** History of Automobile, Classification of Automobile with respect to usage usage, Chassis, Body, Power Sources, capacity, main components of Internal Combustion Engines and their Functions Modern Fuel supply system, Cooling System, Lubrication System & Ignition System, Engine Management System.	8
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module:2 Power Transmission** Clutches: Plate Clutches, Cone Clutch, Centrifugal Clutch, Fluid Flywheel **Gear Box:** Gear Shifting mechanism, synchromesh Gear box, Torque converter, Automatic Manual Transmission (AMT), Automatic Transmission (AT), Continuously Variable Transmission (CVT), Infinitely Variable Transmission (IVT)& IMT, Working of Differential. **Types of Tyres:** Radial & Conventional, Tubeless Tyres, Tubed Tyres-Puncture patching	8
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module:3 Direction Control & Braking** Steering system: Mechanisms & Linkages, Steering gear boxes Rack & pinion, worm & wheel construction & working, power Steering construction & working, steering geometry, Wheel balancing **Braking System:** Mechanism and Linkages, Mechanical Brakes, Hydraulic Brakes, Power Brakes, Parking brakes, ABS **Suspension:** Layout & working of Hydraulic& Air suspension, independent suspension	8
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module:4 Exhaust Emission & Alternate Sources** Exhaust gas pollutants and their effects on environment, Emission norms, IC engine fuel types, extraction& availability,	8

	BIOFUELS – Production and impact. Ethanol engines, CNG vehicles operation, Advantages & disadvantages, overview of Hydrogen fuel cell vehicles, advantages & disadvantages, IC engine/ electric hybrid vehicles overview, layout, transmission & control system, solar powered vehicles wind powered vehicles, super capacitors, supply rails	
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module:5 Electrical Vehicles** **Electric vehicles:** Principle and components layout of two & four-wheeler, Motors used in Electric vehicles –types overview of construction and working, power transmission & control system in Electric vehicles. **Batteries:** Types of batteries, Construction & working principle of Lead acid, nickel based, sodium based, Lithium & Metal Air batteries. Battery charging types and requirements	**8**
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	Electric Vehicle Technology Explained James Larminie Oxford Brookes University, Oxford, UK John Lowry Acenti Designs Ltd., UK
2	Automobile engineering, Kirpal Singh, Vol I and II (12th Edition) Standard Publishers 2011
3	Automotive Mechanics, S. Srinivasan, (2nd Edition) Tata McGraw Hill 2003
4	Automotive mechanics, William H Crouse & Donald L Anglin (10th Edition) Tata McGraw Hill Publishing Company Ltd., 2007
5	Modren Electric, Hybrid Electric, and Fuel Cell Vehicles,MehrdadEhsani, YiminGao, CRC Press, Taylor & Francis Group
6	Automotive mechanics: Principles and Practices, Joseph Heitner, D Van Nostrand Company, Inc
7	Fundamentals of Automobile Engineering, K.K.Ramalingam, Scitech Publications (India) Pvt. Ltd
8	Automobile Engineering, R. B. Gupta, SatyaPrakashan,(4th Edition) 1984

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	**Understand** the working of different systems employed in automobile	**L 2**	**Understand**
CO2	**Apply** the knowledge for selection of automobiles based on their suitability	**L 3**	**Apply**
CO3	**Analyse** the limitation of present-day automobiles	**L 4**	**Analyze**
CO4	**Evaluate** the energy sources suitability	**L 5**	**Evaluate**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://archive.nptel.ac.in/courses/107/106/107106088/
2	https://onlinecourses.nptel.ac.in/noc20_de06/preview
3	https://www.digimat.in/nptel/courses/video/107106088/L01.html
4	https://nptel.ac.in/courses/107106088
5	https://www.youtube.com/watch?v=LZ82iANWBL0&list=PLbMVogVj5nJTW50jj9_gvJmdwFWHaqR5J

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6st**				
Course Title	:	**Design Laboratory**				
Course Code	:	**BME606**				
Course Type (Theory/ Practical/ Integrated)	:	**Practical**				
Course Category	:	**PCCL**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**0:0:2:0**		**SEE**	:	**50 Marks**
Total Hours	:	**14 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**01**				

Course Learning Objectives: Students will be taught to

Sl.No	Course Objectives
1	Compute the natural frequency for both free and forced vibrations in single-degree-of-freedom systems, including the critical speed of rotating shafts.
2	Perform balancing of rotating masses and demonstrate the principles of gyroscopic effects.
3	Analyze the performance and characteristics of mechanical governors.
4	Determine stresses in discs, beams, and plates using a photoelastic bench.
5	Evaluate the pressure distribution in hydrodynamic journal bearings.
6	Analyze stress and strain using strain gauges under compression and bending conditions.
7	Identify and interpret the working of various mechanisms and cam motion systems.

Syllabus:

Week	Experiment No.	Experiments to be covered	Course Outcomes
1	1	Determination of natural frequency, logarithmic decrement, damping ratio and damping coefficient in a single degree of freedom vibrating systems (longitudinal and torsional)	CO1
2	2	Balancing of rotating masses	CO2
3	3	Determination of critical speed of a rotating shaft	CO4
4	4	Determination of equilibrium speed, sensitiveness, power and effort of Porter/Proell/Hartnell Governor.	CO3
5	5	Determination of Pressure distribution in journal bearing	CO5
6	6	Study of different types of cams, types of followers and typical follower motions. Obtain cam profile for any two types of follower motions and types of followers	CO7
7	7	Determination of Fringe constant of Photo-elastic material using: a) Circular disc subjected to diametral compression. b) Pure bending specimen (four-point bending).	CO6

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

CO	Course Outcomes
CO1	Compute the natural frequency, logarithmic decrement, damping ratio, and damping coefficient for free and forced vibrations in single-degree-of-freedom systems, including the critical speed of rotating shafts.
CO2	Perform the balancing of rotating masses and demonstrate the principles of gyroscopic effects through practical experiments.
CO3	Analyze the performance characteristics of mechanical governors and determine their equilibrium speed, sensitivity, and effort.
CO4	Determine stresses in discs, beams, and plates using photoelastic analysis techniques on a photoelastic bench under various loading conditions.
CO5	Determine pressure distribution in a journal bearing and understand its effect on bearing performance.
CO6	Develop cam profiles for different types of follower motions and study the influence of follower and cam types on system behavior.
CO7	Determine the fringe constant of photoelastic material using diametral compression and four-point bending techniques

Mapping of Course Outcomes to Program Outcomes:

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

Assessment Details (CIE and SEE)

The evaluation for the course comprises both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each contributing 50% to the total marks.

1. Minimum passing mark for CIE: 40% of 50 marks → 20 marks
2. Minimum passing mark for SEE: 35% of 50 marks → 18 marks
3. A student is considered to have successfully completed the course if they secure at least 40% of the total combined marks (CIE + SEE), i.e., 40 out of 100 marks.

Continuous Internal Evaluation (CIE):

Total CIE Marks: 50 Marks

Break-up of CIE Marks (60:40 Ratio)

1. Journal/Record and Experiment Evaluation – 60% (30 Marks)
    1. Each experiment is assessed for proper conduction, observation, and detailed record write-up.
    2. Faculty will design rubrics for assessing the journal/write-up for hardware/software experiments and share them with students at the beginning of the lab course.
    3. Each experiment will be graded for 10 marks.
    4. The complete record must include all syllabus-prescribed experiments.
    5. Marks will be scaled down to 30 marks.

2. Test Assessment – 40% (20 Marks)
    - After completing all experiments, the department conducts a test for 100 marks.
    - The test includes:
        - Write-up
        - Experimental conduction
        - Result accuracy
        - Procedural understanding
        - Viva-voce
    - The internal distribution is 60% for performance and 40% for viva-voce.
    - Scores will be scaled down to 20 marks.

Final CIE score = Scaled-down journal score (out of 30) + Test marks (out of 20) = Total 50 Marks

Semester End Evaluation (SEE)

- The SEE for the practical course carries 50 marks.
- It is conducted jointly by two examiners:
    - One external examiner from a different institute or
    - Two internal examiners from the same institute.
- The college/institute is responsible for informing the examiners and scheduling the examination as per the academic calendar.
- All the laboratory experiments specified in the syllabus are mandatory for inclusion in the SEE.
- Rubrics and evaluation criteria:
    - The rubrics (marks distribution and instructions) mentioned on the cover page of the answer booklet must be strictly followed.
    - Alternatively, rubrics may be jointly formulated by the examiners based on the nature of the course.

- Examination procedure:
    - Students are required to pick one experiment randomly from a set of prepared options.
    - The assessment will be conducted jointly by both examiners, covering:
        - Write-up and documentation.

        - Conduction of the experiment.
        - Result interpretation.
        - Viva-voce

- Suggested Evaluation Scheme (for 100 marks):
    - Write-up: 20%
    - Experiment conduction & results: 60%
    - Viva-voce: 20%
    - Final marks obtained will be scaled down to 50

- Additional Guidelines:
    - Only one change of experiment is allowed.
    - If changed, 15% of the marks allotted to the procedure part will be deducted.
    - The minimum duration of the SEE should be 2 hours.

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

Semester	:	**5th Sem**				
Course Title	:	**Analytical and Logical Reasoning**				
Course Code	:	**BME607**				
Course Type (Theory/ Practical/ Integrated)	:	**Theory**				
Course Category	:	**AEC**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**1:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**15 Hrs**		**SEE Duration**	:	**3 Hours**
Credits	:	**01**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	Accurately perform fundamental arithmetic operations, apply principles of number systems, fractions, decimals, percentages, and ratios to solve diverse numerical problems, demonstrating a strong foundation in quantitative reasoning.
2	Solve complex problems involving profit & loss, interest, partnerships, mixtures, time, work, speed, and spatial geometry, effectively applying mathematical concepts to real-world business and movement scenarios.
3	To analyze and solve problems using algebraic equations, inequalities, progressions, permutations, combinations, probability, and set theory, demonstrating an understanding of higher-level mathematical principles.
4	To identify and apply patterns in number and alphabet series, decode relationships in coding-decoding, and classify elements, thereby enhancing their logical reasoning and analytical abilities for various problem types.
5	To analyze and interpret information presented in various data formats (tables, graphs, charts), evaluate data sufficiency, and apply deductive reasoning skills to solve syllogisms, blood relations, directions, and seating arrangement problems.

Teaching-Learning Process

Pedagogy (General Instructions):

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

1. Lecture method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
3. Encourage collaborative (Group) Learning in the class.
4. Ask at least three HOT (Higher-order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
9. Individual teachers can device innovative pedagogy to improve teaching-learning.

DSATM

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

COURSE SYLLABUS

Module No.	Contents of the Module	Hours
1	**Module 1: Arithmetic & Number Fundamentals** Number Systems (properties, HCF/LCM), Fractions, Decimals, Simplification, Percentages, Ratio & Proportion. Core numerical operations, foundational concepts, and their direct applications.	3
Pedagogy	**Demonstration, PPT, Video Lectures**	
2	**Module 2: Commercial Math & Pattern Reasoning** Profit & Loss, Simple & Compound Interest, Partnerships, Mixtures & Alligations, Number Series, Alphabet Series, Coding-Decoding, Classification, Business calculations and basic pattern recognition for logical sequences and codes.	3
Pedagogy	**Hands on Sessions, Experimental Learning**	
3	**Module 3: Time, Work, Speed & Spatial Reasoning** Time & Work, Pipes & Cisterns, Time, Speed & Distance, Problems on Trains & Boats, Mensuration (2D & 3D geometry), Basic Geometry (lines, angles, shapes, properties), Rate-based problems, movement, and fundamental geometric problem-solving.	3
Pedagogy	**Demonstration, Video Lectures, Case Studies**	
4	**Module 4: Advanced Math & Probabilistic Reasoning** Algebra (equations, inequalities, progressions), Permutations & Combinations, Probability, Set Theory, Higher-level mathematical concepts, combinatorial analysis, and probabilistic thinking.	3
Pedagogy	**Demonstration, Hands on Sessions**	
5	**Module 5: Data Analysis & Logical Deductions** Data Interpretation (tables, graphs, charts), Data Sufficiency, Syllogisms, Blood Relations, Directions & Distances, Basic Seating Arrangements, interpreting data, evaluating information completeness, and making precise logical deductions from scenarios.	3
Pedagogy	**Hands on Sessions, Experimental Learning, Case Studies**	

Reference Books	
Books (Title of the Book/Name of the author/Name of the publisher/Edition and Year)	
1	"Quantitative Aptitude for Competitive Examinations" - R.S. Aggarwal, S. Chand Publishing, 2023-2024
2	"A Modern Approach to Logical Reasoning" - R.S. Aggarwal, S. Chand Publishing, 2023-2024
3	"Fast Track Objective Arithmetic" - Rajesh Verma, Arihant Publications, 2023-2024
4	"Analytical Reasoning" - M. K. Pandey, BSC Publishing Co. Pvt. Ltd., 2019 (or latest revised edition)
5	"A New Approach to Reasoning (Verbal, Non-Verbal & Analytical)" - B.S. Sijwali and Indu Sijwali, Arihant Publications, 2023-2024

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

CO	Course Outcomes	RBT Level	Level Indicator
CO1	Fluently apply fundamental arithmetic and number theory concepts	**L 3**	**Apply**
CO2	Solve diverse quantitative aptitude problems in commercial and rate-based contexts	**L 3**	**Apply**
CO3	Utilize advanced mathematical and probabilistic reasoning for problem-solving	**L 3**	**Apply**
CO4	Demonstrate strong logical and pattern recognition capabilities	**L 3**	**Apply**
CO5	Critically interpret data and make sound logical deductions	**L 3**	**Apply**

Mapping of Course Outcomes to Program Outcomes:

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

Web links and Video Lectures (e-Resources)	
1	https://unstop.com/courses/aptitude/logical-reasoning
2	https://www.coursera.org/courses?query=reasoning
3	https://www.tcsion.com/courses/career-creator/introduction-to-logical-reasoning/
4	https://www.udemy.com/course/reasoning-ability-mastery/?srsltid=AfmBOoo6wUrNxnHPpjbW66ZxyFj8BI-v38eRz2Q7uh7IZygBLNSCOtYb&couponCode=ST12MT90625AI

Dayananda Sagar Academy of Technology & Management

(Autonomous Institute under VTU)

Semester	:	**6th**				
Course Title	:	**Project Phase-1**				
Course Code	:	**BME606**				
Course Type (Theory/ Practical/ Integrated)	:	**Project Work**				
Course Category	:	**Project Work**				
Stream	:	**ME**		**CIE**	:	**50 Marks**
Teaching hours/ week (L:T:P:S)	:	**3:0:0:0**		**SEE**	:	**50 Marks**
Total Hours	:	**40 Hrs T**		**SEE Duration**	:	**3 Hours**
Credits	:	**03**				

Course Learning Objectives: Students will be taught to

Sl. No	Course Objectives
1	To encourage independent learning and the innovative attitude of the students.
2	To develop interactive attitude, communication skills, organization, time management, and presentation skills.
3	To impart flexibility and adaptability in team working.
4	To expand intellectual capacity, credibility, judgment and intuition.
5	To adhere to punctuality, setting and meeting deadlines.
6	To train students to present the topic of project work in a seminar without any fear, face the audience confidently, enhance communication skills, involve in group discussion to present and exchange ideas.

Course Outcome: Students will be able to

CO	Course Outcome
CO1	**Apply** the knowledge of Engineering Fundamentals and Modern tool techniques for the defined project work.
CO2	**Analyze** data to produce useful information and draw conclusions in a systematic manner.
CO3	**Evaluate** their skills and the knowledge acquired by Communicating the results, concepts and ideas in written and oral form.
CO4	**Create** new products or generate new ideas with innovative thinking.

Project Phase-I: Students shall 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.

Mapping of Course Outcomes to Program Outcomes:

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