Mahatma Education Society's

Pillai College of Engineering

(Autonomous)

Affiliated to University of Mumbai

Dr. K. M. Vasudevan Pillai's Campus, Sector 16, New Panvel – 410 206.

Admission year 2022-23

Department of Automobile Engineering

Syllabus

of

B.Tech. in Automobile Engineering

for

The Admission Batch of AY 2022-23

First Year - Effective from Academic Year **2022-23**

Second Year - Effective from Academic Year **2023-24**

Third Year - Effective from Academic Year **2024-25**

Fourth Year - Effective from Academic Year **2025-26**

as per

Choice Based Credit and Grading System

Mahatma Education Society's

Pillai College of Engineering

Vision

Pillai College of Engineering (PCE) will admit, educate and train a diverse population of students who are academically prepared to benefit from the Institute's infrastructure and faculty experience, to become responsible professionals or entrepreneurs in a technical arena. It will further attract, develop and retain, dedicated, excellent teachers, scholars and professionals from diverse backgrounds whose work gives them knowledge beyond the classroom and who are committed to making a significant difference in the lives of their students and the community.

Mission

To develop professional engineers with respect for the environment and make them responsible citizens in technological development both from an Indian and global perspective. This objective is fulfilled through quality education, practical training and interaction with industries and social organizations.

n Year 2022-23

Dr. K. M. Vasudevan Pillai's Campus, Sector - 16, New Panvel – 410 206

Department of Automobile Engineering

Vision

To develop an established institution of Automobile Engineering which will become a centre of quality standardization, research and academics through innovation, high quality teaching, projects and world class technology.

Mission

To provide quality education and knowledge that is well-grounded in the fundamental principles of engineering, which fosters innovation, and prepares students for leadership positions and successful careers in industry, academia or entrepreneurial ventures.

Admission Year 2022-23

Program Educational Objectives (PEOs):

I. Students should develop sound fundamental knowledge in mathematics, science and automobile engineering.

II. Students would acquire an ability to function productively as an individual as well as in a team and are well versed in using modern technology and equipment to solve real world problems.

III. Students would be provided with opportunities to develop an instinct for innovation and skills as researchers through industry collaboration, practical training, laboratory experience, projects and the various courses offered to them.

IV. Students would inculcate a professional and ethical attitude, good leadership qualities and commitment to social responsibilities in their thought process.

V. Students will be encouraged to understand the importance of lifelong learning, working on contemporary global issues and to become a successful entrepreneur.

Program Outcomes:

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 modeling to complex engineering activities.

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.

Admission Year 2022-23

Program Specific Outcomes (PSOs):

1. Student should be able to generate and develop ideas that can result in self-employment (eg. Start–ups) and create more jobs.
2. Students should be updated with the latest trends in automobile engineering, beyond curriculum by way of doing internships and research projects.

The Autonomous status of the institute has given an opportunity to design and frame the curriculum in such a way that it incorporates all the needs and requirements of recent developments in all fields within the scope of the technical education. This curriculum will help graduates to attain excellence in their respective field. The curriculum has a blend of basic and advanced courses along with provision of imparting practical knowledge to students through minor and major projects. The syllabus has been approved and passed by the Board of Studies.

Outcome based education is implemented in the academics and every necessary step is undertaken to attain the requirements. Every course has its objectives and outcomes defined in the syllabus which are met through continuous assessment and end semester examinations. Evaluation is done on the basis of Choice Based Credit and Grading System (CBCGS). Optional courses are offered at department and institute level. Selection of electives from the same specialization makes the student eligible to attain a B. Tech. degree with respective specialization.

Every learner/student will be assessed for each course through (i) an Internal/Continuous assessment during the semester in the form of either Practical Performance, Presentation, Demonstration or written examination and (ii) End Semester Examination (ESE), in the form of either theory or viva voce or practical, as prescribed by the respective Board Studies and mentioned in the assessment scheme of the course content/syllabus. This system involves the Continuous Evaluation of students' progress Semester wise. The number of credits assigned with a course is based on the number of contact hours of instruction per week for the course. The credit allocation is available in the syllabus scheme of each semester.

The performance of a learner in a semester is indicated by a number called Semester Grade Performance Index (SGPI). The SGPI is the weighted average of the grade points obtained in all the courses by the learner during the semester. For example, if a learner passes five courses (Theory/labs./Projects/ Seminar etc.) in a semester with credits C1, C2, C3, C4 and C5 and learners grade points in these courses are G1, G2, G3, G4 and G5 respectively, then learners SGPI is equal to:

$$SGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + C_4G_4 + C_5G_5}{C_1 + C_2 + C_3 + C_4 + C_5}$$

The learner's up to date assessment of the overall performance from the time s/he entered for the programme is obtained by calculating a number called the Cumulative Grade Performance Index (CGPI), in a manner similar to the calculation of SGPI. The CGPI therefore considers all the courses mentioned in the scheme of instructions and examinations, towards the

Admission Year 2022-23

minimum requirement of the degree learners have enrolled for. The CGPI at the end of this semester is calculated as,

$$CGPI = \frac{C_1G_1 + C_2G_2 + C_3G_3 + \ldots + C_i * G_i + \ldots + C_nG_n}{C_1 + C_2 + C_3 + \cdots + C_i + \ldots + C_n}$$

The Department of Automobile Engineering offers a B. Tech. programme in Automobile Engineering. This is an eight-semester course. The complete course is a 162 credit course which comprises basic sciences and mathematics,core courses,projects, internship, MOOC course and elective courses. The elective courses are distributed over 7 specializations. The specializations are:

1. Electric Vehicles
2. Motor Sports Engineering
3. Autonomous Vehicles
4. Supply Chain Management and Logistics
5. Automotive Designing

The students also have a choice of opting for Institute level specializations. These are

1. Business and Entrepreneurship
2. Bioengineering
3. Engineering Design
4. Art and Humanities
5. Applied Science
6. Life Skills, Repair, Maintenance and Safety

As minimum requirements for the credits to be earned for the B.Tech in Automobile Engineering program, a student will have to complete a minimum of three specializations of which two are to be chosen from the Department list and one has to be from the Institute level specialization list. In order to complete each specialization, a minimum of three courses under that specialization has to be completed.

- ***At least One MOOC course is highly recommended to be completed with certification in the four years of study.***

Admission Year 2022-23

The credit requirement for the B.Tech. in Automobile Engineering course is tabulated in Table 1.

Table 1. Credit Requirement for B.Tech in Automobile Engineering

Category	Credits
Humanities and Social Sciences including Management courses	6
Basic Science courses	22
Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc	22
Professional core courses	66
Professional Elective courses relevant to chosen specialization/branch	18
Open subjects – Electives from other technical and /or emerging subjects	9
Project work, seminar and internship in industry or elsewhere	20
Mandatory Courses - Environmental Sciences, Induction training, Indian Constitution, Essence of Indian Traditional Knowledge	Non credit
Human Values	2
Total Credits	**162**

Admission Year 2022-23

Proposed Program Structure for First Year Bachelor of Technology (AY 2022-23)

	Course Code	Course Name	*Course Component	Contact Hours			Credits			Semester in which Course is offered for a specific Branch					
				Th	Pr	Tu	Th	Pr	Tu	AE	CE	ECS	EXTC	IT	ME
I	FY 101	Engineering Mathematics I	TL	3	2	-	3	1		1	1	1	1	1	1
II	FY 102	Engineering Mathematics II	TL	3	2	-	3	1		2	2	2	2	2	2
I	FY 103	Engineering Physics I	TL	2	1		2	0.5		1	1	1	1	1	1
II	FY 104	Engineering Physics II	TL	2	1		2	0.5		2	2	2	2	2	2
I	FY 105	Engineering Chemistry I	TL	2	1		2	0.5		1	1	1	1	1	1
II	FY 106	Engineering Chemistry II	TL	2	1		2	0.5		2	2	2	2	2	2
I / II	FY 107	Basic Electrical Engineering	TL	3	2		3	1		1	2	1	1	2	1
I / II	FY 108	Engineering Mechanics and Graphics	TL	2	4		2	2		-	1	2	2	1	-
	FY 109	Engineering Mechanics	TL	3	2		3	1		1	-	-	-	-	1
	FY 110	Engineering Drawing	TL	2	4		2	2		2	-	-	-	-	2
I	FY 111	C Programing	TLP	3	2		3	1		-	1	1	1	1	-
II	FY 112	Python Programing	TLP	3	2		3	1		2		2	2		2
II	FY 113	Java Programing	TLP	3	2		3	1			2			2	
	FY 114	Professional Communication and Ethics I	TLC	2	2		2	1		2	2	2	2	2	2
I	FY 115	Engineering Workshop -I	L		3			1.5		1					1
II	FY 116	Engineering Workshop -II	L		3			1.5		2					2
I	FY117	Basic Workshop Practice-I	L		2			1			1	1	1	1	
II	FY118	Basic Workshop Practice-II	L		2			1			2	2	2	2	

***T- Theory , L- Lab , P-Programming, C- Communication, ** AE & MECH is in one group. Pr: 3/2, means M&AE is 3 hr/week while other disciplines are allocated 2hr/week.**

FY Total number of credits MECH/AUTO

Admission Year 2022-23

Program Structure for
Bachelor of Technology in Automobile Engineering
W.E.F A.Y 2023-24
Semester III

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
AE 201	Production Technology	T	3	-	3	-	3
AE 202	Engineering Mathematics III*	T	2	-	2	-	2
AE 203	Strength of Materials*	TL	3	2	3	1	4
AE 204	Thermodynamics*	T	3	-	3	-	3
AE 205	Engineering Metallurgy and Automotive Materials	TL	3	2	3	1	4
AE 206	Computer Aided Drafting	L	-	2	-	1	1
AE 207	CNC and Additive Manufacturing Lab	LP	-	2	-	1	1
AE 291	Minor Project I	LC	-	4	-	2	2
Total			**14**	**12**	**14**	**6**	**20**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract./ Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs.)			
		1	2	Avg.					
AE 201	Production Technology	40	40	40	60	2	-	-	100
AE 202	Engineering Mathematics III*	30	30	30	45	1.5	-	-	75
AE 203	Strength of Materials*	40	40	40	60	2	25	25	150
AE 204	Thermodynamics*	40	40	40	60	2	-	-	100
AE 205	Engineering Metallurgy and Automotive Materials	40	40	40	60	2	25	-	125
AE 206	Computer Aided Drafting	-	-	-	-	-	25	50	75
AE 207	CNC and Additive Manufacturing Lab	-	-	-	-	-	25	25	50
AE 291	Minor Project I	25 (Mid Sem assessment)					25	25	75
Total									**750**

T- Theory, L- Lab, P-Programming, C- Communication
*** - Common with B.Tech in Mechanical Engineering**

A-Version Year 2022-23

Program Structure for
Bachelor of Technology in Automobile Engineering
W.E.F A.Y 2023-24
Semester IV

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract	Total
AE 208	Automotive Engines & Combustion	TL	3	2	3	1	4
AE 209	Theory of Machines & Mechanisms*	TL	3	2	3	1	4
AE 210	Fluid Mechanics & Machinery*	TL	3	2	3	1	4
AE 211	Engineering Mathematics IV*	T	2	-	2	-	2
AE 212	Human Values and Social Ethics*	T	2	-	2	-	2
AE 213	Elements of Machine Design	T	3	-	3	-	3
AE 214	Data Science	LP	-	4	-	2	2
AE 292	Minor Project II	LC	-	4	-	2	2
Total			**16**	**14**	**16**	**7**	**23**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract. /Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs.)			
		1	2	Avg.					
AE 208	Automotive Engines & Combustion	40	40	40	60	2	25	25	150
AE 209	Theory of Machines & Mechanisms*	40	40	40	60	2	25	25	150
AE 210	Fluid Mechanics & Machinery*	40	40	40	60	2	25	25	150
AE 211	Engineering Mathematics IV*	30	30	30	45	2	-	-	75
AE 212	Human Values and Social Ethics*	-	-	-	-	-	50	-	50
AE 213	Elements of Machine Design	40	40	40	60	2	-	-	100
AE 214	Data Science	-	-	-	-	-	50	25	75
AE 292	Minor Project II	25 (Mid Sem assessment)					25	25	75
Total									**825**

T- Theory, L- Lab, P-Programming, C- Communication

*** - Common with B.Tech in Mechanical Engineering**

Admission Year 2022-23

Program Structure for
Bachelor of Technology in Automobile Engineering
W.E.F A.Y 2024-25
Semester V

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract.	Total
AE 301	Finite Element Analysis*	TL	3	2	3	1	4
AE 302	Heat Transfer*	TL	3	2	3	1	4
AE 303	Automotive Systems	TL	3	2	3	1	4
AE 304	Controls Engineering and Model-based Systems	TLP	3	2	3	1	4
AE 3xx	Department Elective I	T	3	-	3	-	3
AE 391	Minor Project III	LC	-	4	-	2	2
Total			**15**	**12**	**15**	**6**	**21**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract./Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg.					
AE 301	Finite Element Analysis*	40	40	40	60	2	25	25	150
AE 302	Heat Transfer*	40	40	40	60	2	25	25	150
AE 303	Automotive Systems	40	40	40	60	2	25	25	150
AE 304	Controls Engineering and Model-based Systems	40	40	40	60	2	25	25	150
AE 3xx	Department Elective I	40	40	40	60	2	-	-	100
AE 391	Minor Project III	25 (Mid Sem assessment)					25	25	75
Total									**775**

T- Theory, L- Lab, P-Programming, C- Communication
*** - Common with B.Tech in Mechanical Engineering**

Group	Department Specialization	Course Code	DLOC I
1	Electric Vehicles	AE 305	Electric Vehicle Drives and Control
2	Additive Manufacturing	AE 306	CAD for Additive Manufacturing
3	Motorsports Engineering	AE 307	Material Selection and Manufacturing

Admission Year 2022-23

Program Structure for
Bachelor of Technology in Automobile Engineering
W.E.F A.Y 2024-25
Semester VI

Course Code	Course Name	Course Component	Teaching Scheme (Contact Hours)		Credits Assigned		
			Theory	Pract.	Theory	Pract	Total
AE 308	Automotive Body and Chassis Systems	TLP	3	2	3	1	4
AE 309	Automotive Vibrations	TL	3	2	3	1	4
AE 310	Professional Communication and Ethics II	TLC	-	2+2#	-	2	2
AE 3xx	Department Elective II	T/TL	3	-	3	-	3
AE 3xx	Department Elective III	T/TL	3	-	3	-	3
IL 3xx	Institute Elective I	T	3	-	3	-	3
AE 392	Major Project I	LC	-	6	-	3	3
Total			**15**	**14**	**15**	**7**	**22**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract./Oral	Total
		Internal Assessment			End Sem Exam	Exam Duration (Hrs)			
		1	2	Avg					
AE 308	Automotive Body and Chassis Systems	40	40	40	60	2	25	25	150
AE 309	Automotive Vibrations	40	40	40	60	2	25	25	150
AE 310	Professional Communication and Ethics II	-	-	-	-	-	50	-	50
AE 3xx	Department Elective II	40	40	40	60	2	-	-	100
AE 3xx	Department Elective III	40	40	40	60	2	-	-	100
IL 3xx	Institute Elective I	40	40	40	60	2	-	-	100
AE 392	Major Project I						25	50	75
Total									**725**

T- Theory, L- Lab, P-Programming, C- Communication

For an elective which has a laboratory associated, the examination scheme will have additional 25 marks of termwork and that would be a continuous evaluation.

AC Session Year 2022-23

Semester VI

Group	Department Specialization	Course Code	DLOC II
1	Electric Vehicles	AE 311	Automotive Embedded Systems
2	Additive Manufacturing	AE 312	Additive Manufacturing for Engineering application (T)
3	Motor Sports Engineering	AE 313	Race Car Designing (TL)
		AE 314	Electronics in Race Cars (TL)

Group	Department Specialization	Course Code	DLOC III
4	Transportation	AE 315	Fundamentals of Transportation Engineering (T)
		AE 316	Motor Vehicles Acts & Loss Assessments (T)
5	Supply Chain Management & Logistics	AE 317	Supply Chain Management (T)
		AE 318	Production and Operations Management (T)
6	Automotive Designing	AE 319	Concept Sketching, Rendering and Modeling (TL)
7	Autonomous Vehicles	AE 320	Introduction to Self-Driving Cars (T)

Group	Institute Specialization	Course Code	ILOC I
1	Entrepreneurship Development and Management	IL 360	Entrepreneurship
2	Business Management	IL 361	E- Commerce and E-Business
3	IP Management	IL 362	Research Methodology
4	Bioengineering	IL 363	Introduction to Bioengineering
5	Bio Instrumentation	IL 364	Biomedical Instrumentation
6	Engineering Design	IL 365	Design of Experiments
7	Sustainable Technologies	IL 366	Design for Sustainability
8	Contemporary Studies	IL 367	Political Science
9	Art and Journalism	IL 368	Visual Art
10	Applied Science	IL 369	Modern Day Sensor Physics
11	Green Technologies	IL 370	Energy Audit and Management
12	Maintenance Engineering	IL 371	Maintenance of Electronics Equipment
13	Life Skills	IL 372	Cooking and Nutrition
14	Environment & Safety	IL 373	Environmental Management

Admission Year 2022-23

Course Code	Course Name	Credits
FY101	**Engineering Mathematics I**	**3+1**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical/ Oral	Tutorial	Total credits
FY101	Engineering Mathematics - I	3	2	-	05	3	1	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg.					
FY101	Engineering Mathematics- I	40	40	40	60	25	-	-	125

Admission Year 2022-23

Course Objectives:

1. To develop the basic Mathematical skills of engineering students that are imperative for effective understanding of complex numbers in engineering subjects.
2. To acquaint students with the hyperbolic, inverse hyperbolic and logarithmic functions.
3. To understand differentiation and expansions of functions. which will serve as basic tools for specialized studies in many fields of engineering and technology.
4. To learn the partial differentiation techniques and its applications used in engineering problems.
5. To learn the applications of Matrices useful in engineering.
6. To provide hands-on experience using SCILAB software to handle Mathematical modeling.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Apply the basic concept of complex numbers and use it to solve problems in engineering.
2. Apply the basic concept of Hyperbolic, Inverse Hyperbolic, and logarithmic functions in engineering problems.
3. Apply the concept of expansion of functions and successive differentiation in optimization problems.
4. Use the basic concepts of partial differentiation in finding the Maxima and Minima required in engineering problems.
5. Use the concept of matrices in solving the system of equations used in many areas of research.
6. Apply the concept of numerical Methods for solving the engineering problems with the help of SCILAB software.

Syllabus :

Module	Detailed Contents	Hrs.
1	**Complex Numbers** **Pre-requisite:** Review of Complex Numbers-Algebra of Complex Number, Cartesian, polar and exponential form of complex number. 1.1. De Moivre's Theorem.(Without Proof) 1.2. Expansion of sinnθ, cosnθ in terms of powers of sinθ, cosθ and Expansion of sin^nθ, cos^nθ in terms of sines and cosines of multiples of θ. 1.3. Powers and Roots of complex number.	6
2	**Hyperbolic , Inverse Hyperbolic and Logarithmic functions** 2.1 Introduction to Hyperbolic functions, Inverse Hyperbolic Functions. 2.2 Logarithmic functions, Separation of real and Imaginary parts.	6
3	**Successive Differentiation and Expansion of Function** **Pre-requisite :-** Derivative of standard functions and Rules of derivative. 3.1 Successive differentiation: nth derivative of standard functions. Leibnitz's Theorem (without proof) and problems 3.2 Taylor's Theorem (Statement only) and Taylor's series, Maclaurin's series (Statement only). Expansion of $e^{\wedge}(x)$, sin(x), cos(x), tan(x), sinh(x), cosh(x), tanh(x),log(1+x), sin−1(x), cos−1 (x),tan−1 (x).	5
4	**Partial Differentiation and Applications of Partial Differentiation.** 4.1 Partial Differentiation: Function of several variables, Partial derivatives of first and higher order. Differentiation of composite function. 4.2.Euler's Theorem on Homogeneous functions with two independent variables (without proof). Deductions from Euler's Theorem. 4.3 Maxima and Minima of a function of two independent variables, Lagrange's method of undetermined multipliers with one constraint. Jacobian of two independent variables.	7
5	**Matrices :-** **Pre-requisite:** Inverse of a matrix, addition, multiplication and transpose of a matrix ,Elementary row and column transformation 5.1. Symmetric, Skew- Symmetric, Hermitian, Skew Hermitian,Unitary, Orthogonal Matrices and properties of Matrices (Without Proof). 5.2 Rank of a Matrix using Echelon forms, reduction to normal form and PAQ form. 5.3.System of homogeneous and non –homogeneous equations, their consistency and solutions.	6
6	**Numerical Methods** 6.1 **Solution of system of linear algebraic equations**, (1) Gauss Elimination, (2)Gauss Jacobi Iteration Method (3) Gauss Seidel Iteration Method, 6.2 **Solutions of Transcendental equations** (1) Bisection Method (2) Secant Method (3) Newton Raphson Method.	6

Admission Year 2022-23

Assessment

I. Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II. End Semester Theory Examination:

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4sub-questions of 5 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lecture mentioned in the syllabus.

References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication,
4. Matrices, Shanti Narayan, S. Chand publication.
5. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill .

Engineering Mathematics I Laboratory

General Instructions: Each student has to perform at least 4 SCILAB /MATLAB practical's and at least 6 assignments on the entire syllabus.

List of Scilab Programing

1. Gauss Elimination
2. Gauss Seidel Iteration method
3. Gauss Jacobi Iteration Method
4. Bisection method
5. Secant Method
6. Newton Raphson
7. Matrices
8. Maxima and Minima

Term Work:

The distribution of Term Work marks–

1. Attendance (Theory, Practicals) : 05 marks
2. Assignments on entire syllabus : 10 marks
3. SCILAB Practicals : 10 marks

Admission Year 2022-23

Course Code	Course Name	Credits
FY102	**Engineering Mathematics II**	**3+1**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY102	Engineering Mathematics - II	3	2	-	05	3	1	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY102	Engineering Mathematics- II	40	40	40	60	25	-	-	125

Admission Year 2022-23

Course Objectives:

1. To develop the basic mathematical skills of differential equations of engineering students.
2. To understand the linear differential equation with constant coefficients used in mathematical modeling.
3. To acquaint the students with the Beta and Gamma functions
4. To learn different techniques to solve double integrations.
5. To learn the applications of integration in solving complex engineering problems.
6. To provide knowledge of numerical techniques using SCILAB software to handle Mathematical modeling.

Course Outcomes:-

On successful completion of course learner/student will be able to:

1. Apply the basic concept of linear differential equations to solve problems in engineering.
2. Apply the basic concept of applications of LDE with constant coefficient in mathematical modeling to solve real life problems.
3. Apply the basic concepts of beta and gamma functions to solve engineering problems.
4. Apply the concept of double integration in solving problems of engineering and technology.
5. Apply the concept of double integrations to find areas.
6. Apply the concept of differentiation and integration numerically for solving the engineering problems with the help of SCILAB software.

Syllabus:

Module	Detailed Contents	Hrs.
1	**Differential Equations of First Order and First Degree:** 1.1 Exact Differential Equations, Equations reducible to exact form by using integrating factors. 1.2 Linear differential equations, Equations reducible to linear form.	6
2	**Linear Differential Equations With Constant Coefficients and Variable coefficients of higher order:** 2.1. Linear Differential Equation with constant coefficient- complementary function, particular integrals of differential equation of the type f(D)y = X where X is e ^ax , sin($ax + b$) , cos ($ax + b$), x^n, e ^axV, xV. 2.2. Cauchy Differential equation, 2.3Method of variation of parameters two variables	8
3	**Beta and Gamma Function,** 3.1 Gamma Functions and its properties. 3.2 Beta Functions and its properties.	4
4	**Double Integration:** **Prerequisite**: Tracing of curves 4.1. Double integration- Evaluation of Double Integrals.(Cartesian & Polar),Change of order of Integration and evaluation 4.2. Evaluation of integrals over the given region.(Cartesian & Polar) 4.3. Evaluation of double integrals by changing to polar coordinates.	8
5	**Applications of integration** :- 5.1. Application of double integrals to compute Area 5.2. Triple integration**:** Evaluation only (Cartesian, cylindrical and spherical polar coordinates)	4
6	**Numerical Techniques:-** 6.1. **Numerical solution of ordinary differential equation** (a) Euler's method (b) Modified Euler method, (c)Runge-Kutta fourth order method 6.2. **Numerical integration-** (a) Trapezoidal (b) Simpson's 1/3rd (c) Simpson's 3/8th rule	6

Assessment

I. Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II. End Semester Theory Examination:

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4sub-questions of 5 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lecture mentioned in the syllabus.

References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication,

Admission Year 2022-23

4. Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill .

Engineering Mathematics II Laboratory

General Instructions: Each student has to perform at least 4 SCILAB /MATLAB practical's and at least 6 assignments on the entire syllabus.

List of Scilab Programing

1. Euler's Method
2. Euler's Modified Method
3. Runge Kutta Fourth Order
4. Trapezoidal Rule
5. Simpson's 1/3rd Rule
6. Simpson's 3/8th Rule
7. Differential Equations
8. Integration.

Term Work:

The distribution of Term Work marks–

1. Attendance (Theory, Practicals) : 05 marks
2. Assignments on entire syllabus : 10 marks
3. SCILAB Practicals : 10 marks

Admission Year 2022-23

Course Code	Course Name	Credits
FY103	Engineering Physics-I	**2 + 0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY103	Engineering Physics-I	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY103	Engineering Physics-I	30	30	30	45	25	-	-	100

Admission Year 2022-23

Course Objectives:

1. To impart knowledge of basic concepts in applied physics and founding principles of technology..
2. To provide the knowledge and methodology necessary for solving problems in the field of engineering.
3. To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.

Course Outcomes:

Upon successful completion of this course, the learner will be able to:

1. Explain the functioning of lasers and their various applications.
2. Explain the working principle of optical fibres and their applications especially in the field of communication.
3. Understand fundamental concepts of classical optics to study Interference of light in thin films
4. Apply the knowledge of Interference of light in various applications.
5. Explain the limits of Classical Physics and apply the fundamentals of quantum mechanics to study the one dimensional motion of microscopic particles.
6. Apply the knowledge of superconductivity to SQUID and Magnetic levitation.

Syllabus:

Module	Details	Hours.
1.	**Lasers**: 1.1 Basic Definitions and explanation of terms: Spontaneous emission and stimulated emission; metastable state, population inversion, types of pumping, resonant cavity, Einstein's Coefficients and their derivation. 1.2. 3-level and 4-level lasing system and need for at least a 3-level system for lasing action. 1.3. Helium Neon laser: Construction, working and Energy level Diagram. 1.4. Nd: YAG laser: Construction, working and Energy level Diagram. 1.5. Application of Lasers: Holography.	4
2.	**Optical Fibres**: 2.1. Working Principle and Structure 2.2. Derivation of expression for Numerical Aperture for step index fibre. Expression for Critical angle; angle of acceptance for a step Index Fibre. 2.3. Classification of optical fibres. 2.4. Expression for V-number and modes of propagation for a step index fibre. 2.5. Applications : Fibre optic communication system	**3**
3.	**Interference in Thin Films:** 3. Interference in Thin Films 3.1. Interference by division of amplitude and by division of wave front. 3.2.Interference in thin films of constant thickness due to reflected light: Conditions for maxima and minima 3.3.Interference in thin films of constant thickness due to transmitted light: Conditions for maxima and minima 3.4.Interference in Wedge shaped film: Conditions for maxima and minima 3.5.Newton's Rings: Diameter of dark and bright rings	4
4.	**Applications of Interference of light:** 4.1: Thin Films of constant thickness: Origin of colours and estimation of absent colours in interference pattern, Conditions for refractive index and thickness for Highly reflecting and Anti-reflecting thin films on glass. 4.2: Wedge Shaped Thin Film: Relation between fringe width and wedge angle, Estimation of film thickness of a thin foil or wire. 4.3: Newton's Rings: Estimation of ring diameter for a particular wavelength and estimation of refractive index of gap medium.	**3**
5.	**Quantum Mechanics**: 5.1. De Broglie wave hypothesis, properties of matter waves: wave packet, Derivation of expressions for phase velocity and group velocity and their relationship. 5.2. Wave Function, its physical interpretation and salient features. 5.3. Heisenberg's Uncertainty principle statements and their interpretation: momentum and position/energy time forms. 5.4. Derivation of Schrodinger's Time Dependent Wave equation and Schrodinger's Time Independent Wave Equation 5.5.Energy Levels and distribution of probabilities of a charged particle bounded in an infinite potential well	**7**

Admission Year 2022-23

6.	**Superconductivity**: 6.1. Critical temperature, critical magnetic field of a superconductor. 6.2. Meissner Effect, Type I and Type II and high Tc superconductors 6.3. BCS Theory (concept of Cooper pair) 6.4. Applications of superconductors: MAGLEV and qualitative discussion of Josephson effect and SQUID.	**3**

Assessment

I. Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

II.End Semester Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprises of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module (3)
4. Total three questions need to be solved.

References:

1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Modern Engineering Physics – Vasudeva, S.Chand
5. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
6. A TextBook of Engineering Physics, S. O. Pillai, New Age International Publishers.
7. Optics - Ajay Ghatak, Tata McGraw Hill8. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication .
8. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.

Engineering Physics-I Laboratory

List of Experiments:

1. Determination of angular divergence of laser beam.
2. Determination of wavelength of laser light using Diffraction grating. (Laser source)
3. Determination of Numerical Aperture of an optical fibre.
4. Study of a Fibre Optic Communication system (Demonstration only)
5. Determination of Thickness of thin paper sheet using Wedge Shaped film
6. Determination of wavelength of monochromatic source using Newton's Rings
7. Determination of Planck’s constant ‘h’ using LEDs of different colours

Admission Year 2022-23

Term work:

Term Work shall consist of a minimum six experiments. The distribution of marks rubric for term work shall be as follows:

Laboratory work (Experiments and Journal) : 10/20 marks

Group Project **or** Topic Presentation (Optional) : 10 marks

Attendance (Theory and Practical) : 05 marks

Note: Individual teachers may follow a different rubric for distribution of marks for term work.

The final certification and acceptance of Term Work ensures the satisfactory performance of laboratory work and minimum passing in the Term Work.

Admission Year 2022-23

Course Code	Course Name	Credits
FY104	**Engineering Physics-II**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY104	Engineering Physics-II	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY104	Engineering Physics-II	30	30	30	45	25	-	-	100

Admission Year 2022-23

Course Objectives:

1. To impart knowledge of basic concepts in applied physics and founding principles of technology.
2. To provide the knowledge and methodology necessary for solving problems in the field of engineering.
3. To develop scientific temperament for scientific observations, recording, and inference drawing essential for technology studies.

Course Outcomes:

Upon successful completion of this course, the learner will be able to:

1. Comprehend the basic concepts of semiconductor physics and apply the same to electronic devices.
2. Apply the concepts of electromagnetism in focusing systems and CRO.
3. Interpret and explore basic sensing techniques for physical measurements in modern instrumentations.
4. Comprehend the concepts of electrodynamics and Maxwell's equations and their use in telecommunication systems.
5. Comprehend the various material characterisation techniques.
6. Comprehend the knowledge of Piezoelectric and Magnetostriction effect for production of ultrasonic waves and its application in various fields.

Syllabus:

Module	Details	Hours.
1.	**1.Semiconductors**: 1.1 Relation between Conductivity, Mobility, Current density; relation between conductivity, charge concentration, and mobility for metals and semiconductors 1.2 Splitting of energy levels for band formation in semiconductors; classification of semiconductors(doping): Intrinsic and Extrinsic; classification of semiconductors(band gap): Direct and Indirect band gap, Classification of semiconductors (composition):elemental and compound 1.3 Fermi Dirac distribution function: Calculation of energy from probability of occupancy, Fermi level in intrinsic and extrinsic semiconductors; Qualitative discussion on effect of temperature and charge concentration on the fermi levels of n-type and p-type semiconductors, Proof of position of Fermi level in midway of bandgap for an intrinsic semiconductors. 1.4 Energy level diagrams for unbiased and biased P-N junction. 1.5 Hall Effect: Derivation of expression for Hall Voltage and Hall coefficient. 1.6 Semiconductor Devices: I-V curves and mechanism for Solar Cell, LED and Zener Diode	7
2.	**Electron Optics and CRO**: 2.1. Bethe's law 2.2 Electrostatic and Magnetic focussing 2.3 Cathode Ray Tube and its applications. 2.4. Block diagram of a CRO: CRT, Sawtooth Sweep Generator, Synchronisation and power supply 2.5. Applications of CRO: Measurement of : DC and AC voltages, frequency value and phase difference	**4**
3.	**Physics of Sensors**: 3.1.Temperature Sensor 3.2.Pressure Transducer: Capacitive and Inductive types 3.3.Photodiode: IV characteristics and use in measurement of light intensity 3.4.Moisture sensor	4
4.	**Electrodynamics:** 4.1.Scalar and Vector fields, gradient, curl and divergence 4.2.Determination of Maxwell's equations for static and varying fields 4.3.Significance of Maxwell's equations and their application in Antenna design and waveguide. 4.4.Numerical Problems	**5**
5.	**Material Characterisation Techniques** 5.1 X-Ray Diffraction: Bragg’s law and its application in measuring crystal lattice parameter. 5.2 STM and AFM, SEM and TEM: Principle of operation and working using schematic diagram.	**3**

Admission Year 2022-23

6.	**Ultrasonics** : 6.1. Ultrasonic Wave generation; Magnetostriction Oscillator; Piezoelectric Oscillator; 6.2. Applications of ultrasonic: Echo sounding; NDT; ultrasonic cleaning(cavitation); ultrasonic sensors; 6.3.Industrial applications of ultrasonic(soldering, welding, cutting, drilling)	**2**

Assessment

I.Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

II.End Semester Examination

In question paper weightage of each module will be proportional to number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprises of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module (3)
4. Total three questions need to be solved.

References:

1. A text book of Engineering Physics-Avadhanulu & Kshirsagar, S. Chand
2. A textbook of Optics - N. Subramanyam and Brijlal, S.Chand
3. Fundamentals of optics by Jenkins and White, McGrawHill
4. Modern Engineering Physics – Vasudeva, S.Chand
5. Concepts of Modern Physics- Arther Beiser, Tata McGraw Hill
6. A TextBook of Engineering Physics, S. O. Pillai, New Age International Publishers.
7. Optics - Ajay Ghatak, Tata McGraw Hill8. Introduction to Electrodynamics- D. J. Griffiths, Pearson publication .
8. Physics for Engineers, M.R. Srinivasan, New Age International Publishers.

Engineering Physics-II Laboratory

List of Experiments:

1. I-V characteristics of a solar cell and calculation of efficiency.
2. I-V characteristics of a Zener diode and its use as a voltage regulator
3. Demonstration of Hall Apparatus.
4. Use of CRO to determine: DC voltage, frequency and amplitude of AC signals.
5. I-V curves of a photodiode at various light intensities and verification of Inverse Square Law for Light Intensity.
6. Voltage vs. Temperature characteristics of a Temperature Sensor.
7. Use of Ultrasonic distance meter for determination of distance.

Term work:

Term Work shall consist of a minimum six experiments.

Overall Rubric for the distribution of term work marks:
Laboratory work (Experiments and Journal) : 10/20 marks

Group Project **or** Topic Presentation (Optional) : 10 marks

Admission Year 2022-23

Attendance (Theory and Practical) : 05 marks

Note: Individual teachers may follow a different rubric for distribution of marks for term work.

The final certification and acceptance of Term Work ensures the satisfactory performance of laboratory work and minimum passing in the Term Work.

Admission Year 2022-23

Course Code	Course Name	Credits
FY105	**Engineering Chemistry I**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY105	Engineering Chemistry I	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY105	Engineering Chemistry I	30	30	30	45	25	-	-	100

Course objectives

1. To appreciate the need and importance of engineering chemistry in the industry and Engineering field.
2. To include the importance of water in industrial usage.
3. To provide the knowledge of lubrication aspects of machine components.
4. To enable the students to understand the role of engineering materials such as polymers.
5. To introduce composite materials and their applications.
6. To provide an understanding of the fundamental chemical processes that cause environmental problems.

Course outcomes:

Students will be able to:

1. To analyze the quality of water for application in industries and to suggest methods to improve water quality.
2. To acquire knowledge on physical / chemical / biological characteristics of water and the treatment technique for sewage.
3. To select various lubricants for different industrial applications.
4. To identify various polymeric materials and their applications in engineering.
5. To identify, describe and evaluate the properties of different types of composite materials.
6. To develop an understanding of the environmental challenges and suggest methods for their minimisation based on green chemistry principles.

Admission Year 2022-23

Syllabus:

Module	Detailed Contents	Hrs.
1	**Module 1 - Hardness of water** **Pre - requisites** : Knowledge of sources of water, Possible impurities in water, Characteristics imparted by impurities in water. Hardness in water – Types & its units, Determination of hardness by EDTA method, numerical problems. Effects of Hard water in Industries - Boiler corrosion, Priming and Foaming, Scales and Sludges,, caustic embrittlement, (Causes, methods of prevention), Langlier Index Softening of water- Ion exchange process.	3
2	**Module 2 - Water Treatment** Domestic water treatment : Steps involved in domestic water treatment - screening, sedimentation, filtration, disinfection - chlorination ,treatment with ozone. Desalination of brackish water- Reverse Osmosis, Electrodialysis, Ultrafiltration Sewage water treatment **:** BOD and COD, determination and numerical problems, Steps involved in sewage water treatment- primary, secondary (activated sludge process)	3
3	**Module 3 - Lubricants** **Pre - requisites** : Definition of Lubricants and Lubrication, functions of lubricants Functions of lubricants, Mechanisms of lubrication – Thick film, Thin film and Extreme pressure Classification of lubricants - Solid (MoS_2, graphite), Semi solid (greases), Liquid (animal/vegetable oils, mineral oils, Blended oils) Lubricants for special applications Properties of lubricants and their significance - Viscosity and Viscosity Index, Flash and Fire Points, Cloud and Pour Points, Acid Number, Saponification Number, and related numerical problems.	4
4	**Module 4 - Polymeric materials** **Pre - requisite** : Polymer, Monomer, Polymerization, Degree of polymerisation, Classification of polymers, Mechanism of polymerisation. Molecular weight of polymers: Average molecular weight (weight average and number average) of a polymer, Polydispersity Index, Numerical problems. Polymer crystallinity - glass transition temperature and factors affecting Tg, Viscoelasticity Additives in polymers Commercially important polymers - Polyethylene, Polyvinyl acetate, Polydimethyl Siloxane , Epoxy resins , Polylactic acid (PLA) Conducting polymers - Mechanism of conduction in polymers, Examples and applications.	6
5	**Module 5: Polymer Composites** **Prerequisite** :Definition and basic understanding of composite materials. Constitution of composite materials- Matrix and Dispersed phase Classification of composite materials - Particle reinforced composites, Fibre reinforced composites, structural composites . Advantages and Applications of composite materials	4

Academic Year 2022-23

6	**Module 6 - Environmental Chemistry** **Pre- requisites:** Definition of Environment and Primary concept of environmental pollution**.** Industrial Pollution- Causes, Effects and solutions, a case study on industrial pollution E-pollution- Causes, concerns and management , Carbon credit Concept of 12 principles of Green chemistry, discussion with examples (synthesis of indigo, adipic acid), numericals on atom economy.	4

Assessment

I.Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be 75 minutes.

II.End Semester Examination

In the question paper, the weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprise 4 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be random in nature (for example, if Q.2 has part (a) from module 3, then part (b) will be from other than module)
4. Total three questions need to be solved.

References:

1. Engineering Chemistry – P.C.Jain and Monika Jain, Dhanpat Rai Publications
2. A Textbook of Engineering Chemistry, - Shashi Chawla (DhanpatRai publications)
3. A textbook of Engineering Chemistry - S.S. Dara, S. Chand Publishing House
4. Environmental Pollution Control Engineering - C.S.Rao (New Age International)
5. Environmental Chemistry – A.K.De, New Age International

Engineering Chemistry-I Laboratory

List of Experiments:

1. Determination of Hardness in water.
2. Determination of Chloride content in water.
3. Acid value of lubricating oil.
4. Viscosity Index by Redwood viscometer.
5. Determination of Dissolved oxygen in water.
6. Determination of COD.
7. Viscoelasticity of Silly putty.
8. Synthesis of conducting polyaniline from aniline by chemical oxidative polymerization

Term work:

Each student has to perform a minimum of five experiments and four assignments based on the entire syllabus.

The distribution of marks for term work shall be as follows:
Laboratory work (Experiments and Journal) : 10 marks
Assignments and Viva on modules : 10 marks
Attendance (Theory and Practical) : 05 marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

Admission Year 2022-23

Course Code	Course Name	Credits
FY106	**Engineering Chemistry II**	**2+0.5**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY106	Engineering Chemistry II	2	1	-	03	2	1	-	2.5

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY106	Engineering Chemistry II	30	30	30	45	25	-	-	100

Course objectives:

1. To familiarize the students with the basic concepts of chemistry in the industry and Engineering field.
2. To understand the chemistry of various fuels and their combustion mechanism.
3. To acquire knowledge of electrochemical energy systems.
4. To introduce the underlying science of corrosion and the significance of corrosion control to protect the structures.
5. To educate the theory and applications of spectroscopic techniques.
6. To provide an introduction to and an overview over nanomaterials.

Course outcomes

Students will be able to:

1. To understand and analyze the combustion mechanisms of various fuels and be able to characterize the fuels.
2. To develop knowledge on electrochemical energy systems considering the operation.
3. To acquire knowledge of the different battery technologies and understanding the basic mechanisms allowing electrochemical energy storage in batteries
4. To become familiarized with corrosion forms and their effects and to recognize and use the method of corrosion protection.
5. To describe the theoretical background of spectroscopic techniques such as NMR, IR, spectroscopy to apply them for the various fields.
6. To acquire basic knowledge of types of nanomaterials and their synthesis and applications.

Admission Year 2022-23

Syllabus:

Module	Detailed Contents	Hrs.
1	**Module -1 - Fuels and combustion** **Pre- requisites** : What are fuels, Types of fuels, Characteristics of fuels. Calorific value of a fuel - HCV and LCV, Units of Calorific value, Theoretical determination of calorific value of fuel by Dulong's formula, Numerical problems Solid fuels : Coal (Definition and Ranking) Analysis of coal - Proximate and Ultimate analysis, Numerical problems Liquid fuels: Petroleum -Composition, classification (Mining, Refining - Various fractions , their boiling points, composition and uses), Fuels for Internal Combustion Engines - Knocking, Octane number, Anti Knocking agents,Cetane number. Gaseous Fuels: Natural gas, CNG and LNG, (Composition, Properties and uses) Combustion of fuels – Numerical problems for calculating the amount of air needed for the complete combustion of solid and gaseous fuels. Green fuels - Biodiesel	6
2	**Module 2- Engineering Electrochemistry** **Pre -requisite :** redox reaction, cell reaction, electrode and its type, salt bridge Electrode potential, electrode reaction, derivation of Nernst equation for single electrode potential, numerical problems. Electrochemical cells, Concentration cells. Reference electrodes -Types of reference electrodes, Construction, working of SHE, Calomel electrode	3
3	**Module 3- Battery Technology** Battery- classification – primary, secondary and reserve batteries. Characteristics – Capacity, Electricity storage density, energy efficiency, cycle life and shelf life. Construction, working, applications and limitations of Lead acid storage battery, Modern Batteries - Lithium and Lithium ion batteries Fuel Cells: Introduction, classification of fuel cells, limitations & advantages of fuel cells, Construction of Hydrogen oxygen alkaline fuel cells.	3
4	**Module -4- Corrosion and its Control** **Pre- requisites** : corrosion , corrosion product, corrosive and non corrosive metals. Galvanic series and electrochemical series. Mechanism of corrosion - Chemical and Electrochemical corrosion. Types of corrosion : Galvanic corrosion, Differential aeration corrosion, Pitting corrosion, Intergranular corrosion, Waterline corrosion, Stress corrosion. Factors Affecting Corrosion Rate : - (i) Nature of metal, (ii) Nature of environment. Methods of Corrosion Control : Material selection, Design, Cathodic protection Protective Coatings: Metallic coatings - anodic coating (galvanizing) and cathodic coating (Tinning) Methods of Applying Metallic Coatings - Hot dipping, Metal Spraying, Electroplating and Diffusion coating Organic coatings – Paints	6

Academic Year 2022-23

5	**Module 5- Spectroscopic techniques** **Pre-requisites :** Electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum. Spectroscopy - Principle, Interaction of radiation with matter, Selection rules. Classification of spectroscopy - Based on atomic or molecular level, absorption or emission, electronic or magnetic level Types of spectroscopy - IR and NMR Spectroscopy Fluorescence and its applications	3
6	**Module 6 -Nanomaterials** **Prerequisites:** Concept of nano scale, definition of nanoparticles Types of nanomaterials - Fullerenes, Carbon Nanotubes, Properties of nanomaterials – Optical properties, magnetic properties, electrical properties Preparation of Nanomaterials - Top down and Bottom up approach Synthesis of Nanomaterials -Chemical vapour deposition (CVD) method and Laser Ablation Method Applications of nano materials	3

Assessment

I.Internal Assessment Test

Assessment consists of two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be 75 minutes.

II.End Semester Examination

In the question paper, the weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will comprise 4 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be random in nature (for example, if Q.2 has part (a) from module 3, then part (b) will be from other than module)
4. Total three questions need to be solved

References:

1. Engineering Chemistry – P.C.Jain and Monika Jain, Dhanpat Rai Publications
2. A Textbook of Engineering Chemistry, - Shashi Chawla (DhanpatRai publications)
3. A textbook of Engineering Chemistry - S.S. Dara, S. Chand Publishing House
4. Instrumental methods of Chemical Analysis - B.K.Sharma, Goel Publishing House
5. Fundamentals of Molecular Spectroscopy - C.N. Banwell, Tata Mc Graw Hill.

Engineering Chemistry-II Laboratory

List of Experiments:

1. Determination of moisture content and ash value in coal sample.
2. Preparation of bio- diesel.
3. Preparation of Fe2O3 nanoparticles.
4. Cu-Zn electrochemical cell- Effect of conc.on cell potential.
5. Determination of thinner content in paint.
6. Determination of strength of a strong acid by pH meter
7. Determination of strength of a strong acid by conductivity meter
8. EMF measurement

division Year 2022-23

Term work:

Each student has to perform a minimum of five experiments and four assignments based on the entire syllabus.

The distribution of marks for term work shall be as follows:
Laboratory work (Experiments and Journal) : 10 marks
Assignments and Viva on modules : 10 marks
Attendance (Theory and Practical) : 05 marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and

minimum passing in the TW.

Admission Year 2022-23

Course Code	Course Name	Credits
FY107	**Basic Electrical Engineering**	**4**

Course Code	Course Name	Theory	Practical	Tutorial	Total contact hours	Theory	Practical /Oral	Tutorial	Total credits
FY107	Basic Electrical Engineering	3	2	-	5	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY107	Basic Electrical Engineering	40	40	40	60	25	-	25	150

Prerequisite: Resistance, inductance, capacitance, series and parallel connection of resistance, concept of voltage, current, power and energy and its units.

Course Objectives:

1. To provide knowledge on fundamentals of D.C. circuits.
2. To provide knowledge of D.C network theorems and its applications.
3. To impart knowledge on fundamentals of A.C. circuits
4. To impart knowledge on fundamentals of single phase A.C circuits and its applications.
5. To impart knowledge on fundamentals of 3-Φ A.C. circuits and its applications.
6. To impart knowledge on basic operation and applications of electrical machines.

Course Outcomes:

On successful completion of course learner/student will be able to

1. Apply basic concepts to analyse D.C circuits.
2. Apply various D.C network theorems to determine the circuit response/ behavior.
3. Apply basic concepts to analyse A.C waveforms.
4. Evaluate and analyse single phase A.C circuits.
5. Evaluate and analyse three phase A.C circuits.
6. Understand the constructional features and operation of electrical machines.

Admission Year 2022-23

Syllabus

Module	Detailed Contents	Hrs.
1	**DC Circuits** Series and Parallel circuits, Concept of short and open circuits, Star-delta transformation, Ideal and practical voltage and current source, Kirchhoff's laws, Mesh and Nodal analysis (super node and super mesh included), Source transformation.	6
2	**DC Theorems** Linear and Nonlinear Circuit, Active and passive network, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, (Source transformation not allowed for Superposition theorem).	8
3	**AC fundamentals** Generation of alternating voltages, A.C terminology, RMS and Average value, form factor, crest factor, Phasor representation of alternating quantities, addition and subtraction of alternating quantities using phasors.	3
4	**Single Phase AC Circuits** AC through pure resistor, inductor and capacitor. AC through R-L , R-C and R-L-C series and parallel circuits, phasor diagrams, power and power factor, series and parallel resonance, Q-factor**.**	1
5	**Three Phase AC Circuits** Three phase voltage and current generation, star and delta connections (balanced load only), relationship between phase and line currents and voltages, Phasor diagrams, Basic principle of wattmeter, measurement of power by two wattmeter method .	6
6	**Electrical Machines** Working principle of single-phase transformer, EMF equation of a transformer, Transformation Ratio, Transformer Rating. Losses in transformer.	3

Assessment:

I. Internal Assessment Test:

Two Internal assessments will be conducted for 40 marks each with average marks of both assessments as final score.

II. End Semester Examination:

1. Question paper will consist of 5 questions, each carrying 20 marks.
2. Total 3 questions need to be solved.
3. Q.1 will be compulsory, based on the entire syllabus.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of marks should be proportional to number of hours assigned to each module

References:

1. "Basic Electrical Engineering", by Prof. B. R. Patil, Oxford Higher Education
2. "Basic Electrical Engineering (BEE)", by Prof.Ravish Singh", McGraw Hill Education
3. B.L.Theraja "Electrical Technology" Vol-I and II, S. Chand Publications, 23 rd ed. 2003.

Admission Year 2022-23

4. Joseph A Edminister, “Schaum‟s outline of theory and problems of electric circuits” Tata McGraw Hill, 2 nd edition
5. D P Kothari and I J Nagrath “Theory and Problems of Basic Electrical Engineering”, PHI 13th edition 2011.

Basic Electrical Engineering Laboratory

Hardware Requirements: Hardware Kits, Three phase power supply.

List of Experiments:

1. Mesh and Nodal analysis.
2. Verification of Superposition Theorem.
3. Verification Thevenin’s Theorem.
4. Study of R-L series and R-C series circuit.
5. R-L-C series resonance circuit
6. R-L-C parallel resonance circuit
7. Relationship between phase and line currents and voltages in three phase system (star & delta)
8. Power and phase measurement in three phase system by one wattmeter method.
9. Power and phase measurement in three phase system by two wattmeter method

Lab Assessment:

I.Term work Assessment:

Term work consists of performing minimum 06 practical’s. Final certification and acceptance of the term work ensures satisfactory performance of laboratory work.

The distribution of Term Work marks will be as follows:

Attendance (Theory, Practicals) : 5 marks

Assignment on entire syllabus : 10 marks

Practicals : 10 marks

II. Oral/Viva Assessment:

The final certification and acceptance of term work ensures satisfactory performance of laboratory work and minimum passing marks in term work. Practical and Oral exam will be based on the entire syllabus

Admission Year 2022-23

Course Code	Course Name	Credits
FY108	**Engineering Mechanics and Graphics**	**2+2**

Course Code	Course Name	Theory	Practical	Tutorial	Total Contact Hours	Theory	Practical/ Oral	Tutorial	Total Credit
FY108	Engineering Mechanics and Graphics	2	4	-	6	2	2	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
FY108	Engineering Mechanics and Graphics	40	40	40	60	25	50	-	175

Admission Year 2022-23

Course Objectives:

The course is aimed

1. To develop the capacity to predict the effects of force and motion and to acquaint the concept of static and dynamic equilibrium.
2. Ability to visualize physical configurations in terms of actual systems and its constraints, and able to formulate the mathematical function of the system.
3. To study, analyze and formulate the motion of moving particles/bodies.
4. To impart and inculcate proper understanding of the theory of projection.
5. To impart the knowledge of reading a drawing and to improve the visualization skill.
6. To teach basic utility of computer aided drafting (CAD) tools.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two and three dimensional systems with the help of FBD.
2. Illustrate different types of motions and establish Kinematic relations for a particle & rigid body.
3. Analyze particles in motion using force-acceleration, work-energy and impulse momentum principles.
4. Apply the basic principles of projections in reading and converting 3D view to 2D drawing.
5. Visualize an object from the given two views and convert 2D view to 3D drawing.
6. Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.

Syllabus:

Module	Detailed Contents	Hrs.
1	**Coplanar and Non-Coplanar Force System and Resultant:** **1.1 System of Coplanar Forces:** Classification of force systems, Principle of transmissibility, composition and resolution of forces. **1.2 Resultant:** Resultant of coplanar and non-coplanar force system (Concurrent forces, parallel forces and non-concurrent non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane.	**06**
2	**2.1 Equilibrium of System of Coplanar Forces:** Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non- parallel general forces and Couples. Equilibrium of rigid bodies' free body diagrams. **2.2 Equilibrium of Beams:** Types of beams, simple and compound beams, type of supports and reaction. Determination of reactions at supports for various types of loads on beams. (Excluding problems on internal hinges)	**06**
3	**Kinematics of Particle and Rigid Body:** **3.1 Kinematics of Particles:** Motion of particles with variable acceleration. General curvilinear motion. Tangential and Normal component of acceleration, Motion curves (a-t, v-t, s-t curves). **3.2 Kinematics of Rigid Body:** Translation, Rotation & General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR). Location of ICR of mechanism. Velocity analysis of rigid bodies using ICR.	**06**
4	**Kinetics of a Particle:** **4.1 Force and Acceleration:** - Introduction to basic concepts, D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple systems only.) **4.2 Work and Energy:** Work Energy principle for a particle in motion. Application of Work–Energy principle to a system consists of connected masses and Springs. **4.3 Impulse and Momentum:** Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies.	**06**
5	**5.1 *Introduction to Engineering Graphics** Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions. Introduction to plain and diagonal scales. **5.2 @Introduction to Auto CAD:-** Basic Drawing and Editing Commands. Knowledge of setting up layers, Dimensioning, Hatching, plotting and Printing. **5.3 *Orthographic and Sectional Orthographic Projections: -** Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts. **5.4 @Drawing of orthographic projections using Autocad.**	**06**
6	**6.1 *Isometric Projection:**	**06**

Admission Year 2022-23

	Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere). **6.2 @ Drawing of Isometric projections using Autocad.**	

*Will be covered during practical hours. @ Will be covered during Autocad practical hours.

Assessment:

I.Internal Assessment Test (Entirely on Engineering Mechanics):
Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II.End Semester Theory Examination (Entirely on Engineering Mechanics):

1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus **(Module 1-4)** wherein 4 sub-questions of 5 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules **(Module 1-4)**.
5. Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

References:

1. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, Wiley Books
3. Engineering Mechanics (Dynamics) by Meriam and Kraige, Wiley Books
4. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
5. Engineering Mechanics by Shaum Series
6. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing HousePvt. Ltd.
7. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
8. M.B Shah & B.C Rana, “Engineering Drawing”, Pearson Publications.
9. P.J. Shah, “Engineering Graphics”, S Chand Publications.
10. Dhananjay A Jolhe, “Engineering Drawing” Tata McGraw Hill.
11. Prof. Sham Tickoo (Purdue University) & Gaurav Verma, “(CAD Soft Technologies) : AutoCAD 2012 (For engineers and Designers)”, Dreamtech Press NewDelhi.

Engineering Mechanics & Graphics Laboratory

Term Work:

Component-1 Engineering Mechanics Practical (Any Four)

1. Verification of Polygon law of coplanar forces
2. Verification of Principle of Moments (Bell crank lever)
3. Determination of support reactions of a Simply Supported Beam
4. Kinematics of particles. (Collision of bodies)
5. Kinematics of particles. (Projectile motion)

Component -2 Engineering Graphics Practical
One A-3 size sketch book consisting of:-

1. Simple Orthographic Projections.(4 problems)
2. Sectional Orthographic Projections. (4 problems)
3. Isometric projections. (4 problems)

Component-3 AutoCAD Practical

Admission Year 2022-23

Printouts of each from:

1. Orthographic Projections with Section – 3 problems.
2. Isometric projections – 4 problems.
3. Reading of Orthographic Projections – 1 problem.

Note:- 2 hrs /week Auto CAD Practical is essential for completing the Auto CAD Drawings and taking required printouts.

Note: Satisfactory submission of all 3 components is mandatory to fulfill the Term.

End Semester Practical Examination (Auto CAD) (2 hours/ 50 Marks.)

1. Isometric drawing. (1 problem) (20 Marks)
2. Orthographic Projection (With Section) (1 problem). (30 Marks)

Admission Year 2022-23

Course Code	Course Name	Credits
FY109	**Engineering Mechanics**	**3+1**

Course Code	Course Name	Theory	Practical	Tutorial	Total Contact Hours	Theory	Practical / Oral	Tutorial	Total Credit
FY109	Engineering Mechanics	3	2	-	5	3	1	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
FY109	Engineering Mechanics	40	40	40	60	25	-	25	150

Course Objectives:

The course is aimed

1. To develop the capacity to predict the effects of force and motion and to acquaint the concept of static and dynamic equilibrium.
2. Ability to visualize physical configurations in terms of actual systems and its constraints, and able to formulate the mathematical function of the system.
3. To study, analyze and formulate the motion of moving particles/bodies.

Course Outcomes:

On successful completion of course learner/student will be able to

1. Illustrate the concept of force, moment and apply the same along with the concept of equilibrium in two- and three-dimensional systems with the help of FBD.
2. Determine the centroid and MI of plane lamina.
3. Correlate real life application to specific type of friction and estimate required force to overcome friction.
4. Establish relation between velocity and acceleration of a particle and analyze the motion by plotting the relation.
5. Illustrate different types of motions and establish Kinematic relations for a rigid body.
6. Analyze particles in motion using force and acceleration, work-energy and impulse momentum principles.

Admission Year 2022-23

Syllabus:

Module	Details	Hours.
1	**Coplanar Force System and Resultant:** **1.1 System of Coplanar Forces:** Classification of force systems, Principle of transmissibility, composition and resolution of forces. **1.2 Resultant:** Resultant of coplanar force system (Concurrent forces, parallel forces and non-concurrent non-parallel system of forces). Moment of force about a point, Couples, Varignon's Theorem. Force couple system. Distributed Forces in plane. **1.3 Equilibrium of the System of Coplanar Forces and Beams:** Conditions of equilibrium for concurrent forces, parallel forces and non-concurrent non- parallel forces and Couples. Equilibrium of rigid bodies' Free body diagrams. Types of beams, simple and compound beams, type of supports and reaction. Determination of reactions at supports for various types of loads on beams.	08
2	**Centroid and MI:** **2.1** First moment of Area, Centroid of composite plane Laminas **2.2** Second moment of Area, MI of composite plane Laminas	05
3	**Forces in Space:** **3.1** System of Non-Coplanar Force System **3.2** Resultant of Non-Coplanar Force System	05
4	**Friction:** **4.1 Static and Dynamic Friction:** Systems of Statics and Dynamic/ Kinetic Friction, Coefficient of Friction, Angle of Friction, Laws of friction. Concept of Cone of friction. **4.2 Wedge Friction:** Equilibrium of bodies on inclined plane. Application to problems involving wedges and ladders.	06
5	**Kinematics of Particle and Rigid Body:** **5.1 Kinematics of Particles:** Motion of particles with variable acceleration. General curvilinear motion. Tangential & Normal component of acceleration, Motion curves (a-t, v-t, s-t curves). **5.2 Kinematics of Rigid Body:** Translation, Rotation and General Plane motion of Rigid body. The concept of Instantaneous center of rotation (ICR) for the velocity. Location of ICR of mechanism. Velocity analysis of rigid body using ICR	06
6	**Kinetics of a Particle:** **6.1 Force and Acceleration:** - D'Alemberts Principle, concept of Inertia force, Equations of dynamic equilibrium, Newton's second law of motion. (Analysis limited to simple systems only.) **6.2 Work and Energy:** Work Energy principle for a particle in motion. Application of Work – Energy principle to a system consists of connected masses and springs. **6.3 Impulse and Momentum:** Principle of linear impulse and momentum. Impact and collision: Law of conservation of momentum, Coefficient of Restitution. Direct Central Impact and Oblique Central Impact. Loss of Kinetic Energy in collision of inelastic bodies.	06

Admission Year 2022-23

Assessment:

I.Internal Assessment Test:
Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and second class test when additional 35% syllabus is completed. Duration of each test shall be 90 minutes.

II.End Semester Theory Examination:
1. Question paper will comprise of a total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No. 01 will be compulsory and based on the entire syllabus wherein sub-questions of 5 marks will be asked.
4. Remaining questions will be mixed in nature. (e.g. Suppose Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
5. In question paper weightage of each module will be proportional to the number of respective lecture hrs. as mentioned in the syllabus.

III.End Semester Oral Examination:
Pair of Internal and External Examiners should conduct an Oral examination of 25 marks based on the entire syllabus.

References:
1. Engineering Mechanics by Beer &Johnston, Tata McGrawHill
2. Engineering Mechanics (Statics) by Meriam and Kraige, WileyBools
3. Engineering Mechanics (Dynamics) by Meriam and Kraige, WileyBools
4. Engineering Mechanics by F. L. Singer, Harper& Raw Publication
5. Engineering Mechanics by ShaumSeries

Engineering Mechanics Laboratory

List of Experiments:

Minimum six experiments from the following list of which at least one should be from dynamics.

1. Verification of Polygon law of coplanar forces
2. Verification of Principle of Moments (Bell crank lever.)
3. Determination of support reactions of a Simply Supported Beam.
4. Determination of coefficient of friction using inclined plane
5. Collision of elastic bodies (Law of conservation of momentum).
6. Kinematics of particles. (Uniform motion of a particle, Projectile motion, motion under gravity)
7. Kinetics of particles. (collision of bodies)

Admission Year 2022-23

Term Work:

It comprises Laboratory Experiments and Assignments. The distribution of marks for term work shall be as follows:

Practical Work and Journal	: 10 marks
Assignments	: 10 marks
Attendance	: 05 Marks

The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

Course Code	Course Name	Credits
FY110	**Engineering Drawing**	**2+2**

Course Code	Course Name	Theory	Practical	Tutorial	Total Contact Hours	Theory	Practical / Oral	Tutorial	Total Credit
FY110	Engineering Drawing	2	4	-	06	2	2	-	04

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test 1	Test 2	Avg. of 2 Tests					
FY110	Engineering Drawing	40	40	40	60	25	50	-	175

Course Objectives:

The course is aimed

1. To develop graphic skills for communication of concepts, ideas and design of engineering products.
2. To impart and inculcate proper understanding of the theory of projection.
3. To impart the knowledge of reading a drawing
4. To improve the visualization skill.
5. To teach basic utility of Computer Aided drafting (CAD) tools.

Course Outcomes:

On successful completion of course learner/student will be able to

1. Apply the basic principles of projections in Projection of Lines and Planes
2. Apply the basic principles of projections in Projection of Solids.
3. Apply the basic principles of sectional views in Section of solids and development of surfaces.
4. Apply the basic principles of projections in converting 3D view to 2D drawing.
5. Read a given drawing and visualize an object from the given two views.
6. Create, Annotate, Edit and Plot drawings using basic AutoCAD commands and features.

Admission Year 2022-23

Syllabus:

Module	Details	Hours
1	**1.1 Introduction to Engineering Graphics** Principles of Engineering Graphics and their significance, usage of Drawing instruments, Types of Lines, Dimensioning Systems as per IS conventions. Introduction to plain and diagonal scales. **1.2 Engineering Curves** Basic construction of Cycloid, Involutes and Helix (of cylinder) only.	3
2	**2.1 Projection of Points and Lines** Lines inclined to both the Reference Planes (Excluding Traces of lines) and simple application-based problems on Projection of lines. **2.2 Projection of Planes** Triangular, Square, Rectangular, Pentagonal, Hexagonal and Circular planes inclined to either HP or VP only. (Exclude composite planes).	4
3	**Projection of Solids** (Prism, Pyramid, Cylinder, Cone only) Solid projection with the axis inclined to HP and VP. (Exclude Spheres, Composite, Hollow solids and frustum of solids). Use change of position or Auxiliary plane method	5
4	**4.1 Section of Solids** Section of Prism, Pyramid, Cylinder, & Cone cut by plane perpendicular to at least one reference plane (Exclude Curved Section Plane). Use change of position or Auxiliary plane method. **4.2 Development of Lateral Surfaces** Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids, cylinders and cones.	4
5	**5.1 Orthographic and Sectional Orthographic Projections: -** Fundamentals of orthographic projections. Different views of a simple machine part as per the first angle projection method recommended by I.S. Full or Half Sectional views of the Simple Machine parts. **5.2 Missing Views:** The identification of missing views from the given views. Create the third view from the two available views so that all the details of the object are obtained.	5
6	**6.1 Isometric Views: -** Principles of Isometric projection – Isometric Scale, Isometric Views, Conversion of Orthographic Views to Isometric Views (Excluding Sphere).	3

Admission year 2022-23

Assessment:

I.Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. Among the two tests one is Conventional (manual drawing) and Second using CAD Software.

II.End Semester Theory Examination:

1. Question paper will comprise of a total 06 questions, each carrying 15 marks.
2. Any 4 questions need to be solved. There won't be any compulsory Question
3. Total 04 questions need to be solved.
4. Questions will be mixed in nature.(e.g. Suppose Q.2 has part (a) from module3 then part (b) will be from any module other than module 3).
5. In question paper weightage of each module will be proportional to the number of respective lecture hrs. as mentioned in the syllabus.

References:

1. N.D. Bhatt, "Engineering Drawing (Plane and solid geometry)", Charotar Publishing House Pvt. Ltd.
2. N.D. Bhatt & V.M. Panchal, "Machine Drawing", Charotar Publishing House Pvt. Ltd.
3. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publisher.
4. Prof. Sham Tickoo (Purdue University) &Gaurav Verma, "(CAD Soft Technologies) : Auto CAD 2012 (For engineers and Designers)", Dreamtech Press NewDelhi.
5. Dhananjay A Jolhe, "Engineering Drawing" Tata McGraw Hill.

Engineering Drawing Laboratory

Laboratory Syllabus:

Component-1 (Use half Imperial Drawing Sheet)

Sr. No.	Activities to be completed in the Drawing Laboratory.	Hours
1	One Practice sheet on projection of solids (Minimum 2 problems)	4
2	Sheet 1: Projection of Solids (3 Problems).	4
3	One Practice sheet on the Section of Solids. (Minimum 2 problems) # Term Sheet 2: Section of solids. (3 problems).	6
4	One practice sheet on Orthographic projection. (Minimum 1 problem) # Term Sheet 3: Orthographic Projection (With section 1 problem, without section 1 problem).	6
5	One practice sheet on Isometric drawing. (Minimum 2 problems) # Term Sheet 4: Isometric Projection. (3 problems).	4

Component-2

Self-study problems/ Assignment: (In A3 size Sketch book, to be submitted as part of Term Work)

1. Engineering Curves. (2 problems)
2. Projection of Lines (2 problems)
3. Projection of planes (2 problems)
4. Projection of solids. (2 problems)
5. Section of solids (2 problems)
6. Orthographic Projection. (With section 1 problem, without section 1 problem).
7. Missing views. (1 problem)
8. Isometric Drawing. (2 problems)

Component-3

Computer Graphics: Engineering Graphics Software - Orthographic Projections, Isometric Projections, Co-ordinate Systems, Multi-view Projection.

	To be Taught in laboratory.	Hours
PART - A	**Overview of Computer Graphics Covering:** Listing the computer technologies that impact on graphical communication, demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area	3

Admission Year 2022-23

	(Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.	
	Customization & CAD Drawing: Consisting of set up of the drawing page and the printer including scale settings, Setting up of units and drawing limits, ISO and ANSI standards for coordinate dimensioning.	3
	Annotations, layering & other Functions Covering: Applying dimensions to objects, applying annotations to drawings, Setting up and use of layers, layers to create drawings, Create, edit and use customized layers, Changing line lengths through modifying existing lines (extend/lengthen), Printing documents to paper using the print command, orthographic projection techniques, Drawing sectional views of objects (simple machine parts).	4
PART -B	**Activities to be completed in the CAD Laboratory. (All printouts to be part of Term Work.**	
	1. Orthographic Projections (without section)- 1 problem	4
	2. Orthographic Projection (with section)- 1 problem	4
	3. Orthographic Reading – 1 problem	2
	4. Isometric Drawing – 3 problems.	4

Admission Year 2022-23

Term Work:

Component-1	:	7Marks
Component-2	:	6 Marks
Component-3	:	7 Marks
Attendance	:	5 Marks
Total Marks	:	25 Marks

Note: Satisfactory submission of all 3 components is mandatory to fulfill the Term.

End Semester Practical Examination: (Auto CAD) (2 hours/ 50 Marks)

1. Isometric drawing (1 problem) (20 Marks)
2. Orthographic Projection (With Section) (1 problem). (30 Marks)

Course Code	Course Name	Credits
FY 111	**C Programming**	**2+2**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY 111	C Programming	Contact Hours	2	2	-	4
		Credits	2	1	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY 111	C Programming	40	40	40	60	25	25	-	150

Admission Year 2022-23

Course Objectives:

The course is aimed to:

1. To provide exposure to problem-solving by developing algorithms and designing flowchart.
2. Implement the logic to solve real world problems using the C programming language.
3. To develop solutions using different programming concepts.
4. To decompose solutions into smaller units using functions.
5. To create different types of data-structure using structure and arrays.
6. Describe the dynamics of memory using a pointer.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Understand the basic terminology used in computer programming.
2. Use different data types, operators and keywords to write programs
3. Able to logically code using control statements and loops.
4. Design programs involving functions and recursive function.
5. Use the concepts of arrays, strings and Structures to structure complex programs
6. Use of pointers to access different user defined data types like arrays, Strings and Structures

Syllabus:

Module	Module	Detailed Content	Hrs.
1	Fundamentals of C Programming	History of C programming language and its features 1.1 Algorithm & Flowchart : Three construct of Algorithm and flowchart: Sequence, Decision (Selection) and Repetition 1.2 Character Set, Identifiers and keywords, Data types, Constants, Variables. 1.3 Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, other operators. Expression, statements, Preprocessor, Structure of basic C program.	5
2	Control Flow Statements	2.1 Decision making statements- if statement, if-else statement , if-else-if ladder, nested if-else, switch statement 2.2 Looping – while , do-while, for 2.3 Jump Statements- break, continue, goto, return, exit	10
3	Functions	3.1 Introduction to Functions, declaring and defining function, calling function, passing arguments to a function, recursion and its application. 3.2 Library functions – getchar( ), putchar( ), gets( ), puts( ), Math function, Ctype functions 3.3 Storage classes in C-auto, extern, static, register.	5
4	Arrays and Strings	4.1 Array Introduction, Declaration, Initialization, Accessing array element, One and Two-dimensional array. 4.2 Strings Introduction, String using char array, String handling functions	7
5	Structures	5.1 Structure Introduction, Declaration, Initialization, operations on structure. 5.2 Nested structure, Array of Structure.	3
6	Pointers	6.1 Pointer :Introduction, Definition, Pointer Variables, Referencing and Dereferencing operator, Pointer Arithmetic, Pointers to Pointers, void Pointer, 6.2 Pointers to Array and Strings, Passing Arrays to Function, Accessing structure using pointers, Array of Pointers, call by value and call by reference. 6.3 Dynamic Memory Allocation using malloc, calloc, realloc, free	6

Admission Year 2022-23

Assessment:

I.Internal Assessment :

Two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one and half hour.

II.End Semester Theory Examination:

In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 20 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

References:

1. "Programming in ANSI C", by E. Balaguruswamy, Tata McGraw-Hill Education
2. "A Computer Science –Structure Programming Approaches using C ", by BehrouzForouzan , Cengage Learning
3. "Let Us C", by Yashwant Kanetkar, BPB Publication
4. "MASTERING C" by K.R.Venugopal and SudeepR.Prasad , Tata McGraw-Hill Publications.
5. "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publication.
6. "Programming in C", by Pradeep Dey and Manas Gosh, Oxford University Press.
7. Schaum's outlines "Programming with C", by Byron S. Gottfried, Tata McGraw-Hill Publications.
8. "Basics of Computer Science", by BehrouzForouzan , Cengage Learning .

C Programming-Laboratory

List of Experiments:

1.Write algorithm and draw flowchart to find roots of quadratic equation

2.Write a program to swap two integers with and without using temporary variables.

3.Write a program to calculate the volume of a cone. Accept radius & height from the user.

4.Write a program to find the greatest among three integers using ternary operator & if-else.

5.An electric power distribution company charges its domestic customer as follows :

Consumption Units	**Rate of charge**
0 - 200	0.50 per unit
201 - 400	Rs. 100 plus 0.65 per unit excess of 200 units
401 - 600	Rs. 230 plus 0.85 per unit excess of 400 units
601 above	Rs. 390 plus 1.00 per unit excess of 600 units.

Program should read units consumed for a customer and calculate the total bill.

6. Write a program to take input for a character and print the month names starting with that character using a switch case. (Ex: I/P = 'A', O/P = April, August).
7. Write a program to find the result of the series:
   1 - 2^2/3 + 3^2/5……+ n^2/(2n-1)
8. Write a program to print the following pattern : (Take input for the no. of lines 'N').

```
*
* *
* * *
* * * *
```

Admission Year 2022-23

9. Write a program to print the following pattern : (Take input for the no. of lines ‘N’).
   1
   12A
   123BA
   1234CBA
10. Write a program to find if the given number is a palindrome number or not.
11. Write a program for the sum of natural numbers using a recursive function.
12. Write a program to illustrate different ways of passing parameters to a function to demonstrate increment/decrement operators.
13. Write a program to cyclically rotate elements of the integer array in the right direction.
14. Write a program to find transpose using the same matrix.
15. Write a program to find the reverse of a string using another string (Define a user defined function to find the length of the string).
16. Write a program using Structure to accept employee name, emp_id, date_of_joining and salary. Display the result in descending order of salary. Store data for N Employees.
17. Write a program to dynamically allocate memory for the user entered size ‘N’ of an array, accept ‘N’ integers from the user and find the average of these integers using function and pointer (Pass array to the function using pointer).

Practical Assessment:

A Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practical’s based on the above list. Also, Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiments) + 5 Marks (Assignments) + 5 Marks (Attendance)

Admission Year 2022-23

Course Code	Course Name	Credits
FY 112	**Python Programming**	**3+1**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY 112	Python Programming	Contact Hours	3	2	-	5
		Credits	3	1	-	4

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY 112	Python Programming	40	40	40	60	25	25	-	150

Course Objectives:

1. Basics of python including data types, operator, conditional statements, looping statements, input andoutput functions in Python.
2. List, tuple, set, dictionary, string, array and functions
3. Object Oriented Programming concepts in python
4. Concepts of modules, packages, multithreading and exception handling
5. File handling

Course Outcomes:

Upon completion of the course students will be able

1. To understand the structure, syntax of the Python language.
2. To interpret varied data types in python.
3. To implement arrays and functions.
4. To illustrate the concepts of object-oriented programming as used in Python.
5. To create Python applications using modules, packages, multithreading and exception handling.
6. To gain proficiency in writing File Handling programs.

Admission Year 2022-23

Syllabus:

	Module	Description	hrs
	Prerequisite	Python IDE installation and environment setup.	
	Basics of Python	Introduction, Features, Python building blocks – Identifiers, Keywords, Indention, Variables and Comments, Basic data types (Numeric, Boolean, Compound) Operators: Arithmetic, comparison, relational, assignment, logical, bitwise, membership, identity operators, operator precedence Control flow statements: Conditional statements (if, if…else, nested if) Looping in Python (while loop, for loop, nested loops) Loop manipulation using continue, pass, break. Input/output Functions, Decorators, Iterators and Generators.	06
	Advanced data types & Functions	Lists: a) Defining lists, accessing values in list, deleting values in list, updating lists b) Basic list operations c) Built-in list functions Tuples: a) Accessing values in Tuples, deleting values in Tuples, and updating Tuples b) Basic Tuple operations c) Built-in Tuple functions Dictionaries: a) Accessing values in Dictionary, deleting values in Dictionary, and updating Dictionary b) Basic Dictionary operations c) Built-in Dictionary functions Sets: a) Accessing values in Set, deleting values in Set, updating Sets b) Basic Set operations, c) Built-in Set functions Strings: a) String initialization, Indexing, Slicing, Concatenation, Membership & Immutability b) Built-in String functions.	
	Array and Functions	Arrays: a) Working with Single dimensional Arrays: Creating, importing, Indexing, Slicing, copying and processing array arrays. b) Working with Multi-dimensional Arrays using NumPy: Mathematical operations, Matrix operations, aggregate and other Built-in functions Functions: a) Built-in functions in python b) Defining function, calling function, returning values, passing parameters c) Nested and Recursive functions d) Anonymous Functions (Lambda, Map, Reduce, Filter)	
	Object Oriented Programming	Overview of Object-oriented programming, Creating Classes and Objects, Self-Variable, Constructors, Inner class, Static method. Inheritance: Types of Inheritance (Single, Multiple, Multi-level, Hierarchical), super() method, Constructors in inheritance, Method overloading, Method overriding, Abstract class, Abstract method	

Admission Year 2022-23

	Modules and Packages	Modules: Writing modules, importing objects from modules, Pythonbuilt-in modules (e.g. Numeric and Mathematical module, Functional Programming module, Regular Expression module), Namespace and Scoping. Packages: creating user defined packages and importing packages. Multi-threading: process vs thread, use of threads, types of threads, creating threads in python, thread synchronization, deadlock of threads. Exception handling: Compile time errors, Runtime errors, exceptions, types of exception, try statement, except block, raise statement, Assert statement, User-Defined Exceptions.	
	File handling	File Handling: Opening file in different modes, closing a file, Writing to a file, accessing file contents using standard library functions, Reading from a file – read( ), readline( ), readlines(), Renaming and Deleting a file, File Exceptions, Pickle in Python.	

Assessment:

I.Internal Assessment Test:

Assessment consists of two class tests of 40 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed.

II.End Semester Theory Examination:

1. Question paper will comprise of total 05 questions, each carrying 20 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 4/5 sub-questions of 5/4 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to the number of respective lectures mentioned in the syllabus.

References:

1. Dr. R. Nageswara Rao, "Core Python Programming" , Dreamtech Press, Wiley Publication
2. M. T. Savaliya , R. K. Maurya, "Programming through Python", StarEdu Solutions.
3. E Balagurusamy, "Introduction to computing and problem solving using python", McGraw Hill Publication.
4. Zed A. Shaw, "Learn Python 3 the Hard Way", Zed Shaw's Hard Way Series.
5. Martin C. Brown," Python: The Complete Reference", McGraw-Hill Publication.
6. Paul Barry," Head First Python", 2nd Edition, O'Reilly Media, Inc.

Web resources:

1. https://docs.scipy.org/doc/numpy/user/quickstart.html
2. https://matplotlib.org/tutorials/
3. https://pandas.pydata.org/docs/getting_started/
4. https://www.geeksforgeeks.org/python-build-a-rest-api-using-flask/ Back to Scheme

Admission Year 2022-23

Python Programming Laboratory

Minimum Hardware Requirements	Software Requirements	Other Requirements
PC With following Configuration 1. Intel Dual core Processor or higher 2. Minimum 2 GB RAM 3. Minimum 40 GB Hard disk 4. Network interface card	1. Windows or Linux Desktop OS 2. Python 3.6 or higher 3. Notepad ++ 4. Python IDEs like IDLE, Pycharm, Pydev, Netbeans or Eclipse 5. Mysql	1.Internet Connection for installing additional packages

List of suggested Experiments:

1. Write python programs to understand
   a) Basic data types, Operators, expressions and Input Output Statements
   b) Control flow statements: Conditional statements (if, if…else, nested if)
   c) Looping in Python (while loop, for loop, nested loops)
2. Write python programs to understand
   a) Different List and Tuple operations using Built-in functions
   b) Built-in Set and String functions
3. Write python programs to understand
   c) Basic Array operations on 1-D and Multidimensional arrays
   d) Implementing User defined and Anonymous Functions
4. Write python programs to understand
   a) Classes, Objects, Constructors and Static method
   b) Different types of Inheritance
   c) Method overloading, Method overriding, Abstract class and Abstract method
5. Write python programs to understand
   a) Creating User-defined modules/packages and import them in a program
   b) Creating user defined multithreaded application to demonstrate simultaneous execution of multiple threads
   c) Creating a menu driven applications which should cover the built-in exceptions in python
6. Write python programs to understand
   a) Different File Handling operations in Python

Lab Assessments:

1. Term work Assessment:

The Term work shall consist of at least 15 practical's based on the above list. The term work Journal must include at least 2 Programming assignments. The Programming assignments should be based on real world applications which cover concepts from more than one module of syllabus.

Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments/tutorial/write up) + 5 Marks (Attendance)

2. Oral/Viva Assessment:

An Oral & Practical exam will be held based on the above syllabus.

Admission year 2022-23

Course Code	Course Name	Credits
FY 113	**Java Programming**	**3**

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
FY 113	Java Programming	Contact Hours	2	2	-	4
		Credits	2	1	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
FY 113	Java Programming	30	30	30	45	25	25	-	125

Course Objectives:

The course is aimed to:

1. To learn the basic concepts of object-oriented programming
2. To understand the importance of Classes & objects along with constructors
3. To study and understand Arrays, Strings and vectors
4. To study various concepts of JAVA programming like multithreading, exception Handling, packages, etc.
5. To explain components of GUI based programming.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. To apply fundamental programming constructs
2. To illustrate the concept of packages, classes and objects.
3. To elaborate the concept of strings, arrays and vectors
4. To implement the concept of inheritance and interfaces
5. To implement the concept of exception handling and multithreading
6. To develop GUI based applications.

Syllabus:

Prerequisite: Basics of Computer Programming

Module No	Module	Detailed Contents of Module	Hrs.
1	Introduction to Object Oriented Programming	**Overview of procedure and object oriented Programming, Introduction to the principles of object oriented programming**: Classes, Objects, Abstraction, Encapsulation, Inheritance, Polymorphism, Message passing Features of Java Language , JDK, JRE , keywords, Data types, Variables, Operators, Expressions, Types of variables and methods. **Control Statements**: If Statement, If-else, Nested if, switch Statement, break, continue. **Iteration Statements:** for loop, while loop, and do- while loop	08
2	Class, Object, Packages and Input/output	**Classes & Objects:** Reference Variables, Passing parameters to Methods and Returning parameters from the methods, Static members, Non-Static members, Method overloading, Recursive method	08

Admission Year 2022-23

		Constructors: Types of Constructors, chaining of constructor, finalize() Method, Constructors Overloading. **Packages** in java, types, user defined packages Defining packages, creating packages and Importing and accessing packages **Input and output functions** in Java, Command Line Arguments, Scanner class	
3	Array, String and Vector	Array, Strings, String Buffer class, Wrapper classes, Vectors	03
4	Inheritance, Abstract Class and Interfaces	**Inheritance:** Inheritance Basics, Types of Inheritance in Java, member access, using Super- to call superclass Constructor, to access member of super class(variables and methods), creating multilevel hierarchy, Constructors in inheritance, method overriding, **Abstract classes** and methods, using final, Dynamic Method Dispatch **Interfaces:** Defining, implementing and extending interfaces, variables in interfaces, Default Method in Interface, Static Method in interface, Abstract Classes vs Interfaces.	08
5	Exception handling and Multithreading	**Exception Handling:** Exception Handling Fundamentals, Exception Types, Exception class Hierarchy, Using try and catch, Multiple catch Clauses, Nested try Statements, throw, throws, finally, Java's Built-in Exceptions, Creating Your Own Exception Subclasses **Multithreaded Programming:** The Java Thread Model and Thread Life Cycle, Thread Priorities, creating a Thread, Implementing Runnable, Extending Thread, Creating Multiple Threads, Synchronization: Using Synchronized Methods, The synchronized Statement	05
6	GUI programming in JAVA	**Designing Graphical User Interfaces in Java:** Components and Containers, Basics of Components, Using Containers, Layout Managers, AWT Components **Event-Driven Programming in Java:** Event-Handling Process, Event-Handling Mechanism, Event Listeners **Introducing Swing:** AWT vs Swings, Components and Containers, Swing Packages, A Simple Swing Application, Painting in Swing, Designing Swing GUI Application using Buttons, JLabels, Checkboxes, Radio Buttons, JScrollPane, JList, JComboBox, etc. **Introduction to JDBC**: Introduction to JDBC, JDBC-ODBC connectivity, JDBC architecture.	08

Admission Year 2022-23

Assessment:

I.Internal Assessment :

Two class tests of 30 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be one hour.

II.End Semester Theory Examination:

In question, paper weightage of each module will be proportional to the number of respective lecture hours as mentioned in the syllabus.

1. Question paper will consist of 3 questions, each carrying 15 marks.
2. Question number 1 will be compulsory and based on maximum contents of the syllabus
3. Remaining questions will be mixed in nature (for example, if Q.2 has part (a) from module 3 then part (b) will be from other than module 3)
4. Total three questions need to be solved.

References:

1. Herbert Schildt, “Java-The Complete Reference”, Tenth Edition, Oracle Press, Tata McGraw Hill Education.
2. E. Balguruswamy, “Programming with Java A primer”, Fifth edition, Tata McGraw Hill Publication
3. Anita Seth, B.L.Juneja, “ Java One Step Ahead”, Oxford university press.
4. D.T. Editorial Services, “Java 8 Programming Black Book”, Dreamtech Press.
5. Learn to Master Java by Star EDU Solutions
6. Yashvant Kanetkar, “Let Us Java” ,4th Edition ,BPB Publication

Java Programming- Laboratory

List of Experiments:

Hardware & Software Requirements:

Hardware Requirements	Software Requirements	Other Requirements
PC With Following Configuration: 1. Intel PIV Processor 2. 2 GB RAM 3. 500 GB Hard disk 4. Network interface card	1. Windows or Linux Desktop OS 2. JDK 1.8 or higher 3. Notepad ++ 4.JAVA IDEs like Netbeans or Eclipse	1. Internet Connection for installing additional packages if required

1. Programs on Basic programming constructs like branching and looping
2. Programs on Basic programming constructs like branching and looping
3. Programs on class and objects
4. Program on method and constructor overloading.
5. Program on Packages
6. Program on 2D array, strings functions
7. Program on String Buffer and Vectors
8. Program on types of inheritance
9. Program on Multiple Inheritance
10. Program on abstract class and abstract methods
11. Program using super and final keyword
12. Program on Exception handling
13. Program on user defined exception
14. Program on Multithreading
15. Program to create GUI application
16. Mini Project based on the content of the syllabus (Group of 3-4 students)

Practical Assessment: An Practical / Oral exam will be held based on the above syllabus. The final certification and acceptance of TW ensures the satisfactory performance of laboratory work and minimum passing in the TW.

A. Term Work: Term Work shall consist of practical’s based on the above list. Also Term work Journal must include at least 2 assignments based on the topics mentioned in the syllabus.

B. Term Work Marks: 25 Marks (Total marks) = 15 Marks (Experiment) + 5 Marks (Assignments) + 5 Marks (Attendance)

Admission Year 2022-23

Course Code	Course Name	Credits
FY 114	**Professional Communication and Ethics-I**	**3**

Subject Code	Subject Name	Theory (Hrs)	Practical (Hrs)	Tutorial (Hrs)	Theory (Credits)	Practical/Oral (Credits)	Tutorial (Credits)	Total (Credits)
FY 114	Professional Communication and Ethics-I	2	02	--	2	01	--	03

Subject Code	Subject Name	Examination Scheme (tentative)							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal assessment			End Sem. Exam				
		Test1	Test 2	Avg. of 2 Tests					
FY 114	Professional Communication and Ethics-I	-20-	-20-	-20-	30--	25	--		75

Course Objectives:

The course is aimed

1. To understand, compare and demonstrate the importance and relevance of communication with specific emphasis on listening skill.
2. To promote practice in speaking skill and encourage learners to compose on the spot speeches for the purpose of developing and generating ideas.
3. To train learners in reading strategies that will enhance their global understanding of the text and help them to comprehend academic and business correspondence.
4. To illustrate effective writing skills in business, academic and technical areas.
5. To inculcate confident personality traits with grooming and social etiquette.
6. To train learners in producing words on the basis of contextual cues and reflect on errors in sentences.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Listen, comprehend and identify potential barriers in spoken discourse with ease and accuracy.
2. Develop confidence and fluency in speaking at social,academic and business situations as well as make effective professional presentations.
3. Implement reading strategies for systematic, logical understanding, that will enhance the skill of comprehension, summarisation and evaluation of texts.
4. Understand and demonstrate effective writing skills in drafting academic, business and technical documents.

Admission

5. Communicate effectively in academic as well as business settings, displaying refined grooming and social skills.
6.Anticipate the meaning of unfamiliar words with the help of contextual cues and construct grammatically correct sentences.

Syllabus:

Module	Detailed Contents	Hrs.
1	**The Importance and Strategies of Effective Listening** **Prerequisite: Able to listen, read, speak, write and comprehend the target language** Introduction to communication 1.1 Importance and relevance of communication 1.2 Listening skill -ability to discriminate stress and intonation -Comprehend meaning of audio text-graded on the basis of vocabulary, sentence construction and theme. -potential barriers	**5 Hrs**
2	**Developing Speaking Skills** 2.1 Intensive Speaking- on the spot topics 2.2 Responsive speaking-answering a question 2.3 Interactive speaking-conversations 2.4 Extensive speaking-speech, oral presentations-specific emphasis on plagiarism check and generating the report	**6 Hrs**
3	**Strategies and Techniques to build Reading Skil** 3.1 Develop the process of reading- a) predicting content from the given title, b) anticipating content from the given sentence, c) skimming for understanding the theme of the passage, d) scanning for specific information, e) guessing the meaning of unfamiliar words from the context, that is, the careful analysis of structural words f) inferring from the content- conclusion reached on the basis of evidence and reasoning g) deduction- logical conclusions based on the information given in a text Special emphasis on reading comprehension exercises and summarisation	**5 Hrs**
4	**Developing Professional Writing Skills** 4.1 Effective introduction with emphasis on general statement, opposing statement and thesis statement 4.2 Critical response to a text with special reference to purpose, evaluation of the content, theme and style of a text 4.3 Organization of ideas, sentence construction and word choice, grammar and usage 4.4 Explanation and support of ideas (special reference to writing paragraphs and business letters- Sales and Claim letters}	**6 Hrs**

Admission Year 2022-23

5	**Etiquette and Grooming for Personality Development** 5.1 Social Etiquette 5.2 Corporate etiquette 5.3 Confidence building and Personality development	**1 Hr**
6	**Vocabulary and Grammar** 6.1 Contextual vocabulary Development- Word Maps 6.2 Identifying errors in a sentence.	**1 Hr**

Assessment:

I.Internal Assessment Test:
Assessment consists of two class tests of 20 marks each. The first class test is to be conducted when approx. 40% syllabus is completed and the second class test when an additional 35% syllabus is completed. Duration of each test shall be 60 minutes**.(Note: Summarization should be a compulsory question in Test II and not in the End Semester Theory Examination)**

II. End Semester Theory Examination:
Total marks 30, duration 1 and half hours.

1. Question paper will consist of 5 questions, each carrying 10 marks.
2. Total 3 questions need to be solved.
3. Q.1 will be compulsory, based on the entire syllabus.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of marks should be proportional to the number of hours assigned to each module.

References:

1.Raman Meenakshi & Sharma Sangeeta, *Communication Skills,* Oxford University Press
2.Kumar Sanjay & Lata Pushp, *Communication Skills*, Oxford University Press
3.Locker, Kitty O. Kaczmarek, Stephen Kyo. (2019). Business Communication: Building Critical Skills. Place of publication not identified: Mcgraw-hill.
4.Murphy, H. (1999). Effective Business Communication. Place of publication not identified: Mcgraw-Hill.
5.Lewis, N. (2014). Word power made easy. Random House USA.

Professional Communication and Ethics-I Laboratory

Lab Prerequisite: Basic language skills

Syllabus:

Sr. No.	Level 1. Basic 2. Design 3. Advanced 4. Project/Case Study/Seminar	Detailed Lab/Tutorial Description	LO Mapping
1	Assignment 1	Written record of listening activities-Listening practice tasks of 3 types (through audio recordings of (1) Monologues (2) Dialogues (3) Formal/Expert Talk or Lecture)	LO1

mission Year 2022-23

2	Assignment 2	Transcription of the public speech along with a plagiarism report-Practice public speech	LO2
3	Assignment 3	Summarization through graphic organisers (1. Text to graphic organizer 2. Graphic organizer to text)	LO3
4	Assignment 4	1. Case studies on critical thinking 2. 2 business letters in complete block format.	LO4
5	Assignment 5	Documentation of case studies/Role play based on Module 5	LO5
6	Assignment 6	1. Contextual Vocabulary Development 2. Aptitude Test	LO6

Term work:

Term Work shall consist of 6 Assignments .

The distribution of marks for term work shall be as follows:

1.Assignments : **10 marks**

2.Oral Exam/ Public Speaking : **10 marks**

3.Attendance (Theory and Tutorial) : **05 marks**

Admission Year 2022

Course Code	Course Name	Credits
FY 115	**Engineering Workshop I**	**1.5**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
FY 115	Engineering Workshop I	--	3	--	--	--	1.5	1.5

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract./oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FY 115	Engineering Workshop I	--	--	--	--	--	50	--	50

Course Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.

Course Outcomes: Learners will be able to…

1. Develop the necessary skill required to handle/use different fitting tools.
2. Develop skills required for hardware maintenance.
3. Able to install an operating system and system drives.
4. Able to identify the network components and perform basic networking and crimping.
5. Able to prepare the edges of jobs and do simple arc welding.
6. Develop the necessary skill required to handle/use different plumbing tools.
7. Demonstrate the turning operation with the help of a simple job.

Admission Year 2022-23

Trade	Detailed Content		Hrs.

Note: Trade 1 and 2 are compulsory. Select any two trade topics out of the topic at trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same. Report on the demonstration including suitable sketches is also to be included in the term work.
CO-1 is related to Trade-1.
CO-2 to CO-4 is related to Trade-2.
CO-5 is related to trade-3.
CO-6 is related to Trade-4.
CO-7 is related to Trade-5.
CO evaluation is to be done according to the opted Trades in addition to **Compulsory Trades.**Can select Any two trade topics out of the topic at trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same.

Trade-1	**Fitting (Compulsory):** Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling, tapping. Term work to include one job involving following operations : filing to size, one simple male- female joint, drilling and tapping		**10**
Trade-2	**Hardware and Networking: (Compulsory)** Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. · Assembling of PC, Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one) · Basic troubleshooting and maintenance · Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping. NOTE: Hands on experience to be given in a group of not more than four students		**08**
Trade-3	**Welding:*** Edge preparation for welding jobs. Arc welding for different jobs like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.		**06**
Trade 4	**Plumbing*:** Use of plumbing tools, spanners, wrenches, threading dies, demonstration of preparation of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.		**06**
Trade-5	**Machine Shop*** At least one turning job is to be demonstrated and simple job to be made for Term Work in a group of 4 students.		**06**

Admission Year 2022-23

* Optional trade can choose Two trade out of 3,4 and 5

Workshop Assessment
InternalAssessment:50 mark

Term Work:

1. All the jobs mentioned above.

2 Complete Work-Shop Book giving details of drawing of the job and time sheet

The distribution of marks for Term work shall be as follows:

JobWork:30 Marks Workshop
Book :10 marks
Attendance: 10 marks

References:

1. Workshop Technology by H K Hajara Choudhary
2. Manufacturing Technology by R C Jain
3. Workshop Technology by R S Khurmi and J S Gupta

Admission Year 2022-23

Course Code	Course Name	Credits
FY 116	**Engineering Workshop II**	**1**

Course Code	Course Name	Teaching Scheme (Contact Hours)			**Credits Assigned**			
		Theory	Pract.	Tut.	**Theory**		**Pract.**	**Total**
FY 116	Engineering Workshop II		3				**1**	**1**

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Practical	Total
		Internal Assessment				Exam. Duration (in Hrs)			
FY 116	Engineering Workshop II						50		50

Admission Year 2022-23

Course Objectives

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.

Course Outcomes:

Learner will be able to…

1. Develop the necessary skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in the electrical environment.
3. Demonstrate the wiring practices for the connection of simple electrical load/ equipment.
4. Design, fabricate and assemble pcb.
5. Develop the necessary skill required to handle/use different masons tools.
6. Develop the necessary skill required to use different sheet metal and brazing tools.
7. Able to demonstrate the operation, forging with the help of a simple job.

Trade	Detailed Content	Hrs.

Note: Trade 1 and 2 are compulsory. Select any two trade topics out of the topic trade 3 to 5. Demonstrationsandhandsonexperiencetobeprovidedduringtheperiodsallottedforthesame.Reporton the demonstration including suitable sketches is also to be included in the term work Trade evaluation is to be done according to the opted Trades in addition to Compulsory Trades.		
Trade-1	**Carpentry (Compulsory)** 6. Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. 7.Termworktoincludeonecarpentryjobinvolvingajointandreportondemonstrationofajob involving wood turning	**10**
Trade-2	**Basic Electrical workshop:(Compulsory):** 8. Single phase and three phase wiring. Familiarization. Of protection switch-gears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the workplace, safe work practices. Protective equipment. 9. Layout: drawing, layout transfer to pcb, etching and drilling and soldering technique	**08**
Trade-3	**Measurement*** 10. Vernier Height gauge, wire gauge, Dial gauge. Use of the listed gauges and precaution.	**06**
Trade 4	**Sheet metal working*** 11.Use of sheet metal, working hand tools, cutting, bending, spot welding operation	**06**
Trade-5	**Forging (Smithy):*** 12. At least one forging job to be demonstrated and a simple job to be made for Term Work in a group of 4 students.	**06**

* Students can choose Two trades out of Trades 3,4 &5.

Total hours= 10+8+6+6=30 hours

2. Complete Work-Shop Book giving details of drawing of the job and time sheet The distribution of marks for Term work shall be as follows:

2. Job Work: 30 Marks
3. Workshop book 10 marks
4. Attendance : 10 marks

References:

4. Workshop Technology by H K Hajara Choudhary
5. Manufacturing Technology by R C Jain
6. Workshop Technology by R S Khurmi and J S Gupta

Admission Year 2022-23

Course Code	Course Name	Credits
FY117	**Basic Workshop Practice I**	**1.5**

Course Code	Course Name	Teaching Scheme (Contact Hours)			Credits Assigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
FY 117	Basic Workshop Practice-I	--	2	--	--	--	1.5	1.5

Course Code	Course Name	Examination Scheme							
		Theory					Term Work	Pract./oral	Total
		Internal Assessment			End Sem. Exam.	Exam. Duration (in Hrs)			
		Test1	Test 2	Avg.					
FY 117	Basic Workshop Practice-I	--	--	--	--	--	50	--	50

Course Objectives:

1. To impart training to help the students develop engineering skill sets.
2. To inculcate respect for physical work and hard labor.
3. To get exposure to interdisciplinary engineering domain.

Course Outcomes: Learners will be able to…

1. Develop the necessary skill required to handle/use different fitting tools.
2. Develop skills required for hardware maintenance.
3. Able to install an operating system and system drives.
4. Able to identify the network components and perform basic networking and crimping.
5. Able to prepare the edges of jobs and do simple arc welding.
6. Develop the necessary skill required to handle/use different plumbing tools.
7. Demonstrate the turning operation with the help of a simple job.

Admission Year 2022-23

Trade	Detailed Content	Hrs.

Note: Trade 1 and 2 are compulsory. Select any one trade topic out of the topic at trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same. Report on the demonstration including suitable sketches is also to be included in the term work.
CO-1 is related to Trade-1.
CO-2 to CO-4 is related to Trade-2.
CO-5 is related to trade-3.
CO-6 is related to Trade-4.
CO-7 is related to Trade-5.
CO evaluation is to be done according to the opted Trades in addition to **Compulsory Trades. Students Can** select any one trade topics out of the topic at trade 3 to 5. Demonstrations and hands on experience to be provided during the periods allotted for the same.

Trade-1	**Fitting (Compulsory):** Use and setting of fitting tools for chipping, cutting, filing, marking, center punching, drilling. Term work to include one job involving following operations : filing to size, one simple male- female joint & drilling.	**08**
Trade-2	**Hardware and Networking: (Compulsory)** Dismantling of a Personal Computer (PC), Identification of Components of a PC such as power supply, motherboard, processor, hard disk, memory (RAM, ROM), CMOS battery, CD drive, monitor, keyboard, mouse, printer, scanner, pen drives, disk drives etc. · Installation of Operating System (Any one) and Device drivers, Boot-up sequence. Installation of application software (at least one) · Identification of network components: LAN card, wireless card, switch, hub, router, different types of network cables (straight cables, crossover cables, rollover cables) Basic networking and crimping. NOTE: Hands on experience to be given in a group of not more than four students.	**08**
Trade-3	***Welding:** Edge preparation for welding jobs. Arc welding for different jobs like, Lap welding of two plates, butt welding of plates with simple cover, arc welding to join plates at right angles.	**04**
Trade- 4	***Plumbing:** Use of plumbing tools, spanners, wrenches, threading dies, demonstration of preparation of a domestic line involving fixing of a water tap and use of coupling, elbow, tee, and union etc.	**04**
Trade-5	***Machine Shop:** At least one turning job is to be demonstrated and a simple job to be made for Term Work in a group of 4 students.	**04**

Total Hours = 8+8+4=20.* One Optional trade can be chosen out of 3,4 and 5

Workshop Assessment

Internal Assessment: 50

Admission (Ear 2022-23

Marks Term Work:

1. All the jobs mentioned above.

2. Complete Work-Shop Book giving details of drawing of the job and time sheet.

The distribution of marks for Term work shall be as follows:

Job Work: 30 Marks
Workshop book: 10 marks
Attendance: 10 marks

Admission Year 2022-23

Course Code	Course Name	Credits
FY 118	**Basic Workshop Practice II**	**1**

Course Code	Course Name	Teaching Scheme(Contact Hours)			CreditsAssigned			
		Theory	Pract.	Tut.	Theory	Tut.	Pract.	Total
FY118	Basic Workshop Practice-II	--	2	--	--	--	1	1

Course Code	CourseName	ExaminationScheme							
		Theory					TermWork	Pract./ oral	Total
		InternalAssessment			End SemExam.	Exam.Duration(in Hrs)			
		Test 1	Test 2	Avg.					
FY118	BasicWork Workshop Practice-II	--	--	--	--	--	50	--	50

Course Objectives

1. To Impart Training Help the students develop engineering skills sets.
2. Toinculcaterespectforphysicalworkandhard labor.
3. To Get Exposure To Interdisciplinary Engineering Domain.

Course Outcomes:

Learner will be able to…

1. Develop The Necessary Skill required to handle/use different carpentry tools.
2. Identify and understand the safe practices to adopt in the electrical environment.
3. Demonstrate Thewiringpracticesforthe connectionof simpleelectricalload/equipment.
4. Design, fabricateandassemblePCB.
5. Develop Thenecessaryskill Required to handle/use different measuring tools.
6. Develop The Necessary Skill required to use different sheet metal tools.
7. Able To demonstrate the operation,forgingwiththehelpof asimplejob.

Admission Year 2022-23

Trade	Detailed Content	Hrs.
Note: Trade 1 and 2 are compulsory. Select any ONE trade topics out of the topic trade 3 to 5. Demonstrations and hands on experience to be provided during the periods. Report on the demonstration including suitable sketches is also to be included in the term work Trade evaluation is to be done according to the opted Trades in addition to Compulsory Trades.		
Trade-1	**Carpentry (Compulsory)** 6. Use and setting of hand tools like hacksaws, jack planes, chisels and gauges for construction of various joints, wood tuning and modern wood turning methods. 7.Termworktoincludeonecarpentryjobinvolvingajointandreportondemonstrationofa job involving wood turning	**08**
Trade-2	**Basic Electrical workshop:(Compulsory):** 8. Single phase and three phase wiring. Familiarization. of protection switch-gears and their ratings (fuse, MCB, ELCB). Wiring standards, Electrical safety in the workplace, safe work practices. Protective equipment. 9. Layout drawing, layout transfer to PCB, etching and drilling and soldering technique	**08**
Trade-3	**Measurement*** 10. Vernier Height gauge, wire gauge, Dial gauge. Use of the listed gauges and precaution.	**04**
Trade 4	**Sheet metal working*** 11.Use of sheet metal, working hand tools, cutting, bending, spot welding operation.	**04**
Trade-5	**Forging (Smithy):*** 12.AtleastoneforgingjobtobedemonstratedandasimplejobtobemadeforTerm Work in a group of 4 students.	**04**

* Students can choose one trade out of Trades 3,4 & 5.

Total hours= 8+8+4=20 hours

2. Complete Work-Shop Book giving details of drawing of the job and time sheet The distribution of marks for Term work shall be as follows:

5. Job Work: 30 Marks
6. Workshop book 10 marks
7. Attendance : 10 marks

References:

7. Workshop Technology by H K Hajara Choudhary
8. Manufacturing Technology by R C Jain
9. Workshop Technology by R S Khurmi and J S Gupta

Admission Year 2022-23

Course Code	Course Name	Credits
AE201	**Production Technology**	3

Course Objectives:

1. To familiarize with the various production processes used on shop floors
2. To study appropriate production processes for a specific application.
3. To introduce to the learner various machine tools used for manufacturing
4. To familiarize with principle and working of non-traditional manufacturing
5. To introduce to them the Intelligent manufacturing in the context of Industry 4.0

Course Outcomes:

1. Demonstrate an understanding of casting process
2. Illustrate principles of forming processes.
3. Demonstrate applications of various types of welding processes.
4. Differentiate chip forming processes such as turning, milling, drilling, etc.
5. Illustrate the concept of producing polymer components and ceramic components.
6. Illustrate principles and working of non-traditional manufacturing
7. Understand the manufacturing technologies enabling Industry 4.0

Module	Details	Hours
1	**Introduction to Production Processes and Metal Casting** • Classification of Production Processes and applications areas • Pattern making materials, Types of pattern and allowances. • Sand moulding and Machine moulding • Gating system: Types of risers, types of gates, solidification • Special casting processes: CO2 and shell moulding, Investment casting, Die casting, Vacuum casting, Inspection & casting defects and remedies	6
2	**Joining Processes** • Classification of various joining processes; Applicability, advantages and limitations of Adhesive bonding, Mechanical Fastening; Welding and allied processes, Hybrid joining processes. • Classification and working of various welding methods: Gas, Arc, Chemical, Radiant, Solid State etc. • Welding Joints, Welding Positions, Welding defects and their remedies.	8
3	**Forming Processes** • Introduction and classification of metalworking processes, hot and cold working processes • Introduction, classification and analysis of forging and rolling operations, Defects in rolled and forged components, • Extrusion process, Classification and analysis of wire and tube drawing processes.	8

Admission Year 2022-23

	Sheet metal working processes ● Classification of Sheet metal operations, types of Presses used in sheet metal operations, types of dies.	
4	**Machine Tools, Machining Processes** ● **Machine Tools and Machining Processes:** Lathe Machines, Milling Machines, Drilling Machines, and Grinding Machines and selection of grinding wheel (Dressing and Truing), Broaching machines, Lapping/Honing machines (Super Finishing Operations) and shaping/slotting/planning Machines. ● **Gear Manufacturing** Gear milling, standard cutters and limitations, Gear Hobbing, Gear Shaping, Gear Shaving and Gear Grinding processes **Tool Engineering** ● Geometry and nomenclature of single point cutting tool, Speed, feed, depth of cut, Taylor's tool life equation, Concept of chip formation and types of chips. Introduction to Jigs and Fixtures and types.	8
5	**Non Traditional Machining Processes** ● Electro-chemical machining (ECM) ● Electric-discharge machining (EDM) ● Ultrasonic machining (USM) ● Laser Beam Machining (LBM)	4
6.	**Polymer Processing:** ● Polymer Molding Techniques for thermoplastic and thermosetting plastics. Applications of Plastics in the engineering field. **Powder Metallurgy**: ● Introduction to PM, Powder making processes, Steps in PM. Compaction and Sintering processes. Secondary and finishing operations in PM. **Intelligent manufacturing in the context of Industry 4.0**, ● Cyber-physical systems (CPS) ● Internet of Things (IoT) enabled manufacturing ● Cloud Manufacturing	6

Admission Year 2022-23

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests. First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks

2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Welding technology by O P Khanna
2. Foundry technology by O P Khanna
3. Elements of workshop technology. Vol. 1 & II by S K Hajra Choudhury
4. Manufacturing Science by Ghosh and Malik
5. Rapid Manufacturing –An Industrial revolution for the digital age by N.Hopkinson, R.J.M.Hauge, P M, Dickens, Wiley
6. Rapid Manufacturing by Pham D T and Dimov, Springer Verlag
7. Production Technology by WAJ Chapman Vol I, II, III
8. Production Technology by P C Sharma.
9. Production Technology by Raghuvanshi.
10. Industry 4.0: The Industrial Internet of Things by Alasdair Gilchrist, 2016, Apress.
11. Cyber-Physical Systems: From Theory to Practice by Danda B. Rawat, Joel Rodrigues, Ivan Stojmenovic, 2015, C.R.C. Press.
12. Optimization of Manufacturing Systems using Internet of Things by Yingfeng Zhang, Fei Tao, 2017, Academic Press (AP), Elsevier.

Back to Scheme

Admission Year 2-23

Course Code	Course Name	Credits
AE202	Engineering Mathematics III*	2

Course Objectives:

1. To learn the Laplace Transform, Inverse Laplace Transform of various functions, and its applications.
2. To understand the concept of Fourier Series and enhance the problem-solving skills, To learn complex form of Fourier series and Fourier Transform
3. To understand the concept of Fourier Series and enhance the problem-solving skills,
4. To learn complex form of Fourier series and Fourier Transform.
5. To understand the regression analysis and interpolation methods.
6. To learn matrices eigen values and eigen vectors useful in engineering

Course Outcomes

1. Understand the concept of Laplace transform and its application to solve the real integrals.
2. Understand the concept of inverse Laplace transform of various functions and its applications in engineering problems.
3. Apply the knowledge of Fourier series in engineering problems.
4. Apply the knowledge of complex form of Fourier series and Fourier Transform in problem solving.
5. Apply the concept of regression and interpolation in engineering problems.
6. Use the concept of matrices eigen values in many areas of research.

Module	Details	Hours
1	**Laplace Transform** 1.1 Definition, Laplace Transforms of Standard Functions. 1.2 Linearity properties of Laplace Transform, First Shifting theorem, 1.3 Change of scale Property, Effect of multiplication by t, 1.4 Effect of Division by t.	4
2	**Inverse Laplace Transform** 2.1 use of standard formulae of Inverse Laplace Transform , 2.2 Partial fractions method, 2.3 First shift property, 2.4 Convolution theorem (without proof) .	4
3	**Fourier Series** 3.1 Orthogonal and orthonormal set of functions, 3.2 Fourier series of periodic function with period 2π , 3.3 Fourier series of even and odd functions with period 2π, 3.4 Half range Sine and Cosine Series with period π.	4
4	**Fourier Integral and Fourier Transform** 4.1 Complex form of Fourier Series with period 2π , 4.2 Fourier Integrals , 4.3 Fourier transform (Definition only), 4.4 Fourier cosine and sine transform of constant and exponential function.	4

Admission Year 2022-23

5	**Interpolation, Regression , Correlation & Fitting of Curves** 5.1 Interpolation: - Lagrange's Linear and Quadratic 5.2 Linear Regression, Lines of regression 5.3 Karl Pearson's Coefficient of correlation (r) , Spearman's Rank correlation coefficient (R) (Repeated & non repeated ranks problems). 5.4 Fitting of Curves : Fitting of straight line and Second degree curve by Method of least squares.	4
6	**Matrices** **Prerequisite:** Inverse of a matrix, addition, multiplication and transpose of a matrix ,Elementary row and column transformation, System of homogeneous and non –homogeneous equations, their consistency and solutions 6.1 Eigen values and Eigen vectors of Matrices. 6.2 Properties of Eigen values without proof. 6.3 Cayley Hamilton theorem(Without Proof): Verification of Cayley Hamilton theorem (CHT) , 6.4 Application of CHT to find inverse of a matrix .	4

Assessment:

Internal Assessment Test:

Assessment consists of two class tests of 30 marks each. The first-class test is to be conducted when approx. 40% syllabus is completed and IA2 is in the form of Term Work for 30 marks . Duration of the test shall be 75 minutes.

End Semester Theory Examination:

1. Question paper will comprise of total 4 questions, each carrying 15 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein 5 sub-questions of 3 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lectures mentioned in the syllabus.

References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication,
4. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education
5. Advanced Engineering Mathematics H.K. Das, S. Chand, Publications
6. Matrices, Shanti Narayan, S. Chand publication.
7. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice-Hall of India Private Limited.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE203	**Strength of Materials**	3+1

Course Objectives:

1. To understand mechanical behavior of the body by determining the stresses, strains and deflections produced by the loads up to the elastic limit.
2. To understand the fundamental concepts related to shear force and bending moments, torsional moments, strain energy.
3. To understand the fundamental concepts related to deflection of beams, columns and struts, thin cylindrical and spherical shells

Course Outcomes:

Upon successful completion of this course, learner will be able to:

1. Apply principles of statics to determine reactions & internal forces in statically determinate beams
2. Understand the different types of stresses and strains developed in the member subjected to axial, bending, shear & torsional loads.
3. Compute slope and deflection at various points of a beam.
4. Identify, formulate, and solve static engineering problems.
5. Comprehend the behaviour & properties of engineering materials.

Theory Syllabus:

Module	Details	Hours
1	**Simple stresses and strains:** Stress, strain, Stress-strain diagram for ductile and brittle materials, factor of safety. Hooke's law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Bulk Modulus. Interrelation between elastic constants. Thermal stresses and strains. Principal stresses and Principal planes, Mohr's circle. Moment of Inertia and Polar moment of Inertia.	06
2	**Shear Force and Bending Moment in Beams:** Definition of bending moment and shear force, Sign conventions, Relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beam due to concentrated load, uniformly distributed load, uniformly varying load and couple, Point of Contraflexure. Beams with Internal Hinges/Moment Release (limited to two per beam).	07
3	**Stresses in Beams:** **Flexural stresses –** Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus. **Shear stresses –** Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, I, T sections **Direct and Bending stresses-** Introduction, eccentric loading, columns with eccentric loading, Limit of eccentricity,	07
4	**Torsion of Shafts:**	06

Admission Year 2022-23

	Introduction to Torsion, Torsion formula – stresses and deformations in circular and hollow shafts, Stepped shafts, Design of shafts according to theories of failure. **Strain Energy:** Strain energy due to axial load (gradual, sudden and impact), Strain energy due to bending and torsion.	
5	**Deflection of Beams:** **Deflection of a beam:** Double integration method, Maxwell's reciprocal theorems for computation of slopes and deflection in beams for point and distributed loads, derivation of formula for slope and deflection for standard cases, Area moment theorems for computation of slopes and deflections in beams – Conjugate beam method	07
6	**Columns and Struts:** Concept of buckling of columns, derivation of Euler's formula for buckling load for columns with various end conditions, concept of equivalent length, limitations of Euler's formula, Rankine's formula, safe load on columns. **Thin Cylinders and Spheres:** Cylinders and Spheres due to internal pressure, Cylindrical shell with hemispherical ends.	07

Lab Syllabus:

Module	Details	Hours
1.	Tension Test on Mild Steel Bar and other ductile materials using UTM (Universal Testing Machine), for specimens having diameter between 6 - 12 mm.	2
2.	Compression Test on Concrete or Wooden Block using UTM.	2
3.	Flexure (Bending) Test on Simply Supported Beam (3 Point Bending) using UTM.	2
4.	Shear Test on rods of various materials using Shear Attachment on UTM.	2
5.	Hardness Tests using Hardness Testing Machine: (a) Rockwell Hardness Test (b) Brinell Hardness Test	2
6.	Impact Tests on Impact Testing Machine: (a) Izod Impact Test (b) Charpy Impact Test	2
7.	Torsion Test on Tor-steel rod using Torsion Testing Machine.	2
8.	Tensile Test on thin cross-section (rectangular/circular) specimens using Tensile Testing Machine.	2

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Laboratory Assessment:
Term Work: 25 marks
Term Work consists of an ample number of assignments and experiments as decided by the Instructor. Minor-project based on this subject may be undertaken for which the number of assignments may be suitably reduced. Students can also avail NPTEL Certification for this course, which shall be considered in place of the assignment work.
Viva-você / Practical: 25 marks
Viva-você (on the entire syllabus) or Practical exam (on at least one experiment) shall be conducted at the end of the course. In case both viva-voce and practical exams are conducted, 15 marks shall be allotted to viva-voce and 10 marks to the practical exam.

Books/References:

1. S. S. Rattan, Strength of Materials, TMH Publications
2. R.K. Bansal, Strength of Materials, Laxmi Publications, India
3. Beer and Johnston - Strength of materials - CBS Publication
4. Ramamrutham - Strength of material - Dhanpat Rai Publication
5. W. A. Nash and M. C. Potter, Strength of Materials, Schaum's Outline Series, McGraw-Hill
6. Singer and Pytel - Strength of materials - Harper and Row Publication
7. Strength of Materials - Lab Manual, by Anand Jayakumar Arumugham, Notion Press.
8. Experiments in Strength of Materials and Cement Laboratory, by Earl B. Smith, Leopold Classic Library.
9. Laboratory Strength of Materials, by Murad, Hassan, Abdulrahman

Back to Scheme

Admission Year 2021-22

Course Code	Course Name	Credits
AE204	**Thermodynamics**	3

Course Objectives:

1. To explore ideas about energy into forms suitable for engineering analysis.
2. To introduce entropy and show its use for thermodynamic analysis.
3. To study power systems utilizing working fluids like vapour and gas.
4. To study the overview of fuels & combustion.
5. To demonstrate the procedures for determining thermodynamic properties of pure substances from tables of property data.
6. To introduce the first law of thermodynamics, energy balances, and mechanisms of energy transfer to or from a system.

Course Outcomes:

1. Able to solve energy balance problems for closed (fixed mass) systems that involve heat and work interactions
2. Able to apply the second law of thermodynamics to cycles and cyclic devices.
3. Able to evaluate internal energy, enthalpy, entropy of simple compressible systems from properties that are more readily measured.
4. Able to calculate the enthalpy of reaction, enthalpy of combustion, and the heating values of fuels.
5. Able to investigate the performance of vapour & gas power cycles.
6. Able to do the availability analysis for the design and analysis of thermal systems.

Module	Details	Hours
1	**1.1 Introduction** Importance of Thermodynamics, concept of equation of state, energy, internal energy, specific properties, heat & work transfer, pdV work or displacement work. **1.2 First Law of thermodynamics** First law applied to the closed system undergoing a cycle and change of state, ideal gas processes, PMM1. Flow process and flow energy, First law applied to steady flow processes, – vdp work, relation between non flow work and flow work, Limitations of the 1st law.	6
2	**2.1 Second Law of Thermodynamics:** Thermal reservoir, Concept of heat engine, Heat pump and Refrigerator, Statement of the second law of thermodynamics, equivalence between Kelvin-Planck and Clausius statement, Reversible and irreversible Process, Causes of irreversibility, PMM2, Carnot cycle, Carnot theorem, Corollary of Carnot theorem, Thermodynamic temperature scale. **2.2 Entropy:** Clausius Inequality theorem, Entropy - a property of the system, Temperature-Entropy diagram, increase of entropy principle, entropy transfer and entropy generation, Entropy balance, Entropy change during a process.	7
3	**3.1 Availability:** Quality energy, available and unavailable energy, useful work and dead state, availability of closed system and steady flow process.	6

Admission Year 2022-23

	3.2 Thermodynamic Relations Helmholtz and Gibbs functions, Maxwell equation (without derivation), TdS relations, Volumetric expansivity, Isothermal & isentropic compressibility, Clausius-Clapeyron equation, Joule Thomson coefficient – porous plug experiment, definition of third law of thermodynamics.	
4	**4.1 Properties of Pure Substance:** Pure substance, phase change phenomenon of pure substance, saturation pressure and saturation temperature, terminology of pure substance, P-V-T surfaces, p-v, p-T, T-s & h-s (Mollier diagram) diagrams, Steam diagram, critical point and triple point, Quality of steam, Calculation of various properties of steam, advantages & applications of use of steam, **4.2 Vapour Power Cycle:** Carnot cycle, Limitations of Carnot vapour cycle, Rankine cycle, mean temperature of heat addition, Rankine cycle with superheat, reheat.	7
5	**5.1 Gas Power Cycle:** Nomenclature of a reciprocating engine, Mean effective pressure, Assumptions of air Standard Cycle, Otto cycle, Diesel Cycle and Dual cycle, Comparison of Otto and Diesel cycle for same compression ratio. Working principle of Brayton Cycle, Stirling Cycle, Ericsson Cycle, Lenoir cycle and Atkinson cycle. (No Numerical for Brayton, Stirling, Ericsson, Lenoir& Atkinson Cycle).	6
6	**6.1 Combustion Thermodynamics:** Complete and incomplete combustion, air fuel ratio, theoretical and excess air for combustion, enthalpy of formation, analysis for a non flow process involving combustion at constant volume, analysis of steady flow or constant pressure combustion, heating values, adiabatic flame temperature, combustion efficiency enthalpy and internal energy of combustion.	6

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Fundamentals of engineering thermodynamics by Michael J. Moran &Howard N. Shapiro, John wiley and Sons, Fifth edition,

Admission Year 2022-23

2. Applied thermodynamics by B K Ventanna, PHI publications.
3. Thermodynamics: An Engineering Approach by Yunus A. Cengel and Michael A. Boles, 9thedition, TMH
4. Basic Engineering Thermodynamics by Rayner Joel, 5thedition, Longman Publishers
5. Engineering Thermodynamics by P Chattopadhyay, 2ndedition, Oxford University Press India
6. Thermodynamics by P K Nag, 6thEdition,TMH
7. Thermodynamics by Onkar Singh, 4th Edition New AgeInternational
8. Thermodynamics by C P Arora,1stEditionTMH
9. Thermal Engineering By Ajoy Kumar, G. N. Sah, 2nd Edition, Narosa Publishing house
10. Engineering Thermodynamics Through Examples by Y V C Rao, Universities Press (India) Pvt. Ltd
11. Fundamentals of Thermodynamics by Moran &Shapiro, Eighth Edition, Wiley
12. Fundamentals of Classical Thermodynamics by Van Wylen G.H. & Sonntag R.E., 9th Edition John Wiley & Sons
13. Thermodynamics by W.C. Reynolds, McGraw-Hill &Co
14. Thermodynamics by J P Holman, 4th Edition McGraw-Hill & Co.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE205	**Engineering Metallurgy and Automotive Materials**	3+1

Course Objectives:

1. To help students know about the different types of materials
2. To enable students to make a good selection of materials
3. To be able to understand the significance of structure property relationship
4. To understand the role of materials in automotive developments

Course Outcomes: On completion of this course, a learner will be able to

1. Identify the different classes of materials
2. Suggest ways to improve the strength of materials
3. Differentiate between steels and cast irons wrt composition and property development
4. Analyze thephase transformations in steels
5. Apply heat treatment to different components based on the property requirement
6. Evaluate the reasons of failure in components and take corrective actions

Theory Syllabus:

Module	Details	Hours
1.	Stress-strain curve, Deformability and Strengthening Mechanisms-Hot and Cold working, Recrystallisation-its effects and factors affecting it.	6
2.	Concepts of solidification,difference in solidification of metals and alloys, Phases, Phase diagrams, Alloying - Fe-Fe3C diagram and cooling of steels and cast irons.	6
3.	Austenite transformation-equilibrium and non equilibrium,Hardenability and its importance, Hardenability tests, Alloy Steels-stainless steels, tool steels.	8
4.	Heat treatments: Thorough and Surface heat treatment, Isothermal treatments-Patenting, Austempering and martempering, Ausforming and Maraging.	6
5.	Developments in automotive materials with the aim of lightweighting-Shift to composite materials for bodies, interiors and engines.	7
6.	Failure by fracture-micromechanisms-fatigue and creep. Non destructive evaluation to prevent failures.	6

Lab Syllabus:

Experiment	Details	Hours
1	Study of Characterization techniques and Metallographic sample preparation and etching	2
2	Comparison of Microstructures and hardness before and after Annealing, Normalizing and Hardening in medium carbon steel	2
3	Study of tempering characteristics of hardened steel	2
4	Determination of hardenability of steel using Jominy end	2

Admission Year 2022-23

	Quench Test (Using different hardness testers to measure the Hardness)	
5	Fatigue test – to determine number of cycles to failure of a given material at a given stress	2
6	Tension test on mild steel bar (stress-strain behaviour, determination of yield strength and modulus of elasticity)	2
7	Torsion test on mild steel bar / cast iron bar	2
8	Impact test on metal specimen (Izod/Charpy Impact test)	2
9	Hardness test on metals – (Brinell/ Rockwell Hardness Number	2

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks.

Lab Assessment:

Term Work:

The distribution of marks for Term work shall be as follows:

1. Experiment write ups : 20 Marks
2. Attendance : 05 marks

Books/References:

1. Materials Science and Engineering: An Introduction: William Callister Jr. and David G. Rethwisch, Wiley Publication
2. Introduction to Physical Metallurgy, Sidney H. Avner, Tata McGraw Hill
3. Introduction to Engineering Materials,BK Agrawal, TataMcGraw Hill
4. Materials Science and Engineering: A First Course,Raghavan V, Prentice Hall India

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE206	**Computer Aided Drafting**	2

Course Objectives:

1. To impart the 3D modeling skills for development of 3D models of basic engineering components.
2. To introduce Product data exchange among CAD systems.
3. To familiarize with production drawings with important features like GD &T, surface finish.

Course Outcomes: Upon successful completion of this course, learner will be able to

1. Visualize and prepare 2D modeling of a given object using modelling software.
2. Build a solid model of a given object using 3D modeling software.
3. Visualize and develop the surface model of a given object using modelling software.
4. Generate assembly models of given objects using assembly tools of a modelling software

Module	Details	Hours
1.	**CAD Introduction** CAD models Creation, Types and uses of models from different perspectives. Parametric modelling and Non - Parametric Modelling. **GD & T** Limits, Fits and Tolerance	4
2.	**2D Sketching** Geometric modeling of an Engineering component, sketching commands of creation, modification commands and viewing the sketch.	4
3.	**Solid Modeling** 3D Geometric modeling of an Engineering component, modeling features. Using 3D components from software library (Eg. Nut, Bolt, Screw etc.)	6
4.	**Surface Modeling** Extrude, Sweep, Trim etc and Mesh of curves, free form surfaces etc. Feature manipulation using Copy, Edit, Pattern, Suppress, History operations etc.	6
5.	**Assembly** Constraints, Exploded views, interference check. Drafting (Layouts, Standard & Sectional Views, Detailing & Plotting), Bill of materials, Giving machining symbols using software in drafting.	4
6.	**Data Exchange** CAD data exchange formats Like IGES, PDES, PARASOLID, DXF and STL along with their comparison and applicability. **Case Study**	2

Admission Year 2022-23

Assessment:

Term work

Using the above knowledge and skills acquired through six modules students should complete Minimum six assignments/Experiments from the given sets of assignments **(Two from each set)** using standard CAD modelers like PTC Creo/CATIA/ Solid work/UG /any other suitable software.

Set 1: Beginner Level:

3D modeling of basic Engineering components likes Nuts, Bolts, Keys, cotter, Screws, Springs etc.

Set 2: Intermediate Level:

3D modeling of basic Machine components like Clapper block, Single tool post, Lathe and Milling tail stock, Shaper tool head slide, jigs and fixtures Cotter, Knuckle joint, Couplings: simple, muff, flanged Protected flange coupling, Oldham's coupling, Universal coupling, element of engine system and Miscellaneous parts.

Set 3: Advance Level:

1) Generation of any Assembly model (Minimum five child parts) along with Production drawing for any of the system by creating 3D modeling with assembly constraints, Interference check, Exploded view, GD&T, Bill of material.
2) Reverse Engineering of a physical model: disassembling of any physical model having not less than five parts, measure the required dimensions of each component, sketch the Minimum views required for each component, convert these sketches into 3-D model and create an assembly drawing with actual dimensions

The distribution of marks for Term work shall be as follows:

1. Printouts/Plots : 20 marks
2. Attendance : 05 marks

End Semester Practical/Oral examination:

To be conducted by pair of Internal and External Examiner

1. Practical examination duration is two hours, based on Advance level of the Term work.
2. Oral examination should also be conducted to check the knowledge of CAD Modelling Tools.
3. The distribution of marks for practical examination shall be as follows:
   a. Practical Exam : 30 marks
   b. Oral Exam : 20 marks
4. Evaluation of practical examination to be done based on the printout of students work
5. Students work along with evaluation report to be preserved till the next examination

Books/References:

1. Machine Drawing by N.D. Bhatt.
2. A textbook of Machine Drawing by Laxminarayan and M.L.Mathur, Jain brothers Delhi
3. Machine Drawing by Kamat and Rao
4. Machine Drawing by M.B.Shah
5. A text book of Machine Drawing by R.B.Gupta, Satyaprakashan, Tech. Publication
6. Machine Drawing by K.I. Narayana, P. Kannaiah, K.Venkata Reddy
7. Machine Drawing by Sidheshwar and Kanheya

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE207	**CNC and Additive Manufacturing Lab**	1

Course Objectives:

1. To familiarize with subtractive manufacturing processes in particular CNC systems.
2. To acquaint with basic of part programing concept for specific operations.
3. To familiarize with the additive manufacturing process
4. To acquaint with basic process of developing 3D model using biomedical data.

Course Outcomes: Upon successful completion of this course, learner will be able to

1. Develop and execute CNC part programme for any given specific operation.
2. Build any given object using various CNC operations.
3. Develop 3D model using available biomedical data
4. Build any given real life object using the 3D printing process.
5. Understand the integration between various manufacturing systems

Module	Details	Hours
1	Part programming and part fabrication on CNC Turning trainer (Involving processes like Step turning, facing, Taper turning, threading, etc.)	2
2	Part programming and part fabrication on CNC Milling trainer (Involving processes like contouring, drilling, facing, pocketing etc.)	2
3	Part Programming Simulation for any Unconventional Machining Process (Electric Discharge Machining, laser cutting Machining, Plasma Cutting Machining etc.)	2
4	Tool-path generation by translation of part geometry from computer aided design (CAD) to computer aided manufacturing (CAM) systems.	4
5	Development of physical 3D mechanical structure using any one of the rapid prototyping processes.	4
6	Creation of 3D model from 2D images using any image processing software and printing it. (3D Slicer open source) (Application: Any body organ like Heart, Gallbladder etc. as per available DICOM files)	2
7	Manufacturing Simulation and Integration	4
8	Case Study: Report on a visit conducted to any Commercial CNC Machining Centre explaining the Design features, preprocessing in CAM software and its capabilities.	4

Assessment:

Termwork:

Distribution of marks:

Practical Performance : 20 marks (Continuous Evaluation)

Attendance : 05marks

Practical/Oral examination

To be conducted by pair of Internal and External Examiner

The distribution of marks for practical examination shall be as follows:

a. Oral Exam : 10 marks
b. Practical Exam : 15 marks

Admission Year 2022-23

Books/References:

1. CAD/CAM Principles and Applications, P. N. Rao, Tata McGraw Hill Publications
2. CNC Technology and Programming, Krar, S., and Gill, A., McGraw Hill Publishers.
3. CNC Programming for Machining, Kaushik Kumar, Chikesh Ranjan, J. Paulo Davim, Springer Publication.
4. Medical Modelling The Application of Advanced Design and Rapid Prototyping Techniques in Medicine, Richard Bibb, DoMinorc Eggbeer and Abby Paterson, Woodhead Publishing Series in Biomaterials: Number 91, Elsevier Ltd.
5. Biomaterials, artificial organs and tissue engineering, Edited by Larry L. Hench and Julian R. Jones, Woodhead Publishing and Maney Publishing, CRC Press 2005
6. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, I. Gibson l D. W. Rosen l B. Stucker, Springer Publication.
7. Rapid Prototyping and Manufacturing, P. F. Jacobs, Society of Manufacturing Engineers

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE 291	**Minor Project I**	2

Course Objectives:

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcomes: Learner will be able to

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as a member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
9. Demonstrate project management principles during project work.

Guidelines for Minor Project:

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into a problem statement for minor-project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Student groups shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of the minor project.
- A log book has to be prepared by each group, wherein the group can record weekly work progress, and the guide/supervisor can verify and record notes/comments.
- Faculty supervisors may give inputs to students during minor project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/supervisor.
- Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
- The solution has to be validated with proper justification and the report has to be compiled in the standard format.
- With the focus on self-learning and innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Minor Project 1 in semester III and IV. Similarly, Minor Project 2 in semesters V and VI may be considered. In other words, based on the individual students' or group's capability, with the mentor's recommendations, if the proposed Minor Project adhering to the qualitative aspects mentioned above gets completed in odd semester, then that group can be allowed to

Admission Year 2022-23

work on the extension of the Minor Project, in even semester with suitable improvements/modifications.

- Alternatively, student groups can work completely on a new project idea in the even semester, bearing no resemblance with the topic of odd semester. This policy can be adopted on a case to case basis.

Guidelines for Assessment of Minor Project –Continuous assessment and Term Work:

- The review/ progress monitoring committee shall be constituted by heads of departments of each institute. The progress of the minor project to be evaluated on a continuous basis, Minimum two reviews in each semester- 25 marks.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of term work marks for both semesters shall be as below:
  - Quality of project report and presentation- 25 marks

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In the first semester the entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the student group.
  - If the problem is based on development of a mechanism or a simple device for attaining a desired objective, the first presentation shall be reviewed based on generation of multiple feasible solutions to the given problem and identification of the best possible solution based on various parameters which may include one of more of the following viz., the total weight, volume, power consumption, mechanical advantage, efficiency, cost (including labour) per piece once manufactured, and so on. This may include creation of unique free-hand sketches by each and every member of the group to contribute to the solution of the given problem. The best possible solution has to be finalized during one or more brainstorming sessions by the members of the student group. In case the problem is of a programming/coding type, then the first presentation may be dedicated to the understanding of the theory behind the problem related to a particular domain subject, including the drafting of an algorithm and/or flowchart, and may also include the introductory part of the programming.
  - Second review shall be based on the computerization (3D CAD model of parts and assembly), and possibly the animation, depicting the working characteristics of the proposed solution to the given problem, allocating material properties to each part, identifying mass properties of the assembled parts, and so on. Checking interference is one of the important criteria that can be used when assembling the parts. For software based projects, this may include the presentation based on the extension of the programming work so as to cover the major portion of the remaining part of the topic.
- In the second semester expected work shall be procurement of components/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester. For those selecting software based projects, this may include completing the other half of the programming related work, identifying the errors, optimizing the software code, customization, creating a graphical user interface of input and output (GUI), displaying output data in the form of graphs/tables/figures/diagrams, creation of the code in executable (.exe) format or in the form of a mobile App, etc.
  - First review shall be conducted based on the readiness of the working prototype, or

Admission year 2022-23

programming of the remaining code for software based projects.
  - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester. This may also include the testing and validation of tests with the literature/available data/theory. For software based projects, the presentation includes the remaining work other than the programming, as described above.
- Apart from the hardware type (development of device) and software (program/coding) type of projects, the topics may also include computer based work, viz., generation of virtual laboratory (for one or more experiments) for any subject/domain of choice, or CAD modeling, analysis, optimization, and/or product design, without any relevance to developing any physical product.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including:
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalization of problem and proposed solution
  - Second shall be for implementation and testing of solutions.

Assessment criteria of Minor Project:

1. Quality of survey/need identification
2. Clarity of problem definition based on need
3. Innovativeness/uniqueness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness/uniqueness
8. Cost effectiveness and societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual as member or leader
13. Clarity in written and oral communication

- In a **one year project**, the first semester evaluation may be based on the first six criteria as highlighted above and the remaining criteria may be used for second semester evaluation of performance of students in the minor project.
- In the case of a **half year project,** all criteria in general may be considered for evaluation of performance of students in the minor project.

Guidelines for Assessment of Minor Project - Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the Department.
- Minor project shall be assessed through a presentation and demonstration of working model or the execution of programme code by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by the Head of Institution.
- Students shall be motivated to publish a paper based on the work in conferences or student competitions.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE208	**Automotive Engines & Combustion**	3+1

Course Objectives:

1. To provide fundamental idea on Spark Ignition & Compression Ignition Engines.
2. To familiarize with the complexity in combustion processes.
3. To give clear concept of power generation and engine performance.
4. To gather clear knowledge on effects of emission and its control.
5. To acquaint with recent trends in Engine Technology.

Course Outcomes: After completion of this course, learners will be able to

1. Explain the actual engine operation.
2. Analyse the combustion process in IC engines.
3. Illustrate different power boosting methods in IC Engines
4. Analyse operating parameters & performance of IC Engines.
5. Illustrate emission norms and emission control techniques.
6. Comprehend the recent trends in fuels and engines.

Theory Syllabus:

Module	Details	Hrs.
1	**Introduction** Classification of I.C. Engines, Parts of I.C. Engine and their materials, Atkinson Cycle and Miller Cycle, Fuel Air and Actual working cycles analysis, Valve Timing Diagram, LHR & VCR Engines, Homogeneous charge compression Ignition, Rotary Engine-Six stroke engine concept (No Numerical from this module)	4
2	**Spark Ignition Engines** **Fuel Supply System:** Automotive engine air-fuel mixture requirements, principle of carburetion & working (only introduction – No Numerical) Fuel Injection: Single-point and Multipoint injection, Gasoline Direct Injection **Ignition System:** Schematic details and working of different types of Ignition systems in SI Engines **Combustion:** Combustion phenomenon in SI Engines, Ignition delay, Flame propagation, Pressure-Crank angle diagram, Detonation and Knocking, Factors affecting combustion and detonation, Introduction to combustion chamber design, Types of combustion chambers	8
3	**Compression Ignition Engines** **Fuel Injection Systems:** Air injection systems, Airless/solid injection systems, Common rail, individual pump, distributor and unit systems. Injection pumps, Fuel injector, Types of nozzles, Electronically controlled CRDI system **Combustion:** Combustion phenomenon in C I engines, Stages of combustion, Delay period, Knocking, Pressure-Crank angle diagram, Factors affecting combustion and knocking, Types of combustion chambers	8

Admission Year 2022-23

4	**Engine lubrication:** Types of Lubricants, their properties, SAE rating of Lubricants, Types of Lubrication systems. **Engine Cooling:** Necessity of engine cooling, disadvantages of overcooling, Cooling systems and their comparison: Air cooling, Liquid cooling **Supercharging/Turbo-charging:** Objectives, Limitations, Methods and Types, Different arrangements of Turbochargers. Latest Trends in power boosting methods.	6
5	**Engine Testing and Performance:** Measurement of Brake Power, Indicated Power, Frictional Power, Fuel Consumption, Air flow, BMEP, Performance characteristics of SI and CI Engines, Effects of load and speed on Mechanical, Indicated Thermal, Brake Thermal and Volumetric Efficiencies, Heat Balance Sheet. **Engine Exhaust Emission and its control:** Constituents of exhaust emission and its harmful effects on environment and human health, Formation of NOx, HC, CO and particulate emissions, Methods of controlling emissions; Catalytic convertors, particulate traps, Exhaust Gas Recirculation, EURO and BHARAT norms.	8
6	**I C Engine Fuels:** Hydrogen - E diesel(Introduction to Flex Fuel Technology): Properties - Suitability - Engine Modifications - Merits and Demerits as fuels. **Basics of Electronic Engine Controls:** Electronic Control Module (ECM): Components, requirement & working. Sensors: Throttle Position, Crankshaft Position, Camshaft Position, Inlet Air Temperature, Coolant Temperature, Mass Air flow and Exhaust Gas Oxygen sensors (their construction and importance in ECM) Electronic Spark control, Air Management system, Idle speed control	5

Lab Syllabus:

PART A: Dismantle and assemble the following:

1. 2-Stroke/4-Stroke Engines
2. Carburetor
3. Ignition system
4. Fuel injection system

PART B: Actual Test experiments:

1. Morse Test on Multi-cylinder S.I. engine
2. Speed Test on Spark Ignition or/and Compression Ignition engine
3. Load Test on Diesel engine.
4. Heat Balance Sheet on S.I. or C.I. engine.
5. Determination of Air fuel ratio and volumetric efficiency of the engine
6. Exhaust Gas/Smoke analysis of S.I./ C.I. engines

PART C: Measurement Experiments:

1. Calibration of Tachometers.
2. Study of Pressure, Torque, Temperature, Flow Measurement Sensors in IC engine.
3. System Identification of any one of the sensors.

PART D: Topics for Case study of various models:

1. Variable Valve Timing
2. Twin and Triple Turbo charging
3. Variable Compression Ratio Engine
4. Electronic MPFI with various modes
5. Single overhead camshaft and double overhead camshaft

Admission Year 2022-23

6. Engine Downsizing
7. Eco-boost Engine
8. Turbocharging for S.I. Engine

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Lab Assessment:

Term work:

Term work shall consist of minimum 8 exercises, from the list as per following details:

1. 2 must be actual experiments from Part A. From Part A exercise 1 is compulsory.
2. 4 must be actual experiments from Part B
3. 2 must be actual experiments from Part C
4. Case studies based on topics mentioned in Part D for various car models

The distribution of marks for Term work shall be as follows:

1. Experiment write ups : 15 Marks
2. Attendance : 05 marks
3. Case study : 05 Marks

Practical and Oral Examination:

1. Pair of Internal and External Examiner should conduct practical/Oral exam.
2. Distribution of marks for practical and oral examination shall be as follows:
   Practical Exam : 15 marks
   Oral Exam : 10 marks
3. Evaluation of practical examination to be done based on the experiment performed and the output of the experiment during practical examination.
4. Student's work along with evaluation report to be preserved till the next exam.

Text Books:

1. Internal Combustion Engine - Mathur and Sharma
2. Internal Combustion Engine - V Ganesan
3. Internal Combustion Engines - Domkundwar

Reference Books:

1. Internal Combustion Engines Fundamentals, John B. Heywood
2. Internal Combustion Engine, P.M Heldt.
3. Internal Combustion Engines, V.L. Maleeve
4. Internal Combustion Engine, Gills and Smith
5. Internal Combustion Engines, Gupta H N, 2nd ed,
6. Internal Combustion Engine, S.L. Beohar

Admission Year 2022-23

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE209	**Theory of Machines & Mechanisms**	3+1

Course Objectives:

1. To provide students with the knowledge on mechanisms and inversions.
2. To impart students with knowledge about forces acting on machine parts.
3. To enable students to understand the fundamental concepts of machines.
4. To study functioning of motion and power transmission machine elements.
5. To facilitate students to understand the functions of cams, gears, belt drives, chain drives and brakes.

Course Outcomes: Upon successful completion of this course, learner will be able to

1. Identify mechanisms and their inversions.
2. Compute velocity and acceleration of various plane mechanisms by different methods.
3. Apply the principles for analyzing cams, gears and gear trains.
4. Synthesize mechanisms for following useful paths.
5. Draw cam profile for specific follower motion.
6. Develop and design mechanisms.

Theory Syllabus:

Module	Details	Hours
1	**Fundamentals of Kinematics and Mechanisms** Concepts of Kinematics and Dynamics, Mechanisms and Machines, Planar and Spatial Mechanisms, Kinematic Pairs, Kinematic Chains, Kinematic Diagrams, Kinematic Inversion. Four bar chain and Slider Crank Mechanisms and their Inversions, Degrees of Freedom, Mobility and range of movement - Kutzbach and Grubler's criterion, Number Synthesis, Grashof's criterion.	06
2	**Mechanisms with Lower Pairs:** Straight line mechanisms - Exact and Straight, Steering gear mechanisms: Condition for correct steering, Davis steering gear mechanism, Ackermann steering gear mechanism. Hooke's joint-Single and Double.	06
3	**Velocity and Acceleration Analysis:** **Relative velocity method:** Relative velocity of a point on a link, Angular velocity of a link, Sliding velocity, Velocity polygons for simple mechanisms. **Relative acceleration method:** Relative acceleration of a point on a link, Angular acceleration of a link, Acceleration polygons for simple mechanisms. (limit to only 4 link mechanisms) **Instantaneous center of rotation (ICR) method:** Definition of ICR, Types of ICRs, Methods of locating ICRs (limit to only 6 link mechanisms), Kennedy's Theorem, Coriolis component of acceleration.	08

Admission Year 2022-23

4	**Flexible Power Transmission Systems:** **Belts:** Introduction, Types and all other fundamentals of belting, Dynamic analysis—belt tensions, condition of maximum power transmission. **Chains:** Types of chains, chordal action, variation in velocity ratio, length of chain. **Brakes:** Introduction, types and working principles, Introduction to braking of vehicles.	06
5	**Kinematics of Cams:** Types of cams and followers, Cam and follower terminology, displacement, velocity and acceleration diagrams of follower motions viz Uniform velocity, Simple harmonic motion, Uniform acceleration and retardation motion and cycloidal motion.	06
6	**Gears and Gear Trains:** **Gears:** Terminology, Law of Gearing, Characteristics of involute and cycloidal action, Interference and undercutting, centre distance variation, minimum number of teeth, contact ratio, spur, helical, spiral bevel and worm gears, problems. **Gear Trains:** Synthesis of Simple, compound & reverted gear trains, Analysis of epicyclic gear trains.	07

Laboratory Syllabus:

Module	Details	Hours
1	3 to 5 problems on velocity analysis using the ICR method.	04
2	3 to 5 problems on velocity and acceleration analysis using relative velocity and acceleration methods.	04
3	3 to 5 problems on velocity and acceleration analysis using relative velocity and acceleration methods involving Coriolis component.	04
4	Plotting of displacement–time, velocity-time and acceleration-time, jerk-time, and layout of cam profiles - 3 to 5 problems	06
5	Project based learning on design and fabrication of any one mechanism for a group of maximum 4 students.	08

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.
End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks

AC for Academic Year 2022-23

2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks.

Laboratory Assessment:

Term Work: 25 marks

Students have to submit signed and completed assignments based on the modules listed in the table, as a part of the term work. They can also avail NPTEL Certification for this course, for which the assignment work may be suitably reduced, at the discretion of the instructor.

Viva-você: 25 marks

Viva-você exam shall be conducted at the end of the course.

Books/References:

1. S. S. Rattan, “Theory of Machines”, Tata McGraw Hill
2. R L Norton, Kinematics and Dynamics of Machinery, McGraw-Hill Education
3. Ashok G. Ambekar, “Mechanism and Machine Theory”, Prentice Hall, India
4. Theory of Machines, Singh Sadhu, Pearson Education.
5. Shigley J. E., and Uicker J.J., “Theory of Machines and Mechanism”, McGraw Hill Inc.
6. Wilson C.E., Sandler J. P. Kinematics and Dynamics of Machinery”, Pearson Education.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE 210	**Fluid Mechanics & Machinery**	3+1

Course Objectives:

1. To study fluid statics and fluid dynamics
2. To study application of mass, momentum and energy equations in fluid flow.
3. To learn various flow measurement techniques.
4. To study utilization of hydraulic energy

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. Calculate the forces exerted by fluid at rest on submerged surfaces.
2. Apply Bernoulli equation to solve a variety of fluid flow problems.
3. Categorize the type of flow (whether laminar or turbulent) using Reynolds equation.
4. Estimate the loss of energy of the incompressible fluid associated with pipe flow.
5. Compare the impulse and reaction turbine.
6. Classify the pumps into centrifugal and positive displacement pumps.

Theory Syllabus:

Module	Details	Hours
1.	1.1 **Introduction:** Definition of Fluid, Properties of fluid (density, weight density, viscosity, specific gravity). No Numerical. 1.2 Newton's Law of viscosity, Classification of fluid. No Numerical on 1.2. 1.3 **Fluid Statics**: Hydrostatic pressure, Hydrostatic law, Forces on horizontal, vertical and inclined submerged plane.	6
2.	**Fluid Kinematics:** 2.1 Eulerian and Lagrangian approach, Velocity and acceleration in a Eulerian flow field. Classification of the fluid flow, streamlines, path lines and streak lines. 2.2 Definition and equations for stream function, velocity potential function, potential flow, vortex flow. No numerical on 2.2.	6
3.	**Fluid Dynamics:** Definition of control volume and control surface, Differential equations for conservation of mass, energy and momentum, Euler's equations in one and three dimensions. Derivation of Bernoulli's equation from principle of conservation of energy. Application of Bernoulli's equation in flow measurement device (pitot tube, venturimeter, orifice meter). Impulse momentum equation (Numerical on bent pipe only).	7
4.	**4.1 Laminar Viscous flow**: Introduction to Reynolds number, Derivation of relationship between shear stress and pressure gradient, Laminar flow between stationary parallel plates (only derivation), Laminar flow in circular pipe (Hagen-Poiseuille flow). **4.2 Flow through pipes**:	6

Admission Year 2022-23

	Head loss in pipes due to friction (Darcy-Weisbach equation without proof), Loss of energy in pipe (major and minor losses), Hydraulic gradient and Energy gradient line, Pipes in series and parallel. **4.3 Hydrodynamic Boundary Layer Theory:** Concept of formation of boundary layer, boundary layer parameters. (No Numerical) **4.4 Flow around submerged objects:** Concept of drag and lift, Types of drag, Streamlined and bluff bodies. (No Numerical)	
5.	**Hydraulic Turbines:** General layout of hydro-electric power plant. Classification of hydraulic turbines, definition of various turbine parameters like head, Euler head, discharge, work done, input power, output power, efficiency, schematic representation of losses in turbine. 5.1 Pelton Turbine: Components, construction, working, workdone and efficiency, velocity triangle, Calculation of velocity of jet, speed ratio, jet ratio, number of jets, head, power and efficiency. 5.2 Francis Turbine: Components, construction and working, velocity diagram and numerical, Draft tube and its function.	7
6.	**Pumps** 6.1 Detailed classification of Pump, applications. 6.2 Reciprocating pumps: operating principle of reciprocating pump, Different types of head, discharge coefficient, slip. Calculation of work done and power input, concept of indicator diagram. 6.3 Centrifugal Pumps: Different types of head, Euler's equation and velocity triangles, pump losses and efficiency, Priming of pumps, Concept of NPSH (No Numerical) 6.4 Concept of multistage pump (No Numerical)	7

Laboratory Syllabus:

Any 8 of the following to be performed.

Sr. No.	Details	Hours
1	Calibration of Pressure gauge	2
2	Calibration of Venturimeter	2
3	Calibration of Orifice meter	2
4	Determination of Friction factor for pipes	2
5	Determination of Minor losses in pipe fittings	2
6	Verification of Bernoulli's equation	2
7	Trial on Pelton Wheel	2
8	Trial on Francis turbine	2
9	Trial on positive displacement pump (reciprocating/Gear pump/Vane pump/screw pump) (any one)	2
10	Trial on single stage Centrifugal pump	2

Admission Year 2022-23

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Laboratory Assessment:

Internal Assessment

Term Work Marks: 25 Marks

Laboratory Work (Journal Completion) : 20 Marks
Attendance : 5 Marks

End Semester Practical/Oral Examination:

Pair of Internal and External Examiners should conduct practical/viva based on contents.
Distribution of marks for practical/viva examination shall be as follows:

Practical Examination : 15 Marks
Oral Examination : 10 Marks

Books/References:

1. Fluid Mechanics by Yunus A Cengel and John M Cimbala, Tata McGraw Hill Education, 3rd Edition, 2014.
2. Fluid Mechanics and Machinery by C S P Ojha, Chandramouli and R Berndtsson, Oxford University Press, 1st Edition, 2010.
3. Fox and McDonald's Introduction to Fluid Mechanics by Philip J. Pritchard and John W. Mitchell, Wiley Publishers, 9th Edition,2016.
4. A textbook of Fluid Mechanics & Hydraulic machines by R K Bansal, Laxmi Publication, 9th Edition, 2005
5. A textbook of Fluid Mechanics & Hydraulic machines by R K Rajput, S. Chand & company ltd Laxmi Publication, 4th Edition, 2010
6. Fluid Mechanics by Frank M. White, McGraw Hill Education, 7th Edition, 2011.
7. Fluid Mechanics by Victor Streeter, Benjamin Wylie and K W Bedford, McGraw Hill Education, 9thEdition, 2010.
8. Engineering Fluid Mechanics by K. L. Kumar, Eurasia Publishing House (P) Ltd, 1 st Edition and Reprint 2016.
9. Fluid Mechanics and Hydraulic Machinery, Modi and Seth, Standard Book House
10. Introduction to Fluid Mechanics by James A. Fay, MIT Press, Campbridge, 1st Edition, 1996.
11. Fluid Mechanics and Hydraulics by Suresh Ukarande, Ane Books Pvt.Ltd, Revised & Updated 1st Edition, 2016

Back to Scheme

Admission year 2022-23

Course Code	Course Name	Credits
AE211	**Engineering Mathematics IV***	2

Course Objectives:

The course is aimed.

1. To acquaint with the concepts of probability, random variables,

2. To acquaint with the concepts of probability distribution & expectation.

3. To acquaint with the various probability distributions.

4. To acquaint with the concepts of sampling theory.

5. To learn the partial differential equations and Analytical methods to solve it which are used in engineering problems.

6. To learn numerical methods to solve the partial differential equations which are used in engineering problems.

Course Outcomes:

On successful completion of course learner/student will be able to:

1. Illustrate understanding of the concepts of probability & random variables.

2. Illustrate understanding of the concepts of probability distribution and expectation for decision making.

3. Use various probability distributions in data science.

4. Use the concept of sampling theory in data science.

5. To apply the analytical methods to find the solution of Mathematical Models of real-life problems

6.To apply the numerical methods to find the solution of Mathematical Models of real-life problems.

Module	Details	Hours
1	**Probability Theory** **1.1** Introduction to probability, 1.2 Conditional probability, 1.3 Total Probability 1.4 Baye's Theorem.	4
2	**Probability Distribution - I** 2.1 Discrete and Continuous random variables, 2.2 Probability mass and density function, 2.3 Probability distribution for random variables, 2.4 Expectation, Variance, Co-variance .	4
3	**Probability Distribution – II** 3.1 Binomial distribution, 3.2 Poisson distribution, 3.3 Normal distribution .	4
4	**Sampling Theory-** 4.1 Sampling distribution, Test of Hypothesis, Level of Significance, Critical region,	4

Admission Year 2022-23

	4.2 One-tailed, and two-tailed test, Degree of freedom. 4.3 Students' t-distribution (Small sample)- Test the significance of single sample mean 4.4 Test the significance of sample means of two independent sample means (paired t-test) .	
5	**Partial Differential Equations : Analytical methods** **5.1** Introduction of Partial Differential equations Classification 5.2 Method of separation of variables to solve the problem of Vibrations of string, 5.3 One dimensional heat and wave equations.	4
6	**Partial Differential Equations** : **Numerical methods** : 6.1 Numerical methods to solve PDE 6.2 Bender Schmidt scheme 6.3 Simplified Crank Nicholson scheme.	4

Assessment:

Internal Assessment Test:

Assessment consists of two class tests of 30 marks each. The first-class test is to be conducted when approx. 40% syllabus is completed and IA2 is in the form of Term Work for 30 marks . Duration of the test shall be 75 minutes.

End Semester Theory Examination:

1. Question paper will comprise of total 4 questions, each carrying 15 marks.
2. Total 03 questions need to be solved.
3. Question No: 01 will be compulsory and based on the entire syllabus wherein
   5 sub-questions of 3 marks each will be asked.
4. Remaining questions will be randomly selected from all the modules.
5. Weightage of each module will be proportional to number of respective lectures mentioned in the syllabus.

References:

1. Higher Engineering Mathematics, Dr.B.S.Grewal, Khanna Publication
2. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley EasternLimited, 9thEd.
3. Advanced Engineering Mathematics, R. K. Jain and S. R. K. Iyengar, Narosa publication,
4. Probability, Statistics and Random Processes, T. Veerarajan, McGraw-Hill education
5. Advanced Engineering Mathematics H.K. Das, S. Chand, Publications
6. Matrices, Shanti Narayan, S. Chand publication.
7. Introductory Methods of Numerical Analysis, S. S. Sastry, Prentice-Hall of India Private Limited.

Admission Year 2022-23

Course Code	Course Name	Credits
AE 212	**Human Values and Social Ethics**	2

Prerequisite: Should have respect for justice and be able to reflect on one's personal beliefs and values

Course Objectives:

1. To enable learners understand the core values that shape the ethical behaviour of a professional.
2. To develop an awareness on the different ethical dilemmas at the work place and society.
3. To inculcate the ethical code of conduct in writing technical article and technology development.
4. To internalize ethical principles and code of conduct of a good human being at home, society and at work place.

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

1. Learners will be able to recognize the relation between ethics and values pertinent for an engineering professional.
2. Learners will be able to exercise the responsibility for establishing fair and just processes for participation and group decision making
3. Learners will be able to demonstrate an awareness of self-held beliefs and values and how they are altered in interactions with others.
4. Learners will be able to acquire the writing skills necessary to analyse data from research and attribute the source with proper citation.
5. Learners will be competent to incorporate values and ethical principles in social and professional situations.

Module	Details	Hours
1	**Ethics and Values** Meaning & Concept of Ethics Difference between Ethics and Values Ethical code of conduct	03
2	**Professional Ethics** Professional Ethics vs Personal ethics Components of professional ethics Professional values and its importance	05
3	**Ethics and Society** Relevance of values and ethics in social work Ethical dilemmas Values and ethical principles of social work • Service • Dignity and worth of a person • Importance of Human relationships • Integrity • Competence • Social Justice	04
4	**Ethics in Technical writing** Documenting sources	07

Admission Year 2022-23

	Presentation of Information Ethics & Plagiarism	
5	**Ethics and Technology Development** Risk management and Individual rights Moral issues in development and application of technology Privacy/confidentiality of information Managing Technology to ensure fair practices	07

Assessment:
Termwork : 50 marks (Continuous evaluation)

Reference Books:

1. Martin Cohen, *101 Ethical Dilemmas* Routledge, 2nd edition, 2007.
2. M. Govindarajan, S. Natarajan & V.S. Senthilkumar, *Professional Ethics and Human Values,* Prentice Hall India Learning Private Limited, 2013.
3. Mike W. Martin, *Ethics in Engineering*, McGraw Hill Education; Fourth edition, 2017.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE213	**Elements of Machine Design**	3

Course Objectives:

1. To study basic principles of machine design
2. To acquaint with the concepts of design based on strength & rigidity
3. To familiarize with the use of design data books & various codes of practice
4. To make conversant with preparation of working drawings based on designs

Course Outcomes: After completion of this course, learner will be able to

1. Demonstrate understanding of various design considerations
2. Illustrate basic principles of machine design
3. Design machine elements for static as well as dynamic loading
4. Design machine elements based on strength/ rigidity concepts
5. Use design data books in designing various components
6. Acquire skill in preparing production drawings of various designs

Module	Details	Hours
1	**Introduction** Mechanical Engineering Design, Design methods; Material properties and their uses in design; Different considerations in design: Design consideration of casting, forging, Manufacturing, Aesthetic & Ergonomics; Basic principle of Machine Design; Modes of failures; Theories of failures; Different Standards & Codes and Preferred Series and Numbers. Introduction to Reliability and DFMEA	05
2	**Design against static loads** Cotter joint (Socket & Spigot type); Knuckle joint; Turnbuckle; Eccentrically loaded Bolted Joints (considering initial tightening); Eccentrically loaded Welded joints; Power Screw – screw presses, C-clamps along with the Frame.	08
3	**Design against fluctuating loads** Fluctuating, reversed and repeated stresses; Fatigue failure: static and fatigue stress concentration factors; Endurance limit- estimation of endurance limit, Design for finite and infinite life: using Soderberg, Gerber and Goodman design criteria	06
4	**Design of Shafts** power transmission and power distribution shafts, under static criteria and using ASME code. **Keys** Types of Keys and their selection based on shafting condition Design of splines **Couplings** Classification of coupling; Design of Flange couplings and Bush pin type flexible couplings.	10

Admission Year 2022-23

5	**Design of Gears** Design of Spur & Helical Gears: Selection of Material; Gear Blank Design; Number of Teeth; Face Width; Beam Strength of Gear Tooth; Permissible Bending Stress; Effective Load on Gear Tooth; Estimation of Module Based on Beam Strength and Wear Strength.	06
6	**Design of Springs** Helical compression spring under Static and Variable loads; Design of leaf Springs	05

Assessment:

Internal Assessment:

Consisting Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.
5. Duration of test will be two hours and of 60 marks

Text Books:

1. Design of Machine Elements - V.B. Banadari, Tata McGraw Hill Publication
2. Design of Machine Elements - Sharma, Purohit. Prentice Hall India Publication
3. Machine Design by Pandya & Shah, Charotar Publishing

Reference Books:

1. Machine Design -An Integrated Approach - Robert L. Norton, Pearson Education
2. Mechanical Engineering Design by J.E.Shigley, McGraw Hill
3. Machine Design by Reshetov, Mir Publication
4. Machine Design by Black Adams, McGraw Hill
5. Fundamentals of Machine Elements by Hawrock, Jacobson McGraw Hill
6. Machine Design by R.C.Patel, Pandya, Sikh, Vol-I & II C. Jamnadas & Co
7. Design of Machine Elements by V.M.Faires
8. Design of Machine Elements by Spotts
9. Recommended Data Books – PSG and Mahadevan& Reddy

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE214	**Data Science**	2

Course Objectives:

1. To introduce concepts of Data Science using R programming language.
2. To introduce basic concepts of R programming language as well as common packages and libraries.
3. To generate an ability to utilize Data Science concepts with R programming to solve mechanical engineering related problems.

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. To understand concepts of data science with R programming language.
2. To understand fundamentals of R programming and data frame.
3. To be able to visualize the data using R programming package.
4. To be able to prepare the data for analysis.
5. Understanding hypothesis testing and being able to make decisions.

Module	Details	Hours
1.	**Introduction to Data Science** What is Data Science, Importance of Data science, Data science project roles, Understanding the stages of a data science project, Application, Various programming tools to perform data analysis.	02
2.	**Fundamentals of R** Installation of R & R Studio, Getting started with R Script, Basic & advanced data types in R, Variable operators in R, R functions and loops, Creating Data frames, Exploring data frames, Accessing columns in a Data frame, Reading a CSV text file, Removing rows and columns, Renaming rows and columns, sorting and merging data frames.	08
3.	**Data visualization** Need for data visualization, Components of data visualization, Visually checking distributions for a single variable, Visually checking relationships between two variables, Introduction to grammar of graphics, Using the ggplot2 package in R to create visualizations	06
4.	**Basics of Statistics & Probability** Mean, Median, Mode, Variance, Standard Deviations, Skewness, Standard probability distributions: Binomial, Normal etc., Central Limit Theorem, Hypothesis testing, Significance levels & P-Value, statistical tests : t-test, chi-square test, paired t-test, ANOVA	08
5.	**Data Managing** **Cleaning :** Needs & methods of data preparation, Handling missing values, Imputation Methods, Outlier treatment, Transformation, Modifying data with Base R, Data processing with dplyr package **Sampling for modelling and validation:** Test and training splits	06
6.	**Modelling :** Linear Regression, Logistic Regression, K-Means Clustering **Evaluating models :** Evaluating classification models, Evaluating clustering models	08

Admission Year 2022-23

Assessment:

Term Work:

The distribution of marks for Term work shall be as follows:

Experiment write ups : 45 Marks
Attendance : 05 marks

Practical/Oral examination

To be conducted by pair of Internal and External Examiner

The distribution of marks for practical examination shall be as follows:

Practical Exam : 15 marks
Oral Exam : 10 marks

Books/References:

1. R for Data Science, Hadley Wickham, Garrett Grolemund, O'Reilly Media.
2. Hands-On Programming with R, Garrett Grolemund, O'Reilly Media.
3. Any digital resources and online guides for R or its packages.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE 292	**Minor Project II**	2

Course Objectives:

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcomes: Learner will be able to

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as a member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
9. Demonstrate project management principles during project work.

Guidelines for Minor Project:

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into a problem statement for minor-project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Student groups shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of the minor project.
- A log book has to be prepared by each group, wherein the group can record weekly work progress, and the guide/supervisor can verify and record notes/comments.
- Faculty supervisors may give inputs to students during minor project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/supervisor.
- Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
- The solution has to be validated with proper justification and the report has to be compiled in the standard format.
- With the focus on self-learning and innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Minor Project 1 in semester III and IV. Similarly, Minor Project 2 in semesters V and VI may be considered. In other words, based on the individual students' or group's capability, with the mentor's recommendations, if the proposed Minor Project adhering to the qualitative aspects

Admission Year 2022-23

mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Minor Project, in even semester with suitable improvements/modifications.

- Alternatively, student groups can work completely on a new project idea in the even semester, bearing no resemblance with the topic of odd semester. This policy can be adopted on a case to case basis.

Guidelines for Assessment of Minor Project –Continuous assessment and Term Work:

- The review/ progress monitoring committee shall be constituted by heads of departments of each institute. The progress of the minor project to be evaluated on a continuous basis, Minimum two reviews in each semester- 25 marks.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of term work marks for both semesters shall be as below:
  Quality of project report and presentation- 25 marks

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In the first semester the entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the student group.
  - If the problem is based on development of a mechanism or a simple device for attaining a desired objective, the first presentation shall be reviewed based on generation of multiple feasible solutions to the given problem and identification of the best possible solution based on various parameters which may include one of more of the following viz., the total weight, volume, power consumption, mechanical advantage, efficiency, cost (including labour) per piece once manufactured, and so on. This may include creation of unique free-hand sketches by each and every member of the group to contribute to the solution of the given problem. The best possible solution has to be finalized during one or more brainstorming sessions by the members of the student group. In case the problem is of a programming/coding type, then the first presentation may be dedicated to the understanding of the theory behind the problem related to a particular domain subject, including the drafting of an algorithm and/or flowchart, and may also include the introductory part of the programming.
  - Second review shall be based on the computerization (3D CAD model of parts and assembly), and possibly the animation, depicting the working characteristics of the proposed solution to the given problem, allocating material properties to each part, identifying mass properties of the assembled parts, and so on. Checking interference is one of the important criteria that can be used when assembling the parts. For software based projects, this may include the presentation based on the extension of the programming work so as to cover the major portion of the remaining part of the topic.
- In the second semester expected work shall be procurement of components/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester. For those selecting software based projects, this may include completing the other half of the programming related work, identifying the errors, optimizing the software code, customization, creating a graphical user interface of input and output (GUI), displaying output data in the form of graphs/tables/figures/diagrams, creation of the code in executable (.exe) format or in the form of a mobile App, etc.
  - First review shall be conducted based on the readiness of the working prototype, or

Admission Year 2022-23

programming of the remaining code for software based projects.
  - Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester. This may also include the testing and validation of tests with the literature/available data/theory. For software based projects, the presentation includes the remaining work other than the programming, as described above.
- Apart from the hardware type (development of device) and software (program/coding) type of projects, the topics may also include computer based work, viz., generation of virtual laboratory (for one or more experiments) for any subject/domain of choice, or CAD modeling, analysis, optimization, and/or product design, without any relevance to developing any physical product.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including:
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalisation of problem and proposed solution
  - Second shall be for implementation and testing of solutions.

Assessment criteria of Minor Project:

1. Quality of survey/need identification
2. Clarity of problem definition based on need
3. Innovativeness/uniqueness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness/uniqueness
8. Cost effectiveness and societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual as member or leader
13. Clarity in written and oral communication

- In a **one year project**, the first semester evaluation may be based on the first six criteria as highlighted above and the remaining criteria may be used for second semester evaluation of performance of students in the minor project.
- In the case of a half year project, all criteria in general may be considered for evaluation of performance of students in the minor project.

Guidelines for Assessment of Minor Project - Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the Department.
- Minor project shall be assessed through a presentation and demonstration of working model or the execution of programme code by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by the Head of Institution.
- Students shall be motivated to publish a paper based on the work in conferences or student competitions.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE301	**Finite Element Analysis**	3+1

Course Objectives:

1. To equip with the Finite Element Analysis fundamentals.
2. To apply finite element formulation for the solution of mechanical engineering problems.
3. To make the students use simulation techniques to get results for complex problems.

Course Outcomes: Upon successful completion of this course, learner will be able to:

1. Apply weighted residual methods to solve governing differential equations of the problem domain.
2. Discretize the problem domain using appropriate elements and apply boundary conditions.
3. Apply the finite element formulation to solve one-dimensional mechanical engineering problems.
4. Apply the finite element formulation to solve two-dimensional mechanical engineering problems.
5. Apply the finite element method to solve one-dimensional dynamic problems.
6. Use professional-level finite element analysis software to solve real life problems.

Theory Syllabus:

Module	Details	Hours
1.	**Introduction:** Weighted Residual Methods, Variational formulation of boundary value problems, Principal of Minormum Potential Energy, Ritz Method.	4
2.	**Basic concept of Finite Element Method:** Mathematical modeling of field problems in engineering with One dimensional second order equation, discretization, Element types, 1D linear and higher order elements, derivation of shape functions in local and natural coordinate systems, Stiffness matrix and force vectors, assembly of elemental matrices.	8
3.	**1D Analysis:** Application of element stiffness matrix to find Solution of problems from solid mechanics (Step bar, trusses, beams, torsion etc.), heat transfer, fluid flow etc.	8
4.	**Dynamic Analysis:** Dynamic equations of motion, consistent and lumped mass matrices, free vibration analysis.	6
5.	**2D Analysis:** Two dimensional equations, variational formulation, finite element formulation, Plane stresses and plane strain problems, body forces and thermal loads, plate and shell elements, triangular elements - shape functions, elemental matrices, stress analysis and RHS vectors, quadrilateral and higher order elements, isoparametric elements and its shape functions, Convergence and compatibility condition.	8
6.	**Application of FEA:** Discussion of various case studies in different fields and its simulation in FEA software (may include special cases like composites, nonlinear analysis, multi domain analysis etc.).	5

Admission Year 2022-23

Laboratory Syllabus:

Exercise	Details	Hours
1	Introduction to ANSYS (APDL and Workbench)	2
2	Analysis of Rod subjected to axial Load (Step bar, taper rod)	2
3	Truss Analysis	2
4	Beam Analysis	2
5	Thermal Analysis	2
6	Modal analysis	2
7	Axis-symmetry Analysis	2
8	Convergence Study	2
9	Comparison of results while solving the same problem in 1D, 2D or 3D.	2
10	Writing a program using any programming language (Python, R, Matlab, Scilab, C++, etc.) for a finite element solution to any 1D/2D problem.	2
11	Course Project: Simulation of any assembly / Multi domain Analysis / Nonlinear analysis / Analysis of Composites etc.	4

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.
End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks
.
Laboratory Assessment:
Internal Assessment: 25 marks
Term Work:

A. Minimum 6 exercises from 2-10 of the above list need to be undertaken.
B. Validation of the simulation results obtained through software with calculation.
C. Exercise 11 is compulsory. Presentation/Seminar of the study done is required.

The distribution of marks for Term work shall be as follows:

Admission Year 2022-23

Part A : 10 marks
Part B : 5 marks
Part C : 10 marks

End Semester Practical/Oral Examination:

A pair of Internal and External Examiner should conduct practical/viva based on contents. Distribution of marks for practical/viva examination shall be as follows:

Practical Examination : 15 Marks
Oral Examination : 10 Marks

Books/References:

1. J. N. Reddy; An Introduction to Finite Element Method; 3rd Edition, McGraw Hill.
2. R. D. Cook, Davis S. Malkus, Michael E. Plesha and Robert J. Witt; Concepts and Applications of Finite Element Analysis; 4th Edition, Wiley.
3. S. S. Rao; The Finite Element Method in Engineering; 5th Edition, Elsevier, Butter Worth Heinemann.
4. O. C. Zienkiewicz and R. L. Taylor; The Finite Element Method, Vol. I and II, 6th Edition, Elsevier, Butter Worth Heinemann.
5. K.L. Bathe and E.L. Wilson; Finite Element Methods; Prentice Hall.
6. David V Hutton; Fundamentals of Finite element analysis; 7th Edition Tata McGraw Hill.
7. T. R. Chandrupatla and A. D. Belegundu; Introduction to Finite Elements in Engineering; 4th Edition, Pearson.
8. D. L. Logan; A first course in Finite Element Method; 5th Edition, Cengage Learning.
9. P. Seshu; Text book of Finite Element Analysis; 10th Edition, Prentice Hall of India.
10. N. S. Gokhale, S. S. Deshpande, S. V. Bedekar and A. N. Thite; Practical Finite Element Analysis; 1st Edition, Finite to Infinite.
11. Understanding of Differential equations including degree, order, boundary conditions. Solution of Ordinary Differential equations.
12. Understanding of Basic Algebra and Matrices.
13. Understanding of Solid Mechanics, thermal, fluid systems along with their governing equations and variables.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE302	**Heat Transfer**	3+1

Course Objectives:

1. To understand the fundamentals of heat transfer in fluids and solids during steady state and unsteady state.
2. To Study mathematical modeling and designing concepts of heat exchangers

Course Outcomes: Learner will be able to

1. Understand the basic laws of heat transfer
2. Identify, formulate, and solve heat transfer problems in thermal analyses of engineering systems.
3. Analyze problems and develop solution for steady state and unsteady state heat conduction problem in simple geometries
4. Understand the fundamentals of convective heat transfer process Evaluate heat transfer coefficients for natural convection and forced convection.
5. Calculate radiation heat transfer between black body and grey body surfaces.
6. Analyze heat exchanger performance and estimate an effectiveness of heat exchanger.

Theory Syllabus:

Module	Detail Content	Hrs.
1	**Basic concepts of heat transfer** Difference between heat transfer and Thermodynamics, Physical mechanism of different modes of heat transfer, Steady and unsteady heat transfer, one dimensional, two dimensional and three dimensional heat transfer, Fourier law of heat conduction, Thermal conductivity, Thermal resistance concept in heat transfer, Thermal diffusivity, Governing law of convection, Free and forced convection.	6
2	**Conduction** Generalized heat conduction equation in rectangular, cylindrical and spherical coordinates (only equation for cylindrical and spherical coordinates, no derivation), Steady state heat conduction through plane wall, Composite wall, cylinder, composite cylinder wall, sphere, and composite sphere wall, Critical radius of insulation in cylinder and sphere, Thermal contact resistance, Internal Heat generation concept.	7
3	**Heat transfer from Extended Surface** Types of extended surface and its significance Governing differential equation for fin and its solution, Fin performance: Fin effectiveness and Fin efficiency, Thermowell **Unsteady state heat transfer** Applications of unsteady state heat transfer, Lumped system Analysis, characteristic length, Biot Number, Thermal time constant and Response of a thermocouple, Heisler Charts	6
4	**Convection** Determination of heat transfer coefficient, Dimensional Analysis, Dimensionless numbers in free and forced convection and their significance. **External Flow**	7

Admission Year 2022-23

	Velocity Boundary layer and Thermal Boundary layer, Laminar and turbulent, flow over a flat plate, Flow across cylinder and sphere, Flow across bank of tubes **Internal Flow** Velocity Boundary layer and Thermal Boundary layer, Laminar and Turbulent, flow in tubes, General thermal analysis: Constant heat flux and constant surface temperature **Heat Pipe** Introduction and application	
5	**Radiation** Emissivity, transmissivity, reflectivity, absorptivity, black body, Grey body, Opaque body, Radiation intensity, Basic laws of radiation, Radiation heat exchange between black bodies, Reciprocity theorem, Shape factor algebra, Radiation heat exchange between nonblack bodies, Electrical network approach for radiation heat exchange: Radiosity and irradiation, Radiation shield	6
6	**Boiling and Condensation:** Boiling heat transfer, Pool boiling: different regimes and pool boiling curve, Flowboiling: Different Regimes and Boiling curve, Condensation heat transfer, Film condensation, Dropwise Condensation. **Heat Exchangers:** Types of heat exchangers, Overall heat transfer coefficient, Fouling factor Analysis of heat exchangers, LMTD, Effectiveness –NTU method, Correction factor Effectiveness of heat exchangers.	7

Laboratory Syllabus:

SN	Details	Hrs.
1	Measurement of thermal conductivity of insulating powder	2
2	Measurement of thermal conductivity of metal rod	2
3	Performance analysis of extended surfaces under free and force convection	2
4	Unsteady state heat transfer in cylinder/rod/wall	2
5	Measurement of Emissivity of Grey surface	2
6	Estimation of overall heat transfer coefficient and effectiveness of double pipe heat exchanger (parallel flow and Counter flow arrangement)	2
7	Simulation to estimate effect of various parameters on heat transfer	2
8	Heat Transfer analysis/estimation using numerical methods/computational techniques	2

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

Admission Year 2022-23

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Lab Assessment:
Term Work:
The distribution of marks for Term work shall be as follows:

Experiment write ups : 20 Marks
Attendance : 05 marks

Practical/Oral examination
To be conducted by pair of Internal and External Examiner
The distribution of marks for practical examination shall be as follows:

Practical Exam : 15 marks
Oral Exam : 10 marks

Books/References:

1. Introduction to thermodynamics and Heat transfer by Yunus A Cengel 2nd Edition, McGraw Hill International
2. Fundamentals of Heat and Mass Transfer by FPIncropera and D P deWitt, Wiley India
3. Heat Transfer by P S Ghoshdastidar, 2nd Edition, Oxford University Press
4. Heat and Mass Transfer, by R Rudramoorthy and L Malaysamy,2ndEdition, PEARSON
5. Heat Transfer by J P Holman, Mcgraw Hill
6. Heat Transfer by S P Sukhatme, University Press
7. Heat and Mass Transfer by PK Nag, TMH
8. Heat and Mass Transfer by Mahesh Rathod, Laxmi Publications
9. Heat and Mass Transfer byR K Rajput, S Chand and company

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE303	**Automotive Systems**	3+1

Course Objectives:

1. To study basic and advance automotive systems.
2. To study working of different automotive systems and subsystems.
3. To study different types of frames and vehicle layout.
4. To have basic idea about how automotive systems are developed.

Course Outcomes: Learner will be able to

1. Identify different types of frames and axles.
2. Comprehend working of Clutches and transmission systems in automobiles.
3. Interpret the need of driveline components in automobiles.
4. Compare different types of steering systems and analyze steering geometry.
5. Comprehend use of brakes, wheels and tires in automobiles.
6. Identify and Understand working of different vehicle systems and subsystems.

Theory Syllabus:

Module	Details	Hours
1	**Frames and Axles-** Frames-Layouts, types, material, construction, loads acting Front and Rear axles – Types of Front Axles and Stub axles,Construction and Materials, Layout of Two and Three Wheeler **Automotive Clutch-** Necessity of clutch in a automobile, Working and Construction of Single plate, Multi-plate, Centrifugal, Semi Centrifugal, Electromagnetic clutches, Fluid Flywheel ,Clutch Mechanism in Two-Wheeler and Three Wheeler.	06
2	**Automotive Transmission-** Purpose and Elements of Gear Box, Characteristic Curves, Types-Sliding mesh, Constant Mesh, Synchromesh, Determination of gear ratios for vehicles, Layout of transmission in two and three wheeler **Hydrodynamic Transmissions** - Torque converter – Principle - constructional details, Multistage torque converters and Polyphase torque converters. **Epicyclic Gearboxes used in automatic transmissions-** Principle of Planetary gear trains-Wilson, Cotal electromagnetic transmission, Continuously Variable Transmission-Types and Operation of typical CVT Automotive Powertrain, Powertrain Analysis and Transmission Matching , **Gear Shifting Mechanism -** Hand and Foot operated shifting mechanism	8
3	**Drive Line**: UV joint, CV joint, Propeller Shaft construction and arrangement, Elements of drive line, 2WD, 4WD, Part time and Full time 2WD and 4WD.Driving thrust and its effects, Torque reaction and Side thrust, Hotchkiss drive, Torque tube drive, Radius rods, Stabilizers **Final Drive** –Types of Final drive gears and Bearing **Differential** –Principle, Constructional details of Differential unit, Housing, Non slip differential and differential locks, gears and bearing	08
4	**Steering**-Introduction to steering systems, Manual Steering, Ackerman and Davis Steering Mechanisms, Steering Linkages Different types of Steering gear boxes, Reversible and Irreversible steering, Slip angle, Over and under steer Power steering systems, Front Wheel Geometry, Wheel alignment, Steering Frok , Handlebar arrangement.	06

5	**Brakes**- Introduction to Brake System, Components of Brake System, Hydraulic Brake, Air Brake, Anti Lock Brake System, Braking Analysis. Brake control system- Hand and Foot operated brake, Braking System of auto rickshaw.	06
6	**Suspension-** Dependent and Independent Suspension, Types of Suspension Springs-Single leaf, Multi Leaf spring, Coil, Torsion Bar, Rubber, Pneumatic and Hydro elastic suspension spring systems, Mono Shock suspension , Gas filled shock absorber, Preload adjustment procedure motorcycle rear wheel suspension, three wheeler rear suspension for auto rickshaw **Wheels and Tyres-** Tire requirement, tire characteristics, Constructional detail and retreading, tire dimensions and specifications, Types of wheels and Hubs,Selection criteria of wheels and tyre ,their specification for motorcycle , scooters and sports bike.	08

Lab Syllabus:

A. List of Experiments

1. Dismantling and reassembling of Clutch.
2. Dismantling and reassembling Gear box.
3. Dismantling and reassembling of the Propeller Shaft.
4. Dismantling and reassembling of Differential.
5. Dismantling and reassembling of Steering gear linkages and steering gear box.
6. Dismantling and reassembling any one type of braking system.

B. Case Study

Case study and detail report explaining all systems and subsystems on any two of following

1. Passenger Vehicle
2. 2/3 Wheeler
3. Off Road Vehicles
4. Military vehicles

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Laboratory Assessment:

Term Work:

Comprises both A & B

The distribution of marks for term work shall be as follows:

1. Part A: 10 marks
2. Part B: 10 marks

Admission Year 2022-23

3. Attendance (Theory and Practical): 05 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and Minimum passing in the term work.

Text Books:

1. Newton, Steed & Garret, Motor Vehicles, Butterworth Heinemann.
2. N. K. Giri, Automotive Mechanics, Khanna Publishers.
3. D. Crolla, D. E. Foster, T. Kobayashi and N. Vaughan (Editors-in-Chief), Encyclopedia of Automotive Engineering, Parts 1-6, Wiley, 2015.

Reference Books:

1. Crouse. W. H, Automotive Chassis and Body, McGraw Hill New York.
2. Jack Erjavec, Automotive Technology – A systems approach, Cengage Learning.
3. M. J. Nunny, Automotive Technology, SAE Publication.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE304	**Controls Engineering and model based system**	3+1

Course Objectives:

1. To study concept of mathematical modeling of the control system
2. To acquaint with control system under different time domain
3. To study concepts of stability & various methods.
4. To study Multi-Input Multi-Output systems using state space
5. To study application of control systems for automobile systems.

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. Design mathematical models of system/process.
2. Analyze error and differentiate various types of control systems using time domain specifications
3. Analyze various methods and problems associated with stability
4. Analyze systems using graphical methods in frequency response
5. Understand the concept of state space methods for system analysis
6. Comprehend and apply concepts of control systems in automobile applications.

Module	Details	Hours
1.	**Introduction to the Control Systems** Introduction to control systems, Classification of control systems. Open loop and closed loop systems. Mathematical modeling of control systems (Spring mass damper, electrical systems), concept of transfer function, Block diagram algebra - Rules and Problems.	06
2.	**Time Response Analysis** Transient and steady state analysis of first and second order systems. Time Domain specifications. Step response of second order system. Steady-state error, error coefficients, steady state analysis of different type of systems using step, ramp and parabolic inputs	08
3.	**Stability analysis** Introduction to concepts of stability, Concept of S-plane Routh-Hurwitz Criteria for stability; Relative stability analysis; Root-Locus technique and construction of root-loci.	08
4.	**Frequency Response Analysis** Introduction to frequency response; Frequency response plots: Polar plot and Bode plot; Performance specifications in frequency domain. Stability margins in frequency domain; Mapping contours in s-plane; The Nyquist criterion; Relative stability using Nyquist criterion.	08
5.	**State space modeling** Concept of state, state variable, state model. State space representation using physical and phase variables, decomposition of transfer function, diagonalisation. State transition matrix. Transfer function from state model. Controllability and observability of linear systems.	06
6	**Introduction to Model Based system -** Model based systems, Product development V cycle, MIL, SIL, HIL models, Technical Advances in Control systems.	04

Admission Year 2022-23

Laboratory Syllabus:

Sr. No.	Experiment Title
1	MATLAB Onramp Certification - Introduction to MATLAB Environment
2	Simulink Onramp Certification - Introduction to Simulink Environment
3	To study the time response of a first and second order system to standard input signals.
4	To perform stability analysis of control systems using Root Locus Technique.
5	To perform stability analysis of control systems using Bode Plots.
6	Modeling and Simulation of Mass-Spring-Damper System Using Simulink
7	To understand state space analysis in MATLAB - Conversion from State space to Transfer function and Transfer function to state space
8	Design MATLAB simulink system for any one of the given system 1. Automotive Suspension system - 2. Inverted Pendulum system - 3. Anti Lock Breaking system - 4. Engine timing model - 5. Battery Management system in Simulink (Analyze and conclude on different input parameters and output graphs)

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Lab Assessment:
Term Work:
The distribution of marks for Term work shall be as follows:
Experiment write ups : 20 Marks

Admission Year 2022-23

Attendance : 05 marks

End Semester Practical/Oral Examination: 25 Marks

Pair of Internal and External Examiner should conduct practical/viva based on contents.
Distribution of marks for practical/viva examination shall be as follows:

Practical Examination : 15 Marks
Oral Examination : 10 Marks

Text Books:

1. Norman Nise, "Control Systems Engineering", Wiley, 8th edition, 2019.
2. M. Gopal, "Control Systems: Principles and Design", 3rd edition, Tata McGraw Hill, 2008.
3. Richard Dorf, Robert Bishop, "Modern Control Systems", 11th edition, Pearson Education, 2008

Reference Books:

1. Golnaraghi Farid, B. C. Kuo, "Automatic Control Systems", 10th edition, McGraw Hill, 2017.
2. K. Ogata, "Modern Control Engineering", 6th edition, Prentice Hall, 2010.
3. I. J. Nagrath, M. Gopal, "Control System Engineering", New Age International, 2009.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE305	**Electric Vehicle Drives and Control**	3

Course Objectives:

1.To study the concepts of magnetism and energy conversion.

2.To familiarize with the operational characteristics of AC machines, Special purpose machines and their applications

3.To introduce different power conversion topologies such ac to dc, dc to ac and the underlying principles of converter operation aiding to analyze performance.

Course Outcomes: Learner will be able to

1. Explain the importance, working and applications of DC Machines
2. Understand and analyze the importance, working and applications of AC Machines
3. Describe stepper, servo motor and its drive systems along with its applications
4. Illustrate the characteristics of power electronic components.
5. Analyze power electronic convertors and their applications.
6. Analyze the control of power converters and motors in electric vehicle.

Module	Details	Hours
1	**Introduction to Electrical machines** Aspects of Electromechanical Energy conversions, Features of Energy conversion, Energy balance equation. Commonly used Electrical machines in EV.Basic construction and principle of operation of DC Machines- Brushed and Brushless DC motors (BLDC). Characteristic Curves of Machines: Constant-Torque Mode, Constant-Power Mode, Efficiency Map.	04
2	**Ac Machines** Three phase Induction motors Classification, Principle, Construction of Squirrel cage Rotor and phase wound rotor motor, Relation between torque and rotor power factor, Starting torque for squirrel cage and slip ring motor,condition for maximum torque, Torque-slip characteristics. Speed control of the induction motor.Introduction of AC and DC drives, Synchronous Motors Construction, Operating principle, Equivalent circuit and power developed by motor.	06
3	**Special purpose Electric Machines** Stepper motor-PM Stepper motor, DC Servomotor, AC Servomotor, Switched Reluctance motor, Suitability of each machine in Electric vehicle domain for 2W, 3W, 4 wheeler and large size vehicles. Real life examples-Review of advancement in EV Motors and Drives.	06
4	**Introduction to Power Electronics** Construction, Steady state characteristics & Switching characteristics of SCR, power MOSFET and IGBT. Gate characteristics,Gate drive requirements,Gate drive circuits for Power MOSFET & IGBT.	04

Admission Year 2022-23

5	**Power electronic Converter for EV drive** Types of Power electronics converters, Advantages and Disadvantages of Power electronics converters. Power Conversion –Basic Principle, review of DC-DC converters, Switching mode regulators – Buck, Boost,Buck-Boost, Cuk converters, Full bridge DC-DC converters. Power Conversion –Basic Principle, review of inverters.Types- Single phase and three phase inverter - EV traction inverter Modulation schemes: Sinusoidal Pulse Width Modulation, SPWM with Third harmonic injection, Space vector modulation, comparison of modulation techniques.Converter-Inverter Loss calculation, Heat-sinking: passive and active cooling.	08
6	**Control of Power converters and Motors** Induction Motor Control: Variable-Voltage Variable-Frequency Control (VVVF), Field-Oriented Control (FOC), Direct Torque Control (DTC). PM Synchronous Motor Control: Field-Oriented Control of PMSM, Flux Weakening Control of PMSM, Position Sensorless Control of PMSM. SRM motor control: Current chopping control (CCC), Torque-Ripple Minimization Control BLDC Motor Control: Trapezoidal back EMF BLDC motor control.	08

Admission Year 2022-23

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests first test based on approximately 40% of contents and second test based on matlab simulation experiment submission (approximately 40% but excluding contents covered in Test I). Duration of the first test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text Books:

1. Bimbhra P. S., Electric Machinery, Khanna Publisher,
2. B.L.Theraja, A.K.Theraja, Electrical technology Volume-II,S chand Publications.
3. M. H. Rashid, Power Electronics: Circuits, Devices, and Applications, Pearson Education, 2009.
4. N. Mohan and T. M. Undeland, Power Electronics: Converters, Applications and Design, John Wiley & Sons, 2007.

Reference Books:

1. Gopal Dubey,Fundamental of Electrical Drives,Narosa Publication
2. M. V. Deshpande, Electric Machines, PHI
3. S. K. Pillai, A first course on Electrical Drives, New Age Publication
4. Ashfaq Husain, Electric Machines, Dhanpat Rai and Co. Publications
5. R.W. Erickson and D. Maksimovic, Fundamentals of Power Electronics, Springer Science & Business Media, 2007.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE306	**CAD for Additive Manufacturing**	3

Course Objectives:

1. To provide detailed understanding of additive manufacturing processes.
2. Understand the manufacturing procedure of a prototype

Course Outcomes: Learner will be able to…

1. Understand the evolution and need of AM processes. It will develop the ability of select the process for particular application.
2. Understand the basic principle of curing type, extrusion and layer deposition type AM processes. The students will learn the pros & cons of these processes and their applications.
3. Understand the use of pre requirement of AM process. Basic knowledge about the software requirement and processing of drawing.
4. Select and use correct CAD formats in the manufacture of a 3D printed part.
5. Identify STL file problems and apply repair algorithms

Module	Details	Hours
1	**Introduction to Additive Manufacturing (AM):** Introduction to Additive Manufacturing and classification. Applications of additive manufacturing in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating	4
2	**AM technologies**: Introduction to 3D-printing, Stereolithography apparatus (SLA), Fused deposition modelling (FDM), Laminated Object Manufacturing (LOM)),Powder Bed Fusion Processes(PBF)	6
3	**CAD for Additive Manufacturing:** CAD Data formats, Data translation, Data loss, STL format. Softwares used for slicing	4
4	**Pre-Processing in Additive Manufacturing**: Preparation of 3D-CAD model, Reverse engineering and Reconstruction of 3D-CAD model, Part orientation and support generation, STL Conversion, STL error diagnostics, Slicing and Generation of codes for tool path, Surface preparation of materials.	9
5	**CAD & Reverse Engineering:** Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation — Part Orientation and support generation — Model Slicing —Tool path Generation, Softwares for Additive Manufacturing Technology	9
6	**Post-Processing in Additive Manufacturing**: Support material removal, improvement of surface texture, accuracy and aesthetic; property enhancements.	6

Admission Year 2022-23

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text Books:

1. Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing, Springer, 2015
2. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Third Edition, World Scientific Publishers, 2010
3. Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications: Fourth Edition of Rapid Prototyping, World Scientific Publishers, 2014
4. Gebhardt A., "Rapid prototyping", Hanser Gardener Publications, 2003

Reference Books:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive manufacturing technologies: rapid prototyping to direct digital manufacturing Springer, 2010.
2. C.K. Chua, K.F. Leong and C.S. Lim, Rapid prototyping: principles and applications, 3rd Edition, World Scientific, 20 10.
3. Liou L.W. and Liou F.W., "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007
4. Kamrani A.K. and Nasr E.A., "Rapid Prototyping: Theory and practice", Springer, 2006
5. Mahamood R.M., Laser Metal Deposition Process of Metals, Alloys, and Composite Materials, Engineering Materials and Processes, Springer International Publishing AG 2018
6. Ehsan Toyserkani, Amir Khajepour, Stephen F. Corbin, "Laser Cladding", CRC Press, 2004

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE307	**Material Selection and manufacturing**	3

Course Objectives:

1. To understand the requirements for selection of any material.
2. To select and appropriate material as per requirement
3. To be able to manufacture the chosen material

Course Outcomes:

1. Evaluate the need for material selection for a new product or to improve an existing product
2. Estimate the requirement in terms of mechanical properties
3. Decide an appropriate processing route for a selected material
4. Able to make selection of material based on material index

Module	Details	Hours
1	**Motivation for Selection** New Product Development, Improving an existing product, Cost effectiveness and value analysis, Establishing the service requirements, Selection and design in relation to anticipated service	06
2	**Selection of Materials for Mechanical Properties:** Understanding the stress-strain diagram for different classes of materials, Static Strength, Stiffness, toughness, fatigue and creep and the material selection criteria, Ashby diagrams for correlating any two properties	07
3	**Material Selection and Material Processing** Purpose of processing and background to process selection. Casting of alloys, wrought alloys, processing of polymers, composites, powders processing-new trends in additive manufacturing, Joining and fastening processes, Importance of the structure -property-processing	07
4	**Ashby 's Selection of Materials** Defining Function, Objective, Constraints, Free variable and modelling the material index for Light and Stiff material selection, Cheap and Stiff material, Light and strong material. Using Material Index to select the most appropriate material	07
5	**Racing Cars and Technical Specifications** Materials Used in Formula One, making of NASCAR, Off Road trucks, GT,Ferrari	06
6	**Case study:** 1. Material Selection for Vehicle Body, commercial vs racing cars 2. Automobile Structures and materials used 3. Recent trends with green biocomposites in race cars	06

Admission Year 2022-23

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text Books/References:

1. M. F. Ashby, Materials Selection in Mechanical Design, Elsevier Publication, 2005
2. J. G. Gerdeen, H. W. Lord and R. A. L. Rorrer, Engineering Design with Polymers and Composites, Taylor & Francis, 2005
3. J. A Charles, JAG Furness, Selection and use of Engineering Materials, JBH Publishers, 3rd edition.
4. Kenneth. G Budinski & Michael K. Budinski., Engineering Materials: Properties and Selection, 9th edition, 2010
5. M. F. Ashby and K. Johnson, Materials and Design, Butterworth Publication, 2002

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE391	**Minor Project III**	2

Course Objectives:

1. To acquaint with the process of identifying the needs and converting it into the problem.
2. To familiarize the process of solving the problem in a group.
3. To acquaint with the process of applying basic engineering fundamentals to attempt solutions to the problems.
4. To inculcate the process of self-learning and research.

Course Outcomes: Learner will be able to

1. Identify problems based on societal /research needs.
2. Apply Knowledge and skill to solve societal problems in a group.
3. Develop interpersonal skills to work as a member of a group or leader.
4. Draw the proper inferences from available results through theoretical/ experimental/simulations.
5. Analyse the impact of solutions in societal and environmental context for sustainable development.
6. Use standard norms of engineering practices
7. Excel in written and oral communication.
8. Demonstrate capabilities of self-learning in a group, which leads to life-long learning.
9. Demonstrate project management principles during project work.

Guidelines for Minor Project:

- Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity.
- Students should do surveys and identify needs, which shall be converted into a problem statement for minor-project in consultation with faculty supervisor/head of department/internal committee of faculties.
- Student groups shall submit an implementation plan in the form of Gantt/PERT/CPM chart, which will cover weekly activity of the minor project.
- A log book has to be prepared by each group, wherein the group can record weekly work progress, and the guide/supervisor can verify and record notes/comments.
- Faculty supervisors may give inputs to students during minor project activity; however, focus shall be on self-learning.
- Students in a group shall understand the problem effectively, propose multiple solutions and select the best possible solution in consultation with the guide/supervisor.
- Students shall convert the best solution into a working model using various components of their domain areas and demonstrate.
- The solution has to be validated with proper justification and the report has to be compiled in the standard format.
- With the focus on self-learning and innovation, addressing societal problems and entrepreneurship quality development within the students through the Minor Projects, it is preferable that a single project of appropriate level and quality be carried out in two semesters by all the groups of the students. i.e. Minor Project 1 in semester III and IV. Similarly, Minor Project 2 in semesters V and VI may be considered. In other words, based on the individual students' or group's capability, with the mentor's recommendations, if the proposed Minor Project adhering to the qualitative aspects

Admission Year 2022-23

mentioned above gets completed in odd semester, then that group can be allowed to work on the extension of the Minor Project, in even semester with suitable improvements/modifications.

- Alternatively, student groups can work completely on a new project idea in the even semester, bearing no resemblance with the topic of odd semester. This policy can be adopted on a case to case basis.

Guidelines for Assessment of Minor Project –Continuous assessment and Term Work:

- The review/ progress monitoring committee shall be constituted by heads of departments of each institute. The progress of the minor project to be evaluated on a continuous basis, Minimum two reviews in each semester- 25 marks.
- In continuous assessment focus shall also be on each individual student, assessment based on individual's contribution in group activity, their understanding and response to questions.
- Distribution of term work marks for both semesters shall be as below:
  - Quality of project report and presentation- 25 marks

Review/progress monitoring committee may consider following points for assessment based on either one year or half year project as mentioned in general guidelines.

One-year project:

- In the first semester the entire theoretical solution shall be ready, including components/system selection and cost analysis. Two reviews will be conducted based on the presentation given by the student group.
  - If the problem is based on development of a mechanism or a simple device for attaining a desired objective, the first presentation shall be reviewed based on generation of multiple feasible solutions to the given problem and identification of the best possible solution based on various parameters which may include one of more of the following viz., the total weight, volume, power consumption, mechanical advantage, efficiency, cost (including labour) per piece once manufactured, and so on. This may include creation of unique free-hand sketches by each and every member of the group to contribute to the solution of the given problem. The best possible solution has to be finalized during one or more brainstorming sessions by the members of the student group. In case the problem is of a programming/coding type, then the first presentation may be dedicated to the understanding of the theory behind the problem related to a particular domain subject, including the drafting of an algorithm and/or flowchart, and may also include the introductory part of the programming.
  - Second review shall be based on the computerization (3D CAD model of parts and assembly), and possibly the animation, depicting the working characteristics of the proposed solution to the given problem, allocating material properties to each part, identifying mass properties of the assembled parts, and so on. Checking interference is one of the important criteria that can be used when assembling the parts. For software based projects, this may include the presentation based on the extension of the programming work so as to cover the major portion of the remaining part of the topic.
- In the second semester expected work shall be procurement of components/systems, building of working prototype, testing and validation of results based on work completed in an earlier semester. For those selecting software based projects, this may include completing the other half of the programming related work, identifying the errors, optimizing the software code, customization, creating a graphical user interface of input and output (GUI), displaying output data in the form of graphs/tables/figures/diagrams, creation of the code in executable (.exe) format or in the form of a mobile App, etc.

Admission Year 2022-23

- First review shall be conducted based on the readiness of the working prototype, or programming of the remaining code for software based projects.
- Second review shall be based on poster presentation cum demonstration of working model in last month of the said semester. This may also include the testing and validation of tests with the literature/available data/theory. For software based projects, the presentation includes the remaining work other than the programming, as described above.

- Apart from the hardware type (development of device) and software (program/coding) type of projects, the topics may also include computer based work, viz., generation of virtual laboratory (for one or more experiments) for any subject/domain of choice, or CAD modeling, analysis, optimization, and/or product design, without any relevance to developing any physical product.

Half-year project:

- In this case in one semester students' group shall complete project in all aspects including:
  - Identification of need/problem
  - Proposed final solution
  - Procurement of components/systems
  - Building prototype and testing
- Two reviews will be conducted for continuous assessment,
  - First shall be for finalisation of problem and proposed solution
  - Second shall be for implementation and testing of solutions.

Assessment criteria of Minor Project:

1. Quality of survey/need identification
2. Clarity of problem definition based on need
3. Innovativeness/uniqueness in solutions
4. Feasibility of proposed problem solutions and selection of best solution
5. Cost effectiveness
6. Societal impact
7. Innovativeness/uniqueness
8. Cost effectiveness and societal impact
9. Full functioning of working model as per stated requirements
10. Effective use of skill sets
11. Effective use of standard engineering norms
12. Contribution of an individual as member or leader
13. Clarity in written and oral communication

- In a **oneyear project**, the first semester evaluation may be based on the first six criteria as highlighted above and the remaining criteria may be used for second semester evaluation of performance of students in the minor project.
- In the case of a **half year project,** all criteria in general may be considered for evaluation of performance of students in the minor project.

Guidelines for Assessment of Minor Project - Practical/Oral Examination:

- Report should be prepared as per the guidelines issued by the Department.
- Minor project shall be assessed through a presentation and demonstration of working model or the execution of programme code by the student project group to a panel of Internal and External Examiners preferably from industry or research organisations having experience of more than five years approved by the Head of Institution.
- Students shall be motivated to publish a paper based on the work in conferences or student competitions.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE308	**Automotive Body and Chassis Systems**	3+1

Course Objectives:

1. To Understand fundamentals of Vehicle Body design
2. To Study different vehicle structural design and their requirements.
3. To Study Vehicle Aerodynamics.
4. To Study different vehicle body structures and Loads acting on them.
5. To study various materials related to body structures

Course Outcomes: Learner will be able to

1. Apply aerodynamics principles while vehicle body designs.
2. Apply Aesthetic and Ergonomic principles while designing vehicle body.
3. Differentiate between different types of bus body styles.
4. To be wise with different types of commercial vehicle.
5. To be comprehend with material selection for different vehicle components.
6. To be inferred with vehicle body design of passenger and commercial vehicle for different loading conditions.

Admission Year 2022-23

Module	Details	Hours
1	**Aerodynamics** Vehicle Body Styles, Vehicle drag and types, Various types of forces and moments, Effect of forces and moments, Side wind effect on forces and moments, Body optimization techniques to reduce drag, Wind tunnels-Principle of operation and types, Wind tunnel testing such as: Flow visualization techniques, Air flow management test-measurement of various forces and moment by using wind tunnel.	06
2	**Car Body Details** Types of Car Bodies, Visibility, Drivers Visibility, Improvement in visibility and test for visibility, Driver Seat design, Car body construction, Various panels used in car bodies Safety -Safety aspects during design, Safety equipments, Design criteria, Prototype making, Initial tests, crash test on full models, Dummies and Instrumentation.	06
3	**Bus Body Details** Types of bus body: based on capacity, distance travelled and based on construction: Mini bus, Single decker, Double decker, Two level and articulated, Bus body layout-Floor height, Engine location, Entry and exit location, seating dimensions. Constructional details-Conventional and Integral, Frame construction, Double skin construction, metal sections types,	06
4	**Commercial vehicle detail** Types of commercial vehicle bodies-Flat platform, drop side, fix side, tipper body, tanker body, Trailer body, Light commercial vehicle body types, Dimensions of driver seat in relation to controls, Drivers cab design and Regulations Special commercial vehicles: Refrigerated vehicles, paramedic ambulances, pickup van.	06

5	**Body Materials, Trim and Mechanisms** Types of materials used in body construction-Sheet steel, timber, plastics, GRP, Carbon fiber, fibreglass, Shape memory alloys, technologies to reduce NVH properties of materials, Corrosion- anticorrosion methods, Selection of paint and painting procedure and paint problems. Body trim items and Body mechanisms, Body repair tools-Hand tools, power tools, repairing sheet metal, repairing plastic body, fillers, passenger compartment service.	06
6	**Vehicle structure and Body design** Loads on frames, Construction and cross sections of frame, Basic requirement of strength and stiffness, Vehicle structure types, Demonstration of Simple structural surface (SSS), Idealized structure-structure surface, shear panel method, Layout of design, preliminary design, vehicle body weight analysis and Vehicle Weight distribution **Body loads** Symmetric and asymmetric vertical loads in car, longitudinal loads, Different loading situations, Calculation of loading cases, Stress analysis of vehicle body structure under bending and torsion.	06

Laboratory Syllabus:

A. Drawing sheet

1. Minimum 3 A2 size sheets based on Vehicle body styles layouts for Car body, Bus body and Commercial Vehicle body details
2. Transforming Sheets into Solidwork/Ansys Modelling using Dimensions used for drawing sheets.

B. List of Experiments

Analysis of Chassis Frame using any FEA Software's for different sections (C-section, I-section, L-section, O-section, Hat section, Tubular section etc)

1. Structural Analysis of Chassis Frame
2. Modal Analysis of Chassis Frame
3. Harmonic Analysis of Chassis Frame.

C. Mini Project

Analysis of Chassis frame containing a 3D Model of any existing Automobile Chassis or Body or combination of both (Min 2 Max 4 Students per Group)

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Admission Year 2022-23

Laboratory Assessment:

Term Work:

The distribution of marks for term work shall be as follows:

Assignment/Drawing sheets	: 10 marks
Laboratory work (Experiments)	: 05 marks
Mini project	: 05 marks
Attendance (Theory and Practical)	: 05 marks

The final certification and acceptance of term work ensures the satisfactory performance of laboratory work and minimum passing in the term work.

Practical/Oral examination

To be conducted by pair of Internal and External Examiner

The distribution of marks for practical examination shall be as follows:

Practical Exam	: 15 marks
Oral Exam	: 10 marks

Text Books:

1. J. Powloski - "Vehicle Body Engineering"-Business Books Ltd, London,1989
2. John Fenton - "Vehicle Body Layout and analysis-Mechanical Engg. Publications Ltd, London, 1982.
3. J. Reimpell - "The Automotive Chassis: Engineering Principles "Reed Elsevier and Professional publishing Ltd, 2001.

Reference Books:

1. Crouse. W. H, Automotive Chassis and Body, McGraw Hill New York.
2. Wolf Heinrich Hucho, Aerodynamics of Road Vehicles, SAE International, USA
3. Giles J.C Body Construction and Design, Illife Books Butterworth & Co., 1971

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE309	**Automotive Vibrations**	3+1

Course Objectives:

1. To study the basic concepts of vibration analysis.
2. To estimate the natural frequency/frequencies of vibration systems in free vibration, using both exact and numerical methods.
3. To estimate the response of 1 degree of freedom under forced vibration.
4. To acquaint with the basic principles of vibration measuring instruments.
5. To study the balancing of rotating and reciprocating mass systems.

Course Outcomes: Upon successful completion of this course, learner will be able to

1. Develop mathematical models to represent dynamic system.
2. Estimate natural frequency of mechanical system using various methods.
3. Analyze vibratory response of mechanical system under forced vibration.
4. To estimate the natural frequencies and mode shapes of multi-degree of freedom system, using both exact and numerical methods.
5. Balance an existing unbalanced system partially/completely.

Theory Syllabus:

Module	Details	Hours
1	**1.1 Basic Concepts of Vibrations:** Vibration and oscillation, causes and effects of vibrations, vibration parameters—spring, mass and damper, minimum number of parameters required for vibration to occur, vibration terminology, classification of vibrations, steps involved in vibration analysis. **1.2 Free Undamped Single Degree of Freedom Vibration Systems:** Methods to formulate differential equations — Newton's method or D'Alembert's principle, and Energy methods — Based on conservation of total energy, Rayleigh's energy method, Lagrange's energy method, equivalent system method. Springs in series and parallel combination, inclined spring, effect of spring's own mass to calculate natural frequency of system. Application of these methods in longitudinal, transverse and torsional single degree of freedom vibration systems, or a combination of these.	7
2	**2.1 Free Damped Single Degree of Freedom Vibration Systems:** Need of damping in vibration systems, introduction to damper models—viscous, Coulomb (dry friction), slip/interfacial, solid/structural/hysteresis damping (Note: only basic introduction to slip and solid dampings, no calculations expected). Viscous damping—Derivation of differential equation of motion, derivation of solution (response) equations, damping ratio or damping factor, critical damping coefficient, underdamped, critically damped and over damped systems. Logarithmic decrement, Work done by viscous damper, inclined damper, dampers in series and parallel combinations. Coulomb/dry-friction damping—derivation of differential equation, number of cycles covered by the mass to stop once disturbed (disturbance in the form of initial displacement only), comparison of viscous and Coulomb dampings.	8

Admission Year 2022-23

3	**3.1 Free Undamped Multi Degree of Freedom Vibration Systems:** Exact methods for derivation of differential equations of motion for multi degree of freedom systems—Newton method and Lagrangian energy method, matrix analysis to estimate eigenvalues and eigenvectors & hence natural frequencies and mode shapes for multi-mass undamped vibration systems (limited to 2 degree of freedom only), Holzer's method for longitudinal and torsional unbranched vibration systems, Dunkerley's and Rayleigh's methods for estimating fundamental frequency of transverse vibration of simply supported and cantilever beams (up to a maximum of 4 point loads only), influence coefficients and Maxwell's reciprocal theorem.	7
4	**4.1 Forced Single Degree of Freedom Vibration Systems:** Analysis of linear and torsional systems subjected to harmonic excitation in terms of force and motion (viscous damping only), force isolation and transmissibility, isolators and mounts. **4.2 Vibration Measuring Instruments:** Principle of seismic instruments, vibrometer, accelerometer, velometer - with and without measurement errors. Principle of frequency-measuring instruments, Fullarton's tachometer and Frahm's reed tachometer.	7
5	**5.1 Balancing of Rotating Masses:** Static and dynamic balancing of multi-rotor system. **5.2 Balancing of Reciprocating Masses:** Approximate analytical method for finding acceleration of reciprocating piston (mass of connecting rod and crank neglected), primary and secondary unbalanced forces, inline engine, direct and reverse crank method.	7
6	**6.1 Whirling of Shafts / Rotor Dynamics / Critical Speed:** Critical speed of a single rotor—undamped and damped.	3

Laboratory Syllabus:

Sr. No.	Title of the Experiment	Hours
1.	Determining the undamped natural frequency / time period of free undamped vibrations/oscillations of the following systems, theoretically and experimentally: (a) Simple spring-mass system (b) Simple pendulum (c) Compound pendulum (d) Single rotor-shaft system (e) Bifilar suspension system	10
2.	Free damped torsional oscillations.	2
3.	Forced vibration of one degree of freedom system, subjected to frequency-squared excitations (rotating unbalance).	2
4.	Computer program on frequency-domain plots of dimensionless steady-state amplitudes for various values of damping ratio.	2
5.	Vibration measurement of rotating machinery using accelerometer, DAQ system and LabView software; or similar.	2
6.	Balancing of rotating masses.	2
7.	Virtual Laboratory Experiments using Sakshat VLab portal.	2

Admission Year 2022-23

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Laboratory Assessment:

Term Work: 25 marks

Term Work consists of an ample number of assignments and experiments as decided by the instructor. Minor-projects based on this subject may be undertaken for which the number of assignments may be suitably reduced. Students can also avail NPTEL Certification for this course, which shall be considered in place of the assignment work.

The distribution of marks for Term work shall be as follows:

Experiment write ups : 20 marks
Attendance : 05 marks

Viva-você / Practical: 25 marks

Viva-você (on the entire syllabus) or Practical exam (on at least one experiment) shall be conducted at the end of the course. In case both viva-voce and practical exams are conducted, 15 marks shall be allotted to viva-voce and 10 marks to the practical exam.

Books/References:

1. Mechanical Vibrations - S. S. Rao - Pearson Education
2. Mechanical Vibrations - G. K. Grover
3. Fundamentals of Mechanical Vibrations - S. Graham Kelly - Tata McGraw Hill
4. Mechanical Vibrations - Schaum's outline series - S. Graham Kelly- McGraw Hill
5. Mechanical Vibrations - Den, Chambil, Hinckle
6. Mechanical Vibrations - J.P. Den Hartog - McGrawhill Book Company Inc.
7. Introduction to Dynamics and Control - Leonard Meirovitch - Wiley, New York
8. Elements of Vibration Analysis - Leonard Meirovitch - McGraw-Hill, New York
9. Principles of Vibrations - Benson H. Tongue - Oxford University Press.
10. Theory of Vibrations with Applications - W. Thomson - Pearson Education
11. Vibrations - Balakumar Balachandran, Edward Magrab - CENGAGE Learning.
12. Vibration Monitoring, Testing, and Instrumentation (Mechanical Engineering Series) - Clarence W. deSilva - CRC Press.
13. Vibration Testing: Theory and Practice - Kenneth G. McConnell, Wiley.
14. Modal Testing: A Practitioner's Guide - Peter Avitabile - Wiley.
15. Vibration Analysis - P. Srineevasan - Tata McGraw Hill
16. Mechanical Vibrations - Schaum's outline series - William W. Seto- McGrmvHill.
17. Theory and Practice of mechanical vibrations - J. S. Rao, K. Gupta - New Age International Publications.
18. Leonard Meirovitch, Introduction to Dynamics and Conti'oJ. Wiley, New York
19. Leonard Meirovitch, Elements of Vibration Analysis. McGrmv-Hill, New York

Admission Year 2022-23

20. Leonard Meirovitch, Dynamics and Control of Structures. Wiley, New York.
21. Antony J. Pettofrezzo, Matrices and Transformations. Dover, New York.
22. Benson H. Tongue, Principles of Vibration. Oxford University Press.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE310	**Professional Communication and Ethics II**	1+1

Course Objectives:

1. To enable learners to formulate professional documents in a structured manner that meets the corporate requirements.
2. To provide an appropriate environment, opportunity and scope to the learners to acquire skills such as collaboration, leadership qualities, assertiveness etc. necessary for group discussion and team building.
3. To promote the importance of having an impressive personality that will enhance self esteem, build self confidence and sensitize the learners in appropriate behaviour.
4. To prepare the learners for campus placement, employability and competitive examination required for lifelong learning.
5. To inculcate the ethical code of conduct and corporate etiquettes.
6. To develop effective presentation, research and organisational and creative skills necessary for global and industrial set up.

Course Outcomes:

1. Learners will be able to acquire the writing skills necessary for professional documents to meet the corporate requirement.
2. Learners will be able to demonstrate the skills required for self-improvement and effective communication.
3. Develop self-confidence and behave professionally.
4. Learners will be able to perform successfully in competitive exams like GRE, CET and TOEFL
5. Able to determine the importance of ethics and etiquettes in social and professional situations.
6. Able to illustrate effective presentation, research organisational and creative skills necessary for lifelong learning.

Year 2022-23

Theory Syllabus:

Module	Details	Hours
1	**Structure, Style and Language of Report Writing:** 1.1 Introducing the purpose, aim, objective and format of report 1.2 Literature review-ability to gather and analyze information from different sources and summarize. Specific emphasis on plagiarism, use of quotation marks appropriately. 1.3 Research Methodology 1.4 Presenting data-figures, diagrams and labeling 1.5 How and why to write discussion 1.6 Citing and referencing- IEEE format 1.7 Writing an abstract	4
2	**Writing Technical Proposals:** 2.1 Format 2.2 Executive summary 2.3 Defining the problem and presenting the solution 2.4 Summarizing a technical proposal	3
3	**Oral Skills for Employability:**	2

	3.1 Group Discussion- with special reference to leadership qualities, assertiveness, analyzing the topic, developing different perspectives, introducing and concluding the discussion. 3.2 Interview-with special reference to introducing oneself and answering questions with confidence. 3.3 Presentation Skills-with special reference to preparing slides, dress code, non-verbal communication including paralinguistic features, introduction and conclusion.	
4	**Personality Development and Social Etiquettes:** 4.1. Personality Development ● Improving self-awareness-analyzing our own experiences, looking at ourselves through the eyes of others ● Knowing and Building your own identity ● Discovering and Developing your talents ● Teamwork/collaboration 4.2. Social Etiquettes ● Formal Dining Etiquettes ● Cubicle Etiquettes ● Responsibility in Using Social Media ● Showing Empathy and Respect ● Learning Accountability and Accepting Criticism ● Demonstrating Flexibility and Cooperation ● Selecting Effective Communication Channels	2
5	**Ethics and Ethical codes of conduct:** 5.1Writing Resume and statement of purpose 5.2 Business and corporate activities(special emphasis on business meetings) 5.3 Personal ethics, conflicting values, choosing a moral response, the process of making ethical decisions.	2
6	**Content writing:** 6.1 Research Skills 6.2 Organisational skills 6.3 Creative Writing- Blog posts, Web pages etc.	2

Lab Syllabus:

SN	Details of Assignments	Details of Activities	Hours
1.	Written assignment on Literature Review 20 page report on technical topic-(to be included as part of term work)	Sample IEEE papers to be shared with students and train them to identify contributions of each author. These contributions can then be written in the format required in journals.	4
2.	Written assignment on summarising a technical proposal. 4 page technical proposal (to be included as part of term work)	Example of summarising techniques to be demonstrated.	4
3.	Oral Skills for Employability - to be included in term work.	Role play and mock interviews, Mock group discussion, Mock presentation	6
4.	Written Assignment on Documentation of Business Meeting	Mock meetings	2

5.	Written Assignment on Resume writing/Statement of Purpose.	NA	2
6.	Written Assignment on Blog Posts	NA	2

Term work

1. Assignments - 10 marks
2. Group Discussion - 10 marks
3. Interviews - 5 marks
4. Report - 5 marks
5. Technical Proposal - 5 marks
6. Attendance - 5 marks
7. Presentation - 10 marks

Text /Reference Books:

1. Raman Meenakshi & Sharma Sangeeta, *Communication Skills,* Oxford University Press
2. Kumar Sanjay & Lata Pushp, *Communication Skills*, Oxford University Press
3. Virendra Singh Nirban, Krishna Mohan, RC Sharma, *Business Correspondence and Report Writing*

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE311	**Automotive Embedded Systems**	3

Course Objectives:

1. To provide a broad introduction to automotive embedded systems.
2. To understand communication techniques.
3. To understand various types of X by wire technologies.
4. To study concepts involved in embedded hardware for systems realisation.
5. To apply hardware and software knowledge to develop automotive embedded system applications according to requirement and constraints.
6. To provide a comprehensive overview about existing and future automotive electronic systems.

Course Outcomes: Learner will be able to

1. Illustrate basic concepts of embedded systems.
2. Interpret the various types of communication protocols used in Automobiles.
3. Demonstrate various types of X by wire technologies with its challenges and opportunities.
4. Identify various hardware modules used in embedded systems.
5. Recognize Tools for software development from an Automobile viewpoint.
6. Comprehend embedded systems used in Automobiles using different case studies.

Theory Syllabus:

Module	Details	Hours
1	**Introduction:** Definition of Embedded System, Embedded Systems Vs General Computing Systems, Introduction to microprocessors, microcontrollers. Overview of Embedded System Architecture with function of each block in brief, Memory, Sensors and Actuators, Electronic Control Units (ECU'S), Harvard and Von Neumann architecture, RISC and CISC processors, Categories of embedded systems, Quality attributes (Design Metric) of embedded system and Major Application Areas.	6
2	**Embedded Communication:** Modes of data communication: serial, parallel, synchronous and asynchronous communication. Serial communication protocols: I2C,CAN, USB, Parallel communication protocols: ISA, PCI. A Review of Embedded Automotive Protocols , CAN Protocol: Introduction, Features, Networks Organization, CAN Frame Types (Standard CAN Frame and Extended CAN Frame), Bus Arbitration and Different message types in CAN. FlexRay Protocol: Introduction, Features, Bus Level, Networks Organization, Flex Ray Frame.	6
3	**Drive By Wire:** Challenges and opportunities of X by Wire,System and design requirements steer by wire, brake by wire, suspension by wire, gas by wire, power by wire, and shift by wire. Future of automotive electronics.	5
4	**Introduction to Microcontrollers:** ARM cortex M microcontrollers family,STM32F103C8T6 features, Modes of operation, Functional block diagram overview, Programming model	8

Admission Year 2022-23

	Map Overview, Pulse width Modulator (PWM) and on chip ADC serial communication protocol: SCI, SPI, I2C, CAN.	
5	**Software Developments Tools:** Introduction to STM32CudeIDE. Student learning kit & PBMCU (Project board). Flashing code into STM32F103C8T6 board and testing. Simulating simple programs such as Switch Operation, Toggling of an LED, Breathing of LED's(PWM),CAN TX and RX.	6
6	**Case study :** Implementing Application Prototype: Power windows and automotive lighting system.Case Studies on Adaptive Cruise Control, Anti-lock brake system and Air Bag system in Automobiles.	5

Theory Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text Books:

1. Sarmad Naimi ,Muhammad Ali Mazidi, Sepehr Naimi STM32F103 Arm Microcontroller and Embedded Systems.
2. Shibu K.V,‖ Introduction to Embedded Systems‖, Mc Graw Hill, 2nd edition.
3. Automotive Electronics By Tom H.Denton
4. Automotive Electrical and Electronic Systems by John F. Kershaw, James D.
5. Halderman / Pearson Education
6. Automotive Embedded System Handbook by Nicolas Navet/CRC PRESS

Reference Books:

1. Distributed Automotive Embedded System
2. Embedded System Handbook by Richard Zurawski

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE312	**Additive Manufacturing for Engineering Applications**	3

Course Objectives:

1. Know the Principles, Methods, areas of usage, Possibilities and Limitations as well as environmental effects of the additive manufacturing technologies,
2. Be familiar with the characteristics of various materials that are used in AM technologies

Course Outcomes: Learner will be able to

1. Compare and contrast different additive manufacturing processes by explaining their working principles, materials used, accuracy, speed, and cost.
2. Identify and describe specific medical applications (e.g., prosthetics, implants, surgical guides etc.) of polymer and liquid-based additive manufacturing processes.
3. Gain knowledge of at least five additive manufacturing techniques used in aerospace and automotive industries. Provide examples of components produced using these techniques, and explain the benefits.
4. explain the hybrid manufacturing process by detailing examples where additive and subtractive manufacturing techniques are combined. Highlight the advantages and challenges of using hybrid manufacturing in industrial applications.
5. Learn and describe at least three specific applications of bio additive manufacturing in medical fields (e.g., tissue engineering, organ printing, drug delivery systems). Provide data on the success rates, challenges, and future prospects of these applications.
6. Analyze and summarize case studies (one from Automobile is mandatory) from different fields that demonstrate the real-life applications of additive manufacturing processes.

Theory Syllabus:

Module	Details	Hours
1	**Introduction:** Additive Manufacturing: Its background, features, characteristics and standardization. Different industries benefited from Additive Manufacturing Technology. Design for Additive manufacturing. New Materials used in Engineering Applications: Overview-history-materials-tooling-applications.	4
2	**Polymer - Based Additive Manufacturing :** Materials and Techniques used: Fused Deposition Modelling (FDM) or Fused Filament Fabrication (FFF), Direct ink writing (DIW) etc., and applications in the medical field (orthopedics, cardiovascular, drug delivery, ear-nose-throat, and tissue engineering etc.)	9

Admission Notification 2023

	Liquid Based Additive Manufacturing: Stereolithography: Apparatus-Principle, Process, Advantages, disadvantages and Applications.	
3	**Powder Based Additive Manufacturing: (Ceramic, polymer, Metal, Alloys)** Materials and Techniques used: Selective Laser Sintering (SLS) and Selective Laser Melting (SLM), Electron Beam Melting (EBM), Direct Energy Deposition (DED), Binder jetting etc. Applications in the automobile , aerospace industries.	8
4	**Hybrid Additive Manufacturing:** Need of Metal Hybrid Manufacturing Processes, various processes with applications in automobile industries.	9
5	**Bio-additive Manufacturing:** Image Developing and Processing Bio-additive Manufacturing, Customized Implants and Prosthesis, Design and Production, Computer Aided Tissue Engineering(CATE)	7
6	**Case Studies:** Case study on application in: 1. Automobile Industry 2. Aerospace Industry 3. Mechanical 4. Civil 5. Biomedical 6. Energy 7. Consumer goods Minimum 3 case studies. Case study on Automotive Industry is compulsory. Rest two can be chosen from other options given.	2

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents / presentations (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum

Admission Year 2022-23

3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text /Reference Books:

1. ASTM International, "F2792-12a - Standard Terminology for Additive Manufacturing Technologies," Rapid Manuf. Assoc., pp. 10–12, 2013.
2. I. Gibson, D. Rosen, and B. Stucker, Additive Manufacturing Technologies. 2015.
3. Royal Academy of Engineering, "Additive Manufacturing: Opportunities and Constraints," in Additive Manufacturing: Opportunities and Constraints, 2013, no. May 2013, p. 21.
4. D. Eyers and K. Dotchev, "Technology review for mass customisation using rapid manufacturing," Assem. Autom., vol. 30, no. 1, pp. 39–46, 2010.
5. A. Rosochowski and A. Matuszak, "Rapid tooling: the state of the art," J. Mater. Process. Technol., vol. 106, no. 1–3, pp. 191–198, 2000.
6. J. W. Choi and N. Kim, "Clinical application of three-dimensional printing technology in craniofacial plastic surgery," Arch. Plast. Surg., vol. 42, no. 3, pp. 267–277, 2015.
7. Materialise, "AM software system and service provider." [Online]. Available: www.materialise.com
8. https://archive.nptel.ac.in/courses/112/103/112103306/#
9. https://archive.nptel.ac.in/courses/112/104/112104312/#
10. Additive Manufacturing-Applications for Metals and Composites, By K.R. Balasubramanian and V. Senthilkumar , IGI Global
11. Additive manufacturing for Advanced Applications by Pawan Sharma and Vishvesh Badhekha, CRC press Taylor and Francis group.
12. Additive Manufacturing for Chemical Sciences and Engineering, by Editors Suresh K. Bhargava, Seeram Ramakrishna, Milan Brandt, PR. Selvakannan , Springer
13. Additive manufacturing of polymer-based structures by extrusion technologies, Alianna Maguire, Neethu Pottackal, M.A.S.R. Saadi, Muhammad M. Rahman, Pulickel M. Ajayan, Oxford Open Materials Science, 2021, 1(1): itaa004

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE313	**Race Car Designing**	3

Course Objectives:
The objective is for engineers to understand the interaction and performance balance between the major vehicle subsystems including Chassis and Bodyworks, Powertrain, Drive train; to design and optimize the same

Course Outcome: Learner will be able to
1. Design wheels and tyres for selected layout
2. Design and optimise race car layout, chassis and seat
3. Design engine systems in context with race car
4. Design and optimise drivetrain and brakes.
5. Select and design suspension and steering systems
6. Get acquainted with vehicle set up and testing and gg diagrams.

Theory Syllabus:

Module	Details	Hours
1	**Introduction to race car designing** Basic layout used for racing cars, design methodology, location of CG loads acting on wheels, design of tyres for selected layout	7
2	**Chassis and Bodyworks** Types of Chassis, Chassis Loads, stress analysis of chassis design of chassis for crash safety, seat design and mountings design	7
3	**Powertrain** Engine systems, Design modifications in context with race car, Engine tuning, Engine management systems	6
4	**Drive Train and Brakes** Types of drives, gearbox design, differentials and brake design	7
5	**Suspension and Steering** Suspension selection, Suspension geometry and links, Optimising setup, uprights design, steering design	8
6	**Driver Vehicle Relations and Ergonomics** Vehicle Setup and testing, Vehicle and driver relation, Driver Safety, Ergonomics	5

Laboratory:
6-8 experiments based on the modules mentioned in the theory to be performed.

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.
End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.
1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum

Admission Year 2022-23

3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Lab Assessment:

Term Work: 25 marks

Term Work consists of experiments and/or assignments as decided by the Instructor. Students can also avail NPTEL or equivalent Certification for this course, which shall be considered in place of the assignment work.

Text Books:

1. Racing and sports car (chassis Design) - Michael Costin, David Phipps B T BATSFORD London
2. Race car design – Derek Seward, Palgrave, Macmillan Publishers
3. Tune to win – Caroll Smith, Aero publishers
4. Racing Car Vehicle Dynamics – Millikens and Millikens, SAE international

Reference Books:

1. Chassis Engineering/Chassis Design, Building & Tuning for High Performance Handling by Herb Adams
2. Competiton Car Suspension: Design, Construction, Tuning by Allan Staniforth
3. Race Car Chassis: Design and Construction [Powerpro] by Forbes Aird
4. Engineer to Win: The Essential Guide to Racing Car Materials Technology or How to Build Winners Which Don't Break by Carroll Smith
5. How to Make Your Car Handle by Fred Puhn
6. Supercharging, Turbocharging, & Nitrous Oxide Performance Handbook [Powerpro] by Earl Davis, Diane Davis
7. Maximum Boost: Designing, Testing, and Installing Turbocharger Systems by Corky Bell
8. Turbochargers by Hugh MacInnes
9. Supercharged! Design, Testing and Installation of Supercharger Systems by Corky Bell
10. Four-Stroke Performance Tuning by A. Graham Bell
11. Engine Management: Optimizing Carburettors, Fuel Injection and Ignition Systems by Dave Walker
12. Fiberglass & Composite Materials: An Enthusiast's Guide to High Performance Non-Metallic Materials for Automotive Racing and Marine Use by Forbes Aird
13. Racer's Encyclopedia of Metals, Fibers & Materials by Forbes Aird

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE314	**Electronics in Race Cars**	3

Course Objectives:
The objective is for engineers to know the electronics used in race cars to improve performance of the cars.

Course Outcomes: Learner will be able to

1. Comprehend the basics of electronics and control theory
2. Differentiate between types of sensors and actuators based on their function.
3. Interpret the working, use and types of ECUs
4. Setup a basic Data Acquisition System.
5. Gain knowledge about power train and vehicle motion control system
6. Know the principle and working of automotive instrumentation, telematics and navigation systems.

Module	Details	Hours
1	**Basics of Electronics and control theory** use of feedback in op amps, microprocessor, control theory and instrumentation, microcomputer applications in race cars, electronics control system diagnostics	8
2	**Sensors and Actuators in Automobiles** Types of sensors and their working, Types of actuators modelling of actuators	8
3	**Engine Control Unit (ECU) Fundamentals** Functions of an ECU, Working of ECU, Controlling engine parameters using ECU, Difference between Piggyback ECU & Standalone ECU, Speeduino (Arduino based programmable ECU) basics.	7
4	**Setup of DAQ system** Types of data acquisition systems, Requirements of DAQ system, software and hardware required, use of DAQ systems in race cars	5
5	**Power train and Vehicle motion control system** control modes for crank, warm up, acceleration deceleration, differential, hybrid electric powertrain control,Electronic cruise control, electronic steering, Electronic suspension control	7
6	**Telematics and navigation system** Automotive Instrumentation, telematics used in cars, GPS systems used in race cars, GPS structure	4

Laboratory:
6-8 experiments based on the modules mentioned in the theory to be performed

Theory Assessment:
Internal Assessment:
Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

Admission Year 2022-23

End Semester Examination:
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Lab Assessment:
Term Work: 25 marks
Term Work consists of experiments and/or assignments as decided by the Instructor. Students can also avail NPTEL or equivalent Certification for this course, which shall be considered in place of the assignment work.

Books/References:

1. Understanding Automotive Electronics (An Engineering Perspective) - William Ribbens, Butterworth Heinemann imprint of Elsevier
2. Analysis Techniques for Racecar Data Acquisition Second Edition - Jörge Segers SAE international
3. Automotive Mechatronics (Automotive Networking, Driving Stability Systems, Electronics) - Konrad Reif , Bosch Professional Automotive Information, Springer
4. Handbook of power electronics - Ali Emadi, CRC Press Taylor and Francis

Back to Scheme

Admission Year 22-23

Course Code	Course Name	Credits
AE315	**Fundamentals of Transportation Engineering**	3

Course Objectives:

1. To become familiar with transport system.
2. To be aware of the organisational structure of transport corporations and their interactions.
3. To learn about depot facilities and terminals.
4. To understand economic analysis of transport projects.
5. To provide knowledge of traffic control devices and its techniques in transportation interaction.

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. To gain knowledge about MVA and traffic rules.
2. To acquaint with concept of taxation in automotive industry.
3. To be conversant with different types of vehicle insurance.
4. Able to select effective and economic mode of transport.
5. Able to identify the roles of research organization in motor industry.
6. Familiarize with different traffic management techniques.

Admission Year 2022-23

Module	Details	Hours
1.	**Motor vehicle Act**: Short title, extent and commencement, terminologies, Licensing of driving motor vehicle, Necessity for driving licence, Responsibility of owner and drivers of different types of motor vehicle, Rules and regulation to issue different types of driving license, Extent of effectiveness of licences to drive motor vehicles, Powers of licensing authority , Powers of Honourable. Court (Judiciary) to disqualify licensing, Powers of state and central government to make rules, RTO forms, Rules regarding registration of motor vehicle (Different types of registration marks available in India eg. Temporary registration , Special provision for registration of motor vehicles of diplomatic officers , Effectiveness in India of registration and its transfer in various cases) , Maintenance of State Registers of Motor Vehicles , Penalties and offences under Motor vehicle act , Power of Central and State Government to make rules regarding construction and maintenance of vehicles, Provision of permit, Power of Central and State Government to make rules regarding permit, Power of Central Government to make rules regarding motor vehicles temporally leaving or visiting India, amendments in motor vehicle act 2019 .	08
2.	**Motor vehicle Taxation :** Short title, extent and commencement , Levy of tax (environment tax , Road Safe Cess) , Payment of tax and issuance of tax certificate , Payment of additional tax , Refund of tax, Special provision for fleet owners , Destination and utilisation of the proceeds of tax, Arrears of tax and interest recoverable as arrears of land revenue , Restrictions on use of motor vehicles in certain cases. , Power to seize and detain motor vehicle in case of non-payment of tax. , Exemptions, Power of Police Officer and the Motor Vehicles Department Officers , Penalty for possession or control of motor vehicle without payment of tax and interest for incomplete and untrue declaration, etc. , Other penalties, Compounding of offences.	06

3.	**Motor vehicle Insurance:** Need and objectives of insurance, Types of policies , Claims initiation and settlement (Total loss claim, third party claim, theft claim, Compromise settlement , Motor accident claims tribunal, Jurisdiction of MACT , Compensation settlement under MACT , Factors Affecting the Claim for Compensation of Motor Vehicle Accident in India, Duties of Owner and driver in case of accident, Section 64UM of the Insurance Act , Surveyor and loss assessor duties,	06
4.	**Passenger and Goods transport operation system:** Terms used in transportation like Transport and public service vehicle, Goods carriage vehicle. Methods of transportation and its comparison. Elements of transport management system: - Market potential, selection of vehicle, Organization set-up, Legal compliance, Policies of Government bodies towards Employee and passenger service, Bus and crew scheduling, Bus depot layout, Record keeping, Maintenance management of State Transport Undertaking (STU), Bus Rapid Transport system (BRTS), THE PETROLEUM ACT, 1934, Green corridor, importance and benefits of green corridor	06
5.	**Motor transport and research organization:** Structure of transport organization like, MSRTC. Functions of research organizations like Central institute of road transport, Automotive research association of India, Vehicle Research and Development Establishment, CRRI-Central Road Research Institute, Petroleum Conservation Research Association, Role of Engineer in Motor transport industry.	06
6.	**Traffic management and control system:** Basic components of traffic flow, road user, vehicle, environment and their characteristics, speed–volume–density relationship, homogenous and heterogonous traffic flow, PCU concept, vehicle operating cost, Traffic regulations,driver, vehicle,flow and general controls traffic devices control, signs, homogenous and heterogonous traffic flow, traffic management authorities, road lighting, Signalling system to manage traffic, GPS.	06

Admission Year 2022-23

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Kadiyali, L.R., Traffic Engineering & Transport Planning, Khanna Publishers, New Delhi

2. Jotin Khisty, S.C. and Kent Lall, B., Transportation Engineering – An Introduction, Prentice-Hall, NJ
3. S.C. Saxena Traffic Planning and Design. Dhanpat Rai Pub, New Delhi Reference Books:
4. Hutchison, B.G., Introduction to Transportation Engineering, & Planning, McGraw Hill Book Co.
5. John W. Dickey, Metropolitan Transportation Planning, Tata McGraw Hill Pub. Co.
6. Vukan R. Vuchic, Urban Public Transportation System & Technology, Prentice Hall, Inc.
7. Papacostas, C.S., Fundamentals of Transportation System Analysis, PHI
8. Economics of Transport, S.K. Shrivastava
9. Transport Development in India, S. Chand & Co. Pvt. Ltd., New Delhi.
10. Peter R. White: Public Transport: Its Planning, Management and operation (Natural and Built Environment Series, Kindle Edition, September 2008.)
11. John Doke-Fleet Management
12. Kitchin L.D. - Bus Operation, Illiffe and sons Co. London, III edition.
13. Sudarshan, P. -Passenger Amenities in STU, Manual of Central Institute of Road Transport, Pune.
14. Sudarshan, P. -Bus Station management, Manual of Central Institute of Road Transport, Pune.
15. Sudarshan, P. -Bus and Crew Scheduling, Manual of Central Institute of Road Transport, Pune.
16. Minorstry of transport,Central M.V Rules 1989, Central Government, Govt of India.
17. Kitchin, L. D., Bus Operation, Iliffe and Sons Ltd. London,2nd Edition,1952,ISBN No.9780408028103
18. Rex W, Faulks, Bus and Coach operation, Butterworth Heinneman,1987.1st edition,1952,ISBN No.9780408028103
19. Khilery, V. S., Sharma Satpal, Gupta Shaman, Motor Vehicle Act And Transport Management, Ishan Publication,1st Edition, ISBN No.13:978-9381551950.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE316	**Motor Vehicles Acts & Loss Assessments**	3

Course Objectives:

1. To study in detail about transport authority and its hierarchy.
2. To study rules and regulation regarding Construction and maintenance of motor vehicle
3. To study in detail about vehicle insurance types.
4. To study claim compensation procedure.

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. Able to identify the roles of Transport authority and its functioning.
2. To be conscious about rules and regulations about construction of motor vehicle.
3. To commiserate with the guidelines for different offences & penalty procedure for traffic control.
4. To be conversant with different types of vehicle insurance.
5. To be wise with Vehicle Impact analysis Analysis of an accidental vehicle.
6. To be aware about claim procedure for assessing various losses of accidental vehicle.

Module	Details	Hours
1	**Transport Authority:** Different transport authority and its functions, Anatomy of different types of vehicle, Permit and its types, Provisions regarding issuance of permit, Provisions for state and transport undertakings , Power of Central and State Government to make rules regarding permit, Motor vehicle department and its operational hierarchy.	06
2	**Construction and maintenance of motor vehicle**: Rules and regulation regarding construction of motor vehicle, Provisions regarding: Lamps, Brakes, Horn, Silencer, Mirror, Safety glass, Wind screen wiper, Tyres, Speedometer, Steering, Springing, Direction indicator and stop light, First Aid Box, Emission of smoke, vapour and grit, for attaching side-car to a motor-cycle, Power of Central and State Government to make rules regarding construction and maintenance of vehicles	08
3	**Traffic offences and Traffic control:** Limits of Speed and loading limit of vehicle with respect to power to weight ratio, Provisions regarding vehicle with Left-hand control, The duties of driver and owner. The provisions regarding 1. Motor vehicle temporarily leaving or visiting India. 2. Payment of compensation on the principle of no fault. 3. Punishment of offences. 4. Disobedience, obstruction and refusal of information 5. Allowing driving of vehicle by unauthorized person 6. Offences relating to Licences 7. Using the vehicle without registration of permit 8. Driving the vehicle exceeding permissible weight 9. Driving the uninsured vehicle 10. Power to detain the vehicles used without certificate of registration of permit. Guide Line for following offences such as: 1. Driving recklessly or dangerously 2. Driving while under the influence of drink or drugs	08

Admission Year 2022-23

	3. Taking part in unauthorized race or trial of speed 4. Driving when disqualified 5. Obtaining or applying for a licence without giving particulars of endorsement 6. Failing to stop the occurrence of an accident. 7. Basic components of traffic flow, road user, vehicle, environment and their characteristics, speed–volume–density relationship, homogeneous and heterogeneous traffic flow, PCU concept, vehicle operating cost, Traffic regulations,driver, vehicle,flow and general controls traffic devices control, signs	
4	**Vehicle insurance types:** Origin, history and development of insurance, Act liability only, Third party only. Comprehensive policy. Policies with Zero Depreciation Option, Policy term and condition.	06
5	**Vehicle Impact analysis:** Causes of accidents. Effect of Impact from any one side Head on collision. Vehicle topples. Failure of vehicle. Detailed analysis has to be done.	06
6	**Insurance survey and claim investigation:** Claims initiation and settlement (Total loss claim, third party claim, theft claim, Compromise settlement , Motor accident claims tribunal, Jurisdiction of MACT , Compensation settlement under MACT , Factors Affecting the Claim for Compensation of Motor Vehicle Accident in India, Duties of Owner and driver in case of accident, Section 64UM of the Insurance Act , Important aspects of survey , Fraud claims , Surveyor and loss assessor duties , Licensing authority and controller of insurance.	06

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Motor Vehicles Act, 1989 -Government of India.
2. The Gujarat Motor Vehicles Rules,1989-Government of Gujarat.
3. The Central Motor Vehicle Rules,1989-Government of India.
4. Universal's Legal Manual, "Motor Vehicles laws (Act and Regulations) ISBN-978-81-7534-936-0", Universal Law Publishing Co. Pvt Ltd.
5. Dr. L. P. Gupta, "Insurance claims Solutions, ISBN-978-9383303038",.
6. Rudolf Limpert, "Motor vehicle Accident Reconstruction & Cause Analysis 7th Addition", Lexisnexis Publication.

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE317	**Supply Chain management**	3

Course Objectives:

1. To learn objectives of supply chain management and its interrelationships within companies.
2. To study logistics, Warehousing, transportation, outsourcing

Course Outcomes: Learner will be able to

1. Compare the primary difference between logistics and supply chain management
2. Evaluate the fundamental elements and functions of the supply chain.
3. Design supply chain for various industries considering facility locations.
4. Correlate the individual processes of supply chain management
5. Develop the logistics and warehouse transportation strategy.
6. Compare the traditional SCM and Green/Sustainable SCM in manufacturing industries.

Module	Details	Hours
1	**Objectives of a Supply Chain:** Stages of Supply chain, Value Chain Process, Cycle view of Supply Chain Process, Key issues in SCM, logistics & SCM, Supply Chain Drivers and obstacles, Supply chain strategies, strategic fit, Best practices in SCM, Obstacles of streamlined SCM.	6
2	**Logistics:** Evolution, Objectives, Components and Functions of Logistics Management, Distribution related Issues and Challenges; Gaining competitive advantage through Logistics Management, Transportation-Functions, Costs, and Mode; Network and Decision, Containerization, Cross docking.	8
3	**Supply Chain Performance:** Bullwhip effect and reduction, Performance measurement: Dimension, Tools of performance measurement, SCOR Model. Demand chain management, Global Supply chain- Challenges in establishing Global Supply Chain, Factors that influence designing Global Supply Chain Network.	7
4	**Warehousing:** Concept and types, Warehousing strategy, Warehouse facility location & network design, Reverse logistics, Outsourcing-Nature and concept, Strategic decision to Outsourcing, Third party logistics (3PL), Fourth party logistics (4PL).	7
5	**Supply Chain and CRM**: Linkage, IT infrastructure used for Supply Chain and CRM, Functional components for CRM, Green supply chain management, Supply Chain sustainability.	6
6	**Emerging Areas in SCM**:Difference between traditional supply chain management and trending supply chain management Green Supply chain management system design and development in Manufacturing industries Sustainable Supply Chain management system design and development in Manufacturing industries	6

Assessment:
Internal Assessment:

Admission Year 2022-23

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Chopra, Sunil, Meindl, Peter and Kalra, D. V.; Supply Chain Management: Strategy, Planning 1. and Operation; Pearson Education
2. Altekar, Rahul V.; Supply Chain Management: Concepts and Cases
3. Ballou, Ronald H.; Supply Chain Management; Pearson Education
4. Sahay, B.S.; Supply Chain Management; Macmillan
5. Ballou, R.H. Business Logistics Management. Prentice-Hall Inc.
6. Bowersox D.J., Closs D.J., Logistical Management, McGraw-Hill, 1996; Chopra, S, and P. Meindl, 2004, Supply Chain Management Strategy, Planning and Operation, 2nd edition, Pearson Education (ISBN 81-297-0172-3)

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE318	**Production & Operations management**	3

Course Objectives:

1. To provide an exposure to Production Planning & Systems and its significance in Manufacturing Industries
2. To give exposure to forecasting methods, aggregate planning and capacity planning techniques.
3. To give insights of various inventory control techniques and system approach of MRP
4. To give exposure to production scheduling and sequencing so as to optimize resources
5. To understand heuristics methods for design of manufacturing system.

Course Outcomes: Learner will be able to

1. Understand the role of Production/Operations Management in business processes.
2. Learn various production processes and service systems
3. Do the quantitative analysis of problems arising in the management of operations
4. To learn the scientific decision making and modern trend in the management process
5. To study Inventory Management and its types.
6. Learn various manufacturing operation systems.

Module	Details	Hours
1	**Introduction to production management**: Objectives; Introduction; Production Management; Scope of Production Management; Production System; Types of Production; Benefits of Production Management;Responsibility of a Production Manager; Decisions of Production Management	6
2	**Production planning and control**: Objectives of Production Planning and Control; Characteristics; Stages of Production Planning and Control; Functions /scope of production planning & Control; Challenges in Production Planning and Control; Factors Affecting Production Planning and Control; Production Planning System; Making the Production Plan; Process Planning; Manufacturing Planning and Control System; Role of Production Planning and Control in Manufacturing Industry	8
3	**Project Analysis**: Project Controlling and Project Control Systems; Types of Project Management; Role Technique - CPM/PERT; Planning, Scheduling & Control; The Framework for PERT and CPM; CPM/PERT Network; Tabulation & Analysis of Activities; PERT Calculations for the Social Project; Estimating Risk; Expected Length of a Project; Probability of Project Completion by Due Date	6
4	**Plant location and layout**: Factors affecting location, theory and practices, cost factor in location - Plant layout principles - space requirement; Different types of facilities; Innovation Management - Function and Intention of Innovation Management; Classifications in Innovation Management; Phases of an Innovation Management Process;Uses of Innovation Management; Aggregate Product Planning	6
5	**Manufacturing Operation systems**: Aggregate Planning, Master Production schedule (MPS), Material Requirements planning (MRP-1), Capacity Requirements Planning (CRP), Production Activity control (PAC), Shop Floor Control (SFC)	6

Admission Year 2022-23

6	**Inventory management:** Different Types of Inventory; Need for Inventory Management; Finished Goods Inventory; Independent and Dependent Demand Inventories; Inventory Costs; Inventory Classification; Factors affecting Inventory Operations; Inventory Planning; Good Inventory Management Practices; Inventory Management Techniques	6

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Books/References:

1. Operations Management by William J. Stevenson. Eighth Edition, Irwin / McGraw-Hill,2005.
2. Production and operations management by S.N. Chary
3. Production and operations management - manufacturing and services by Nicholas J. Aquilano and Richard B. Chase
4. Production and operations management by R. Panneerselvam

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE319	**Concept Sketching, Rendering and Modelling**	3

Course Objectives:

1. To conceptualise and develop design ideas
2. To communicate and be able to interpret graphical information

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. Build up different views starting from a point
2. Conceptualization and rendering of different automobiles and its parts.
3. Sketching for Automobiles
4. Animation and its types.
5. Concept modelling for graphical, physical and virtual models.

Theory Syllabus:

Module	Details	Hours
1	**Concept sketching:** Introduction to Prospective views, Single-point Perspective Two-Point Perspective, Horizon Lines, Importance of Perspective, Perspective Grids – How to Draw Equal Size Boxes in Perspective **Proportion:** Introduction, Working Out the Proportions, Box Design, One-Box, Two-Box, Three-Box Designs **Tools and Equipment:** Requirements, Usage & Importance of Papers, Pens/Pencils, markers, Colors, Guides & Templates	6
2	**Sketching for Automobiles** Copying and Tracing, Drawing views (Side, front, top etc.) **Case studies:** Role of Angle, Prospective, Proportion & stance (Comparison study of different companies and automobile models)	6
3	**Object Rendering:** Introduction Object-Rendering, Hardware requirements rendering **Texturing:** Different types of Texture. Render to texture tool. Various scene elements into texture Ray Tracing, Ray Casting, Radiosity **Lighting:** Types of lights spot, point, directional, natural, diffused, ambient Uses of Lighting, **Shades Shadows & Reflections Shading**: Flat Shading, Polygon Mesh Shading, Gouraud Shading Model, Phong Shading, Transparency Effect, Shadows	8
4	**Introduction to animation**, Key-Frame Animation, Construction of an Animation Sequence, Motion Control Methods, Procedural Animation, Key-Frame Animation vs. Procedural Animation, Introduction to Morphing, Three-Dimensional Morphing	6
5	**Concept Modeling:** Definition, Process, Types of models Graphical, Physical, Virtual **Case studies:** of different Automobile Models	5
6	**Course work submission:** Clay modeling / Digital modeling(2D using sketchbook and 3D using blender) of a concept from a sketch	6

Admission Year 2022-23

Theory Assessment:
Internal Assessment:
Internal Tests First based on approximately 40% of contents – **40 Marks**
End Semester Examination – Jury / Viva on a course project following can be marks distribution – Total 60 Marks (15 Marks each)

- File submission 6-8 assignments based on hand sketching different types of vehicles.
- Project submission on concept model – including hand sketches, Digital Sketches, Clay model (Min 1:20 to 1:15 scale)
- Final Concept Presentation / Poster / Demonstration in external viva
- Oral Examination in external.

Books/References:

1. The British Car Sketch Book, Barber Edward,Lulu.com,ISBN:9781716508011,
2. Sketching, BIS Publishers B.V.,ISBN:9789063695330, 9789063695330,2019
3. The Car Book, Dorling Kindersley Ltd, ISBN: 9781405361750, 1405361751,Edition: 2011
4. Design, Construction and Manufacture of Automobiles, Salzwasser - Verlag Gmbh, ISBN: 9783861952589, 9783861952589

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Credits
AE320	**Introduction to Self Driving Cars**	3

Course Objectives:

1. To Understand fundamentals of self-driving/autonomous cars
2. To Identify the main components of Hardware and Software
3. To familiarize with concepts of Functional safety and automotive cyber security

Course Outcomes: Learner will be able to…

1. Understand levels of Autonomy
2. Identify the main components of Hardware used in Self-driving cars
3. Apply the data gathered from Hardware (Sensors) to perceive the dynamic environment
4. Understand the architecture and safety environment of vehicles.
5. Apply the knowledge gathered to prepare and test the vehicle environment.
6. Describe the importance of functional safety and automobile cyber security from the perspective of self-driving vehicles

Module	Details	Hours
1	**Introduction to Self-driving Technology and Background** History of Self-driving vehicles, SAE Levels, Need, Challenges of Self-driving cars, the Basic framework of Self-driving cars,	4
2	**Hardware** Sensors: Considerations and types of sensors Automotive Radar and Lidar Computation platform: considerations and few examples of computing platforms Actuators: Components of actuator interfacing,	8
3	**Perception** Localisation, Mapping, SLAM, Object detection, Multi-sensor data fusion	6
4	**Architecture** Functional Architecture: Perception, Planning(Route, Behavioral, Motion) and Vehicle control **What is ADAS?** ADAS, Adaptive cruise control, Blind spot detection, Occupant and pedestrian protection, Lane departure warning,360 surround view, Driver monitoring, Driver drowsiness assists, Emergency brake assist System architecture: Hardware layer, Middleware layer, and Application layer ROS (Robotic Operation System)	8
5	**Bringing everything together** Preparation: Choose vehicle, Vehicle network, Sensor selection, and calibration Development: OSCC, Installing middleware and drivers, Map building and localization, Reading data and sending commands. Testing: Unit, Integration testing, system and acceptance testing Road runner environment in MATLAB/Simulink	6
6	**Future technological aspects:** Automotive Functional safety: ISO26262 and challenges Automotive Cybersecurity: Standards and Challenges	8

Admission Year 2022-23

	V2X communication: Standards and challenges Backend systems (OTA, HD Maps)	

Assessment:

Internal Assessment:

Consisting of Two Compulsory Tests First test based on approximately 40% of contents and second test based on remaining contents (approximately 40% but excluding contents covered in Test I). Duration of each test shall be one hour and thirty minutes and would be for 40 marks.

End Semester Examination:

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the curriculum.

1. Question paper will comprise of four questions, each carrying 20 marks
2. Question 1 will be compulsory and should cover maximum contents of the curriculum
3. Remaining questions will be mixed in nature (for example if Q.2 has part (a) from module 3 then part (b) will be from any module other than module 3)
4. Only three questions need to be solved.

Duration of test will be two hours and would be for 60 marks

Text Books/References:

1. Theories and Practices of Self-driving vehicles, Zhou,Shen, Yong,Zhao and Zhi, Elsevier
2. Autonomous Vehicles: Opportunities, Strategies, and Disruptions, Michael E. McGrath
3. Driverless: Intelligent Cars and the Road Ahead, HOD Lipson and Melba Kurman, The MIT Press
4. Driver in the Driverless Car, Vivek Wadhwa and Alex Salkever, Berrett-Koehler Publishers
5. Self-Driving Car, Stephen Currie, Norwood House Press

Back to Scheme

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 360	Entrepreneurship	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 360	Entrepreneurship	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand the basic concepts of entrepreneurship.
2. To understand the role of entrepreneurship in economic development
3. To understand the importance of opportunity recognition and internal and external analyses to the success of a business venture
4. To enable the learners to know the factors contributed in failure of the enterprise

Course Outcomes: Learner will be able to

1. Analyse the business environment in order to identify business opportunities
2. Identify the elements of success of entrepreneurial ventures
3. Evaluate the effectiveness of different entrepreneurial strategies,
4. Interpret their own business plan

Module	Detailed Contents	Hrs
1	Conceptual definition of entrepreneurs and entrepreneurship, Advantages and Disadvantages of Being an Entrepreneur , Entrepreneurial motivation, Entrepreneurial characteristics	8
2	Recognizing, assessment and Exploiting the Opportunity, Conducting Internal and External Analyses, Determining the Feasibility of the Concept, Selecting a Marketing Strategy	6
3	Entrepreneurial Business Types A. Overview of Franchising and Their Advantages and Disadvantages B. Overview of Buyouts & Their Advantages and Disadvantages C. Overview of Family Businesses and Their Advantages and Disadvantages	6
4	The Overall Business Plan, Purpose of the Business Plan, Components of the Business Plan, Presentation of the Business Plan, Matching the Business Plan to the Needs of the Firm	6
5	The Marketing Plan, Conducting a Market Analysis, Understanding the Target Market, Reaching the Target Market through Locale and Engagement	8
6	Entrepreneurial failure, early stage failure, late stage failure	6

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

Admission Year 2022-23

End Semester Examination: 60 marks
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Reference Books:

1. Fundamentals of Entrepreneurship by H. Nandan, PHI
2. Entrepreneurship by Robert Hisrich, Michael Peters, Dean Shepherd, Sabyasachi Sinha, Mc Graw Hill
3. Why startups fail: A new roadmap for entrepreneurial success by Tom Eisenmann

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 361	E-Commerce and E-Business	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 361	E-Commerce and E-Business	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand the factors needed in order to be a successful in ecommerce
2. Identify advantages and disadvantages of technology choices such as merchant server software and electronic payment options.
3. Analyse features of existing e-commerce businesses, and propose future directions or innovations for specific businesses.

Course Outcomes: Learner will be able to

1. Appreciate the global nature and issues of electronic commerce as well as understand the rapid technological changes taking place.
2. Define and differentiate various types of E-commerce
3. Discuss various E-business Strategies.

Module	Detail Content	Hrs.
1	**E-commerce system:** Introduction- scope of electronics commerce, definition of e-commerce, difference between e-commerce and e-business, business models of e-commerce transactions. E-commerce infrastructure: client server technology, two tier client server architecture for e-commerce, drawbacks, three tier architecture for e-commerce.	8
2	**Business strategies for e-commerce:** Introduction- elements of e-commerce strategy, simplicity, mobile responsiveness, choosing e-commerce store platform, user-based focus, compliance and security measures, e-commerce strategy: strategy overview, strategy task, technology issues. Case study: Flipkart v/s Amazon, competitive edge, marketing strategy, sales strategy	8
3	**Design of E-commerce systems:** e-commerce types- electronic market, electronics data interchange EDI, modeling of e-commerce system, three tier component model of e-commerce system, e-commerce system design- data model, web modeling, database structure design, process model, user friendly design of e-commerce site.	7
4	**Technologies for e-commerce systems:** Introduction- technologies for e-commerce, PHS and Java script, SEO, Social Plugins, payment processes, SSL Encryption, hosting server, Service oriented architecture.	7
5	**Scalability of e-commerce systems:** Web scalability- Vertical scalability , horizontal scalability, Load balancing- working of load balancers, global server load balancers, cloud load balancing- goals of cloud balancing, automated cloud balancing. web caching and buffering	6

Admission Year 2022-23

6	**E-commerce system implementation:** E-commerce implementation, - website testing, web maintenance, web advertisement, copyright services, SMS alert services, bulk email services, Web personalization- techniques for gathering information, analysis techniques for website personalization, domain name registration and web hosting- different types of web hosting, different components of web hosting, features in web hosting.	6

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Reference Books:

1. Electronic Business and Electronic Commerce Management, 2nd edition, Dave Chaffey, Prentice Hall, 2006
2. Elias. M. Awad, " Electronic Commerce", Prentice-Hall of India Pvt Ltd.
3. E-Commerce Strategies, Technology and applications (David Whitley) Tata McGrawHill
4. E-business- theory and practise, Brahm Canzer, cengage learning
5. Secure e-commerce systems (Kindle edition), Amazon publishing, P S Lokhande, B B Meshram, first edition

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 362	Research Methodology	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 362	Research Methodology	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand Research and Research Process
2. To acquaint students with identifying problems for research and develop research strategies
3. To familiarize students with the techniques of data collection, analysis of data and interpretation

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

1. Prepare a preliminary research design for projects in their subject matter areas.
2. Accurately collect, analyse and report data.
3. Present complex data or situations clearly.
4. Review and analyse research findings.

Module	Detail Content	Hrs.
1	**Introduction and Basic Research Concepts** 1.1 Research – Definition; Concept of Construct, Postulate, Proposition, Thesis, Hypothesis, Law, Principle. Philosophy and validity of research 1.2 Objectives of Research 1.3 Characteristics of Research: Systematic, Valid, Verifiable, Empirical and Critical 1.4 Need of Research in Business and Social Sciences 1.5 Issues and Problems in Research	8
2	**Types of Research** 2.1. Pure and Applied Research 2.2. Descriptive and Explanatory Research 2.3. Analytical Research 2.4 Qualitative and Quantitative Approaches 2.5 Literature review 2.6 Developing the objectives.	8
3	**Research Design and Sample Design** 3.1 Research Design – Meaning, Types and Significance 3.2 Sample Design – Meaning and Significance Essentials of a good sampling Stages in Sample Design Sampling methods/techniques Sampling Errors	7
4	**Research Methodology**	8

Admission Year 2022-23

	4.1 Meaning of Research Methodology 4.2. Stages in Scientific Research Process: a. Identification and Selection of Research Problem b. Formulation of Research Problem c. Review of Literature d. Formulation of Hypothesis e. Formulation of research Design f. Sample Design g. Data Collection h. Data Analysis i. Hypothesis testing and Interpretation of Data j. Preparation of Research Report	
5	**Formulating Research Problem** 5.1 Considerations: Relevance, Interest, Data Availability, Choice of data, Analysis of data, Generalization and Interpretation of analysis.	4
6	**Outcome of Research** 6.1 Preparation of the report on conclusion reached. 6.2 Validity Testing & Ethical Issues 6.3 Suggestions and Recommendation 6.4 Identification of future scope	4

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Dawson, Catherine, 2002, Practical Research Methods, New Delhi, UBS Publishers Distributors.
2. Kothari, C.R.,1985, Research Methodology-Methods and Techniques, New Delhi, Wiley Eastern Limited.
3. Kumar, Ranjit, 2005, Research Methodology-A Step-by-Step Guide for Beginners, (2nded), Singapore, Pearson Education

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 363	Introduction to Bioengineering	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 363	Introduction to Bioengineering	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand and analyze the human body as a mechanical assembly of linkages and describe the fundamentals of biomechanics.
2. To Study the deformability, strength, visco elasticity of bone and flexible tissues, modes of loading and failure and describe the types and mechanics of skeletal joints.
3. To describe movement precisely, using well defined terms (kinematics) and also to consider the role of force in movement (kinetics).
4. To teach students the unique features of biological flows, especially constitutive laws and boundaries.
5. To teach students approximation methods in fluid mechanics and their constraints.
6. To consider the mechanics of orthopedic implants and joint replacement , mechanical properties of blood vessels and Alveoli mechanics

Course Outcomes: Learner will be able to

1. Apply a broad and coherent knowledge of the underlying principles and concepts of biomechanics, particularly in the fields of kinematics and kinetics as applied to human and projectile motion.
2. Understand and describe the properties of blood , bone and soft tissues like articular cartilage tendons and ligaments.
3. Gain broad knowledge about the mechanics of moving systems and familiarity with human anatomy to competently analyze gross movement of the human body.
4. Be able to computationally analyze the dynamics of human movement from the most commonly used measurement devices in the field, such as motion capture and force platform systems.
5. Use knowledge gained to competently interpret the current understanding of human movement and present recommendations for further study.

Admission Year 2022-23

Module	Detail Content	Hrs.
1	**Introduction:** Definition of Biomechanics, Selected Historical highlights, The Italian Renaissance, Gait century, Engineering Physiology & Anatomy	6
2	**Biomedical Instrumentation:** Patient monitoring system, Arrythmia and ambulatory monitoring instrumentation, cardiac pacemakers, cardiac defibrillators, physiotherapy and electrotherapy equipment, ventilators	8

3	**Medical Image Processing:** Introduction to X-rays based imaging systems, Magnetic Resonance Imaging (MRI), Positron Emission Tomography (PET), Single-Photon Emission Computerized Tomography (SPECT) scan, Computed Tomography (CT) scan and Ultrasound (sonography)	7
4	**Biomaterials:** Brief Anatomy, Bone, cartilage, ligament, tendon, Muscles, biofluid their physical properties	6
5	**Implants:** General concepts of Implants, classification of implants, Soft tissues	6
6	Application of advanced engineering techniques to the human body, case studies.	6

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Nigg, B.M.and Herzog, W., "BIOMECHANICS of Musculo skeleton system", John Willey & Sons, 1st Edition.
2. Saltzman, W.L., "BIOMEDICAL ENGINEERING: Bridging medicine and Technology", Cambridge Text, First Edition.
3. Winter, D., "BIOMECHANICS and Motor Control of Human Movement", WILEY Interscience Second edition
4. Prof. Ghista,Biomechanics, Private Publication UAF, 2009
5. White &Puyator, Biomechanics, Private publication UAE, 2010
6. R. M. Kennedy, A textbook of Biomedical Engineering, GTU, 2010
7. Richard Shalak & ShuChien, Handbook of Bioengineering,
8. Sean P. Flanagan, Flanagan, Biomechanics: A case based Approach, Jones & Bartlett Publishers, 2013
9. Y. C. Fung, Yuan-Cheng Fung, Biomechanics: mechanical Property of living Tissue, Springer, 1996.
10. Carol A. Oatis, The Mechanics and Pathomechanics of Human Movement, Lippincott Williams & Wilkins, 2010

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 364	Biomedical Instrumentation	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 364	Biomedical Instrumentation	40	40	40	60	-	-	--	100

Course Objectives:

1. Develop a fundamental understanding of human physiology and anatomy to comprehend the sources of biomedical signals and their role in medical diagnosis and treatment.
2. Understand the origin and characteristics of bioelectric signals and learn about the various types of electrodes, biosensors, smart sensors, and biomedical recorders used in healthcare.
3. Gain knowledge of biomaterials, bone structure, composition, and the biomechanics of soft tissues and joints, as well as their applications in implants, prosthetics, and orthotics.
4. Learn about the operation and application of diagnostic instruments
5. Understand the principles and applications of therapeutic instruments
6. Study the integration of AI in healthcare.

Course Outcomes: Learner will be able to

1. Explain the fundamentals of human physiology and anatomy and identify the sources of biomedical signals critical to medical diagnostics and instrumentation.
2. Analyze the structure and properties of biomaterials, bones, soft tissues, and joints, and evaluate their applications in developing implants, prosthetics, and orthotic devices.
3. Describe the principles, design, and functionality of basic and intelligent medical instrumentation systems.
4. Assess the functionality and clinical applications of diagnostic instruments.
5. Explain the working principles and applications of therapeutic instruments.
6. Illustrate the role of artificial intelligence in healthcare.

Module	Detail Content	Hrs
1	**Fundamentals of Bioengineering:** A brief on human physiology and anatomy, sources of biomedical signals, basic medical instrumentation system, intelligent medical instrumentation systems, regulation of medical devices.	6

Admission Year 2022-23

2	**Biomaterials and Biomechanics:** Introduction to biomaterials, Bone structure & composition, Structure and functions of Soft Tissues, types of joint , Implants, Prosthetics and orthotics.	6
3	**Bioelectric signals and electrodes:** Origin of Bioelectrical signals, Recording electrodes, Microelectrodes, Biosensors, Smart Sensors, Biomedical recorders.	8
4	**Introduction to Diagnostics Instruments:** Patient monitoring system, Arrythmia and ambulatory monitoring instrumentation, oximeters, Blood flowmeter, Cardiac output measurement, Pulmonary analyzers, Blood gas analyzers, Blood cell counters.	7
5	**Introduction to Therapeutic Instruments:** cardiac pacemakers, cardiac defibrillators, instruments for surgery, physiotherapy and electrotherapy equipment, hemodialysis machine, ventilators	6
6	**AI for Health care:** Medical Imaging, Surgical Assistance, Personalized medicine, Wearable Devices and monitoring, Healthcare management system	6

Assessment:
Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. "Handbook of Biomedical Instrumentation" by R. S. Khandpur
2. "Biomedical Instrumentation and Measurements" by Leslie Cromwell, Fred J. Weibell, and Erich A. Pfeiffer
3. "Medical Instrumentation: Application and Design" by John G. Webster
4. "Biomechanics: Principles and Applications" by Donald R. Peterson and Joseph D. Bronzino
5. "Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again" by Eric Topol.

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 365	Design of Experiments	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 365	Design of Experiments	40	40	40	60	-	-	--	100

Course Objectives:

1. To understand the issues and principles of Design of Experiments (DOE)
2. To list the guidelines for designing experiments
3. To become familiar with methodologies that can be used in conjunction with experimental designs for robustness and optimization

Course Outcomes: Learner will be able to…

1. Fundamentals of experiments and its uses
2. Basic statistics including ANOVA and regression
3. Experimental designs such as RCBD, BIBD, Latin square, factorial and fractional factorial designs.
4. Apply statistical models in analyzing experimental data
5. RSM to optimize response of interest from an experiment
6. Use software such as Minitab

Module	Detailed Contents	Hrs
1	**Introduction** 1. Why experiment? 2. Terms and Component of Experiment 3. Experimental Units and Responses 4. Types of Data ,Plots and Charts 5. Importance of Product Reliability 6. Uncertainty of Measurement 7. Classification of DOE 8. Software for DOE 9. Principle of Experimental Design 10. Types of Experimental Design	08
2	**Basic Statistics and ANOVA** 1. Random Variable and Probability Distribution 2. Normal Distribution 3. Sampling Distribution 4. Estimation	08

Admission Year 2022-23

	5. Hypothesis Testing 6. Determination of Sample size 7. Analysis of Variance(ANOVA) 8. Estimation of model parameters and Adequacy test 9. ANOVA-Pair wise comparison and Tukey's and Fishers LSD test 10. Two way ANOVA 11. Multi way ANOVA 12. Determination of Sample Size for ANOVA	
3	**Regression** 1. Introduction to Multiple Linear Regression(MLR) 2. Sampling distribution of Regression coefficients 3. MLR: Hypothesis testing and Model Adequacy Test 4. MLR:Diagnostic and Testing for Lack of Fit 5. Regression approach to ANOVA	07
4	**Experimental Designs** 1. Randomized Complete block design (RCBD) 2. RCBD-Estimation of Parameters 3. RCBD-Balanced Incomplete block design(BIBD) 4. RCBD-Latin square design 5. Introduction to Factorial Design 6. Statistical Analysis of Factorial Design 7. Estimation of parameters and Model Adequacy test 8. Full factorial design 9. Two level factorial design 10. Statistical Analysis of the 2^k Design 11. Blocking and Confounding in the 2^k Design 12. Fractional Factorial Design	08
5	**Response Surface Methods and Designs** 1. Introduction to Response Surface Methodology 2. RSM-First order model 3. Experimental design for fitting Response Surfaces 4. RSM-Fitting Second order model 5. Analysis of Second order RSM	06
6	**Taguchi Approach** 1. Crossed Array Designs and Signal-to-Noise Ratios 2. Analysis Methods 3. Robust design examples	04

Admission Year 2022-23

Assessment:
Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks

2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Raymond H. Mayers, Douglas C. Montgomery, Christine M. Anderson-Cook, Response Surface Methodology: Process and Product Optimization using Designed Experiment, 3rd edition,John Wiley & Sons, New York, 2001
2. D.C. Montgomery, Design and Analysis of Experiments, 5th edition, John Wiley & Sons, New York, 2001
3. George E P Box, J Stuart Hunter, William G Hunter, Statistics for Experimenters: Design, Innovation and Discovery, 2 nd Ed. Wiley
4. W J Diamond, Practical Experiment Designs for Engineers and Scientists, John Wiley and Sons Inc. ISBN: 0-471-39054-2
5. Design and Analysis of Experiments (Springer text in Statistics), Springer by A.M. Dean, and D. T.Voss

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 466	Design for Sustainability	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 466	Design for Sustainability	40	40	40	60	-	-	--	100

Course Objectives:

1. Understand the complex environmental, economic, and social issues related to sustainable engineering
2. Become aware of concepts, analytical methods/models, and resources for evaluating and comparing sustainability implications of engineering activities
3. Critically evaluate existing and new methods
4. Develop sustainable engineering solutions by applying methods and tools to research a specific system design
5. Clearly communicate results related to their research on sustainable engineering

Course Outcomes: Learner will be able to

1. Account for different theoretical and applied design principles and models for sustainable design
2. Account for and critically relate to sustainable design from an ethical, cultural and historical perspective
3. Critically review different design solutions ecological, social and economical consequences, risks, possible uses and functions in the work for a sustainable development
4. Independently apply a specific design theory on a specific challenge within the sustainability field.

Module	Detailed Contents	Hrs
1	Introduction - Need, Evolution of sustainability within Design, environmental - economic sustainability concept, Challenges for sustainable development, Environmental agreement & protocols	6
2	Product Life Cycle Design – Life Cycle Assessment, Methods & Strategies, Software Tools	6
3	Sustainable Product - Service System Design, Definition, Types & Examples ,Transition Path and Challenges, Methods and Tools, Design thinking and design process for sustainable development	8
4	Design for Sustainability – Engineering Design Criteria and Guidelines	6
5	Design for Sustainability – Architecture, Agriculture, Cities & Communities, Carbon Footprint	6
6	Green Building Technologies - Necessity, Principles, low energy materials, effective systems	6

Admission Year 2022-23

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. C. Vezzoli, System Design for sustainability. Theory, methods and tools for a sustainable / satisfaction system/design, Rimini, Maggioli Edition, 2007.
2. C. Vezzoli and E. Manzini, Design for Environmental Sustainability, Springer – Verlag, London, 2008.
3. L. Nin and C. Vezzoli, Designing Sustainable Product-Service Systems for all. Milan: Libreria, CLUP, 2005
4. A. Tukker and U. Tischner (eds.), New Business for Old Europe, Product Services, Sustainability and Competitiveness, Greenleaf Publishing, Shefield, 2008.
5. A. Tukker, M. Charter, C. Vezzoli, E. Sto and M.M. Andersen (eds.), System innovation for Sustainability Perspective on Radical Changes to sustainable consumption and production, Greenleaf Publishing, Shefield, 2008
6. UNEP, Product-Service Systems and Sustainability. Opportunities for sustainable solutions, CEDEX, Paris, 2002, at http://www.uneptie.org/pc/sustain/reports/pss/pss-imp-7.pdf

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 367	Political Science	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 367	Political Science	40	40	40	60	-	-	--	100

Course Objectives:

1. Provide a good grounding in the basic concepts of Political Theory.
2. Familiarize learners with fundamental rights and duties.
3. Teach students the structure and process of the electoral system, the features and trends of the party system and create an awareness of the social movements in India.
4. To inculcate the values of renowned thinkers on law, freedom of thought and social justice.
5. To prepare the learners for understanding the importance of Comparative Government and Politics.
6. To train learners in understanding International Relations.

Course Outcomes: Learner will be able to

1. Acquire conceptual and theoretical knowledge in the basic concepts of political theory.
2. Demonstrate understanding of fundamental rights and duties and directive principles.
3. Perform successfully in expressing the process of the electoral system, the features and trends of the party system and the importance of the social movements in India.
4. Illustrate the contribution of renowned thinkers and relate it to the current scenario.
5. Compare and contrast Indian Government and Politics with European countries.
6. Develop an understanding of International Relations with respect to Indian foreign policy.

Module	Detail Content	Hrs.
1	Understanding Political Theory- Evolution of State, Nation, Sovereignty, Types and Linkages between Power and Authority; Interrelationships between Law. Liberty, Equality, Rights; Justice and Freedom, Democracy vs Authoritarianism	4
2	Constitutional Government in India - Evolution of the Indian Constitution, Fundamental Rights and Duties. Directive Principles. Union-State Relations, Union Legislature: Rajya Sabha, Lok Sabha: Organisation, Functions – Law making procedure, Parliamentary procedure, Government in states: Governor, Chief Minister and Council of Ministers: position and functions – State Legislature: composition and functions. Judiciary: Supreme Court and the High Courts: composition and functions – Judicial activism. Constitutional amendment. Major recommendations of National Commission to Review the Working of the Constitution.	6

Admission Year 2022-23

3	Politics in India: Structures and Processes- Party system: features and trends – major national political parties in India: ideologies and programmes. Coalition politics in India: nature and trends. Electoral process: Election Commission: composition, functions, role. Electoral reforms. Role of business groups, working class, peasants in Indian politics, Role of (a) religion (b) language (c) caste (d) tribe. Regionalism in Indian politics. New Social Movements since the 1970s: (a) environmental movements (b) women's movements (c) human rights movements.	6
4	Indian Political Thought- Ancient Indian Political ideas: overview. Kautilya: Saptanga theory, Dandaniti, Diplomacy. Medieval political thought in India: overview (with reference to Barani and Abul Fazal). Legitimacy of kingship. Principle of Syncretism, Modern Indian thought: Rammohun Roy as pioneer of Indian liberalism – his views on rule of law, freedom of thought and social justice. Bankim Chandra Chattopadhyay, Vivekananda and Rabindranath Tagore: views on nationalism. M.K. Gandhi: views on State, Swaraj, Satyagraha.	7
5	Comparative Government and Politics- Evolution of Comparative Politics. Scope, purposes and methods of comparison. Distinction between Comparative Government and Comparative Politics.	6
6	Perspectives on International Relations- Understanding International Relations: outline of its evolution as academic discipline. Major theories: (a) Classical Realism and Neo-Realism (b) Dependency (c) World Systems theory. Emergent issues: (a) Development (b) Environment (c) Terrorism (d) Migration. Making of foreign policy. Indian foreign policy: major phases: 1947-1962; 1962-1991; 1991-till date. Sino-Indian relations; Indo-US relations.	7

Revision Year 2022-23

Assessments:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. O.P. Gauba. (2021). *An Introduction to Political Theory*. Mayur books
2. Vibhuti Bhushan Mishra. (1987). *Evolution of the Constitutional History of India (1773-1947 : With Special Reference to the Role of the Indian National Congress and the Minorities).* South Asia Books
3. Chetna Sharma Pushpa Singh. (2019). *Comparative Government and Politics.* SAGE Publications India Pvt Ltd.
4. Henry R. Nau. (1900). *Perspectives on International Relations: Power, Institutions and Ideas*. CQ Press

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 368	Visual Art	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 368	Visual Art	40	40	40	60	-	-	--	100

Course Objectives:

1. To enable learners to develop aesthetic judgement, visual perception, critical thinking skills in the different forms of art and understand its application.
2. To promote the concept of visual design and understand the different meanings assigned to colours, its impact and problems.
3. To provide the opportunity and scope to use the image editing software for creating images for Web and Video.
4. To inculcate the basic skills required in drawing and painting through exposure in nature and study of still objects.
5. To train students to express their feelings and write imaginatively.
6. To prepare the learners for the use of clay modelling techniques and its industrial applications.

Course Outcomes: Learner will be able to

1. Acquire the skills necessary for aesthetic judgement, visual perception and critical thinking required in different forms of art.
2. Demonstrate the understanding of the concept of visual design with respect to the different meanings assigned to colours and the problems associated.
3. Illustrate effective use of image editing software for creating images for the Web and Video.
4. Determine the importance of drawing and painting with respect to nature and still objects.
5. Perform successfully in expressing their feelings creatively.
6. Develop the techniques required for clay modelling and sculpture for industrial use.

Module	Detail Content	Hrs.
1	History of Art and Architecture- Changing needs and forms of art from the Palaeolithic period to The Renaissance period with special reference to Roman, Indian and Chinese art	4
2	Introduction and concepts of visual design with special emphasis on the psychological impact of colour	5
3	Introduction to image editing software, tools, application and creating Images for Web and Video. With special reference to Adobe Photoshop	7
4	Fundamentals of Drawing- study of forms in nature, study of objects and study from life, creative painting- basic techniques, tools and equipment, medium of painting.	6

Admission Year 2022-23

5	Creative writing- Movie critique, book reviews, Poems, short plays and skits, Humorous Essays, Autobiography and short stories.	7
6	Creative sculpture- Introduction to clay modelling techniques, study of natural and man-made objects in clay, Sculpture with various materials - Relief in Metal Sheets – Relief on Wood – Paper Pulp - Thermocol. Sculpture with readymade materials.	7

Assessments:
Internal Assessment: 40 marks
End Semester Examination: 60 marks
.

Reference Books:

1. Gill Martha. (2000). Color Harmony Pastels: A Guidebook for Creating Great Color Combinations. Rockport Publishers.
2. Janson, Anthony F. (1977). History of art, second edition, H.W. Janson. Instructor's manual. Englewood Cliffs, N.J.: Prentice-Hall.
3. Brommer, Gerald F. (1988). Exploring Drawing. Worcester, Massachusetts: Davis Publications.
4. Wendy Burt Thomas. (2010). The Everything Creative Writing Book: All you need to know to write novels, plays, short stories, screenplays, poems, articles, or blogs: All You Need ... - Stories, Screenplays, Blogs and More. Fw Media; 2nd edition.
5. Élisabeth Bonvalot. (2020). Sculpting Book: A Complete Introduction to Modeling the Human Figure.

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 369	Modern Day Sensor Physics	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 369	Modern Day Sensor Physics	40	40	40	60	-	-	--	100

Course Objectives:

1. Acquire knowledge about the principles and analysis of sensors.
2. Emphasis on characteristics and response of micro sensors.
3. Acquire adequate knowledge of different transducers and Actuators.
4. Learn about the Micro sensors and Micro actuators.
5. Selection of sensor materials for fabrication for different applications

Course Outcomes: On successful completion of course learner/student will be able to:

1. Analyze the basics and design the resistive sensors.
2. Identify the materials and designing of inductive and Capacitive Sensors.
3. Analyze various types of Actuators.
4. Design Micro sensors and Micro Actuators for various applications.
5. Implement fabrication process and technologies and compare various Micro machining processes

Module	Detail Content	Hrs.
1	**Fundamentals of Sensors :** Difference Between Sensor, Transducer And Actuators- Classification Of Sensors: Proprioceptive And Exteroceptive – Active And Passive– Contact And Non-Contact, Selection And Characteristics: Range; Resolution, Sensitivity, Error, Repeatability, Linearity And Accuracy, Primary Sensing Elements.	6
2	**Temperature sensors:** Principle of operation, construction details, characteristics and applications of Bimetallic thermometer, Resistance thermometer, Thermistor, Thermocouples and Total radiation Pyrometers	8
3	**Strain, Force, Torque and Pressure Sensors** Strain gauges, strain gauge beam force sensor, piezoelectric force sensor, load cell, torque sensor, Piezo- resistive and capacitive pressure sensor, Manometer, vacuum sensors, Pirani gauge.	6

Admission Year 2022-23

4	**Displacement, Level and Flow Sensors** **Displacement Sensors:** LVDT, RVDT, eddy current, transverse inductive, Hall Effect, magneto resistive, magnetostrictive sensors. **Liquid level sensor**: Fabry Perot sensor, ultrasonic sensor, capacitive liquid level sensor. **Flow sensors**: pressure gradient technique, ultrasonic, electromagnetic sensors and Hot wire anemometer. Micro flow sensor, Coriolis mass flow and drag flow sensor.	8
5	**Micro Machining Technologies** Overview of silicon processes techniques, Photolithography, Ion Implantation, and Diffusion, Chemical Vapor Deposition, Physical vapor Deposition, Epitaxy, Etching, Bulk micromachining, Surface Micromachining, LIGA and other techniques.	6
6	**Actuators** Definition, types and selection of Actuators; linear; rotary; Logical and Continuous Actuators, Pneumatic actuator, Hydraulic actuator - Control valves and cylinders Electrical actuating systems: Solenoids, Electric Motors- D.C motors - AC motors - Three Phase Induction Motor, Stepper motors -Piezoelectric Actuator.	5

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/Reference:

1. Robert H Bishop, “The Mechatronics Hand Book”, CRC Press, 2002.
2. Thomas. G. Bekwith and Lewis Buck.N, “Mechanical Measurements”, Oxford and IBH publishing Co. Pvt. Ltd.,
3. Massood Tabib and Azar, “Microactuators Electrical, Magnetic, thermal, optical, mechanical, chemical and smart structures”, First edition, Kluwer academic publishers, Springer, 1999.
4. Manfred Kohl, Shape Memory Actuators, first edition, Springer.
5. Patranabis.D, Sensors and Transducers, Wheeler publisher, 1994.

Admission year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 370	Energy Audit and Management	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 370	Energy Audit and Management	40	40	40	60	-	-	--	100

Course Objectives:

1. To impart basic knowledge to the students about current energy scenario, energy conservation, audit and management.
2. To inculcate among the students systematic knowledge and skill about assessing the energy efficiency, energy auditing and energy management.
3. To introduce performance evaluation criteria of various electrical and thermal installations to facilitate the energy management
4. To relate the data collected during performance evaluation of systems for identification of energy saving opportunities.

Course Outcomes: Upon successful completion of this course, the learner will be able to

1. To identify and describe the present state of energy security and its importance.
2. To identify and describe the basic principles and methodologies adopted in energy audit of an utility
3. To describe the energy performance evaluation of some common electrical installations and identify the energy saving opportunities.
4. To describe the energy performance evaluation of some common thermal installations and identify the energy saving opportunities.
5. To analyze the data collected during performance evaluation and recommend energy saving measures

Module	Detail Content	Hrs.
1	**Energy Scenario:** Energy needs of growing economy, Long term energy scenario, Energy pricing, Energy sector reforms, Energy and environment: Air pollution, Climate change, Energy security, Energy conservation and its importance, Energy strategy for the future, Energy conservation Act2001 and its features.	4
2	**Energy Management and Audit:** Definition, Energy audit- need, Types of energy audit, Energy management (audit) approach-understanding energy costs, Bench marking, Energy performance, Matching energy use to requirement, Maximizing system efficiencies, Optimizing the input energy requirements, Fuel and energy substitution, Energy audit instruments.	10

Admission Year 2022-23

	Material and Energy balance: Facility as an energy system, Methods for preparing process flow, Material and energy balance diagrams. **Financial Management:** Investment-need, Appraisal and criteria, Financial analysis techniques- Simple payback period, Return on investment, Net present value, Internal rate of return, Cash flows, Risk and sensitivity analysis, Financing options, Energy performance contracts and role of ESCOs	
3	**Energy Management and Energy Conservation in Electrical System:** Electricity billing, Electrical load management and maximum demand Control; Power factor improvement, Energy efficient equipments and appliances, star ratings. Energy efficiency measures in lighting system, Lighting control: Occupancy sensors, daylight integration, and use of intelligent controllers. Energy conservation opportunities in: water pumps, industrial drives, induction motors, motor retrofitting, soft starters, variable speed drives.	10
4	**Energy Management and Energy Conservation in Thermal Systems:** Review of different thermal loads; Energy conservation opportunities in: Steam distribution system, Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system. General fuel economy measures in Boilers and furnaces, Waste heat recovery, use of insulation- types and application. HVAC system: Coefficient of performance, Capacity, factors affecting Refrigeration and Air Conditioning system performance and savings opportunities.	10
5	**Energy Performance Assessment: On site Performance evaluation techniques, Case studies based on:** Motors and variable speed drive, pumps, HVAC system calculations; Lighting System: Installed Load Efficacy Ratio (ILER) method, Financial Analysis.	3
6	**Energy conservation in Buildings: Energy Conservation Building Codes (ECBC):** Green Build Building, LEED rating, Application of NonConventional and Renewable Energy Sources	3

Admission Year 2022-23

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Handbook of Electrical Installation Practice, Geofry Stokes, Blackwell Science
2. Designing with light: Lighting Handbook, By Anil Valia, Lighting System
3. Energy Management Handbook, By W.C. Turner, John Wiley and Sons
4. Handbook on Energy Audits and Management, edited by A. K. Tyagi, Tata Energy Research Institute (TERI).
5. Energy Management Principles, C.B.Smith, Pergamon Press
6. Energy Conservation Guidebook, Dale R. Patrick, S. Fardo, Ray E. Richardson, Fairmont Press
7. Handbook of Energy Audits, Albert Thumann, W. J. Younger, T. Niehus, CRC Press

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 371	Maintenance of Electronics Equipment	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 371	Maintenance of Electronics Equipment	40	40	40	60	-	-	--	100

Course Objectives:

1. To demonstrate use of different types of hand tools.
2. To understand testing of different active and passive components mounted on PCB
3. To understand functionality TTL and CMOS digital IC tester.
4. To demonstrate computer assembling, troubleshooting and software installation.
5. To understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting.
6. To understand concept of designing, manufacturing electronic circuit, medical equipment.

Course Outcomes:

1. Demonstrate use of different types of hand tools.
2. Understand testing of different active and passive components mounted on PCB.
3. Understand functionality TTL and CMOS digital IC tester.
4. Demonstrate computer assembling, troubleshooting and software installation.
5. Understand/demonstrate concept of circuit diagram of LED/LCD TV, DTH and mobile phone troubleshooting.
6. Understand concept of designing, manufacturing electronic circuit, medical equipment.

Detailed Lab/Tutorial Description: Students will have to perform six to eight experiments / tutorials in lab from the following list and write journal as a term work.

SN	Detailed Lab/Tutorial Description	Hrs.
1	Demonstrate working, use of two instruments in electronics laboratory.	4
2	Test the performance of different passive electronic components (fixed/variable)	4
3	Test the performance of active electronic components like general purpose transistor/FET/MOSFET/SCR/ DIAC/TRIAC with DMM and CRO OR Components Tester	4
4	Verify the functionality of TTL and CMOS Digital IC's using IC tester	4

Admission Year 2022-23

5	Explore a datasheet of minimum any five electronics components and analog/ Digital IC's.	4
6	Draw the given regulated power supply circuit/ SMPS (from any television/fridge/ computer system/ laboratory etc)	4
7	Identify basic sections of a personal computer/Laptop	4
8	Demonstrate Assembling of Personal Computer/Laptop	4
9	Troubleshoot the booting process of computer system and install different hardware associated with computer (HDD, LAN Card, Audio System etc)	4
10	Study Installation of Software and Configure Internet	4
11	Explore circuit diagram of LED/LCD TV.	4
12	Demonstrate Installation of DTH system	4
13	Demonstrate installation Solar power system	4
14	Practice steps for mobile troubleshooting	4

In addition, the students will have to submit report in prescribed format and give presentation at the end of semester on any one of the following activity:

SN	Details of Activity	Hrs.
1	Design and assembling of small electronic project circuit on PCB. Students will learn design of circuit, its simulation, PCB design, PCB manufacturing, soldering of components, troubleshooting of the circuit.	12
2	Visit to medical equipment industry / laboratory	12

Assessments:
Internal Assessment: 40 marks
End Semester Examination: 60 marks

Books/References:

1. Troubleshooting and Maintenance of Electronics Equipment, Singh K. Sudeep, Katson Book, New Delhi, II edition, Reprint 2014
2. Mobile repairing Books, Manohar Lotia, BPB Publication, New Delhi , latest edition
3. Troubleshooting Electronic Equipment: Includes Repair and Maintenance, Second Edition, Khandpur R. S., Tata McGraw-Hill Education, New Delhi, India, latest edition.
4. Data Books, National semiconductor.
5. Modern Digital Electronics, Fourth edition, R. P. Jain, Tata McGraw-Hill Education, New Delhi, India.
6. Manuals of instruments in electronics laboratories.

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 372	Cooking and Nutrition	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 372	Cooking and Nutrition	40	40	40	60	-	-	--	100

Course Objectives: The course is aimed to

1. To understand nutrition and of health problems related to diet and various factors affect diet
2. To various statistical tools required to analyze the experimental data in nutrition and community research
3. Gain information about various food constituents, and changes that occur in them during food processing.
4. To gain food-related knowledge and skills so that they can organise and manage family resources effectively according to the needs and lifestyles of family members
5. To be able to make informed judgements and choices about the use of food available.
6. To create interest in the creative side and enjoyment of food and the skills necessary for food preparation and food preservation. And to be aware of relevant mandatory and other necessary safety and hygiene requirements

Course Outcomes: On successful completion of course learner/student will be able to

1. To understand the importance and mechanisms of the food components taking place during food processing,
2. To understand nutrition and of health problems related to diet and various factors affect diet
3. To aware how eating patterns and dietary needs depend on age and social group
4. Ability to assess the effectiveness and validity of claims made by advertisers
5. To enhance aesthetic and social sensitivity to dietary patterns and to develop an interest in the creative aspect and enjoyment of food
6. To develop skills necessary for food preparation and food preservation and knowledge of safety and hygiene requirements

Module	Detail Content	Hrs.
1	**Nutritional terms**: proteins (high biological and low biological value), carbohydrates (monosaccharide, disaccharide and polysaccharide), fats, vitamins (A, C, D, E, K, B group – thiamin, riboflavin, nicotinic acid and cobalamin), mineral elements (calcium, iron, phosphorous, potassium, sodium, iodide) water Sources and uses of food energy. Sources and functions of dietary fibre.	3
2	**Kitchen equipment & Kitchen planning:** Selection, Use and care of: modern cookers, thermostatic control and automatic time-controlled ovens, microwave ovens, slow electric cook pots, refrigerators and freezers, small kitchen equipment, e.g. knives, pans, small electrical	4

Admission Year 2022-23

	kitchen equipment, e.g. food processors, electric kettles, Advantages and disadvantages of microwave ovens, Organisation of cooking area and equipment for efficient work., Selection, Use and care of: work surfaces, flooring, walls and wall coverings, lighting, ventilation	
3	**Meal planning and guidelines:** Factors affecting food requirements, Planning and serving of family meals, Meals for different ages, occupations, cultures and religions, Special needs of: people with food allergies and intolerances, people with medical conditions linked to diet, such as diabetes, convalescents, vegetarians, including vegans and lacto-vegetarians, Meals for special occasions, festivals, packed meals, snacks, beverages, Use of herbs, spices and garnishes, Attractive presentation of food, Terminology describing recommended dietary intakes, e.g. Dietary Reference Value (DRV) and Reference Daily Intake (RDI).	6
4	**Strategic cooking**: Transfer of heat by conduction, convection and radiation. Principles involved in the different methods of cooking, baking, boiling, braising, cooking in a microwave oven, frying, grilling, poaching, pressure cooking, roasting, simmering, steaming, stewing, use of a slow cooker. Reasons for cooking food, Sensory properties of food (flavour, taste, texture), Effect of dry and moist heat on proteins, fats and oils, sugars and starches, and vitamins to include: caramelisation, coagulation dextrinization, enzymic and non-enzymic browning, gelatinisation, rancidity, smoking point, Preparation and cooking of food to preserve nutritive value, Economical use of food, equipment, fuel and labour.	6
5	**Convenience foods and Basic proportions:** Foods partly or totally prepared by a food manufacturer – dehydrated, tinned, frozen, ready-to-eat, Intelligent use of these foods, Advantages and disadvantages, Food additives – types and function, Packaging – types, materials used, Labelling – information found on labels, Importance of maintaining proportions, maintaining proportions for : Bakery products, melting, rubbing-in and whisking methods, Pastries – shortcrust, flaky and rough puff, Sauces – pouring and coating, roux and blended methods, Batters – thin (pouring) and coating, Sweet and savoury yeast products	5
6	**Food preservation & Kitchen safety and first aid**: Food preservation & Kitchen safety and first aid: Reasons for preserving food, Methods of preservation and an understanding of the principles involved: heating – canning, bottling; removal of moisture – dehydrating; reduction in temperature – freezing; chemical preservation – sugar, salt, vinegar; modified atmosphere packaging; irradiation; Awareness of potential danger areas in the kitchen. Safety precautions. First aid for burns and scalds, cuts, electric shock, fainting, shock.	5

Admission Year 2022-23

Assessment:

Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks

Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Fundamentals of Food and Nutrition by Tejmeet Rekhi, Heena Yadav
2. Food Process Engineering And Technology by Akash Pare, B L Mandhyan

Admission Year 2022-23

Course Code	Course Name	Scheme	Theory	Practical	Tutorial	Total
IL 373	Environmental Management	Contact Hours	3	-	-	3
		Credits	3	-	-	3

Course Code	Course Name	Examination Scheme							
		Theory Marks				Term Work	Practical	Oral	Total
		Internal Assessment			End Sem Exam				
		IA 1	IA 2	Average					
IL 373	Environmental Management	40	40	40	60	-	-	--	100

Objectives:

1. To promote the safety, health, and welfare of people and the environment through engineering professionals.
2. To encourage students to be productive and contributing members of the environmental profession as practitioners, entrepreneurs, researchers, or teachers.
3. To develop environmental awareness among students that meet specified engineering needs with consideration of public health, safety, and welfare, as well as global, environmental, and legal factors.

Outcomes: On successful completion of the course learner/student will be able to:

1. Understand core concepts and methods from ecological sciences and their application in environmental problem-solving.
2. Recognize different types of toxic substances and analyze toxicological information
3. Acquire and apply environmental knowledge to the engineering field as needed.
4. 4. Assist industries and projects in obtaining environmental clearance and compliance with other environmental laws.
5. Interpret appropriate environment-related legislation.
6. Develop a thorough understanding of practice and procedure followed by various enforcing agencies/bodies/countries.

Module	Detail Contents	Hrs.
1	**Fundamentals of Environmental Sciences** Definition, Principles, and Scope of Environmental Science. Structure and composition of the atmosphere, hydrosphere, lithosphere, and biosphere. Concept of Ecology- Ecosystem, Food chain, Food web, Ecological pyramid, Ecological succession, limiting factor, and carrying capacity. Global Environmental Concerns (Global warming, Loss in Bio-diversity, Ozone depletion, E-waste management) and Renewable Energy Resources (Solar Energy, Wind Energy, Hydrothermal Energy, etc.)	8
2	**Environmental Chemistry Toxic chemicals:** Pesticides and their classification and effects. Biochemical aspects of	8

Admission Year 2022-23

	heavy metals (Hg, Cd, Pb, Cr) and metalloids (As, Se), Sewage treatment, Concept of DO, BOD, and COD. Composition of air-chemical processes in the formation of inorganic and organic particulate matter, Thermochemical and photochemical reactions in the atmosphere, Oxygen and Ozone chemistry. Photochemical smog, Air Quality Index	
3	**Fundamentals of Environmental Management** Concept of Environmental Management, Need & Objective of Environmental Management, Role of Engineers in Environmental Management, Career Opportunities. The need for sustainable development, Sustainable Development Goals	5
4	**Scope of Environmental Management** Role and functions of Government as a planning and regulatory agency. Environment Quality Management and Corporate Environmental Responsibility. Total quality Environmental management: ISO 14000, EMS Certification. Environmental Management System Standards (ISO-14000 series). Environment and Social Management Plan	7
5	**Overview of Environmental Laws in India** Constitutional provisions in India (Articles 48A and 51A). Wildlife Protection Act, 1972 Indian Forest Act, Water (Prevention and Control of Pollution) Act, Air (Prevention and Control of Pollution) Act, Environmental (Protection) Act, 1986, The e-waste (Management) Rules 2016	5
6	**Environmental Conventions and Agreements** Stockholm Conference on Human Environment 1972, Montreal Protocol, 1987, Earth Summit at Rio de Janeiro, 1992, Agenda-21, Convention on Biodiversity (1992), UNFCCC, Kyoto Protocol, 1997, Copenhagen Summit, Paris Agreement, CITES.	6

Admission Year 2022-23

Assessment:
Internal Assessment: 40 marks

1. Consisting of One Compulsory Class Tests of 40 Marks
2. Continuous evaluation: Class Test/ Assignments / Quiz/ Case studies/ Seminar presentation of 40 Marks

End Semester Examination: 60 marks
Weightage of each module in the end semester examination will be proportional to the number of respective lecture hours mentioned in the syllabus.

Books/References:

1. Environmental Management: Principles and Practice, C J Barrow, Routledge Publishers London, 1999
2. A Handbook of Environmental Management Edited by Jon C. Lovett and David G.Oakwell, Edward Elgar Publishing
3. Environmental Management, V Ramachandra and Vijay Kulkarni, TERI Press

4. Indian Standard Environmental Management Systems — Requirements With Guidance For Use, Bureau of Indian Standards, February 2005
5. Environmental Management: An Indian Perspective, S N Chary and Vinod Vyasulu, Macmillan India, 2000

Admission Year 2022-23

Course Code	Course Name	Credits
AE392	**Major Project I**	**3**

Course Objectives:

1. To acquaint with the process of undertaking literature survey or market survey or feasibility study /industrial visit and identifying the problem
2. To familiarize the process of problem solving in a group
3. To acquaint with the process of applying basic engineering fundamental in the domain of practical applications
4. To inculcate the process of research

Course Outcomes: Learner will be able to

1. Do literature surveys based on market or feasibility study/industrial visit and identify the problem.
2. Apply basic engineering fundamentals in the domain of practical applications
3. Cultivate the habit of working in a team
4. Attempt a problem solution in the right approach.
5. Correlate the theoretical and experimental/simulations results and draw the proper inferences
6. Prepare project reports as per guidelines and with proper references/citations.
7. Exhibit and explain project ideas/models at various platforms.

Guidelines for Project

- Students should do literature survey/Market survey/ feasibility study/visit industry/analyze current trends and identify the problem for Project and finalize the project title in consultation with Guide/Supervisor.
- Students should use multiple literatures and understand the problem.
- Students should attempt a solution to the problem by experimental/simulation methods.
- The solution to be validated with proper justification and report to be compiled in standard format.

Assessment:

Project I should be assessed based on following points

1. Quality of problem selected
2. Clarity of Problem definition and Feasibility of problem solution
3. Relevance to the specialization
4. Clarity of objective and scope
5. Breadth and depth of literature survey
6. Societal importance
7. Presentation skill/ Question-answer session.

Project I should be assessed through a presentation by the student project group to a panel of Internal and External examiners appointed by the Head of the Department/Institute of respective Programme.

Back to Scheme

Admission Year 2022-23