ESTD. 1939

KARNATAK LAW SOCIETY'S

GOGTE INSTITUTE OF TECHNOLOGY

"JNANA GANGA" UDYAMBAG, BELAGAVI-590008,
KARNATAKA, INDIA.
Approved by AICTE and UGC
Permanently Affiliated and Autonomous Institution
Under
Visvesvaraya Technological University, Belagavi

www.git.edu

ESTD. 1979

3rd and 4th Semester B.E.

Aeronautical Engineering

Scheme and Syllabus (2021 Scheme)

INSTITUTION VISION

Gogte Institute of Technology shall stand out as an institution of excellence in technical education and in training individuals for outstanding caliber, character coupled with creativity and entrepreneurial skills.

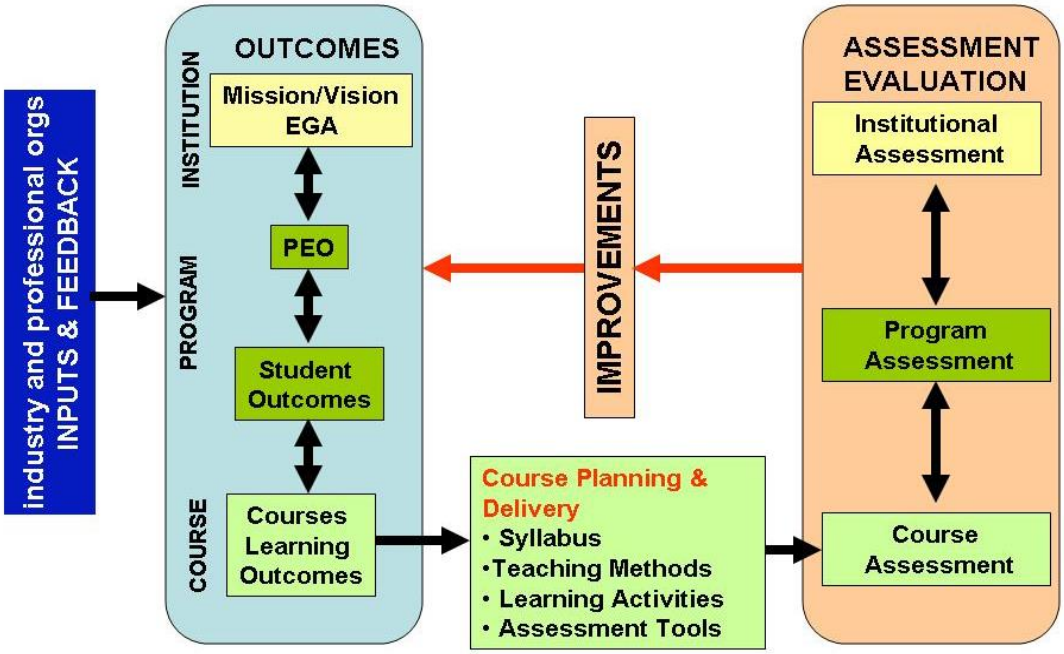
MISSION

To train the students to become Quality Engineers with High Standards of Professionalism and Ethics who have Positive Attitude, a Perfect blend of Techno-Managerial Skills and Problem solving ability with an analytical and innovative mindset.

QUALITY POLICY

- Imparting value added technical education with state-of-the-art technology in a congenial, disciplined and a research oriented environment.
- Fostering cultural, ethical, moral and social values in the human resources of the institution.
- Reinforcing our bonds with the Parents, Industry, Alumni, and to seek their suggestions for innovating and excelling in every sphere of quality education.

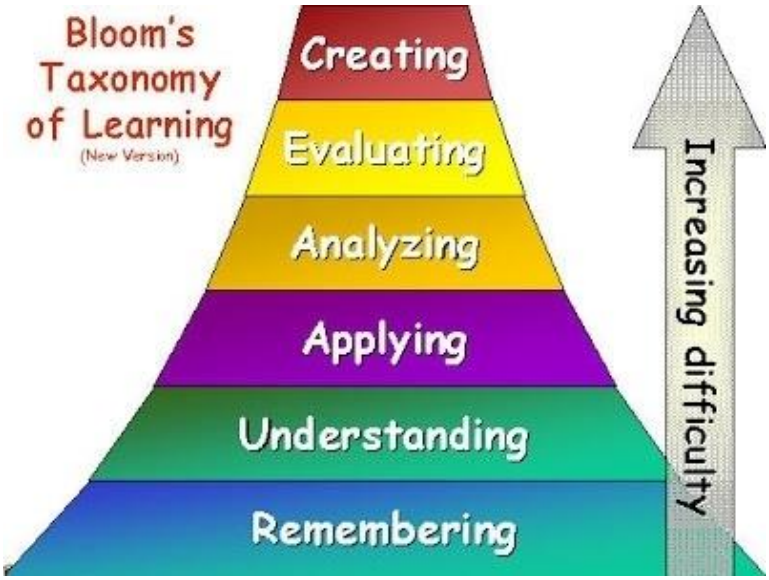
OUTCOME BASED EDUCATION (OBE)



BLOOM'S TAXONOMY OF LEARNING OBJECTIVES

Bloom's Taxonomy in its various forms represents the process of learning. It was developed in 1956 by Benjamin Bloom and modified during the 1990's by a new group of cognitive psychologists, led by Lorin Anderson (a former student of Bloom's) to make it relevant to the 21st century. The **revised taxonomy** given below emphasizes what a learner "Can Do".

Lower order thinking skills (LOTS)		
RE	Remembering	Retrieve relevant knowledge from memory.
UN	Understanding	Construct meaning from instructional material, including oral, written, and graphic communication.
AP	Applying	Carry out or use a procedure in a given situation – using learned knowledge.
Higher order thinking skills (HOTS)		
AN	Analyzing	Break down knowledge into its components and determine the relationships of the components to one another and then how they relate to an overall structure or task.
EV	Evaluating	Make judgments based on criteria and standards, using previously learned knowledge.
CR	Creating	Combining or reorganizing elements to form a coherent or functional whole or into a new pattern, structure or idea.



PROGRAM OUTCOMES:

National Board of Accreditation (NBA) has framed the Program Outcomes (PO) based on twelve Graduate Attributes (GA). These POs are generic to engineering education and applies to all branches of Engineering.

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 with an understanding of the limitations.

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

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

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

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

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

11. Project management and finance: Demonstrate knowledge and understanding of the engineering 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 lifelong learning in the broadest context of technological change.

KLS Gogte Institute of Technology
1st Year B.E. (Common to all programs)
Scheme of Teaching and Examination 2021-22
(Effective from the academic year 2021-22)

Total credits for B.E. Program: 160

As per the guidelines of UGC CBCS the courses can be classified into:

Abbreviations used:

BSC - Basic Science Course, **PCC-** Professional Core Course, **HSMC -** Humanity and Social Science & Management Courses, PEC- Professional Elective Course, **OEC –** Open Elective Course, **AEC –** Ability Enhancement Courses. **INT –** Internships, **UHV –**Universal Human Values, **MP -** Mini Project.
L –Lecture, **T –** Tutorial, **P-** Practical/Drawing, **S –** Self Study Component, **CIE –**Continuous Internal Evaluation, **SEE –**Semester End Examination

Foundation Courses: The Foundation Courses are of two kinds:
These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.
The courses are: **Basic Science Courses (BSC), Engineering Science Courses (ESC)**.

Professional Core Courses (PCC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

Universal Human Value Courses (UHV): These are value based courses aimed at man making education.
Humanities and Social Science including Management Studies Courses(HSMS). Humanity and Social Science Courses: The Humanities and Social Sciences are the studies of human behavior and interaction in social, cultural, environmental, economic, and political contexts. The Humanities and Social Sciences have a historical and contemporary focus, from personal to global contexts, and consider challenges for the future. Students will develop the ability to question, think critically, solve problems, communicate effectively, make decisions, and adapt to change. Thinking about and responding to issues requires an understanding of the key historical, geographical, political, economic, and societal factors involved, and how these different factors interrelate. Humanities and Social Science Courses includes-Technical-English, Courses on Regional/State languages (Kannada), etc.

Elective Courses: This is course, which can be chosen from the pool of papers. It may be supportive to the discipline/ providing extended scope/enabling an exposure to some other discipline / domain / nurturing student proficiency skills. These courses will have 3 credits per course.
An elective may be **Discipline Centric Course (PEC)** or may be chosen from other discipline (**Open Elective Course- OEC**).

Ability Enhancement Courses (AEC): The Ability Enhancement (AE) Courses may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC).
"AECC" courses are the courses based upon the content that leads to Knowledge enhancement; Environmental Science, English. Biology for Engineers, Bioinformatics, Music and Vibration, Art and Architecture etc
"SEC" courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

Mandatory Non-Credit Courses (MNC): These courses are mandatory but do not have any credits and students must successfully complete these courses before the completion of degree.

Credit definition:

Offline Courses	**Online Courses**
• 1 hour Lecture **(L)** per week = 1 Credit • 2 hours Tutorial **(T)** per week = 1 Credit, • 2 hours Practical /Drawing **(P)** per week = 1 Credit	04 weeks =1 Credit 08 weeks = 2 Credit 12 weeks = 3 Credit
• Four-credit courses are to be designed for 50 hours of Teaching-Learning process. • Three credit courses are to be designed for 40 hours of Teaching-Learning process. • Two credit courses are to be designed for 25 hours of Teaching-Learning process. • One credit courses are to be designed for 15 hours of Teaching-Learning process.	

Semester wise distribution of credits for B.E program

Year	Semester	Credits	Total/Year	Cumulative Credits
1st	AE, CV, ME (I-P & II-C)	19+21	40	40
	CSE, EC, EE, ISE (I-C & II-P)	18+22		
2nd	III	20	40	80
	IV	20		
3rd	V	23	45	125
	VI	22		
4th	VII	17	35	160
	VIII	18		
Total			160	

Curriculum frame work:

Structure of Undergraduate Engineering program

S.No.	Category of courses	KLSGIT Breakup of credits

1	Humanities and Social Sciences including Management courses (English, Kannada, Indian Constitution, Environmental Sciences and Management)	8
2	Basic Science courses	22
3	Engineering Science courses including workshop, drawing	20
4	Professional Core Courses	49
5	Professional Elective courses relevant to chosen specialization/branch	9
6	Open subjects – Electives from other technical, emerging, arts commerce and	9
7	Mini, Project, Major Project work and Seminar	9
8	Summer Internship and Research /Industrial Internship	20
9	Ability Enhancement Courses, including Research Methodology, NCC/NSS/ Sports/Ex- Curricular, Online Certification Course	12
10	Universal Human Values	2
	TOTAL	**160**

L-T-P Model for Courses

	Contact Hours				Credits	
S.No.	**L-T-P**	**Lecture**	**Tutorial**	**Practical**	**L-T-P**	**Total**
1	3 - 0 - 0	3	0	0	3 - 0 - 0	3
2	3 - 2 - 0	3	2	0	3 - 1 - 0	4
3	3 - 0 - 2	3	0	2	3 - 0 - 1	4
4	2 - 0 - 2	2	0	2	2 - 0 - 1	3
5	1 - 0 - 4	1	0	4	1 - 0 - 2	3

Theory courses having the corresponding lab are converted to integrated type course. Also, the electives (if possible) can also be made integrated type.

Integrated courses (Professional Core/Electives): Integrated courses will have **Theory Syllabus with Practical Syllabus of the same course**. Continuous Internal Evaluation (CIE) will be conducted for the practical topics. In such a course there could be **No Semester End Examination (SEE) for the practical syllabus** of the course.

KLS Gogte Institute of Technology
B.E. in Aeronautical Engineering
3rd and 4th Semester B.E. Scheme of Teaching and Examination 2021-22
(Effective from the academic year 2021-22)

Total credits for B.E. Program: 160

As per the guidelines of UGC CBCS the courses can be classified into:

Abbreviations used:

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These courses are the courses based upon the content that leads to Knowledge enhancement. These courses provide opportunities to improve technological knowledge before entering industry as well as preparing students for higher degrees in technological subjects. They are mandatory for all disciplines. These courses will have 4 credits per course.
The courses are: **Basic Science Courses (BSC), Engineering Science Courses (ESC)**.

Professional Core Courses (PCC): This is the course which is to be compulsorily studied by a student as a core requirement to complete the requirements of a program in a said discipline of study. These courses will have 4 credits per course.

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An elective may be **Discipline Centric Course (PEC)** or may be chosen from other discipline (**Open Elective Course- OEC**).

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Theory courses having the corresponding lab are converted to integrated type course. Also, the electives (if possible) can also be made integrated type.

Integrated courses (Professional Core/Electives): Integrated courses will have **Theory Syllabus with Practical Syllabus of the same course**. In such a course there could be **no Semester End Examination (SEE) for the practical syllabus** of the course, however, Continuous Internal Evaluation (CIE) will be conducted for the practical topics.

Credit definition:

Offline Courses	Online Courses
• 1-hour Lecture **(L)** per week = 1 Credit • 2 hoursTutorial **(T)** per week = 1 Credit, • 2 hours Practical /Drawing **(P)** per week = 1 Credit	04 weeks =1 Credit 08 weeks = 2 Credit 12 weeks = 3 Credit
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Semester wise distribution of credits for B.E program

Year	Semester	Credits	Total/Year	Cumulative Credits
1st	AE, CV, ME (I-P & II-C)	19+21	40	40
	CSE, EC, EE, ISE (I-C & II-P)	18+22		
2nd	III	20	40	80
	IV	20		
3rd	V	23	45	125
	VI	22		
4th	VII	17	35	160
	VIII	18		
Total			160	

Curriculum frame work:

Structure of Undergraduate Engineering program

S.No.	Category of courses	VTU Breakup of credits	KLSGIT Breakup of credits
1	Humanities and Social Sciences including Management courses (English, Kannada, Indian Constitution, Environmental Sciences and Management)	10	8
2	Basic Science courses	23	22
3	Engineering Science courses including workshop, drawing	20	20
4	Professional Core Courses	46	49
5	Professional Elective courses relevant to chosen specialization/branch	9	9
6	Open subjects – Electives from other technical, emerging, arts commerce and	6	9
7	Mini, Project, Major Project work and Seminar	13	9
8	Summer Internship and Research /Industrial Internship	20	20
9	Ability Enhancement Courses, including Research Methodology, NCC/NSS/ Sports/Ex- Curricular, Online Certification Course	11	12
10	Universal Human Values	2	2

	TOTAL	**160**	**160**

L-T-P Model for Courses

	Contact Hours				Credits	
S.No.	**L-T-P**	**Lecture**	**Tutorial**	**Practical**	**L-T-P**	**Total**
1	3 - 0 - 0	3	0	0	3 - 0 - 0	3
2	3 - 2 - 0	3	2	0	3 - 1 - 0	4
3	3 - 0 - 2	3	0	2	3 - 0 - 1	4
4	2 - 0 - 2	2	0	2	2 - 0 - 1	3
5	1 - 0 - 4	1	0	4	1 - 0 - 2	3

New Scheme of Teaching (Including branch specific additional course)

B.E. (Common to all branches)
Scheme of Teaching and Examination 2021-22

		1st Semester	**For AE,CV,ME – Physics Cycle**		Total contact hours/week				Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT11	Calculus and Linear Algebra	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21PHY12	Applied Physics	Physics	3	0	0	3	3	100	100	200
3	ESC	21CIV13	Engineering Mechanics	CV	3	0	0	3	3	100	100	200
4	ESC	21EME14	Basics of Mechanical Engg.	ME	3	0	0	3	3	100	100	200
5	ESC	21EGR15	Engineering Graphics	ME	1	0	4	5	3	100	100	200
6	BSC	21PHL16	Applied Physics Lab	Physics	0	0	2	2	1	50	50	100
7	AEC	21IIL17	Idea to Innovation Lab	Engg. Depts	1	0	2	3	1	100	-	100
8	HSMS	21ENG18	Communicative English	English	1	0	0	1	1	50	50	100
									19			

		2nd Semester	**For AE, CV, ME – Chemistry Cycle**		Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT21	Differential Equations and Laplace Transforms	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21CHE22	Applied Chemistry	Chemistry	3	0	0	3	3	100	100	200
3	ESC	21ELE23	Basics of Electrical and Electronics Engg.	E & E	3	0	0	3	3	100	100	200
4	ESC	21CCP24	Problem Solving using C	CSE & ISE	3	0	0	3	3	100	100	200
5	BSC	21CHL25	Chemistry Lab	Chemistry	0	0	2	2	1	50	50	100
6	ESC	21CPL26	C Programming Lab	CSE & ISE	0	0	2	2	1	50	50	100
7	ESC	21EEL27	Electrical and Electronics Engg. Lab	E & E	0	0	2	2	1	50	50	100
8	HSMS	21ENG28	Professional Writing Skills in English	English	1	0	0	1	1	50	50	100

9	AEC	21AEC29A1	Introduction to Innovation and Startup	Any Dept.	1	0	0	1	1	50	--	50
		21AEC29A2	Leadership and Public Speaking									
		21AEC29A3	Interpersonal Skills									
10	ESC	21AAE29B	Elements Of Aeronautics	AE	3	0	0	3	3	100	100	200
		21ACV29B	Basics of Civil Engineering	CV								
		21AME29B	Material Science and Engineering	ME								
									21			

		1st Semester	**For CSE, EC, EE and ISE – Chemistry Cycle**		Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT11	Calculus and Linear Algebra	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21CHE12	Applied Chemistry	Chemistry	3	0	0	3	3	100	100	200
3	ESC	21ELE13	Basics of Electrical and Electronics Engg.	E & E	3	0	0	3	3	100	100	200
4	ESC	21CCP14	Problem Solving using C	CSE & ISE	3	0	0	3	3	100	100	200
5	BSC	21CHL15	Chemistry Lab	Chemistry	0	0	2	2	1	50	50	100
6	ESC	21CPL16	C Programming Lab	CSE & ISE	0	0	2	2	1	50	50	100
7	ESC	21EEL17	Electrical and Electronics Engg. Lab	E & E	0	0	2	2	1	50	50	100
8	HSMS	21ENG18	Communicative English	English	1	0	0	1	1	50	50	100
9	AEC	21AEC191	Introduction to Innovation and Startup	Any Dept.	1	0	0	1	1	50	--	50
		21AEC192	Leadership and Public Speaking									
		21AEC193	Interpersonal Skills									
									18			

		2nd Semester	For CSE, EC, EE and ISE – Physics Cycle		Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title	Teaching Dept.	L	T	P			CIE	SEE	Total
1	BSC	21MAT21	Differential Equations and Laplace Transforms	Mathematics	3	2	0	5	4	100	100	200
2	BSC	21PHY22	Applied Physics	Physics	3	0	0	3	3	100	100	200
3	ESC	21CIV23	Engineering Mechanics	CV	3	0	0	3	3	100	100	200
4	ESC	21EME24	Basics of Mechanical Engg.	ME	3	0	0	3	3	100	100	200
5	ESC	21EGR25	Engineering Graphics	ME	1	0	4	5	3	100	100	200
6	BSC	21PHL26	Applied Physics Lab	Physics	0	0	2	2	1	50	50	100
7	AEC	21IIL27	Idea to Innovation Lab	All Engg. depts	0	0	2	2	1	100	--	100
8	HSMS	21ENG28	Professional Writing Skills in English	English	1	0	0	1	1	50	50	100
9	ESC	21ACS29	Object Oriented Programming Using C++	CSE	3	0	0	3	3	100	100	200
		21AEC29	Fundamentals of Electronics and Communication Engineering	E & C								
		21AEE29	Fundamentals of DC and AC Systems	E & E								
		21AIS29	Object Oriented Programming Using C++	ISE								
									22			

NOTE:

Summer Internship - I:

All the 1st year students admitted to B.E. program shall have to undergo a **mandatory summer internship of 03 weeks** during the vacation of II semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during III semester and the prescribed credit shall be included in III semesters. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. **SEE component will be the only seminar/Presentation and question answer session.** (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.

The course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs:

1. The **mandatory non – credit courses Additional Mathematics I and II (MATDIP) prescribed for III and IV semesters respectively**, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech., programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the **Continuous Internal Evaluation (CIE).** In case, any student fails to register for the said course/fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured an F grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.
2. All the students admitted under the lateral entry category shall have to undergo a mandatory **SUMMER INTERNSHIP-I of 03 weeks during the intervening vacation of III and IV semesters**. Summer Internship shall include Inter / Intra Institutional activities. A Vivavoce examination shall be conducted during the IV semester and the prescribed credit shall be included in the III semester after students clear this head. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

3rd Semester B.E				Teaching Dept.	Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title		L	T	P			CIE	SEE	Total
1	BSC	21AE31	Fourier Techniques, Partial differential Equations and Numerical Methods	Mathematics	3	0	0	3	3	100	100	200
2	PCC	21AE32	Mechanics of Materials	AE	3	0	2	5	4	100	100	200
3	PCC	21AE33	Fluid mechanics	AE	3	0	2	5	4	100	100	200
4	PCC	21AE34	Computer aided Aircraft Component's drawing	AE	3	0	2	5	4	100	100	200
5	INT	21INT1	**Summer Internship -I**	AE					2	50	50	100
6	**HSMS**	**21AE35**	**Kannada**	**Kannada**	**1**	**1**	**0**	**1**	**1**	50	50	100
			Constitution of India and Professional Ethics		**1**	**0**	**0**	**1**				
7	**UHV**	**21AE36**	**Universal Human Values**	**AE**	**1**	**0**	**0**	**1**	**1**	50	50	100
			Social Connect and Responsibility		1	0	0	1				
8	AEC	21AECAE37	Introduction to the MATLAB & SIMULINK	AE	0	0	2	2	1	50	50	100
9	BSC*	21MDIPAE-31	MATDIP	Mathematics	3	0	0	3	MNC	100	--	100
			TOTAL						20			

*Only for Diploma Lateral Entry Students

4th Semester B.E				Teaching Dept.	Hours/week			Total contact hours/week	Credits	Examination		
S.No.	Course Type	Course Code	Course Title		L	T	P			CIE	SEE	Total
1	BSC	21AE41	Statistics And Probability	Mathematics	3	0	0	3	3	100	100	200
2	PCC	21AE42	Aerodynamics	AE	3	0	2	5	4	100	100	200
3	PCC	21AE43	Aircraft structures	AE	3	0	2	5	4	100	100	200
4	PCC	21AE44	Engineering Thermodynamics	AE	3	0	2	5	4	100	100	200
5	**AEC**	**21AE45**	**Human Anatomy and Physiology**	**Medical Sciences**	**2**	**0**	**0**	**2**	**2**	50	50	100
6	**HSMS**	**21AE46**	**Constitution of India and Professional Ethics**	AE	1	0	0	1	1	50	50	100
			Kannada		1	1	0	1				
7	**UHV**	**21AE47**	**Social Connect and Responsibility**	AE	1	0	0	1	1	50	50	100
			Universal Human Values		1	0	0	1				
8	AEC	21AECAE48	Introduction to PYTHON	AE	0	0	2	2	1	50	50	100
9	BSC*	21MDIPAE-41	MATDIP	Mathematics	3	0	0	3	MNC	100	--	100
			TOTAL						20			

*Only for Diploma Lateral Entry Students

Summer Internship-II: At the End Of **fourth Semester four - weeks Summer Internship** Shall Be Carried Out – Based on Industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. It will be credited in fifth Semester. All the students admitted shall have to undergo mandatory internship of 04 weeks during the vacation of IV semesters. A Viva-Voce examination shall be conducted during V semester and the prescribed credit shall be included in V semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. SEE component will be the only seminar/Presentation and question answer session. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship).

Kannada: Balake Kannada (Kannada for communication) is for non-Kannada speaking, reading, and writing students, and Samskrutika Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Professional Elective Courses [5th-7th sem]: Elective will be offered by the respective department.

Open Elective Courses [5th-7th sem]: All Open Electives are offered to students of all branches in general. However, a student shall choose an open Elective from the list in such a manner that he/she has not studied the same course in any form during the Programme. Students can select any one of the open electives offered by other Departments except those that are offered by the parent Department.

Selection of an open elective shall not be allowed if,

- The candidate has studied the same course during the previous semesters of the programme.

- The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.
- Registration to electives shall be documented under the guidance of Programme Coordinator/ Advisor/Mentor.

Mini-project work(Single discipline/Interdisciplinary)[6th sem]: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini-project can be assigned to an individual student or a group having not more than 4 students. (or Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications)

Research/Industrial Internship - At the End of the sixth / Seventh semester (in two cycles to accommodate all the students of the University) Research/Industrial Internship shall be carried out – Based on industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo a mandatory internship of 24 weeks during the vacation of VI/VII semesters. A Viva-Voce examination shall be conducted during VII/VIII semester and the prescribed credit shall be included in VII/VIII semester. The internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements.

Research internship: Students have to take up research internships at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organizations / Institutes. A research internship is intended to give you the flavour of current research going on a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Certification (6- 8 weeks duration; Shall have proctored examination): **It can be done any time between 5th – 8th sem and credited during the 8th semester.**

NPTEL/SWAYAM/NASSCOM /Industry-Institute partnered certification. (List of the courses will be notified by the departments)

Fourier Techniques, Partial differential Equations and Numerical Methods

Course Code:	**21MAT31**	**Course type**	BSC	**Credits L-T-P**	3 – 0– 0
Hours/week: L-T-P	3 – 2– 0			**Total credits**	3
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives At the end of the course students should be able to	
1.	Get acquainted with the concept of Fourier series and transforms
2.	Get familiar with the concepts of applications of partial differential equations.
3.	Understand Numerical interpolation and integration.
4.	Understand Numerical techniques to solve Algebraic, Transcendental and Differential equations.
5.	Get familiar with various concepts connected to Z transforms and Calculus of variation.

Pre-requisites: Basic Trigonometry, Calculus, Algebra, Matrices.

Unit – I	**Contact Hours = 8 Hours**
Fourier Series: Drichlet's conditions, Fourier series, Half range Fourier sine and cosine series. Practical examples, Harmonic analysis. **Fourier transforms**: Infinite Fourier Transform and Properties. Fourier Sine and Cosine Transforms Properties and Problems	

Unit – II	**Contact Hours = 8 Hours**
Partial Differential Equations: Partial Differential Equations-Formation of PDE by elimination of arbitrary constants and arbitrary functions, Solution by method of separation of variables. Derivation of One dimensional Heat and Wave equations. Solutions of one dimensional Heat and Wave equations.	

Unit – III	**Contact Hours = 8 Hours**
Numerical Interpolation and Integration: Forward and Backward differences, Newton's Forward and Backward Interpolation Formulae, Divided Difference, Newton's Divided Difference Formula (without proof). Lagrange's Interpolation Formula. Illustrative examples. Numerical Integration: Newton- Cotes Quadrature formula, Trapezoidal rule, Simpsons $1/3^{rd}$ rule, Simpsons $3/8^{th}$ rule, Weddle's rule. Practical Examples	

Unit – IV	**Contact Hours = 8 Hours**
Numerical Solutions: Numerical solution of Algebraic and Transcendental equations**:** Method of false position, Newton-Raphson method (with derivation), Fixed point iteration method (without derivation).Numerical solution of Ordinary differential equations of first order **:** Taylor's Series method, Euler and Modified Euler method, Fourth order Runge–Kutta method	

Unit –V	Contact Hours = 8 Hours
Z transforms and Calculus of variations: Definition, Standard Z transforms, Linearity, Damping rule, Shifting properties, Initial and Final value Theorems-Examples. Inverse Z transforms and Solution of Difference Equations by Z transforms. Concept of a Functional, Extremal of a Functional, Euler's equation and equivalents. Standard problems. **Applications**: Geodesics, Hanging chain, Minimal surface of revolution and Brachiostochrone problem	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions					

Books	
	Text Books:
1.	B. S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
	Reference Books:
1.	B.V.Ramana –Engineering Mathematics, Tata Mcgrew Hill Publishing Company Limited 2004 and onwards.
	E-resource's (NPTEL/SWAYAM.. Any Other)- mention links
1.	https://onlinecourses.nptel.ac.in/noc22_ma74/preview
2.	https://onlinecourses.nptel.ac.in/noc22_ph42/preview

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)/Matlab
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	To **USE** Fourier Series to express a function in sines and cosines. To **APPLY** Fourier transforms for non periodic functions.	**Ap**	1	1
2.	To **UNDERSTAND** and **USE** the methods to solve PDE	**Ap**	1	1

3.	To **APPLY** the concepts related to finite differences with numerical data.	**Ap**	1	1
4.	To **USE** Numerical methods to solve algebraic and transcendental equations and differential equations.	**Ap**	1	1
5.	**Use** Z transforms for discrete signals and calculus of variations for optimization problems.	**Ap**	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/Matlab	Course Seminar	Total Marks
Marks	25+25= 50	4* 5 marks = 20	10+10 =20	10	100
OBA- Open Book Assignment **Minimum score to be eligible for CIE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1(Low)	**60% of the students score Less than 50 % of the total marks.**
2(Medium)	**60% of the students score 50 – 70 % of the total marks.**
3(High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													**CO-PSO Mapping(Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	**√**										**√**	**√**	**√**		
2	**√**										**√**	**√**	**√**		
3	**√**										**√**	**√**	**√**		
4	**√**										**√**	**√**	**√**		
5	**√**										**√**	**√**	**√**		

Mechanics of Materials

Course Code	21AE32	**Course type**	**PCC**	**Credits L-T-P**	3 - 0 - 1
Hours/week: L - T- P	3 - 0 - 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	Explain basic concept of stress, strain, transformation of stress/strain and strength of materials.
2.	Teach the concepts and calculation of shear force, bending moments, deflections and stresses in the beams due to various loading and boundary conditions.
3.	Introduction to the concept of torsion and shear stresses in shafts.
4.	Introduction to the concept of buckling of simple columns subjected to various boundary conditions

Required Knowledge of : Engineering Mechanics, Engineering Mathematics

Unit – I	**Contact Hours = 8 Hours**
Concept of Stress: Introduction, definition, Types of Stresses: Normal stress and shear stress, Uni-axial, Bi-axial and Tri-axial stresses, plane stress condition, bearing stress. **Concept of strain**: Introduction, Type of Strains: Normal strain, shear strain, Lateral strain, Longitudinal strain, Volumetric strain. Introduction to strain energy, **Analysis of Bars:** Deformation of bars under axial loading, Analysis of stepped bar. **Stress-Strain Relations:** Hooke's Law, Stress-strain diagrams, Elastic Limit, Poisson's Ratio, Modulus of elasticity, Bulk Modulus, Modulus of Rigidity, Factor of Safety, Margin of Safety. Introduction to Mechanical Properties of Aircraft Materials.	

Unit – II	**Contact Hours = 8 Hours**
Thermal Stresses: Deformation, Stress and Strain due to Temperature difference. Temperature stresses in composite bars. **Transformation of Stresses (2D):** Stresses on oblique plane, Principal Stresses and planes, Maximum shear stress and planes, Mohr's Stress Circle. **Theories of failure:** Maximum principal stress theory, maximum shear stress theory, maximum strain theory, maximum strain energy theory and maximum shear strain energy theory.	

Unit – III	**Contact Hours = 8 Hours**
Types of Loads: Point load, UDL, UVL, Couple**. Types of Support:** Simply support, fixed, hinged, roller supports, Internal hinge, Shear force and bending moment diagram for various types of beams with various support conditions subjected to different loads.	

Unit – IV	**Contact Hours = 8 Hours**
Bending Stresses in the beam: Introduction, Pure Bending, Theory of Simple Bending, Bending Stress Equation, Section Modulus, Bending of composite sections. **Shear stresses:** Shear stress equation, shear stress distribution in various cross sections. **Deflection:** Deflection in simply supported and cantilevers beams with concentrated loads, and uniformly distributed loads by Double integral Method, Macaulay's method, moment area method.	

Unit – V	Contact Hours = 8 Hours
Torsion of Circular Shafts and Elastic Stability of Columns: Introduction, Pure torsion, derivation of torsional equations, torsional rigidity/stiffness of shafts. Power transmitted by solid and hollow circular shafts. **Columns:** Euler's theory for axially loaded elastic long columns. Derivation of Euler's load for hinged ends conditions only, Numerical on Euler's formula for different end conditions, limitations of Euler's theory. Derivation of Rankine's Equation. Introduction to the Beam-Columns.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	01	02	02	03	02

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	5	1. Tensile test on Mild Steel
		2. Compression test on Wooden Block
		3. Shear of bars
		4. Hardness Test: Rockwell, Brinell, Vickers.
		5. Impact Test: Izod and Charpy
4	2	6. Deflection of beams
		7. Experimental evaluation of Young's modulus using beam set-up.
5	2	8. Torsion of Shaft
		9. Buckling of Long Column

Unit No.	Self-Study Topics
I	Analysis of tapered bars (Circular and Rectangular) under axial load, Analysis of bars under self-weight
II	Stresses in thin-walled pressure vessel.
III	Relation between load intensity, shear force and bending moment, Point of contra-flexure. Overhang beams.
IV	Section modulus for T, I sections, Shear stresses in circular sections
V	Buckling load for Euler's column with various support conditions, Buckling of column with eccentric axial load

Books	
	Text Books:
1.	R. C. Hibbeler, "Mechanics of Materials", Prentice Hall. Pearson Edu. 9th edition, 2005 ISBN-13: 978-9332584037
2.	Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kumar Jain, "Mechanics of Materials" Laxmi Publications Pvt. Ltd. 1st edition, 2016.
3.	James M. Gere, "Mechanics of Materials", Thomson, Fifth edition 2004.
4.	Andrew Pytel, Jaan Kiusalaas, "Mechanics of Materials", Cengage Learning Publishers, 2011.
	Reference Books:
1.	S. S. Rattan , "Strength of Materials", Tata McGraw Hill, 2009

2.	S.S.Bhavikatti , "Strength of Materials", Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
3.	Ferdinand Beer & Russell Johnston, "Mechanics of Materials", McGraw Hill Education India Private Limited; Seventh edition, 2017.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL course: Strength of Materials, by Dr. Satish C Sharma, IIT Roorkee. https://nptel.ac.in/courses/112107146
2.	NPTEL course: Mechanics of Materials by Dr. U Saravanan, IIT Madras. https://nptel.ac.in/courses/105106172/
3.	Mechanics of Solids by Prof. Priyanka Ghosh, IIT Kanpur. https://onlinecourses.nptel.ac.in/noc22_ce46/preview

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs) **Learning Levels:** **Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create**				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Explain and evaluate the mechanical properties of the materials	AN	1,2,3,8,9,10	1
2.	Explain the basic concept of various loads, stresses, strains, and transformation of stresses for various structures.	UN	1, 2	1
3.	Describe and calculate the shear force and bending moment variation for different beams, loads and draw shear force and bending moment diagram.	AP	1, 2	1
4.	Calculate or evaluate experimentally deformations, slopes, stresses, and strains for a given bar/beam/shaft/column structure under various loading conditions.	AN	1, 2, 3,8,9,10	1

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks

IA Test: 1. No objective part in IA question paper 2. All questions descriptive
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks
Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1 (Low)	**50 % of the total marks is scored by 60% of the students. (% can be varied)**
2 (Medium)	**50 % of the total marks is scored by 60% -70% of the students. (% can be varied)**
3 (High)	**50 % of the total marks is scored by 70% of the students. (% can be varied)**

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	**√**	**√**	**√**					**√**	**√**	**√**			**√**		
2	**√**	**√**											**√**		
3	**√**	**√**											**√**		
4	**√**	**√**	**√**					**√**	**√**	**√**			**√**		

Fluid Mechanics

Course Code	21AE33	**Course type**	PC	**Credits L-T-P**	3 – 0 - 1
Hours/week: L - T- P	3 – 0 – 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	Explain the mechanics of fluids at rest by observing the fluid Phenomena
2.	Compute the pressure measurement and stability of submerged bodies.
3.	Explain the mechanics of fluids in motion under ideal and real conditions.
4.	Examine energy losses in pipe transitions. Apply Buckingham Pi theorem for various cases of fluid flow.
5.	Evaluate pressure drop in pipe flow using Hagen-Poiseuille equation for laminar flow in a pipe. Distinguish types of flows

Pre-requisites : Knowledge of basic engineering mathematics and mechanics.

Unit – I	**Contact Hours = 8 Hours**
Introduction, Properties of fluids, Newton's law of viscosity, variation of viscosity with temperature, surface tension and capillarity. Newtonian and Non-Newtonian fluids. **Fluid Statics:** Pascal's law, Hydrostatic Law, levels of pressure. Units and Inter conversion. Pressure measurement by simple, differential manometers. Total force and center of pressure for inclined plane surface submerged in static fluid.	

Unit – II	**Contact Hours = 8 Hours**
Buoyancy: Buoyancy, center of buoyancy, meta center and meta centric height. Stability of floating bodies. **Fluid Kinematics:** Introduction, Eulerian and Lagrangian description of fluid motion, types of flows, velocity and acceleration of a fluid particle, concept of local and convective accelerations. Law of conservation of mass in 2D and 3D Cartesian coordinates, Discharge and mean velocity.	

Unit – III	**Contact Hours = 8 Hours**
Fluid Dynamics: Introduction, Euler's equation of motion and subsequent derivation of Bernoulli's equation, Bernoulli's equation for real fluids, Laplace equation for flow and boundary conditions. Introduction to Streamlines, Pathlines, two dimensional source, Uniform flow, sink and doublet flows. **Flow measurements:** Application of Bernoulli's theorem such as venturimeter, pitot tube, orifices etc. Discharge over rectangular notch and triangular notch. Numerical examples.	

Unit – IV	**Contact Hours = 8 Hours**
Losses in fluid flow: Energy consideration in pipe flow, Losses in pipe flow, Darcy Weisbach formula, major losses. Minor losses in pipe flow. Numerical on combined losses. **Dimensional analysis:** Dimensions and units, Dimensional Homogeneity and dimensionless ratios, methods of dimensional analysis, Buckingham Pi theorem, Numerical, types of Similitude and non-dimensional parameters used in Fluid Mechanics.	
Unit – V	**Contact Hours = 8 Hours**

Laminar flow and viscous effects: Entrance flow and Developed flow, fully developed laminar flow in circular pipes, Hagen – Poiseuille equation, Numerical. **Flow past immersed bodies:** Drag, Lift, expression for lift and drag (no derivation), pressure drag and friction drag, streamlined and bluff bodies. Numerical Examples **Introduction to compressible flow:** Propagation of sound waves through compressible fluids, sonic velocity and Mach number. Numerical.

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	1. Conduct an experiment on Hydraulic fluid to determine viscosity of the fluid
2&3	5	2. Conduct an experiment to determine the metacentric height of a floating body and evaluate its stability. 3. An experiment on Venturimeter to determine the co efficient of discharge. Compare the experimental Coefficient of Discharge value with that obtained graphically. 4. An experiment on Orifice meter to determine the co efficient of discharge. Compare the experimental Coefficient of Discharge value with that obtained graphically. 5. To determine the coefficient of discharge of a triangular notch (V-notch. 6. To determine the coefficient of discharge of a rectangular notch (R-notch.
4	2	7. Conduct an experiment on frictional losses in pipe flow. Compare the theoretical and experimental values of friction loss and friction factor with Moody's chart. 8. Conduct an experiment for minor losses in pipe flow. Compare the theoretical and experimental minor losses (bend, elbow, expansion, contraction and gate valve).
5	1	9. An experiment on Reynolds apparatus and classify the flow as laminar and turbulent.

Books	
	Text Books:
1.	K.L. Kumar, "Engineering Fluid Mechanics", Multicolor revised edition, S. Chand and Co, Eurasia Publishing House, New Delhi, 2010 ISBN-13: 978-8121901000
2.	R.K. Bansal, "A text book of Fluid Mechanics", Laxmi Publications Pvt. Ltd., New Delhi.2018, ISBN-13: 978-8131808153
	Reference Books:
1.	Yunus A. Cenegal, and John M. Cimbala, "Fluid Mechanics", Second edition, McGraw Hill Education (India) Pvt. Ltd. 2017, ISBN-13: 978-9339204655

2.	Fox, McDonald, Introduction to Fluid Mechanics, John Wiley Publications, 6th edition onwards.
3.	Anderson, Jr. J.D. "Fundamentals of Aerodynamics", McGraw-Hill Education / Asia; 5 edition (16 May 2011). ISBN-13: 978-0071289085
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	**NPTEL:** Online Resources: Lecture by: Prof Suman Chakraborty, IIT Kharagpur. (https://onlinecourses.nptel.ac.in/noc17_me04/preview)
2.	**NPTEL:** Online Resources: Lecture by: Prof S. Datta and Prof Niranjan Sahoo., IITG (Guwahati) (http://www.nptel.ac.in/courses/Webcourse-contents/IIT-%20Guwahati/fluid_mechanics/index.htm)
3.	**NPTEL**: Online Resources: Lecture by: Prof Viswanathan Shankar (IIT Kanpur) (http://nptel.ac.in/courses/103104044/)

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Explain** the mechanics and properties of fluids at rest and in motion by observing the fluid phenomena.	UN	1,2,8,9,10,12	1,2,3
2.	**Develop** the dimensional equations and **analyze** the various types of flows over different bodies.	AN	1,2,8,9,10,12	1,2,3
3.	**Analyze** the flow using different basic principles for **understanding** various flow measuring devices and losses in flows.	AP	1,2,8,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):

For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks
IA Test: 1. No objective part in IA question paper 2. All questions descriptive					
Conduct of Lab: 1. Conducting the experiment and journal: 5 marks 2. Calculations, results, graph, conclusion and Outcome: 5 marks 3. Viva voce: 5 marks					

Lab test: (Batchwise with 15 students/batch) 1. Test will be conducted at the end of the semester 2. Timetable, Batch details and examiners will be declared by Exam section 3. Conducting the experiment and writing report: 5 marks 4. Calculations, results, graph and conclusion: 10 marks 5. Viva voce: 10 marks
Eligibility for SEE: 1. 40% and above (24 marks and above) in theory component 2. 40% and above (16 marks and above) in lab component 3. **Lab test is COMPULSORY** 4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√	√						√	√	√		√	√	√	√
2	√	√						√	√	√		√	√	√	√
3	√	√						√	√	√		√	√	√	√

Computer Aided Aircraft Component's drawing

Course Code	**21AE34**	**Course type**	**PCC**	**Credits L-T-P**	3 - 0 - 1
Hours/week: L - T- P	3 - 0 - 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	Introduce Bureau of Indian Standards on drawing practices and standard components.
2.	Impart knowledge of Machine component and its conversion into 2D drawing.
3.	Familiarize various thread forms and representation of standard thread components.
4.	Make awareness of structural riveted joints along with their standard empirical relations
5.	Model parts and create assembly using standard CAD packages like CATIA
6.	Familiarize with standard components and their assembly of an aircraft.

Required Knowledge of: Basics of Mathematics, Engineering drawing

Unit – I	**Contact Hours = 8 Hours**
Introduction: Introduction to BIS Specification for line conventions, dimensioning, Tolerance representation, Surface finish representation. Conventional representation of common features, Introduction to limits, fits and tolerances (No questions are to be set from this section). **Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders resting on their base only (No problems on spheres and hollow solids). True shape of sections. Self-learning topics: Sections of Tetrahedrons and Cylinders	

Unit – II	**Contact Hours = 8 Hours**
Orthographic Views: Conversion of pictorial views into orthographic Projections of simple machine parts with and without section. (Bureau of Indian Standards conventions are to be followed for the drawings) Precedence of lines Basics of geometric dimensions	

Unit – III	**Contact Hours = 8 Hours**
Thread Forms: Thread terminology, Thread conventions, ISO Metric (Internal & External), BSW (Internal &External) Square, Acme and Sellers Thread. **Fasteners:** Representation of Hexagonal headed bolt and nut assembly with washer, simple assembly of stud with hexagonal nut and lock nut.	

Unit – IV	**Contact Hours = 8 Hours**
Riveted Joints: Single and double riveted lap joints, butt joints with Single/double cover straps of equal width (Chain and Zigzag riveting arrangement using snap head rivets).	

Unit – V	**Contact Hours = 8 Hours**
Assembly of Machine & Aircraft Components (Using the given part drawings): Introduction to software and their workbenches, drawing of aircraft components assembly.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	1	1. Draw various sections of solids of Pyramids, Prisms, Cubes, Tetrahedrons, Cones and Cylinders using software
2	1	2. Conversion of pictorial views into orthographic Projections of simple machine parts and drafting using software
3	2	3. Draw various thread forms using drafting tool in software 4. Draw various views of fasteners using drafting tool in software
4	1	5. Draw various views of threads and its forms using drafting tool in software
5	7	Part modelling and Assembly of: 6. Screw jack (Bottle type) 7. Plummer block (Pedestal Bearing). 8. Drafting of propeller and hub assembly 9. Drafting of wing assembly 10. Drafting of fuselage assembly 11. Drafting of main rotor blade assembly of helicopter 12. Drafting of Landing Gear Assembly

Unit No.	Self-Study Topics
1	Sections of Pyramids
2	Sellers Thread
3	Representation of square headed bolt and nut assembly with washer
4	Butt joints with double cover straps (Chain and Zigzag, using snap head rivets)
5	Design of Engine Mounts, I.C. Engine connecting rod

Books	
	Text Books:
1.	N. D. Bhat &V. M. Panchal, 'Machine Drawing', Charotar Publications, 26thEdn. 1991.
2.	K.R. Gopal Krishna, 'Machine drawing' Subhash Publication.,2003
	Reference Books:
1.	S. Trymbaka Murthy 'A Text Book of Computer Aided Machine Drawing', CBS Publishers, New Delhi, 2007
2.	N. Siddeshwar, P. Kanniah, V.V.S. Sastri,'Machine Drawing', published by Tata McGraw Hill, 2006
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL course: Introduction to Engineering Drawing by Prof. Robi, P.S, IIT Guwahati. (https://nptel.ac.in/courses/112103019)
2.	NPTEL course: Orthographic projection by Prof. Prof. Avlokita Agrawal, IIT Roorkee. (https://onlinecourses.nptel.ac.in/noc21_ar01/preview)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination

Course Outcome (COs)
Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Identify components/assembly drawings either manually or by using standard CAD packages	UN	1,2,5,12	1,2,3
2.	Practice with drafted components and their assembly of an aircraft	AP	1,2,5,12	1,2,3
3.	Distinguish drawings of machine and aircraft components	AN	1,2,5,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks

IA Test:
1. No objective part in IA question paper
2. All questions descriptive

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks
3. Viva voce: 5 marks

Lab test: (Batchwise with 15 students/batch)
1. Test will be conducted at the end of the semester
2. Timetable, Batch details and examiners will be declared by Exam section
3. Conducting the experiment and writing report: 5 marks
4. Calculations, results, graph and conclusion: 10 marks
5. Viva voce: 10 marks

Eligibility for SEE:
1. 40% and above (24 marks and above) in theory component
2. 40% and above (16 marks and above) in lab component
3. **Lab test is COMPULSORY**
4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	Target
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (planned)												CO-PSO Mapping (planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	✓	✓			✓							✓	✓	✓	✓
2	✓	✓			✓							✓	✓	✓	✓
3	✓	✓			✓							✓	✓	✓	✓

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

Samskrutika Kannada (Kannada for Administration) is for students who speak, read and write Kannada.

Course Code		**Course type**	**HSMS**	**Credits L-T-P**	0– 1 - 0
Hours/week: L - T- P	0 – 2 – 0			**Total credits**	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content	---			**SEE Marks**	50 (2 Hours)

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

1. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.
2. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.
3. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು.
4. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷೆಯ ಬಳಕೆ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

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

1. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
2. ಇತ್ತೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು - ಅಂದರೆ ಕವಿ-ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.
3. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ -1 ಲೇಖನಗಳು	**Contact Hours = 4 Hours**

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ - ಹಂಪ ನಾಗರಾಜಯ್ಯ
2. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ - ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ
3. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ - ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಘಟಕ -2 ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	Contact Hours = 4 Hours
1. ವಚನಗಳು : ಬಸವಣ್ಣ, ಅಕ್ಕಮಹಾದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ.	
2. ಕೀರ್ತನೆಗಳು : ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ - ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ - ಕನಕದಾಸರು	
3. ತತ್ವಪದಗಳು : ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು - ಶಿಶುನಾಳ ಶರೀಫ	

ಘಟಕ -3 ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	Contact Hours = 4 Hours
1. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಅಯ್ದ ಕೆಲವು ಭಾಗಗಳು	
2. ಕುರುಡು ಕಾಂಚಾಣ : ದಾ.ರಾ. ಬೇಂದ್ರೆ	
3. ಹೊಸಬಾಳಿನ ಗೀತೆ : ಕುವೆಂಪು	

ಘಟಕ -4 ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	Contact Hours = 4 Hours
1. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ : ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ - ಎ ಎನ್ ಮೂರ್ತಿರಾವ್	
2. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ : ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	

ಘಟಕ -5 ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	Contact Hours = 4 Hours
1. ಯುಗಾದಿ : ವಸುಧೇಂದ್ರ	
2. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ : ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	

ಪಠ್ಯಪುಸ್ತಕ	
1.	ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಡಾ. ಹಿ.ಚಿ.ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ, ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignments
		3.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1	ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ. Discuss and Explain the history and culture of Karnataka	AP	10	
2	Discuss the contributions made to Kannada literature	AP	10	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two Assignments	Total Marks
Maximum Marks	15+15 = 30	10+10 =20	50
1. Writing the IA tests is compulsory 2. **Minimum marks required to be eligible for SEE: 20 out of 50**			

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 2 hours duration.
2.	**Minimum marks required in SEE to pass: 20 out of 50**
3.	Question paper will have choices.

Rubrics:Levels	**Target**
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1										✓					
2										✓					
Tick mark the CO, PO and PSO mapping															

ಬಳಕೆ ಕನ್ನಡ - baLake Kannada (Kannada for Usage)

Balake Kannada (Kannada for communication) is for non-Kannada speaking, reading, and writing students

Course Code		**Course type**	**HSMS**	**Credits L-T-P**	0– 1 - 0
Hours/week: L - T- P	0 – 2 – 0			**Total credits**	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content	---			**SEE Marks**	50 (2 Hours)

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):

- To Create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To train the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process - General Instructions) :

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

1. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಿಟಿಯು ಸೂಚಿಸಿರುವ ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.
2. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.
3. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತಿ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.

Unit- I	**Contact Hours = 4 Hours**

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activities
3. Key to Transcription.
4. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ/ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು - **Personal Pronouns, Possessive Forms, Interrogative words**

Unit - II	Contact Hours = 4 Hours

1. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು - **Possessive forms of nouns, dubitive question and Relative nouns**
2. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು **Qualitative, Quantitative and Colour Adjectives, Numerals**
3. **ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಅ, ಅದು, ಅವ್ವ, ಅಲ್ಲಿ) Predictive Forms, Locative Case**

Unit - III	Contact Hours = 4 Hours

ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases, and Numerals

ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers

ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು

Defective / Negative Verbs and Colour Adjectives

Unit - IV	Contact Hours = 4 Hours

ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತು ಒತ್ತಾಯ ಆರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು

Permission, Commands, encouraging and Urging words (Imperative words and sentences)

ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು

Accusative Cases and Potential Forms used in General Communication

"ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು - Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs

ಹೋಲಿಕೆ (ತರತಮ) , ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು

ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ- Comparitive, Relationship, Identification and Negation Words

Unit - V	Contact Hours = 4 Hours

1. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು - ifferent types of forms of Tense, Time and Verbs
2. ದ್, -ತ್, - ತು, - ಇತು, - ಆಗಿ, - ಅಲ್ಲ, - ಗ್, -ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿಗೆ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ - Formation of Past, Future and Present Tense Sentences with Verb Forms
3. **Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು - Kannada Words in Conversation**

ಪಠ್ಯಪುಸ್ತಕ	
1.	ಬಳಕೆ ಕನ್ನಡ ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Assignments
		3.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Communicate (converse) in Kannada language in their daily life with kannada speakers.	AP	10	
2.	Read and write Kannada language as per requirement.	AP	10	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two Assignments	Total Marks
Maximum Marks	15+15 = 30	10+10 =20	50
1. Writing the IA tests is compulsory 2. **Minimum marks required to be eligible for SEE: 20 out of 50**			

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 2 hours duration.
2.	**Minimum marks required in SEE to pass: 20 out of 50**
3.	Question paper will have choices.

Rubrics:Levels	Target
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1										✓					
2										✓					
Tick mark the CO, PO and PSO mapping															

UNIVERSAL HUMAN VALUES AND PROFESSIONAL ETHICS

Course Code		Course type	UHV	Credits L-T-P	1 – 0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 20 Hrs; T = 0 Hrs; P = 0 Hrs Total = 20 Hrs			CIE Marks	50
Flipped Classes content	--			SEE Marks	50

Course learning objectives

1. To provide understanding of basic human values
2. To implement the human values in Engineering profession.

Knowledge required : English Language, Social Studies

Unit – I Human Values	6 Hours
Objectives, Morals , Values, Ethics, Integrity, Work ethics, Service learning, Virtues, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage ,Valuing time, Cooperation, Commitment, Empathy, Self-confidence, Challenges in the work place, Spirituality.	

Unit – II Professional Ethics	8 Hours
Engineering Ethics: Overview, senses of engineering ethics, variety of moral issues, types of enquiries, moral dilemma, moral autonomy, moral development (theories), consensus and controversy, profession, models of professional roles, responsibility. Theories about right action (ethical theories), self-control, self-interest, customs, religion, self-respect, case studies (Choice of the Theory), engineering as experimentation, engineers as responsible experimenters.	

Unit – III Professional Ethics	6 Hours
Codes of ethics, Environmental ethics, Computer ethics, Engineers as managers, Ethics and code of business conduct in MNC	

Illustrative case studies (3 cases related to Human value and 3 cases related Professional Ethics)

	Books
1.	Nagarazan R.S., Professional Ethics and Human Values, New Age International Publishers Pvt.Ltd. 2006

Course Outcome (COs)		
At the end of the course, the student will be able to:		Bloom's Level
1.	Identify and practice the human values	UN
2.	Understand and implement ethics in Engineering profession.	RE, AP

Program Outcome of this course (POs)		PO No.
1.	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	6
2.	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.	8

Course delivery methods		Assessment methods	
1.	Lecture	1.	I. A. test
2.	Presentation	2.	SEE
3.	Expert talks		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests
Maximum Marks: 50	25+25 = 50
Minimum score to be eligible for SEE: 20 OUT OF 50	

Scheme of Semester End Examination (SEE):	
1.	SEE question paper for 50 marks having descriptive type questions will be conducted for two hours duration.
2.	**Minimum marks required in SEE to pass: 20 out of 50**
3.	Choice in each unit.

Rubrics:Levels	Target
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
1						✓									
2								✓							
Tick mark the CO, PO and PSO mapping															

Introduction to the MATLAB & SIMULINK

Course Code	21AECAE37	**Course type**	**AEC**	**Credits L-T-P**	0 - 0 - 1
Hours/week: L - T- P	0 - 0 - 2			**Total credits**	1
Total Contact Hours	L = 0 Hrs; T = 0 Hrs; P = 20 Hrs Total = 20 Hrs			**CIE Marks**	50
Flipped Classes content	0 Hours			**SEE Marks**	50

Course learning objectives	
1.	Learn basics of MATLAB programming
2.	Will be able to use MATLAB to solve computational problems
3.	Learn the basics of Simulink.
4.	Model a simple system in Simulink.

Required Knowledge of : Engineering Mathematics

List of Experiments

No. of Experiments	**Topic(s) related to Experiment**
1	Basics of MATLAB programming
2	Array operations in MATLAB
3	Loops and execution control
4	Working with files: Scripts and Functions
5	Plotting and program output
6	Differentiation and numerical integration
7	Introduction to the block diagram in SIMULINK
8	Plotting various graphs using SIMULINK
9	Solving differential equations using SIMULINK
10	Mass-Spring-Damper model for different inputs using SIMULINK

Self-Study Topics
Solving step bars subjected to axial load problems using MATLAB
Solving Bernoulli's equation using MATLAB
Plotting Mohr's stress circle using MATLAB
Solving differential equations for real life problems using SIMULINK
Solving Euler Angles using SIMULINK

Books	
	Text Books:
1.	Rudra Pratap, 'Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers', Oxford University press, South Asia Edition.
2.	Kumar Tyagi Agam, 'MATLAB and SIMULINK for Engineers', Oxford University Press India, 2012 Edition
	Reference Books:

1.	B. H. Hahn & D. T. Valentine, 'Essential MATLAB for Engineers and Scientists', Elsevier Publications, 4th Edition
2.	Modelling & Simulation using MATLAB SIMULINK, ' Shailendra Jain, Newdelhi Willey, 2011 Edition
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	**NPTEL course: Matlab Programming for Numerical Computation, by Prof. Niket Kaisare, IIT Madras.** https://onlinecourses.nptel.ac.in/noc20_ge05/preview
2.	**MATHWORKS Web Page: Getting started with SIMULINK** https://in.mathworks.com/help/simulink/getting-started-with-simulink.html

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)
Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Explain basic steps involved in MATLAB programming	UN	1, 5	1
2.	Explain processes involved in SIMULINK	UN	1, 5	1
3.	Write, Execute, & Debug appropriate codes to solve various mathematical problems	AP	1, 2, 3, 5, 8, 9, 10, 12	1, 2, 3
4.	Construct & Run a physical model using SIMULINK	AP	1, 2, 3, 5, 8, 9, 10, 12	1, 2, 3

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

LAB (50 marks)			Total
Conduction	Journal Submission	Open Ended Experiment	
25 marks	15 marks	10	100 marks

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks
3. Viva voce: 5 marks

Journal Submission
1. Students will submit the journal at the end of the semester

Open Ended Experiment
1. Students will perform one open ended experiment at the end of the semester

Rubrics:

Levels	Target
1 (Low)	60% of the students score Less than 50 % of the total marks.
2 (Medium)	60% of the students score 50 – 70 % of the total marks.
3 (High)	60% of the students score More than 70 % of the total marks.

CO-PO Mapping (planned)													CO-PSO Mapping (planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√				√								√		
2	√				√								√		
3	√	√	√		√			√	√	√		√	√	√	√
4	√	√	√		√			√	√	√		√	√	√	√

Third Semester

Bridge Course Mathematics-I

(Common to all Branches)

(A Bridge course for Lateral Entry students of III Sem. B. E.)

Course Code	21MATDIP -31	**Course type**	**BS**	**Credits L-T-P**	0 – 0 - 0
Hours/week: L - T- P	3– 0 – 0			**Total credits**	0
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
				SEE Marks	0

Course learning objectives	
1.	Get acquainted with different applications of Calculus.
2.	Understand the basic concepts of partial differentiation.
3.	Get familiar with Laplace transforms and various properties associated with it.
4.	Learn to find the inverse Laplace Transforms of all the functions discussed earlier.
5.	Get familiar with various topics in Linear Algebra.

Pre-requisites : Basic Trigonometry, Calculus ,Algebra

Unit – I: Calculus	**Contact Hours = 8 Hours**
Introduction to limits, continuity and differentiation: Polar Curves, angle between radius vector and tangent, angle between polar curves, Radius of curvature (Cartesian and polar form only).	

Unit – II: Partial Differentiation:	**Contact Hours = 8 Hours**
Definition and simple problems. Total Differentiation-Problems. Partial Differentiation of Composite functions – Problems. Maxima and minima of function of two variables. Lagrange's method of Undetermined multipliers. Jacobians.	

Unit-III: Laplace Transforms	**Contact Hours = 8 Hours**
Definition. Laplace Transforms of elementary functions. Properties. Laplace Transforms of $e^{at}f(t)$,$t^n f(t)$,$\int_0^t f(t)dt$, $\frac{f(t)}{t}$ (without proof), Periodic functions (with proof).	

Unit-IV: Inverse Laplace Transforms	**Contact Hours = 8 Hours**
Inverse Laplace Transforms-Problems, Convolution Theorem -Problems. Laplace transform of the derivative. Solution of Linear Differential Equation using Laplace Transforms, Applications- L-C-R series circuit.	

Unit – V: Linear Algebra-I	**Contact Hours = 8 Hours**
Rank of a matrix by elementary transformation, consistency of system of linear equations-Gauss Jordan method and Gauss-Seidal method. Eigen value and Eigen vectors – Rayleigh's Power method.	

Books	
	Text Books:
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
3.	B. V.Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.
	Reference Books:
1.	Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.
2	Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Tests (OBT)
3.	Online Classes	3.	Course Seminar
		4.	Semester End Examination

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

	Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create	**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Review** basic concepts of Calculus.	Un	1	1
2.	**Understand** multivariable Calculus.	Un	1	1
3.	**Understand** LaplaceTransforms and its properties.	Un	1	1
4.	**Understand** Inverse LaplaceTransforms and its properties.	Un	1	1
5.	**Understand** basic Linear Algebra**.**	Un	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs \Math tools	Course Seminar	Total Marks
Marks	25+25 = 50	4*5 marks=20	10+10 =20	10	100
	OBA - Open Book Assignment **Minimum score for passing: 40 OUT OF 100**				

Rubrics:

Levels	Target
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													CO-PSO Mapping (Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1															
2															
3															
4															
5															
Mention the levels: 1, 2, 3															

Statistics And Probability

Course Code:	**21MAT41**	**Course type**	Theory	**Credits L-T-P**	3 – 0– 0
Hours/week: L-T-P	3 – 2 – 0			**Total credits**	3
Total Contact Hours	L = 40 Hrs; T = 0Hrs;P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives At the end of the course students should be able to	
1.	Fit a suitable data by method of least squares.
2.	Get acquainted with various hypothesis testing techniques.
3.	Get familiar with various sampling distributions and estimation of various parameters.
4.	Get knowledge about various probability distributions involving discrete /continuous random variable.
5.	Understand Joint discrete PDF and various stochastic processes.

Pre-requisites : Basic statistics, Basic probability.

Unit – I	**Contact Hours = 8 Hours**
Curve fitting: Curve fitting: $y=ax+b$, $y = ax^2+bx+c$, $y=ae^{bx}$, $y =ax^b$ by method of least squares Problems. Correlation: Karl Pearson coefficient of correlation, Regression: Lines of regression Problems. Multiple correlation.	

Unit – II	**Contact Hours = 8 Hours**
Probability: Random Variables (RV), Discrete and Continuous Random variables, (DRV,CRV) Probability Distribution Functions (PDF) and Cumulative Distribution Functions(CDF), Expectations, Mean, Variance. Binomial, Poisson, Exponential and Normal Distributions. Practical examples.	

Unit – III	**Contact Hours = 8 Hours**
Hypothesis Testing : Null and alternate hypothesis, Critical region, Sampling, Sampling errors, Level of significance and confidence limits ,Testing hypothesis of mean, Testing hypothesis of variance, Testing hypothesis of proportion.	

Unit – IV	**Contact Hours = 8 Hours**
Sampling distribution: Sampling distribution, Sampling distribution of means, Test of significance for small and large samples. 't' and 'chi square' distributions. Practical examples.	

Unit –V	**Contact Hours = 8 Hours**
Joint PDF and Stochastic Processes: Discrete Joint PDF, Conditional Joint PDF, Expectations (Mean, Variance and Covariance).Definition and classification of stochastic processes. Discrete state and discrete parameter stochastic process, Unique fixed probability vector, Regular Stochastic Matrix, Transition probability, Markov chain.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions					

Books	
	Text Books:
1.	B. S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012 and onwards.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006 and onwards.
	Reference Books:
1.	Fundamentals of Mathematical Statistics by S.C.Gupta and V.K.Kapoor., Sultan Chand and Sons, 2009 and onwards.
2.	B.V.Ramana –Engineering Mathematics, Tata Mcgraw Hill Publishing Company Limited 2004 and onwards.
	E-resource's (NPTEL/SWAYAM… Any Other)- mention links
1.	https://archive.nptel.ac.in/courses/111/102/111102111/ (Prob and Stochastic)
2.	https://archive.nptel.ac.in/courses/111/104/111104147/(Sampling and Linear regression)

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)/Matlab
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)
At the end of the course, the student will be able to

	Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create	**Learning Level**	**PO(s)**	**PSO(s)**
1.	To **USE** method of least squares to fit a curve.	**AP**	1	1
2.	To **UNDERSTAND** the concept of random variable and various probability distributions connected with discrete and continuous random variable.	**AP**	1	1
3.	To **APPLY** methods to test a hypothesis.	**AP**	1	1
4.	To **APPLY** the concepts related to sampling distribution to practical problems.	**AP**	1	1
5.	To **UNDERSTAND** the joint discrete probability distributions and Markov chain.	**AP**	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/Matlab	Course Seminar	Total Marks

Marks	25+25= 50	4* 5 marks = 20	10+10 =20	10	100
OBA- Open Book Assignment **Minimum score to be eligible for CIE: 40 OUT OF 100**					

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration. It will be reduced to 50 marks for the calculation of SGPA and CGPA.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1(Low)	**60% of the students score Less than 50 % of the total marks.**
2(Medium)	**60% of the students score 50 – 70 % of the total marks.**
3(High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													**CO-PSO Mapping(Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	**√**										**√**	**√**	**√**		
2	**√**										**√**	**√**	**√**		
3	**√**										**√**	**√**	**√**		
4	**√**										**√**	**√**	**√**		
5	**√**										**√**	**√**	**√**		

Aerodynamics

Course Code	21AE42	Course type	PC	Credits L-T-P	3 – 0 – 1
Hours/week: L - T- P	3 – 0 – 2			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	50 marks
Flipped Classes content	10 Hours			SEE Marks	50 marks

Course learning objectives	
1.	To understand the basic concepts of control volume approaches & flow properties
2.	To understand the governing equations used in aerodynamics
3.	Acquire knowledge on 2D Inviscid Incompressible Flows
4.	To understand various Lift theorems. Lift and Drag of the Aircraft
5.	Acquire knowledge on wind tunnel equipment & its measuring techniques

Required Knowledge of: Fluid Mechanics, Physics and Mathematics

Unit – I:	Contact Hours = 8 Hours
Fundamental Principles of Aerodynamics: Introduction, Flow similarities, Types of Flow, Control volume approach to continuity, momentum and energy equations. Path lines, Streamlines, and Streak lines, Angular velocity, Vorticity, Circulation, and Stream function, Velocity potential and Relationship between them.	

Unit – II:	Contact Hours = 8 Hours
Incompressible flow over 2D bodies: Non-lifting flow over a two-dimensional circular cylinder, vortex flow. Lifting flow over a two-dimensional circular cylinder, Generation of lift. aerodynamic forces and moments, center of pressure, pressure coefficient, types of drags, calculation of airfoil lift and drag from measured surface pressure distributions.	

Unit – III:	Contact Hours = 8 Hours
Incompressible Flow over Finite wings: Induced Downwash and Drag, Kelvin's circulation theorem and the starting vortex, vortex sheet, vortex filaments, Kutta condition, Prandtl's Classical Lifting line theory, Delta wing, Airplane Lift and Drag.	

Unit – IV:	Contact Hours = 8 Hours
Introduction to Compressible flows: Inviscid, Compressible flow, Shock waves, speed of sound, Normal shock wave, oblique shock wave and expansion waves, shock wave boundary layer interaction, flow through nozzles, diffusers and wind tunnels.	

Unit – V:	Contact Hours = 8 Hours
Introduction to Aerodynamic Testing: Principles of wind tunnel flow simulation, open and closed-circuit wind tunnels, Major features of low speed, transonic and supersonic wind tunnels, smoke and tuft flow visualization techniques-Surface oil film & Particle Image Velocimetry, Pressure and Aerodynamic load measurements on a model, total drag determination of two-dimensional bodies using wake survey at low speeds.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	2	2	2	2	2

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
1	2	1. Smoke flow visualization studies on a two-dimensional body at low speeds for studying path line and streamlines. 2. Tuft flow visualization on a flat plate at different angles of attack at low speeds.
2	2	3. Surface pressure distributions on a two-dimensional circular cylinder at low speeds and calculation of pressure drag. 4. Surface pressure distributions on a two-dimensional symmetric airfoil at different incidences at low speeds.
3	2	5. Calculation of total drag of a two-dimensional Flat plate and cylinder at low speeds using pitot-static probe wake survey. 6. Calculation of total drag of a two-dimensional symmetric and cambered airfoil at low speeds using pitot-static probe wake survey.
5	2	7. Calibration of a subsonic wind tunnel by inclined manometer. 8. Study of the characteristics of three-dimensional body involving measurement of lift, drag, pitching moment using force balance method.

Unit No.	**Self-Study Topics**
1	Mach number & Mach number regimes
2	Pitot-tube measurement of airspeed based on Bernoulli's equation
3	Airfoil geometry and wing plan-form geometry selection, Kutta-Joukowski theorem
4	Estimation of Skin friction drag for laminar and turbulent flow
5	Types of visualization techniques used for subsonic aerodynamic analysis

Books	
	Text Books:
1.	Anderson, Jr. J.D. "Fundamentals of Aerodynamics", McGraw-Hill Education / Asia; 5th edition (16 May 2011). ISBN-13: 978-0071289085
2.	Houghton E.L and Carpenter P.W. "Aerodynamics for Engineering Students, Elsevier; Sixth edition (2012) ISBN-13: 978-9382291176
	Reference Books:
1.	Pope A. and Harper, J J. "Low Speed Wind Tunnel testing", John Wiley Inc. New York, 1966, ISBN: 978-0-471-55774-6
2.	Anderson, Jr. J.D. "Introduction to Flight", Tata McGraw-Hill Publishing Co. Ltd., New Delhi, 2007. (Special Indian Edition), ISBN-10-0071263187
3.	Schlichting, H. "Boundary Layer Theory" McGraw Hill, New York, 2004. ISBN-978-3-662-57095-1

4.	Pope A. and Goin, KL. "High Speed Wind Tunnel Testing", John Wiley & Sons Inc. New York, ISBN-0-471-55774-9
	E-resources (NPTEL/SWAYAM)
1.	**NPTEL:** Online Resources: Lecture by: Prof Prof. Job Kurian IIT Madras https://nptel.ac.in/courses/101106040/,
2.	**NPTEL:** Online Resources: Lecture by: Prof.K P Sinha Mahapatra, IIT Kharagpur. https://nptel.ac.in/courses/101105059/

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Surprise and Scheduled)
3.	Flipped Classes	3.	Open Book Tests (OBT)
4.	Online classes	4.	Course Seminar
		5.	Semester End Examination

Course Outcome (COs)				
At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Describe the control volume approach and apply vorticity, circulation concepts to Aerodynamic applications	AP	1,2,8,9,10,12	1,2
2.	Analyze the 2-dimensional incompressible flow over various bodies and understand related theories.	AP	1,2,8,9,10,12	1,2
3.	Apply finite wing theory for incompressible flow.	AP	1,8,9,10,12	1,2
4.	Interpret generation of various shock waves generated in compressible flow.	AN	1,2,12	1,2
5.	Demonstrate different techniques in experimental Aerodynamic analysis.	AN	1,2,8,9,10,12	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBTs	Course Seminar	Total Marks	Final Marks
Theory	25+25 = 50	20	10+10 =20	10	100	100 **(Reduced to 50)**
Minimum score to be eligible for SEE: 20 out of 50						

Self-Study topics could be evaluated during Quiz/ Assignments

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 %**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**

1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	√	√						√	√	√		√	√	√	
2	√	√						√	√	√		√	√	√	
3	√							√	√	√		√	√	√	
4	√	√										√	√	√	
5	√	√						√	√	√		√	√		
Mention the levels: 1, 2, 3															

Aircraft Structures

Course Code	21AE43	**Course type**	**PCC**	**Credits L-T-P**	3 - 0- 1
Hours/week: L-T-P	3 - 0 - 2			**Total credits**	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs;P = 20 Hrs Total = 60 Hrs			**CIE Marks**	100
Flipped Classes content	10 Hours			**SEE Marks**	100

Course learning objectives	
1.	Explain basic concept of stress, strain, transformation of stress/strain and strength of materials.
2.	Teach the concepts and calculation of Torsion of thin wall structures
3.	Shear flow in thin wall structure due to shear load
4.	To understand Fracture, Fatigue and buckling Analysis of aircraft

Required Knowledge of : Engineering Mechanics, Engineering Mathematics, Mechanics of Materials

Unit – I	**Contact Hours = 8 Hours**
Loads on Aircraft, Types of loads, Concept of allowable stress and factor of safety, Introduction to thin wall structure ,sectional properties of thin wall structures, idealized structures, unsymmetrical bending, position of neutral axis	

Unit – II	**Contact Hours = 8 Hours**
Torsion of thin wall structures (Open, Closed, Combined) , Introduction to shear center, center of twist and shear flow, Breadt- Batho equations, Torsional constants, angle of twist , torsion of idealized structure.	

Unit – III	**Contact Hours = 8 Hours**
Shear flow in thin wall structure due to shear load (Open, Closed, Combined), Calculation for position of shear center for open and closed structure, shear of idealized structure (Open, Closed, Combined), Wagner beam, Analysis of tapered shear beams.	

Unit – IV	**Contact Hours = 8 Hours**
Energy Methods Strain energy due to tension, shear, torsion and bending, Castigliano's theorem, Maxwell's Reciprocal theorem, Principle of super position, Unit load method, Stress due to impact load, tension due to impact, bending due to impact, torsion due to sudden applied torque	

Unit –V	**Contact Hours = 8 Hours**
Fracture and Fatigue Analysis, Stress intensity factor, Crack growth rate, Goodman and Soldberg equations, Fatigue Life cycle, Buckling of thin wall column, Thin plates, Stiffened panels, Primary and Secondary buckling, Needhams and Gerards methods to evaluate crippling loads	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	01	02	02	02	03

List of Experiments

Unit No.	No. of Experiments	Topic(s) related to Experiment
4	4	1. Verification of Castigliano's Load Theorem
		2. Verification of Maxwell's Reciprocal Theorem
		3. Verification of Principle Of Super Position
		4. Verification of Unit Load Method Using Beam Apparatus
5	4	5. To find out the buckling load of column using column test setup for different end condition.
		6. Wagner Beam experiment
		7. Fatigue Analysis of a beam.
		8. Non-destructive testing

Unit No.	Self-Study Topics
I	Loads acting on major components of aircraft, aircraft structural layout ,Aircraft materials
II	Vertical and horizontal shear stresses, distribution of shear stress over rectangular ,circular & I sections
III	Shear Flow Distribution ,Tension field beams- complete diagonal tension
IV	Strain energy produced by bending and twisting, experimental determination of critical load for a flat plate
V	Fracture, Fatigue and buckling Analysis of aircraft

Books	
	Text Books:
1.	T H G Megson, Aircraft Structures for Engineering Students, Elsevier aerospace engineering series fifth edition.
2.	Ferdinand Beer & Russell Johnston, "Mechanics of Materials", McGraw Hill Education India Private Limited; Seventh edition, 2017.
3.	L Srinath, Advanced Mechanics of Solids McGraw Hill Education India Private Limited; third edition.
	Reference Books:
1.	Timoshenko S., "Engineering-Mechanics", McGraw-Hill Education, 5th Edition, ISBN: 9781259062667, 9781259062667
2.	S.S.Bhavikatti , "Strength of Materials", Vikas publications House -1 Pvt. Ltd., 2nd Ed., 2006.
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL course: Aircraft Structures – I By Prof. Anup Ghosh | IIT Kharagpur https://onlinecourses.nptel.ac.in/noc20_ae08
2.	NPTEL course: Mechanics of Materials by Dr. U Saravanan, IIT Madras. https://nptel.ac.in/courses/105106172/
3.	NPTEL course: Mechanics of Solids by Prof. Priyanka Ghosh, IIT Kanpur.

	https://onlinecourses.nptel.ac.in/noc22_ce46/preview

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)
Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Apply the concepts of thin wall structure for different analysis	AP	1,2	1,2
2.	Evaluate the response of the various structures in terms of deformation, stress, strain, and shear flow under different loading condition	AN	1, 2, 5,8,9,10	1,2
3.	Apply the concept of energy method to solve for the structural response of various structures	AN	1, 2, 5,8,9,10	1,2
4.	Explain the phenomenon of fatigue and fracture fatigue life cycle related to aero structure	AN	1, 2, 5,8,9,10	1,2

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)**will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	
25 marks	25 marks	10 marks	15 marks	25 marks	100 marks

IA Test:
1. No objective part in IA question paper
2. All questions descriptive

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks
3. Viva voce: 5 marks

Lab test: (Batchwise with 15 students/batch)
1. Test will be conducted at the end of the semester
2. Timetable, Batch details and examiners will be declared by Exam section
3. Conducting the experiment and writing report: 5 marks
4. Calculations, results, graph and conclusion: 10 marks
5. Viva voce: 10 marks

Eligibility for SEE:
1. 40% and above (24 marks and above) in theory component
2. 40% and above (16 marks and above) in lab component
3. **Lab test is COMPULSORY**
4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1(Low)	**60% of the students score Less than 50 % of the total marks.**
2(Medium)	**60% of the students score 50 – 70 % of the total marks.**
3(High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (planned)													**CO-PSO Mapping(planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	**√**	**√**											**√**	**√**	
2	**√**	**√**			**√**			**√**	**√**	**√**			**√**	**√**	
3	**√**	**√**			**√**			**√**	**√**	**√**			**√**	**√**	
4	**√**	**√**			**√**			**√**	**√**	**√**			**√**	**√**	

Engineering Thermodynamics

Course Code	21AE44	Course type	PCC	Credits L-T-P	3 - 0 - 1
Hours/week: L - T- P	3 - 0 - 2			Total credits	4
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 20 Hrs Total = 60 Hrs			CIE Marks	100
Flipped Classes content	10 Hours			SEE Marks	100

Course learning objectives	
1.	To understand the basic definitions, calculations of thermodynamic properties and work done in case of a closed system executing different thermodynamic processes.
2.	To understand the first and second laws of thermodynamics and the concept of entropy.
3.	To compare air-standard cycles and acquire the knowledge of testing of IC engines.
4.	To understand the working principles of gas power cycles.
5.	To understand the working of a reciprocating air compressor, the VCR system and to explain concepts of psychrometry.

Required Knowledge of: Basics of Mathematics, Physics & Chemistry

Unit – I	Contact Hours = 8 Hours
Fundamental Concepts: Definition, Systems and control volume, Macroscopic v/s microscopic approaches, Equilibrium, Property, Process, Quasi-equilibrium process, Cycle, Specific volume, Pressure, Illustrative Problems. Temperature, Zeroth law of thermodynamics. **Pure Substance:** Definition, Phase change processes of a pure substance on T-v diagram, Property tables. Illustrative problems. **Work & Heat:** Thermodynamic definition of work. Work done at the moving boundary of a simple compressible system in a quasi-equilibrium process. Expression for work: Constant pressure, isothermal and polytropic processes. Problems on work. Definition of heat. Comparison of heat and work.	

Unit – II	Contact Hours = 8 Hours
First Law of Thermodynamics: Definition, the 1st law of thermodynamics for a system undergoing a cycle/Process. Concept of energy, Internal energy, enthalpy, Illustrative problems. The steady state steady flow process. Illustrative problems.	

Unit – III	Contact Hours = 8 Hours
Second Law of Thermodynamics: Kelvin Planck and Clausius statements of 2nd law. Equivalence of the two statements. The reversible process, Carnot cycle. Introduction to Entropy, Illustrative Problems. **Air-standard Cycles:** Assumptions, Otto and Diesel cycle descriptions on P-v and T-s diagrams & their efficiencies, Comparison of Otto and Diesel cycles: For same compression ratio and for same maximum pressure and temperatures. Numericals.	

Unit – IV	Contact Hours = 8 Hours

IC Engines: Performance analysis of IC engines: Measurement of BP, IP and FP, Willian's line method, Morse test, Heat balance sheet, Numericals. **Gas Turbine Cycles:** Ideal Brayton cycle, Isentropic efficiencies, Brayton cycle with regeneration, Methods to improve thermal efficiency with their analysis on T-s diagrams: Intercooling, reheating and regeneration. Numerical. Ideal Jet propulsion cycle.

Unit – V	**Contact Hours = 8 Hours**
Reciprocating Compressors: Derivation of work per cycle for a single-stage compressor (with/without clearance), volumetric efficiency, minimum work for compression. Multi-stage compressors, saving in work, optimum intermediate pressure, Numericals. **Refrigeration:** VCR system: Description, analysis, refrigerating effect, units of refrigeration, COP, Numerical. VAR system.	

Flipped Classroom Details

Unit No.	**I**	**II**	**III**	**IV**	**V**
No. for Flipped Classroom Sessions	**2**	**2**	**2**	**2**	**2**

List of Experiments

Unit No.	**No. of Experiments**	**Topic(s) related to Experiment**
1	1	1. Use of Computer Aided Thermodynamic Table (CATT) software
2	1	**2.** To determine the Calorific Value of solid fuel using a Bomb calorimeter
3&4	5	3. Performance test on a single cylinder diesel engine (Mechanical Loading) 4. Performance test on a single cylinder diesel engine (Bulb Loading) 5. Performance test on a twin cylinder diesel engine (Resistance Loading) 6. Performance test on a single cylinder VCR diesel engine **7.** Morse test on a multi-cylinder petrol engine.
5	1	**8.** To evaluate volumetric efficiency of a 2-stage reciprocating air compressor

Unit No.	**Self-Study Topics**
1	Ideal gas equation of state.
2	Factors that render a process irreversible and entropy as a property of the system.
3	Definitions of BP, IP, FP, SFC and Mechanical & Thermal efficiencies.
4	Modifications of the jet propulsion engine.
5	Refrigerants and their desirable properties.

Books	
	Text Books:
1.	Claus Borgnakke, Richard Sonntag, "Fundamentals of Thermodynamics", John Wiley & Sons, 7th Edition, 2009.
2.	Yunus Cengel and Michael Boles, "Thermodynamics: An Engineering Approach (SI Units)", Tata McGraw Hill, 6th Edition and onwards, 2012 and onwards.

3.	V. Ganesan, "Internal Combustion Engines", McGraw-Hill Education, New Delhi, 4th Edition and onwards, 2012 and onwards.
4.	Dr. S.S. Banwait, Dr. S.C. Laroiya, "Properties of Refrigerant & Psychrometric Tables & Charts in SI Units", Birla Publications Pvt. Ltd., New Delhi, 17th Edition and onwards, 2008 and onwards.
	Reference Books:
1.	Michael J. Moran, Howard N. Shapiro, "Principles of Engineering Thermodynamics", Wiley India, 7th Edition and onwards, 2012 and onwards.
2.	Claus Borgnakke, Richard Sonntag, "Computer Aided Thermodynamic Tables (CATT)", John Wiley & Sons, 7th Edition and onwards, 2009 and onwards.
	E-resources (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL course: Basic Thermodynamics by Prof. Goutam Biswas and Prof. Y.V.C. Rao, IIT Kanpur. (http://www.nptel.ac.in/courses/112104113/)
2.	NPTEL course: Basic Thermodynamics by Prof. Pradip Dutta and Prof. K. Shrinivasan, IISc, Bangalore. (http://www.nptel.ac.in/courses/112108148/)
3.	NPTEL course: Basic Thermodynamics by Prof. S.K. Som, IIT Kharagpur. (http://www.nptel.ac.in/courses/112105123/)
4.	Basic Thermodynamics software solutions, Dr. M. Thirumaleshwar. (https://bookboon.com/en/basic-thermodynamics-software-solutions-part-i-ebook)

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination

Course Outcome (COs)
Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Describe** the basic concepts and Laws of thermodynamics, property diagrams of a pure substance, work and heat.	UN	1, 8,9,10	1
2.	**Apply** the first law of thermodynamics for a control volume, including with turbines, compressors, nozzles, diffusers, heat exchangers, and throttling devices	AP	1, 2, 8,9,10	1
3.	**Analyze** the performance of power cycles used in Gas turbines and **evaluate** the performance parameters of IC engines.	AP	1, 2, 8,9,10	1
4.	**Examine** the effectiveness of energy conversion process in mechanical power generation for the benefit of mankind	AN	1, 2, 8,9,10	1

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)** will be part of the CIE. **No SEE for Lab**.

THEORY (60 marks)			**LAB (40 marks)**		Total
IA test 1	IA test 2	Assignment (OBA/Lab Project/ Industry assignment)	Conduction	Lab test	

25 marks	25 marks	10 marks	15 marks	25 marks	100 marks

IA Test:
1. No objective part in IA question paper
2. All questions descriptive

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks
3. Viva voce: 5 marks

Lab test: (Batchwise with 15 students/batch)
1. Test will be conducted at the end of the semester
2. Timetable, Batch details and examiners will be declared by Exam section
3. Conducting the experiment and writing report: 5 marks
4. Calculations, results, graph and conclusion: 10 marks
5. Viva voce: 10 marks

Eligibility for SEE:
1. 40% and above (24 marks and above) in theory component
2. 40% and above (16 marks and above) in lab component
3. **Lab test is COMPULSORY**
4. Not eligible in any one of the two components will make the student **Not Eligible** for SEE

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 100 marks of 3 hours duration.
2.	**Minimum marks required in SEE to pass: 40 out of 100**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	**Target**
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (planned)													**CO-PSO Mapping (planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1	**√**							**√**	**√**	**√**			**√**		
2	**√**	**√**						**√**	**√**	**√**			**√**		
3	**√**	**√**						**√**	**√**	**√**			**√**		
4	**√**	**√**						**√**	**√**	**√**			**√**		

HUMAN ANATOMY AND PHYSIOLOGY

Course Code:	**21AE45**	**Course type**	**AEC**	**Credits L-T-P**	2 – 0– 0
Hours/week: L-T-P	2 – 0 – 0			**Total credits**	2
Total Contact Hours	L = 25 Hrs; T = 0Hrs; P = 0 Hrs Total = 25 Hrs			**CIE Marks**	50
Flipped Classes content	---			**SEE Marks**	50

Course learning objectives	
1.	to provide students with a understanding of the general anatomy and the human body

Knowledge required : Elementary Biology

Unit – I	**Contact Hours = 5 Hours**
Cell and Tissue Structure: Structure of Cell – structure and functions of sub organelles – Cell Membrane –Transport of Across Cell Membrane - Action Potential – Cell to Cell Signaling – Cell Division. Types of Specialized tissues – Functions	

Unit – II	**Contact Hours = 5 Hours**
Skeletal System: Types of Bone and function – Physiology of Bone formation – Division of Skeleton – Types of joints and function – Types of cartilage and function. **Muscular System:** Parts of Muscle – Movements. **Respiratory System:** Parts of Respiratory Systems – Types of respiration - Mechanisms of Breathing – Regulation of Respiration	

Unit – III	**Contact Hours = 5 Hours**
Cardiovascular System: Components of Blood and functions.- Blood Groups and importance – Structure of Heart – Conducting System of Heart – Properties of Cardiac Muscle - Cardiac Cycle - Heart Beat – Types of Blood vessel – Regulation of Heart rate and Blood pressure. Lymphatic: Parts and Functions of Lymphatic systems – Types of Lymphatic organs and vessels	

Unit – IV	**Contact Hours = 5 Hours**
Nervous System: Cells of Nervous systems – Types of Neuron and Synapses – Mechanisms of Nerve impulse – Brain : Parts of Brain – Spinal Cord – Tract and Pathways of Spines – Reflex Mechanism – Classification of Nerves - Autonomic Nervous systems and its functions. **Endocrine** - Pituitary and thyroid gland, **Sense Organs:** Eye and Ear	

Unit –V	**Contact Hours = 5 Hours**
Digestive system: Organs of Digestive system – Digestion and Absorption. Urinary System: Structure of Kidney and Nephron – Mechanisms of Urine formation – Regulation of Blood pressure by Urinary System – Urinary reflex	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	--	---	--	--	--

Books	
	Text Books:
1.	Elaine.N. Marieb, Essential of Human Anatomy and Physiology", Eight Edition, Pearson Education, New Delhi, 2007
2.	Prabhjot Kaur. Text Book of Anatomy and Physiology. Lotus Publsihers. 2014
	E-resource's (NPTEL/SWAYAM.. Any Other)- mention links
1.	
2.	

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Scheduled)
3.		3.	Course Seminar
4.		4.	Semester End Examination

Course Outcome (COs)

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

	Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr – Create	**Learning Level**	**PO(s)**	**PSO(s)**
1.	Discuss and Explain basic structure and functions of cell, anatomy and physiology of various systems of human body	Un	10,12	
2.	Explain correlate the human body systems with Engineering systems	Un	10,12	

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Course Seminar	Total Marks
Marks	15+15= 30	2* 5 marks = 10	10	50
Minimum score to be eligible for SEE: 20 OUT OF 50				

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 2 hours duration.
2.	**Minimum marks required in SEE to pass: 20 out of 50**
3.	Question paper contains two questions from each unit each carrying 20 marks. Students have to answer one full question from each unit.

Rubrics:

Levels	Target
1(Low)	**60% of the students score Less than 50 % of the total marks.**
2(Medium)	**60% of the students score 50 – 70 % of the total marks.**
3(High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													CO-PSO Mapping(Planned)		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1										**√**		**√**			
2										**√**		**√**			
3										**√**		**√**			
4										**√**		**√**			
5										**√**		**√**			

CONSTITUTION OF INDIA

Course Code	21AE46	Course type	HSMS	Credits L-T-P	1 – 0 - 0
Hours/week: L - T- P	1 – 0 – 0			Total credits	1
Total Contact Hours	L = 15 Hrs; T = 0 Hrs; P = 0 Hrs Total = 15 Hrs			CIE Marks	50
Flipped Classes content	5 Hours			SEE Marks	50 (2 Hours)

Course learning objectives	
1.	To enable the student to understand the importance of the constitution
2.	To understand the structure of executive, legislature, and judiciary and fundamental rights and duties
3.	To understand the central and state relation: administrative
4.	To understand the autonomous nature of constitutional bodies like Supreme Court and high court and election commission of India

Pre-requisites : NIL

Unit – I	Contact Hours = 3 Hours
Introduction to Indian Constitution: Constitution meaning of the term, Indian Constitution – Sources and constitutional history, Features – Citizenship, Preamble, Fundamental Rights and Duties, Directive Principles of State Policy.	

Unit – II	Contact Hours = 3 Hours
Union Government and its Administration Structure of the Indian Union: Federalism, Centre - State relationship, President: Role, power and position, LokSabha , RajyaSabha, Prime Minister and Council of ministers, Cabinet and Central Secretariat, The Supreme Court and High Court: Powers and Functions.	

Unit – III	Contact Hours = 3 Hours
State Government and its Administration: Governor – Role and Position Chief Minister and Council of ministers, State Cabinet, State Legislature State Secretariat: Organisation, Structure and Functions.	

Unit – IV	Contact Hours = 3 Hours
Local Administration – District's Administration Head – Role and Importance, Municipalities – Mayor and role of Elected Representative – CEO of Municipal Corporation Panchayati Raj: Functions, Panchayati Raj Institution: ZilaPanchayat, Elected officials and their roles, CEO ZilaPanchayat: Block level Organizational Hierarchy – (Different departments), Village level – Role of Elected and Appointed officials – Importance of grass root democracy.	

Unit – V	Contact Hours = 3 Hours
Election Commission: Election Commission- Role of Chief Election Commissioner and Election Commissionerate State Election Commission, Functions of Commissions for the welfare of SC/ST/OBC and women.	

Flipped Classroom Details

Unit No.	I	II	III	IV	V
No. for Flipped Classroom Sessions	1	1	1	1	1

Books	
	Text Books:
1.	Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi
2.	SubashKashyap, Indian Constitution, National Book Trust
3.	H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)
4.	
	Reference Books:
1.	Name of the author(s), Title of the Book, Publisher, Edition/Year _____ and onwards
2.	
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	
2.	

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Online Quizzes (Scheduled)
3.	Flipped Classes	3.	Assignments
		4.	Semester End Examination

Course Outcome (COs)

At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)

	Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create	**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Discuss the significance of Indian Constitution and the structure of Central and State Government**	UN		

2.	**Exercise the fundamental rights in proper sense and identify responsibilities in national building.**	AP		

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Addition of two Assignments	Total Marks
Marks	15+15 = 30	10+10 =20	50
Writing the IA test is Compulsory **Minimum marks required to be eligible for SEE: 20 out of 50**			

Scheme of Semester End Examination (SEE):	
1.	It will be conducted for 50 marks of 2 hours duration.
2.	**Minimum marks required in SEE to pass: 20 out of 50**
3.	Question paper contains questions from each unit each carrying 10 marks. Students have to answer one full question from each unit.

Rubrics:Levels	**Target**
1 (Low)	**60% of the students score Less than 50 % of the total marks.**
2 (Medium)	**60% of the students score 50 – 70 % of the total marks.**
3 (High)	**60% of the students score More than 70 % of the total marks.**

CO-PO Mapping (Planned)													**CO-PSO Mapping (Planned)**		
CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PSO 1**	**PSO 2**	**PSO 3**
1															
2															
3															
4															
5															
Tick mark the CO, PO and PSO mapping															

SOCIAL CONNECT AND RESPONSIBILITIES

Course Code	21AE47	Course type	UHV	Credits L-T-P	1-0-0
Hours/week: L - T- P	1-0-0			Total credits	1
Total Contact Hours	15 Hours of engagement			CIE Marks	50
Flipped Classes content	--			SEE Marks	50

Course learning objectives	
1.	Bridging the gap between theory and practice through community engagement
2.	Interaction with the community for identification and solution to real life problems faced by the community
3.	Catalyzing acquisition of values and responsibilities for public service to make better citizens

Required Knowledge of: Interpersonal skills, Communication skills

Activities to be planned and conducted by the Department Associations are:

1. **Linking learning with the community through Knowledge Sharing**: In this the students can apply their knowledge and skills to improve the lives of the people. The knowledge available with the students can be shared to the school students of the local community. It can be in the form of engaging the classes, developing projects which can used by the students and teachers, training sessions on MS word, Excel, PPT for students and teachers etc.
2. **Creating Awareness about health and hygiene:** The students can arrange talks on Importance of cleanliness, health, and hygiene by taking help of Doctors, Public Health Organizations, NGOs etc.
3. **Including the Practitioners as teachers:** Arrange the invited talks by experts in agriculture for the farmers in the local community to create awareness about Organic farming, new methods of agriculture such as hydroponics, vertical farming etc.
4. **Environmental Sustainability:** Students can take initiatives to educate the local community regarding protecting our environment through tree plantations, preserving water bodies etc.
5. **Social Innovations for Rural development**

Course Outcome (COs)

Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		Learning Level	PO(s)	PSO(s)
1.	Gain knowledge about the culture and societal realities	Un		
2.	Develop sense of responsibility and bond with the local community	Un		
3.	Make significant contributions to the local community and the Society at large	Ap		
4	Identify opportunities for contribution to the Socio-economic development	Ev		

Scheme of Continuous Internal Evaluation (CIE):

• Students must maintain the diary of the activities conducted. • The activities can be conducted in groups/batches. • Faculty members can design the evaluation system.	50 marks

Scheme of Semester End Examination (SEE):			
• Students must prepare the report of the learnings and the outcomes. • Presentations can be conducted for the SEE. • Department can form a team of two faculty members as evaluators. NGOs, Officials from Govt./ Semi-Govt. organizations could be included in the evaluation process.	Report	Presentation	Total
	20	30	50

Rubrics:

Levels	**Target**
1 (Low)	**50 % of the total marks is scored by 60% of the students. (% can be varied)**
2 (Medium)	
3 (High)	

CO-PO-PSO mapping

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1															
2															
3															
4															

Introduction to PYTHON

Course Code	21AECAE48	Course type	PCC	Credits L-T-P	0-0-1
Hours/week: L-T-P	0-0-2			Total credits	1
Total Contact Hours	L = 0 Hrs; T = 0Hrs;P = 20 Hrs Total =20 Hrs			CIE Marks	100
Flipped Classes content	5			SEE Marks	100

Course learning objectives	
1	Learn the syntax and semantics of Python programming language.
2	Illustrate the process of structuring the data using lists & tuples
3	Understand set & Dictionaries in Python
4	Implement Object Oriented Programming concepts in Python
5	Demonstrate the use of built-in functions to navigate the file system ,plotting graph & math operations

Required Knowledge of : Basics of C

No. of Experiments	Topic(s) related to Experiment
1	**Basics of python**
2	**Basics of variables and strings operations**
3	Basics of list and tuples operations
4	Basics of set and dictionaries operations
5	Basics of loops, array, class and function operations
6	Basics of file read/write/create/delete
7	Plotting of graph
8	Basics of math operations

Unit No.	Self-Study Topics
I	Installation procedure of python, pyplot, matploylib
II	SQL
III	MANGODB
IV	Classes and methods
V	User input

Books	
	Text Books:
1.	Charles R. Severance, "Python for Everybody: Exploring Data Using Python 3", 1st Edition, Create Space Independent Publishing Platform, 2016. (http://do1.drchuck. com/pythonlearn/EN_us/pythonlearn.pdf) (Chapters 1 – 13, 15)

2.	Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2ndEdition, Green Tea Press, 2015. (http://greenteapress.com/thinkpython2/thinkpython2.pdf) (Chapters 15, 16, 17)(Download pdf files from the above links)
	Reference Books:
1.	Wesley J Chun, "Core Python Applications Programming", 3rd Edition, Pearson Education India, 2015. ISBN-13: 978-9332555365
2.	Charles Dierbach, "Introduction to Computer Science Using Python", 1st Edition, Wiley India Pvt Ltd. ISBN-13: 978-8126556014
3	Mark Lutz, "Programming Python", 4th Edition, O'Reilly Media, 2011.ISBN-13: 978-9350232873
	E-resourses (NPTEL/SWAYAM.. Any Other)- mention links
1.	NPTEL: Joy of computing using python by Prof. Sudarshan Iyengar, Prof. Yayati Gupta, IIT Ropar https://onlinecourses.nptel.ac.in/noc21_cs32/preview
2.	NPTEL: Python for Data Science by Prof. Ragunathan Rengasamy, IIT Madras https://onlinecourses.nptel.ac.in/noc22_cs32/preview

Course delivery methods		**Assessment methods**	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Assignments (OBA)/ Lab Project
3.	Flipped Classes	3.	Lab Test
4.	Practice session/Demonstrations in Labs	4.	Semester End Examination
5.	Virtual Labs (if present)		

Course Outcome (COs)
Learning Levels:
Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create

At the end of the course, the student will be able to		**Learning Level**	**PO(s)**	**PSO(s)**
1.	Explain Python syntax and semantics	UN	1,5	1
2.	Construct the Python Programs using core data structures like lists and tuples ,sets & Dictionaries.	AP	1,2,3,5,8,9,10,12	1,2,3
3.	Interpret the concepts of Object-Oriented Programming file handling , graph plotting & math operations.	AN	1,2,3,5,8,9,10,12	1,2,3

Scheme of Continuous Internal Evaluation (CIE):
For integrated courses, a lab test also will be conducted at the end of the semester. The lab test **(COMPULSORY)**will be part of the CIE. **No SEE for Lab**.

LAB (50 marks)			Total
Conduction	Journal Submission	Open Ended Experiment	
25 marks	15 marks	10	100 marks

Conduct of Lab:
1. Conducting the experiment and journal: 5 marks
2. Calculations, results, graph, conclusion and Outcome: 5 marks

3. Viva voce: 5 marks
Journal Submission 1. Students will submit the journal at the end of the semester
Open Ended Experiment 1. Students will perform one open ended experiment at the end of the semester

Rubrics:

Levels	Target
1(Low)	60% of the students score Less than 50 % of the total marks.
2(Medium)	60% of the students score 50 – 70 % of the total marks.
3(High)	60% of the students score More than 70 % of the total marks.

CO-PO Mapping (planned)													CO-PSO Mapping(planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√				√								√		
2	√	√	√		√			√	√	√		√	√	√	√
3	√	√	√		√			√	√	√		√	√	√	√

Fourth Semester

Bridge Course Mathematics-II

(Common to all Branches)

(A Bridge course for Lateral Entry students of IV Sem. B. E.)

Course Code	21MATDIP-41	**Course type**	**BS**	**Credits L-T-P**	0 – 0 - 0
Hours/week: L - T- P	3– 0 – 0			**Total credits**	0
Total Contact Hours	L = 40 Hrs; T = 0 Hrs; P = 0 Hrs Total = 40 Hrs			**CIE Marks**	100
				SEE Marks	0

Course learning objectives	
1.	Learn differential equations of first and second order and their applications to second order.
2.	Get familiar with concepts of beta, gamma functions and multiple integrals.
3.	Learn advanced concepts of Linear Algebra
4.	Learn and use various concepts in vector differentiation
5.	Learn and use various concepts in vector integration.

Pre-requisites : Basic Trigonometry, Calculus,Algebra.

Unit – I:Differential Equations:	**Contact Hours = 8 Hours**
Bernoulli and Exact (excluding reducible). Orthogonal trajectory. Linear differential equations of higher order **w**ith constant coefficients. Problems on second order only. Applications to- vibration of a spring, Electric circuits and bending of beams.	

Unit-II: Multiple Integrals	**Contact Hours =8 Hours**
Introduction to integration Beta, Gamma functions .Double integral, Change of order, change of variables. Application to area, Triple integral (based on limits given). Application to find volume.	

Unit –III: Linear Algebra II	**Contact Hours = 8 Hours**
Diagonalization of a square matrix, Orthogonal matrix Quadratic form and reduction to Canonical forms by Orthogonal Transformation. Linear Transformation. Regular transformation: Identity, stretching along an axis, reflection with respect to axis, Rotation Shear, projection. (planar illustration).	

Unit-IV: Vector Differentiation	**Contact Hours = 8 Hours**
Scalar and Vector point function, Gradient, Divergence, Curl, Solenoidal and Irrotational vector fields, scalar potential and its applications (Directional Derivative, Angle between surfaces). Vector identities- $div(\phi A)$, $curl(\phi A), curl(grad\phi)$, $div(curlA)$.	

Unit –V: Vector Integration	**Contact Hours =8 Hours**
Line Integral, Surface Integral, Volume Integral, Green's Theorem, Stoke's Theorem, Gauss Divergence Theorem (all theorems statement only) and problems.	

Books	
	Text Books:
1.	B.S. Grewal – Higher Engineering Mathematics, Khanna Publishers, 42nd Edition, 2012.
2.	Erwin Kreyszig –Advanced Engineering Mathematics, John Wiley & Sons Inc., 9th Edition, 2006.
3.	B. V. Ramana- Higher Engineering Mathematics, Tata McGraw-Hill Education Private Limited, Tenth reprint 2010 and onwards.
	Reference Books:
1.	Peter V. O' Neil – Advanced Engineering Mathematics, Thomson Brooks/Cole, 7th Edition, 2011.
2.	Glyn James – Advanced Modern Engineering Mathematics, Pearson Education, 4th Edition, 2010.

Course delivery methods		Assessment methods	
1.	Chalk and Talk	1.	IA tests
2.	PPT and Videos	2.	Open Book Tests (OBT)
3.	Online Classes	3.	Course Seminar
		4.	Semester End Examination

Course Outcome (COs) At the end of the course, the student will be able to (Highlight the **action verb** representing the learning level.)				
Learning Levels: Re - Remember; Un - Understand; Ap - Apply; An - Analysis; Ev - Evaluate; Cr - Create		**Learning Level**	**PO(s)**	**PSO(s)**
1.	**Apply** Differential equations to solve physical phenomena.	**Ap**	1	1
2.	**Understand** the concept of Beta, Gamma functions and Multiple Integrals.	**Re**	1	1
3.	**Understand** the concept of diagonalization of matrices, Transformations and relevant concepts.	**Un**	1	1
4.	**Use** the various terminologies connected with vector/scalar functions	**Ap**	1	1
5.	**Understand** the applications of vector Integration.	**Un, Ap**	1	1

Scheme of Continuous Internal Evaluation (CIE):

Components	Addition of two IA tests	Online Quiz	Addition of two OBAs/Math tools	Course Seminar	Total Marks
Marks	25+25 = 50	4*5 marks=20	10+10 =20	10	100
	OBA - Open Book Assignment **Minimum score for passing: 40 OUT OF 100**				

Rubrics:

Levels	Target
1(Low)	60% of the students score Less than 50 % of the total marks.
2(Medium)	60% of the students score 50 – 70 % of the total marks.
3(High)	60% of the students score More than 70 % of the total marks.

CO-PO Mapping (Planned)													CO-PSO Mapping(Planned)		
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	√										√	√	√		
2	√										√	√	√		
3	√										√	√	√		
4	√										√	√	√		
5	√										√	√	√		