RAMAIAH
Institute of Technology

CURRICULUM
for the Academic year 2026 – 2027

DEPARTMENT OF AEROSPACE ENGINEERING

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
BANGALORE – 54

III & IV Semester
B. E. Aerospace Engineering
Batch-2025

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 18 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A^{+}' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 70% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation.

The Entrepreneurship Development Cell (EDC) and "Ramaiah Evolute" have been set up on campus to incubate startups. MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, M S Ramaiah Institute of Technology has achieved 75th rank among 1463 top Engineering Institutions & 21st Rank among 115 Schools of Architecture in India for the year 2025.

About the Department

The Department of Aerospace Engineering was established in 2024 and offers a four-year B.E. Aerospace Engineering Program with an intake of 60 students and a two-year M.Tech. Aerospace Engineering Program with an intake of 18 students. The emphasis of the department is on imparting quality education in Aerospace Engineering, enabling the creation of expertise in this specialized area to cater to the requirements of the fast-growing aerospace sector in the country. In addition, the Department actively promotes research initiatives in the various sub-domains of the discipline.

At present, the department has seven full-time faculty members with all of them possessing Ph.D. degrees with specializations across various streams within aerospace engineering. All faculty members have extensive teaching and research experience and have consistently published and presented their work in reputed peer-reviewed international journals and conferences. In addition, they possess proven expertise in executing externally funded research projects. The faculties have been recognized as Research Supervisors by Visvesvaraya Technological University to supervise Scholars pursuing Ph.D./M.S.(Research)/ Integrated Ph.D. programs

The department has established well-equipped academic laboratories in areas of aerodynamics, structures, propulsion and flight simulation. Key facilities include a well-instrumented computerized subsonic wind tunnel, a micro gas turbine engine test rig, and a high-fidelity flight simulator with advanced features. The department also supports design and analysis activities via CAD modelling and simulation facilities. These resources significantly support both faculty and students in conducting in-house research and development activities. The department has been promoting extracurricular activities, allowing students to establish clubs like the Aeromodelling Club, CubeSat Club, alongside many other initiatives which are currently in the pipeline. In addition to academics, the students are encouraged to participate in various competitions allowing them gain recognition and receive prizes.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio-economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

1. Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
2. Establishing research clusters in emerging areas in collaboration with globally reputed organizations
3. Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at M S Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To be a centre of repute in Aerospace Engineering in imparting quality technical education with emphasis on industrial connect and research.

MISSION OF THE DEPARTMENT

1. To create conducive learning environment with state-of-the-art facilities to impart quality education in aerospace engineering
2. To promote industry collaborated activities to develop aerospace domain clusters for skill development suitable for aerospace research and employment
3. To develop and promote student centric centers of aerospace engineering for providing national/ international exposure through projects and related activities

Program Educational Objectives (PEOs):

To produce engineers

PEO 1 – with the ability to apply their knowledge in basic sciences, engineering sciences and aerospace engineering domain to excel in their professional career

PEO 2 – with the ability to apply learnt skills to solve real-time problems in areas of aeronautics and space applications

PEO 3 – with capabilities to work in teams and communicate effectively to take up diverse roles in the field of aerospace engineering

PEO 4 – with environmental awareness, commitment towards professional ethics, social responsibilities and focus on lifelong learning.

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

Program Outcomes (POs): As per NBA guidelines

PO1: Engineering Knowledge: Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.

PO2: Problem Analysis: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)

PO3: Design/Development of Solutions: Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)

PO4: Conduct Investigations of Complex Problems: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).

PO5: Engineering Tool Usage: Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)

PO6: The Engineer and The World: Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).

PO7: Ethics: Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)

PO8: Individual and Collaborative Team work: Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.

PO9: Communication: Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences

PO10: Project Management and Finance: Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.

PO11: Life-Long Learning: Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PSOs of the Program Offered:

Aerospace Engineering Graduates will be able to:

PSO1: apply their knowledge in aerospace sub-domains of aerodynamics, propulsion, structures, control, guidance and navigation to solve real-time problems

PSO2: apply the knowledge gained / skills acquired to work and excel in professional roles in the aerospace engineering domain

PSO3: inculcate ethical practices, support social and environmental concerns and evolve as responsible professionals

Breakup of Credits for BE Degree Curriculum (I to VIII Semester) BATCH 2025-2029

Semester / Course Category	First	Second	Third	Fourth	Fifth	Sixth	Seventh	Eighth	Total Credits
Applied Science Course (ASC)	08	08	03	--	--	--	--	--	19
Engineering Science Course (ESC)	03	05	--	--	--	--	--	--	08
Programming Language Course (PLC)	04	--	--	--	--	--	--	--	04
Emerging Technology Course (ETC)	03	--	--	--	--	--	--	--	03
Humanities, Social Sciences and Management (HSMC)	01	02	--	--	03	--	03	--	09
Ability Enhancement Course (AEC)	01	01	01	01	01	--	--	--	05
Universal Human Values (UHV)	--	--	02	--	--	--	--	--	02
Skill Development Course (SDC)	--	--	--	--	--	01	--	--	01
Professional Core Courses (PCC)	--	04	11	12	11	11	04	--	53
Integrated Course (IC)	--	--	04	04	04	--	04	--	16
Professional Elective Courses (PEC)	--	--	--	03	03	03	03	--	12
Open Elective Courses (OEC)	--	--	--	--	--	03	03	--	06
Internship (INT)	--	--	--	✔	--	--	--	04	04
Mini Project / Project Work (PW)	--	--	--	--	--	04	02	12	18
Non Credit Mandatory Courses (NCMC)	--	--	✔	✔	✔	✔	--	--	--
Total Credits	20	20	21	20	22	22	19	16	160

B.E. in Aerospace Engineering
Scheme of Teaching – Batch : 2025

III SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week			
					L	T	P	Total	L	T	P	S
1	AS31	Transform Techniques & Partial Differential Equations	Mathematics	ASC	2	1	0	3	2	2	0	2
2	AS32	Mechanics of Materials	AS	PCC(IC)	3	0	1	4	3	0	2	3
3	AS33	Fundamentals of Space Mechanics	AS	PCC	3	0	0	3	3	0	0	3
4	AS34	Fluid Mechanics	AS	PCC	3	0	0	3	3	0	0	3
5	AS35	Thermodynamics	AS	PCC	2	1	0	3	2	2	0	2
6	UHV36	Universal Human Value Course	AS	UHV	2	0	0	2	2	0	0	2
7	ASAEC37	Measurements and Metrology	AS	AEC	1	0	0	1	1	0	0	1
8	ASL38	Fluid Mechanics lab	AS	PCC	0	0	1	1	0	0	2	0
9	ASL39	Computer Aided Aircraft Drawing lab	AS	PCC	0	0	1	1	0	0	2	0
				Total	**16**	**2**	**3**	**21**	**16**	**4**	**6**	**16**
10	PE69	Physical Education		NCMC	All students have to register compulsorily for any one of the courses with the concerned coordinator (Yoga Teacher/ Physical Education Director/ NSS Coordinator) in the beginning of the III semester. Attending the registered course from III to VI semesters. Successful completion of the registered course and requisite CIE score is mandatory for the award of the degree.							
	YO69	Yoga										
	NS69	NSS										
11	AM31	Additional Mathematics - I *		NCMC	0	0	0	0	-			

Nomenclature: ASC: Applied Science Course, **IC:** Integrated Course (Practical Integrated with Theory Course), **PCC:** Professional Core Course, **UHV:** Universal Human Value Course, **AEC:** Ability Enhancement Course, **NCMC:** Non-credit Mandatory Course

Credit Definition:

- **1 credit = 1 hour/week of lecture (L)**
- **1 credit = 2 hours/week of tutorial (T)**
- **1 credit = 2 hours/week of practical(P)**
- **Self-Learning Hours (S)**

PCC & ASC courses are theory courses with or without tutorial sessions.

- Each theory credit corresponds to one contact hour per week, while each tutorial credit corresponds to two contact hours per week.
- The course shall be evaluated through Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each having a weightage of 50%.
- The CIE is evaluated for 50 marks through internal tests (30 marks) and other components (20 marks). Each internal test will have three questions and students shall answer any two full questions. Each question shall address all the Course Outcomes (COs) prescribed for that test. The average of the two tests shall be considered for awarding 30 marks. The remaining 20 marks shall be assessed through assignments, tutorial tests, quizzes, surprise tests, mini-projects, or other components as decided by the course instructor.
- The SEE examination shall consist of ten questions with internal choice (two questions per unit). Students shall answer any five full questions, selecting at least one question from each unit.

PCC (IC) is an Integrated course, combining theory with practical components.

- Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.
- Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component shall be assessed only through CIE (No SEE).
- The CIE is evaluated for 50 marks through internal tests (30 marks) and other components (20 marks). Each internal test will have three questions and students shall answer any two full questions. Each question shall address all the Course Outcomes (COs) prescribed for that test. The average of the two tests shall be considered for awarding 30 marks. The remaining 20 marks shall be assessed through assignments, tutorial tests, quizzes, surprise tests, mini-projects, or other components as decided by the course instructor.
- The SEE examination shall consist of ten questions with internal choice (two questions per unit). Students shall answer any five full questions, selecting at least one question from each unit.
- However, questions from the practical component of the Integrated course (IC) can be included in the SEE question paper.

AEC is a 1-credit course involving 1 contact hour per week. The course shall be evaluated through Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each having a weightage of 50%.

- The CIE will comprise of two tests of 30 marks each having Part-A with MCQs for 6 marks and Part-B with Descriptive questions. The remaining 20 marks shall be assessed through assignments, surprise tests, quizzes, or other components as decided by the course instructor.
- The SEE will comprise of Part-A with MCQs (10 marks) and Part-B (5x8=40 marks) with descriptive questions.

UHV is a 2-credit course involving 2 contact hours per week. The course shall be evaluated through Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each having a weightage of 50%.

- The CIE is evaluated for 50 marks through internal tests (30 marks) and other components (20 marks). Each internal test will have three questions and students shall answer any two full questions. Each question shall address all the Course Outcomes (COs) prescribed for that test. The average of the two tests shall be considered for awarding 30 marks. The remaining 20 marks shall be assessed through assignments, tutorial tests, quizzes, surprise tests, mini-projects, or other components as decided by the course instructor.

The SEE examination shall consist of ten questions with internal choice (two questions per unit). Students shall answer any five full questions, selecting at least one question from each unit.

PCC Laboratory is a 1-credit lab course involving 2 hours of lab sessions per week and uses both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) for assessment.

- CIE totals 50 marks, with 30 marks for lab sessions (Each laboratory experiment shall be evaluated for 10 marks based on the experiment record, conduction of the experiment, and observations, and the cumulative marks shall be scaled down to 30 marks.). Another 15 marks from a lab test and 05 marks for viva.
- SEE totals 50 marks, comprising 40 marks for procedure write up, experiment conduction & results and 10 marks for viva voce.

The Non Credit Mandatory Course, Physical Education (Sport and Athletics)/Yoga/National Service Scheme (NSS):

- Student shall select any one of the NCMC's namely, Physical Education (Sport and Athletics)/Yoga/ NSS prescribed for four semesters and shall attend the course from the III semester to VI semester to complete all the formalities of the course and earn requisite CIE score. The Pass/Fail shall be reflected in the VI semester grade card.

- The above mentioned NCMC's shall not be considered for vertical progression as well as for the calculation of SGPA/CGPA but completion of the courses shall be mandatory for the award of degree.
- CIE marks will be allotted by the concerned course teacher based on attendance and performance in the practice sessions/field work every semester (III to VI) for 100 marks and the total 400 marks scored by the student are scaled down to 100 in the VI semester.
- In case, any student fails to secure the minimum 40% of the prescribed marks, he/she shall be deemed to have secured 'F' grade.

*** Lateral Entry Students:**

The Non-Credit Mandatory Course, Additional Mathematics I: is prescribed for III Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other III semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured 'F' grade. In such a case, the student has to fulfil the requirements during subsequent semester/s to appear for CIE. In case the student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics I shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Lateral Entry Students:

The Non-Credit Mandatory Course, Inter/Intra Institutional Internship: All the students admitted under lateral entry category shall have to undergo a mandatory Internship of 02 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during IV semester based on which a student will be declared pass or fail. The internship shall be considered as a head of passing for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete internship requirements during subsequent semesters.

Lateral Entry Students:

AICTE Activity Points Requirement for BE Programs: As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be eligible for the award of the degree. The points to be earned is:

1. **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
2. **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
3. **Students transferred** from other universities directly into the V semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are non-credit and will not be considered for the SGPA/CGPA or be used for vertical progression. However, earning Activity Points is mandatory for the award of the degree, and the points earned will be reflected on the eighth semester Grade Card. If a student completes all the semesters (eight or six) at the end of the program but fails to earn the required Activity Points, the VIII semester Grade Card will be withheld until the requirement is fulfilled. Also, the degree will be awarded only after the Grade Card has been released. The hours spent earning the activity points will not be counted for regular attendance requirements. Students can accumulate these points at any time during their program period, including weekends, holidays, and vacations, starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity by AICTE.

B.E. in Aerospace Engineering
Scheme of Teaching – Batch : 2025

IV SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week			
					L	T	P	Total	L	T	P	S
1	AS41	Aerospace Structures – I	AS	PCC(IC)	3	0	1	4	3	0	2	3
2	AS42	Finite Element Analysis	AS	PCC	2	1	0	3	2	2	0	4
3	AS43	Aerospace Propulsion	AS	PCC	3	0	0	3	3	0	0	3
4	AS44	Low Speed Aerodynamics	AS	PCC	3	0	0	3	3	0	0	3
5	ASE45x	Program Elective Course - I	AS	PEC	3	0	0	3	3	0	0	3
6	ASAEC46	Non Destructive Testing	AS	AEC	1	0	0	1	1	0	0	1
7	ASL47	Finite Element Analysis Lab	AS	PCC	0	0	1	1	0	0	2	0
8	ASL48	Aerospace Propulsion Lab	AS	PCC	0	0	1	1	0	0	2	0
9	ASL49	Aerodynamics Lab	AS	PCC	0	0	1	1	0	0	2	0
				Total	**15**	**1**	**4**	**20**	**15**	**2**	**8**	**15**
10	INT410	Inter/ Intra Institutional Internship		NCMC	0	0	0	0	-			
11	AM41	Additional Mathematics II *		NCMC	0	0	0	0	-			

LIST OF COURSES OFFERED UNDER PROGRAM ELECTIVE COURSE -1

Sl. No.	Subject Code	Subject
1	ASE451	Aerospace Systems and Instrumentation
2	ASE452	Aircraft Maintenance, Repair and Overhaul
3	ASE453	Air Transportation: an overview
4	ASE454	Probability & Statistics

Nomenclature: IC: Integrated Course (Practical Integrated with Theory Course), **PCC:** Professional Core Course, **PEC:** Professional Elective Course, **AEC:** Ability Enhancement Course, **NCMC:** Non-credit Mandatory Course

Credit Definition:

- **1 credit = 1 hour/week of lecture (L)**
- **1 credit = 2 hours/week of tutorial (T)**
- **1 credit = 2 hours/week of practical(P)**
- **Self-Learning Hours (S)**

PCC(IC) is an Integrated course, combining theory with practical components.

- Theory sessions shall be conducted for 3 hours per week, while the practical sessions shall be conducted for 2 hours per week.
- Theory components shall be evaluated through both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE).
- The practical component shall be assessed only through CIE (No SEE).
- The CIE shall consist of two internal test of 30 marks each. Each test will have three questions and student shall answer any two full questions. Each question shall have all CO's addressed for that test. An average of two test shall be taken to award 30 marks.
- The CIE shall have other component for 20 marks assessed through assignments, quiz, surprise test, etc. as decided by the instructor of the course.
- The SEE examination shall consist of 10 questions with internal choice and student shall answer any five full questions.

- However, questions from the practical component of the Integrated course (IC) can be included in the SEE question paper.

PCC & PEC courses are theory courses with or without tutorial sessions.

- Each theory credit corresponds to one contact hour per week, while each tutorial credit corresponds to two contact hours per week.
- The course shall be evaluated through Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each having a weightage of 50%.
- The CIE is evaluated for 50 marks through internal tests (30 marks) and other components (20 marks). Each internal test will have three questions and students shall answer any two full questions. Each question shall address all the Course Outcomes (COs) prescribed for that test. The average of the two tests shall be considered for awarding 30 marks. The remaining 20 marks shall be assessed through assignments, tutorial tests, quizzes, surprise tests, mini-projects, or other components as decided by the course instructor.
- The SEE examination shall consist of ten questions with internal choice (two questions per unit). Students shall answer any five full questions, selecting at least one question from each unit.

AEC is a 1-credit course involving 1 contact hour per week. The course shall be evaluated through Continuous Internal Evaluation (CIE) and Semester End Examination (SEE), each having a weightage of 50%.

- The CIE will comprise of two tests of 30 marks each having Part-A with MCQs for 6 marks and Part-B with Descriptive questions. The remaining 20 marks shall be assessed through assignments, surprise tests, quizzes, or other components as decided by the course instructor.
- The SEE will comprise of Part-A with MCQs (10 marks) and Part-B (5x8=40 marks) with descriptive questions.

PCC Laboratory is a 1-credit lab course involving 2 hours of lab sessions per week and uses both Continuous Internal Evaluation (CIE) and Semester End Examination (SEE) for assessment.

- CIE totals 50 marks, with 30 marks for lab sessions (Each laboratory experiment shall be evaluated for 10 marks based on the experiment record, conduction of the experiment, and observations, and the cumulative marks shall be scaled down to 30 marks.). Another 15 marks from a lab test and 05 marks for viva.
- SEE totals 50 marks, comprising 40 marks for procedure write up, experiment conduction & results and 10 marks for viva voce.

*** Lateral Entry Students:**

The Non-Credit Mandatory Course, Additional Mathematics II: is prescribed for IV Semester Lateral Entry Diploma students admitted to III Semester of BE Program. The student shall register for this course along with other IV semester courses. The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured 'F' grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. In case the student fails to register for the said course/ falls short of attendance, he/she will repeat the course whenever it is offered next. Additional Mathematics II shall have CIE component only and no SEE component. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

Lateral Entry Students:

The Non-Credit Mandatory Course, Inter/Intra Institutional Internship: All the students admitted under lateral entry category shall have to undergo a mandatory Internship of 02 weeks during the intervening vacation of III and IV semesters. Summer Internship shall include Inter / Intra Institutional activities. A Viva-voce examination shall be conducted during IV semester based on which a student will be declared pass or fail. The internship shall be considered as a head of passing for the award of degree. Those, who do not take up / complete the internship shall be declared fail and shall have to complete internship requirements during subsequent semesters.

Lateral Entry Students:

AICTE Activity Points Requirement for BE Programs: As per AICTE guidelines (refer Chapter 6 – *AICTE Activity Point Program, Model Internship Guidelines*), in addition to academic requirements, students must earn a specified number of **Activity Points** to be eligible for the award of the degree. The points to be earned is:

1. **Regular students** admitted to a 4-year degree program must earn **100 Activity Points**.
2. **Lateral entry students** (joining from the second year) must earn **75 Activity Points**.
3. **Students transferred** from other universities directly into the V semester must earn **50 Activity Points** from the date of entry into VTU.

These Activity Points are non-credit and will not be considered for the SGPA/CGPA or be used for vertical progression. However, earning Activity Points is mandatory for the award of the degree, and the points earned will be reflected on the eighth semester Grade Card. If a student completes all the semesters (eight or six) at the end of the program but fails to earn the required Activity Points, the VIII semester Grade Card will be withheld until the requirement is fulfilled. Also, the degree will be awarded only after the Grade Card has been released. The hours spent earning the activity points will not be counted for regular attendance requirements. Students can accumulate these points at any time during their program period, including weekends, holidays, and vacations, starting from the year of admission, provided they meet the minimum hours of engagement prescribed for each activity by AICTE.

III SEMESTER

TRANSFORM TECHNIQUES & PARTIAL DIFFERENTIAL EQUATIONS	
Course Code: AS31	**Credits: 2:1:0**
Prerequisite: Calculus	**Contact Hours: 30L + 15T + 30S**
Course Coordinator: Dr. B Azghar Pasha & Dr. G Kalpana	

Course Content

Unit I

Laplace Transform: Definition and existence condition, Laplace transform of elementary functions, Properties of Laplace transform. Evaluation of definite integrals using Laplace transform. Laplace transform of periodic functions

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation
- Links: ➢ https://nptel.ac.in/courses/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/119640/593

Unit II

Inverse Laplace Transform: Laplace transform of unit–step and unit–impulse function. Inverse Laplace transform, Convolution theorem. Evaluation of inverse Laplace transform using convolution theorem and partial fractions. Solution of ordinary differential equations (ODE's) and system of first order ODE's by Laplace transform method.

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation
- Links: ➢ https://nptel.ac.in/courses/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/119640/593

Unit III

Fourier Series & Fourier Transform: Introduction to Fourier Series, Half range Fourier Sine & Cosine series**.** Infinite Fourier transform, Fourier Sine and Cosine transform, inverse transform, Convolution theorem, Parseval's identities.

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation
- Links: ➢ https://nptel.ac.in/courses/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/119640/593

Unit IV

Partial Differential Equations: Introduction to PDE, solutions of partial differential equations - direct integration method, Lagrange's method and method of separation of variables. Classification of second order PDE's. Solution of Laplace equation, one dimensional heat equation and one dimensional wave equation using the method of separation of variables

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➢ https://nptel.ac.in/courses/111101153
  ➢ https://nptel.ac.in/courses/111108152
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/2583981/1205
  ➢ https://a.impartus.com/ilc/#/course/290290/703

Unit V

Applications of Laplace and Fourier transforms to solve PDE's: Solution of diffusion equation and one dimensional wave equation using Laplace transform technique. Solution of two dimensional Laplace

equation, one dimensional wave equation and one dimensional heat equation using Fourier transform technique.

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➢ https://nptel.ac.in/courses/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/59742/295
  ➢ https://a.impartus.com/ilc/#/course/2975585/1331

Text books:

1. **ERWIN KREYSZIG** -Advanced Engineering Mathematics, Wiley publication, 10th edition, 2015
2. **I.N. SNEDDON** - Elements of Partial Differential Equations, McGraw-Hill, 1957.
3. **S. SANKAR RAO** - Introduction to Partial Differential Equations, Prentice Hall of India, 3rd edition, 2010.

Reference books:

1. **S.J. FARLOW** - Partial Differential Equations for scientists and Engineers, Dover, 1993.
2. **B. S. GREWAL** – Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
3. **M.D. RAISINGHANIA** - Advanced Differential Equations, S. Chand, 20th edition, 2023.

Course Outcomes (COs):

After completing this course, students will be able to

1. Determine Laplace transform of standard functions. (PO-1,2 & PSO-1, 2)
2. Obtain Inverse Laplace transform and use it to solve ODE's
3. Construct the Fourier series expansion of functions and determine the Fourier transform of functions. (PO-1, 2 & PSO-1, 2)
4. Find the solution of partial differential equations. (PO-1, 2 & PSO-1, 2)
5. Apply Laplace and Fourier transforms to solve PDE's. (PO-1, 2 & PSO-1, 2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test – I	30	CO1,CO2,CO3
Internal test – II	30	CO3,CO4,CO5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1,CO2,CO3
Assignment	10	CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5

MECHANICS OF MATERIALS	
Course Code: AS32	**Credits: 3:0:1**
Prerequisite:	**Contact Hours: 45L + 30P + 45S**
Course Coordinator: Dr. Senthamilselvi A	

Course Content

Unit I

Simple stress and strain: Introduction, stress, strain, Hook's law, Extension/shortening of a bar, bars with cross sections varying in steps, bars with continuously varying cross sections (circular and rectangular) due to axial loading, principle of superposition, stress in composite section.

Volumetric strain: expression for volumetric strain, Elastic constants and relationships.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit II

Compound stresses: Introduction, plane stress, stresses on inclined sections, principal stresses and maximum shear stresses, Mohr's circle for plane stress.

Thick and thin cylinders: stresses in thin cylinders, changes in dimensions of cylinder (diameter, length and volume), Thick cylinders subjected to internal and external pressures (Lame's equation) (compound cylinders not included)

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit III

Bending moment and shear force in beams: Introduction, rate of loading, sign conventions, relationship between shear force and bending moments, shear force and bending moment diagrams for different beams subjected to concentrated loads, uniform distributed load (UDL)and couple for different types of beams.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Bending and shear stresses in beams: Theory of simple bending, moment carrying capacity of a section, numericals for rectangular, I and T sections. Shear stress equation, shear stress for rectangular, I and T sections.

Deflection of beams: Introduction, differential equation for deflection, equations for deflections, slope and moments, double integration method for cantilever and supported beams for point load, UDL. Macaulay's Method.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Torsion of circular shafts: Pure torsion equation, torsional rigidity/stiffness of shafts, power transmitted by solid and hollow circular shafts.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Mechanics of materials, S.I units, Ferdinand Beer & Russell Johnston, TATA McGraw-Hill – 1st edition 2003

2. Strength of materials, W.A Nash, Schaums outline series, 4th edition – 2007
3. A Textbook of Strength of Materials, SI Units, R.K. Rajput, S Chand and Company Limited, Revised Edition, 2018,

Reference Books:

1. Mechanics of materials, K.V. Rao, G.C. Raju, 1st edition, 2007
2. Strength of materials, Ramamrutham, 5th edition 2006.
3. Mechanics of materials, James. M Gere. Thomson, 5th edition, 2004

List of Experiments:

1. Tensile Test
2. Compression Test
3. Shear Test
4. Bending Test
5. Torsion Test
6. Wear Test
7. Rockwell hardness test
8. Brinell hardness test
9. Izod Test
10. Charpy Test

Course Outcomes (COs):

1. Develop an understanding of behavior of components when subjected to various types of loading.
2. Comprehend fundamentals of mechanics of materials for engineering applications.
3. Develop ability to identify a problem and apply the fundamental concepts of mechanics of materials.
4. Develop competence to design and analyze problems of engineering involving design of components subjected to stresses and strains.
5. Demonstrate the ability to pursue knowledge advancement in advanced subjects such as finite element analysis, aerospace structures, and UAV design.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE- THEORY) : 50 Marks		
Assessment tool	Marks	Course outcomes addressed
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Lab components- 20 Marks		
Experiment conduction and record writing	10	CO1 to CO5
Lab CIE	10	CO1 to CO5
Semester End Examination (SEE): 100 Marks		
Course end examination (Answer any one question from each unit – Internal choice)	100	CO1 to CO5

FUNDAMENTALS OF SPACE MECHANICS	
Course Code: AS33	**Credits: 3:0:0**
Prerequisite: Nil	**Contact Hours: 45L + 0P + 45S**
Course Coordinator: Dr. Vigneswaran C M	

Course Content

Unit I

Gravity and Space Environment: History of Space Flight & spacecraft technologies, Difference between space and atmosphere. Gravitation, variation of 'g', Gravitational energy, Kepler's Laws of planetary motion. Introduction to basic orbital mechanics, types of Orbits. Simple problems.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos
- Links: https://nptel.ac.in/courses/101105083

Unit II

Rocket Propulsion: Introduction to rocket propulsion-fundamentals of solid propellant rockets, Fundamentals of liquid propellant rockets, Tsiolkovsky rocket equation, Concepts of Specific Impulse, Staging of Rockets. Launch Vehicle Selection. Numerical Problems

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos
- Links: https://nptel.ac.in/courses/101105083

Unit III

Fundamentals of Orbit Mechanics and Maneuvers: Conic section, Two-body motion, Hohmann Transfer, Bielliptical Transfer, Combined Maneuvers, Propulsion for Maneuvers. Numerical Problems

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos
- Links: https://nptel.ac.in/courses/101105083

Unit IV

Atmospheric Reentry: Introduction, reentry corridor, General equation of motion for atmospheric reentry, Ballistic Orbital Reentry, Skip Reentry, Lifting Body Reentry, Aerodynamic heating, Numerical Problems

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos
- Links: https://nptel.ac.in/courses/101105083

Unit V

Satellite Attitude Dynamics: Torque free Axi-symmetric rigid body, Attitude Control for Spinning Spacecraft, Attitude Control for Non-spinning Spacecraft, The Yo-Yo Mechanism, Gravity – Gradient Satellite, Dual Spin Spacecraft, Attitude Determination

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos
- Links: https://nptel.ac.in/courses/106108703

Text Books:

1. Rocket Propulsion and Space Dynamics, J.W. Cornelisse, J.W. Freeman & Co., Ltd, 1982
2. Spaceflight Dynamics, W.E. Wiesel, McGraw Hill, 2nd edition, 2014

Reference books:

1. Fundamentals of Space Systems, Vincent L. Pisacane, Oxford University Press, 2005
2. Introduction to Flight, John D. Anderson, McGraw-Hill Education, 8th edition, 2015
3. Introduction to Space Flight, Pearson, 1993

Course Outcomes (COs):

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

1. Articulate the basic concepts of space flight and orbital motion of planets. (PO-1, PO-2, PO-3, PO-4)
2. Illustrate fundamental principles of rocket propulsion and solve rocket staging problems (PO-1, PO-2, PO-3, PO-4)
3. Apply the knowledge of orbital mechanics to overcome orbital maneuvering obstacles (PO-1, PO-2, PO-3, PO-4)
4. Comprehend the concepts of reentry vehicle dynamics and solve related problems (PO-1, PO-2, PO-3, PO-4)
5. Apply the principles of satellite attitude dynamics and control to analyze spacecraft orientation and stabilization problems (PO-1, PO-2, PO-3, PO-4, PO-5, PO-8, PO-9)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes addressed
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE): 100 Marks		
Course end examination (Answer any one question from each unit – Internal choice)	100	CO1 to CO5

FLUID MECHANICS	
Course Code: AS34	**Credits: 3:0:0**
Prerequisite: Nil	**Contact Hours: 45L + 0P + 45S**
Course Coordinator: Dr. Inamul Hasan	

Course Content

Unit I

Introduction & Basic Concepts: Definition of fluid, Newton's law of viscosity, Units and Dimensions-Properties of fluids, mass, density, specific volume, specific gravity, viscosity, compressibility and surface tension, Pascal's law, Pressure variation with depth, manometers. Control volume approach of continuity, momentum and energy equation (Integral & Differential forms), Introduction to Navier –Stokes Equations.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit II

Fluid Kinematics & Incompressible flows: Lagrangian & Eulerian Description of Fluids, Types of Fluid Flows, Stream line, streak line and path line, circulation and vorticity, stream function and velocity potential function, continuity equation in Integral form and 3D Cartesian coordinates.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit III

Fluid Dynamics & Measurements: Equations of motion: Euler's and Bernoulli's equation for ideal and real fluids. Momentum equation, Fluid flow measurements. Numerical problems. Venturimeter, Orificemeter, Pitot & Pitot Static tube.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Dimensional analysis and similarity: Units and Dimensions, Dimensional Homogeneity, Dimensional Analysis-Rayleigh's Method, Buckingham's π-Theorem, Dimensionless numbers. Model Analysis, Types of Similarities and Similitude, Similarity Laws.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Compressible Flows: Steady, one-dimensional gas dynamics, Propagation of pressure waves in a compressible medium, velocity of sound, Mach number, Mach cone, Stagnation properties, Bernoulli's equation for isentropic flow, normal shock waves. Stagnation Pressure, Temperature and Density.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Frank M White, "Fluid Mechanics" 7th Edition, 2012, McGraw Hill Education.
2. Bansal, R.K, "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi 2015,
3. Yunus A. Cengel & John M Cimbala, Fluid Mechanics and Applications, McGraw Hill Education; 3rd edition, 2013.

Reference Books:

1. Ramamritham. S "Hydraulic Fluid Mechanics and Fluid Machines", Dhanpat Rai & Sons, Delhi, 1988
2. Fundamentals of Aerodynamics, Anderson J .D, 5th Edition, 2011, McGraw-Hill International Edition, New York.
3. Radhakrishnan. E, "Fluid Mechanics", Prentice-Hall of India Pvt. Ltd, 2010.

Course Outcomes (COs):

1. Identify the basic properties of fluids, pressure variation, viscosity, and fundamental fluid flow concepts.
2. Apply different descriptions of fluid motion and continuity equations to simple fluid flow problems.
3. Solve fluid flow problems using Bernoulli's equation, momentum principles, and basic flow measurement techniques.
4. Use dimensional analysis, dimensionless numbers, and similarity principles in fluid flow and model studies.
5. Analyze the basic concepts of compressible flow, including Mach number, stagnation properties, and normal shock waves.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) - 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO-1, CO-2
Internal test-II	30	CO-3, CO-4 &CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz	10	CO-1, CO-2, CO-3, CO-4 &CO-5
Assignments	10	CO-1, CO-2, CO-3, CO-4 &CO-5
Semester End Examination (SEE) - 100 Marks		
Semester End Examination	100	CO-1, CO-2, CO-3, CO-4 &CO-5

THERMODYNAMICS	
Course Code: AS35	**Credits: 2:1:0**
Prerequisite: Nil	**Contact Hours: 30L + 15T + 0P + 30S**
Course Coordinator: Dr. Jayaram R. Pothnis	

Course Contents

UNIT I

Fundamental Concepts & Definitions:

Introduction, Applications, Macroscopic versus microscopic approaches, Thermodynamic System and Control Volume, Thermodynamic Properties, Processes and Cycles, Homogeneous and Heterogeneous systems, Concept of thermodynamic equilibrium, Quasi-static Process, Concept of Continuum, Units and Dimensions, Zeroth law of thermodynamics, Measurement of Temperature, Comparison of Thermometers, Different Types of Thermometers, International Practical Temperature Scale, Numericals.

Work and Heat:

Work Transfer, Displacement work, Other types of Work Transfer, Heat Transfer, Path functions, Specific and Latent heat.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Link - https://nptel.ac.in/courses/112105123
- Lab: https://www.youtube.com/watch?v=CVlAz3FBBiU
  https://www.youtube.com/watch?v=7HpXKucBSIM

UNIT II

First Law of Thermodynamics:

First law for a closed system undergoing a cycle and undergoing a change of state, energy- A property, Different forms of stored energy, Specific Heats, Enthalpy, Perpetual Motion Machine of first kind, Limitations of first law, Numericals, Application of the First Law to flow processes: steady-flow energy equation, selected examples, Variable flow processes, selected examples, Numericals

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Link - https://nptel.ac.in/courses/112105123
- Lab: https://www.youtube.com/watch?v=AnLRRw9uG74

UNIT III

Second Law of Thermodynamics and Entropy

Qualitative Difference between heat and work, cyclic heat engine, energy reservoirs, Kelvin-Planck and Clausius statements, Refrigerator and heat pump, Reversibility and Irreversibility, Causes of irreversibility, Carnot cycle, Reversed Heat engine, Carnot's Theorem and corollary, Absolute thermodynamic temperature scale.

Entropy: Clausius inequality, entropy as a property, entropy change, principle of increase in entropy, TdS relations.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Link - https://nptel.ac.in/courses/112105123
- Lab: https://www.youtube.com/watch?v=WVtmEnbeqFI

UNIT IV

Ideal and Real Gases, Gas Compressors

Introduction, Equation of State, Ideal versus real gas, Analysis of reversible processes of perfect gas Compression Processes, work of Compression, single-stage Reciprocating Air compressor,

volumetric efficiency, multi-stage compression, inter-cooling, Numericals.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Link: https://nptel.ac.in/courses/112105123
- Lab: https://www.youtube.com/watch?v=UADNxsgQo_Y

UNIT V

Gas Power Cycles and Jet Propulsion

Air-standard cycles: Otto, Diesel. Brayton cycle and its application to gas turbines, Numericals
Jet propulsion: turbojet, turbofan, ramjet engines (no numericals).

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation
- Link: https://nptel.ac.in/courses/112106133
- Lab: https://www.youtube.com/watch?v=LDotzmLwTcw
  https://www.youtube.com/watch?v=9Gmeqq6ukCQ

Text Books:

1. P K Nag, Basic and Applied Thermodynamics, 2nd Edition, Tata McGraw Hill, 2002.
2. A Venkatesh, Basic Engineering Thermodynamics, Universities Press, India, 2007.

Reference Books:

1. P K Nag, Engineering Thermodynamics, 3rd Edition, Tata McGraw Hill, 2005.
2. Yunus A. Cenegal and Michael A. Boles, Thermodynamics: An Engineering Approach, Tata McGraw Hill, 2002
3. Holman, J. P, Thermodynamics, 4th Edition by Tata McGraw Hill, New Delhi, 2015.

Course Outcomes (COs):

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

1. Understand and apply fundamental thermodynamic concepts such as system properties, thermodynamic equilibrium, and energy interactions
2. Analyze and apply the First Law of Thermodynamics to closed and open systems
3. Evaluate thermodynamic cycles using the Second Law of Thermodynamics and entropy concepts.
4. Analyze ideal gases, understand and analyze the working of reciprocating compressors
5. Assess the performance of gas power cycles and propulsion systems to optimize efficiency in engineering applications.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	Marks	Course outcomes addressed
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5
Semester End Examination (SEE): 100 Marks		
Course end examination (Answer any one question from each unit – Internal choice)	100	CO1 to CO5

UNIVERSAL HUMAN VALUE COURSE	
Course Code: UHV36	**Credits: 2:0:0**
Prerequisite:	**Contact Hours: 30L + 0T + 0P + 30S**
Course Coordinator:	

Course content

Unit I

Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

1. Understanding the need, basic guidelines, content and process for Value Education
2. Self-Exploration–what is it? - its content and process; 'Natural Acceptance' and experiential Validation- as the mechanism for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facilities- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario.
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Holistic Development and Role of Education https://youtu.be/sGZtTPe-lhQ

Unit II

Understanding Harmony in the Human Being - Harmony in Myself!

1. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
2. Understanding the needs of self ('I') and 'Body' - Sukh and Suvidha
3. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
4. Understanding the characteristics and activities of 'I' and harmony in 'I'
5. Understanding the harmony of I with the Body: Sanyam and Swasthya; correct appraisal of Physical needs, meaning of Prosperity in detail
6. Programs to ensure Sanyam and Swasthya

Practice Exercises and Case Studies will be taken up in Practice Sessions.

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Human Being- Self and Body https://youtu.be/0ERSMkRPQBM
- Links: Harmony in Human Being- Self https://youtu.be/83oGJ4oDeIg
- Links: Harmony between Self and Body Prosperity https://youtu.be/aJ_BU2OgpKs

Unit III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

1. Understanding Harmony in the family – the basic unit of human interaction
2. Understanding values in human-human relationship; meaning of Nyaya and program for its fulfillment to ensure Ubhay-tripti
3. Trust (Vishwas) and Respect (Samman) as the foundational values of relationship
4. Understanding the meaning of Vishwas; Difference between intention and competence.
5. Understanding the meaning of Samman, Difference between respect and differentiation; the other salient values in relationship
6. Understanding the harmony in society (society being an extension of family)
7. Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals
8. Visualizing a universal harmonious order in society- Undivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family!

Practice Exercises and Case Studies will be taken up in Practice Sessions

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Family- Trust https://youtu.be/F2KVW4WNnS8
- Links: Harmony in family- Respect https://youtu.be/iLqNRPuv0_8
- Links: Harmony in family- Other Feeling Justice https://youtu.be/TcYJB7reKnM
- Links: Harmony in the Society https://youtu.be/BkWgFinrnPw

Unit IV

Understanding Harmony in Nature and Existence - Whole existence as Co-existence

1. Understanding the harmony in the Nature
2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature
3. Understanding Existence as Co-existence (Sah-astitva) of mutually interacting units in all-pervasive space
4. Holistic perception of harmony at all levels of existence

Practice Exercises and Case Studies will be taken up in Practice Sessions

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration
- Links: Harmony in Nature https://youtu.be/K1Jpd_ojydw
- Links: Harmony in Existence https://youtu.be/mormUeZ_RUE

Unit V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

1. Natural acceptance of human values
2. Definitiveness of Ethical Human Conduct
3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order.
4. Competence in professional ethics:
   A. Ability to utilize the professional competence for augmenting universal human order
   B. Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems,
   C. Ability to identify and develop appropriate technologies and management patterns for above production systems.
5. Case studies of typical holistic technologies, management models and production systems
6. Strategy for transition from the present state to Universal Human Order:
   A. At the level of individual: as socially and ecologically responsible engineers, technologists and managers.
   B. At the level of society: as mutually enriching institutions and organizations

Suggested Learning Resources:

- Pedagogy / Course delivery tools: Chalk and talk, PowerPoint presentation, Videos.
- Lab component / Practical Topics: Survey/polls for self-exploration

Text Books:

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 2010, ISBN 978-8-174-46781-2

Reference Books:

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Publishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen(Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Web links and Video Lectures (e-Resources):

1. https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw
2. https://www.youtube.com/watch?v=P4vjfE-YnVk&list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

3. **Course handouts:**
   https://drive.google.com/drive/folders/1zioX_4L2fCNX4Agw282PN86pcZZT3Osr?usp=sharing
4. **Presentation slides:**
   https://drive.google.com/drive/folders/1rMUKh1s0HPRBlpp_b1mpSduNRcwS6YH?usp=sharing

Course Outcomes (COs):

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

1. Apprehend the need of Value Education over Human aspirations
2. Assimilate Harmony over the physical needs and to overcome the self- needs for a prosperous life.
3. Recognize the need of Harmony in the Family and Society for a better World.
4. Explain the need of mutual understanding for Holistic Harmony in all the Levels of Human Existence.
5. Explain the Holistic understanding of Harmony and Professional Ethics at Individual Level and Society.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) - 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO-1, CO-2, CO-3
Internal test-II	30	CO-3, CO-4 & CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz	10	CO-1, CO-2, CO-3, CO-4, CO-5
Assignment / Presentation	10	CO-1, CO-2, CO-3, CO-4, CO-5
Semester End Examination (SEE) - 100 Marks		
Semester End Examination	100	CO-1, CO-2, CO-3, CO-4 & CO-5

MEASUREMENTS AND METROLOGY	
Course Code: ASAEC37	**Credits: 1:0:0**
Prerequisite: Nil	**Contact Hours: 15L + 0T + 0P + 15S**
Course Coordinator: Dr. Radhakrishnan P M	

Course Content

Unit I

Introduction to Measurements & Standards: Definition and Need for Metrology, Physical measurement, Measuring instruments, selection and classification, types of measurements, SI units, Role of measurements in aerospace, aerospace-specific standards.

Measurement Errors & Uncertainty: Types of errors: systematic, random, gross accuracy, precision, resolution, uncertainty analysis in aerospace testing.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit II

Linear & Angular Measurements: Vernier, micrometer, height gauge, sine bar, bevel protractor; applications in aircraft component inspection.

Surface Roughness & Form Measurement: Surface finish in aerospace components, instruments like profilometer, roundness tester.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit III

Non-Contact Measurement Methods: Laser interferometry, photogrammetry, coordinate measurement systems in aerospace manufacturing

Pressure & Temperature Measurement in Aerospace Systems: Pitot-static systems, strain-gauge-based transducers, thermocouples, RTDs.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit IV

Calibration & Quality Control: Calibration standards, traceability, tolerance, limits, role of metrology labs in aerospace.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit V

Industry Trends & Digital Metrology: 3D scanning, digital twins, Industry 4.0 applications in aerospace measurement systems.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Text Books:

1. Jain R. K., Engineering Metrology, Special Edition, Khanna Publishers, India, 2022
2. Beckwith T.G., Marangoni R.D., Lienhard J.H., Mechanical Measurements, Sixth Edition, Pearson Education International, UK, 2007.

Reference Books:

1. Raghavendra N.V., Krishnamurthy L., Engineering Metrology and Measurements, First Edition, Oxford University Press, India, 2013.
2. Doebelin E.O. Manik D.N., Measurement Systems: Application and Design, Fifth Edition, McGraw Hill Education (India) Private Limited, India, 2007.

Course Outcomes (COs):

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

1. Explain the importance of measurements and standards in engineering. (PO-1, PO-2, PO-10)
2. Identify key characteristics of measuring instruments used in manufacturing and testing. (PO-1, PO-2, PO-9)
3. Apply tolerance and calibration principles to components. (PO-1, PO-3, PO-5)
4. Analyze measurement errors and uncertainty in measurement systems. (PO-1, PO-2, PO-4)
5. Relate metrological requirements to quality control and safety in engineering systems. (PO-1, PO-6, PO-7)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) - 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO-1 &CO-2
Internal test-II	30	CO-3, CO-4 & CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz/Case Study/Mini Project/Surprise Test/ Presentation	10	CO-1, CO-2, CO-3, CO-4, CO-5
Assignment	10	CO-1, CO-2, CO-3, CO-4, CO-5
Semester End Examination (SEE) – 50 Marks		
Semester End Examination	50	CO-1, CO-2, CO-3, CO-4 & CO-5

FLUID MECHANICS LAB	
Course Code: ASL38	**Credits: 0:0:1**
Prerequisite:	**Contact Hours: 30P**
Course Coordinator: Dr. Vigneswaran C M	

List of Experiments

1. Calculation of Coefficient of Discharge using Venturimeter
2. Calculation of Coefficient of Discharge using Orificemeter
3. Calculation of Coefficient of Discharge using Rectangular Notch
4. Calculation of Coefficient of Discharge using V - Notch
5. Verification of Bernoulli's theorem.
6. Velocity measurement using Pitot Static tube
7. Calibration of Subsonic Wind tunnel
8. Prediction of Laminar and Turbulent flows using smoke flow visualization for cylindrical model.
9. Prediction of Laminar and Turbulent flows using smoke flow visualization for airfoil at various angle of attack.
10. Verification of flow Similarity parameters.

Course Outcomes (COs):

Students will be able to:

1. Conduct experiments to determine discharge coefficients and verify fundamental fluid flow principles.
2. Measure flow velocity and assess flow behavior using Pitot-static tube, wind tunnel calibration, and flow visualization techniques.
3. Analyze flow characteristics and verify similarity parameters using experimental fluid-flow measurements.

Course Assessment and Evaluation

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory journals/ reports after the conduction of every Experiment	30	CO1, CO2 & CO3
Practical Test	20	CO1, CO2 & CO3
Semester End Examination (SEE)	50	CO1, CO2 & CO3

COMPUTER AIDED AIRCRAFT DRAWING LAB	
Course Code: ASL39	**Credits: 0:0:1**
Prerequisite: Nil	**Contact Hours: 0L + 0T + 30P + 0S**
Course Coordinator: Dr. Radhakrishnan P M	

List of Experiments

1. Introduction to Sketch and Part Modelling.
2. Modelling of typical aircraft wing surface using airfoil coordinates.
3. Modelling of typical aircraft wing structural members – ribs, spars and stringers.
4. Modelling of a typical aircraft wing containing various structural elements.
5. Modelling of a typical aircraft fuselage containing various structural elements.
6. Modelling and assembly of a turbojet engine.
7. Modelling and assembly of a landing gear.
8. Modelling and assembly of hexagonal headed bolt with nut.
9. Modelling and assembly of double riveted lap joint.
10. Modelling and assembly of Single riveted butt joint with double cover plates.

Course Outcomes (COs):

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

1. Create 2D sketches and 3D part models of basic mechanical and aerospace components using CAD tools (PO-1, PO-2, PO-3, PO-4, PO-5, PO-9, PO-10, PO-11).
2. Model aircraft structural components and assemblies including wings, fuselage, and engine systems (PO-1, PO-2, PO-3, PO-4, PO-5, PO-9, PO-10, PO-11).
3. Develop and assemble mechanical joints, fasteners, and landing gear systems using solid modeling techniques (PO-1, PO-2, PO-3, PO-4, PO-5, PO-9, PO-10, PO-11).

Text Books and Reference Books:

1. Computer Aided Machine Drawing, K.R. Gopalkrishna and A.S. Ravindra, Subhash Publications, 2015
2. Fundamentals of Machine Drawing, Sadhu Singh, PHI Learning Pvt. Ltd., 2012

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment	30	CO1, CO2 & CO3
Practical Test	20	CO1, CO2 & CO3
Semester End Examination (SEE)	50	CO1, CO2 & CO3

PHYSICAL EDUCATION	
Course Code: PE69	**Credits: NCMC**
Prerequisite: Nil	
Course Coordinator: Dr. Kiran Kumar H.K.	

Course Content

Course Learning Objectives:

1. To introduce students to the importance of physical fitness for success in any career.
2. To instill in them concepts of team spirit and team building
3. To develop positive thinking, goal setting and decision-making abilities under duress.
4. To harness values and skills like leadership, communication and sacrifice.
5. To inculcate in students, the ability to handle success and failures with equanimity.

Selection Process: A Student shall select any one of the following Sports based on his/her interest and the facility available. The details **of Sports Facilities available (both indoor and outdoor) at institute campus** are as below:

Outdoor Games		Indoor Games		Athletics	
Games	**No. of Students**	**Games**	**No. of Students**	**Events**	**No. of Students**
Volleyball	12 x 4 = 48	**Badminton**	30	**Sprint -** 100mt, 200mt, 400mt	60
Basketball	12 x 4 = 48	**Table Tennis**	30	**Middle distance running** – 800mt, 1,500mt	
Kabaddi	12 x 4 = 48	**Chess**	30	**Long distance running** – 5,000mt, 10,000mt	
Kho Kho	12 x 4 = 48	**Weight Training [Gym]**	35	**Jumping Events** – Long Jump,Triple Jump,High Jump	30
Throw ball	12 x 4 = 48			**Throwing Events** Shot Put Discuss Javelin	30
Football	16 x 4 = 64	**Note: Students should bring their own sports attires**			
Hockey	16 x 4 = 64				
Cricket	16 x 4 = 64				

Contact Sessions: A student shall abide by the following during the sessions scheduled in the semester.

Session 1

Fundamentals of Physical Education, value addition to personality through fitness education, discipline and team building activities, Orientation towards particular sports and skill training

Session 2

Formation of teams based on student's orientation and preference. Team practice and skill enhancement.

Session 3

Conduction of matches in all sporting events registered by Students. Evaluation of each student shall be based on their performance either in team or individual. The student representing the Institute at University/State/National/International Level will be awarded additional marks during evaluation.

Course Outcomes (COs):

1. Develop interest and skill in playing particular sports.
2. Understand the process of organizing sporting events.
3. Appreciate the role of fitness for a better lifestyle.
4. Derive lessons from sports activities for effective planning and discipline in Life.
5. Analyze situations and optimize end results.

Course Assessment & Evaluation:

1. A committee consisting of Sports Director and Coaches of respective Sports will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation process will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 6th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE.

YOGA	
Course Code: YO69	**Credits: NCMC**
Prerequisite: Nil	
Course Coordinator: Dr. Hari Chandra B.P. & Dr. Parimala P.	

Course Content

Course Learning Objectives:

1.To introduce to the students, the fundamental theoretical aspects of yoga.
2.To inculcate in students a habit of practicing yoga.
3.To be able to demonstrate basic yoga asanas.
4.To be able to practice fundamental breathing practices and mudras.
5.To understand the relevance of yoga and research in modern times.

Introduction: Definition of yoga, benefits, astangas of yoga, Relevance of yoga and yoga-research in modern times.

Asanas: Kriyathmakachalanas, Suryanamaskar, Superbrain yoga, Vrikshasana, Trikonasana, Veerabhadrasana, Paschimotasana, Purvothanasana, Bharadwajasana, Amruthasana, Parivruttha Trikonasana, Parsvakonasana, Ustrasana, Padmasana, Jaaanushirshasana, Navasana, Ardhachakrasana, Ardhakatichakrasana, Jataraparivarthanasana, Sethubandasana, Sarvangasana, Mathyasana, Dhanurasana, Shirshasana.

Pranayamas: Anuloma-Viloma, Suryanuloma, Chandranuloma, Brahmari, Suryanbedhana, Chandrabedhana, Sheetali, Seethkari, Sadantha, bastrika.

Mudras: Chinmudra-Jnanamudra, Praana mudra, panchaprana mudras, panchabhoota mudras, Pruthvi mudra, Shoonya mudra, Surya mudra, Jalodharanashaka mudra, Kundalini mudra, shoonyavaayu mudra, shakti mudra, sandhi mudra, vajra mudra and garuda mudra.

Course Outcomes (COs):

At the end of the course, a student will

1. Understand the fundamental and theoretical aspects of yoga.
2. Develop a habit of practicing yoga.
3. Demonstrate basic yoga asanas.
4. Demonstrate fundamental breathing practices.
5. Understand the relevance of yoga and its research in modern times.

Reference Books:

1. Light on yoga, B K S Iyengar, Publisher -Thorsons, UK, 2006
2. Light on pranayama, B K S Iyengar, Publisher - Element; First Edition
3. The Essential Yoga Mudras for Healing, Dr. Aasoori K. Rangaraja Iyengar, Saranga Publishing;
First Edition 2021

Pedagogy:

- Chalk and talk, demonstration, videos, ppt.

Contact Sessions:

There would be one introduction class, and five contact classes in each semester.
The candidates shall practice yoga on a daily basis, or in the worst case on alternate days at their place of residence and maintain a short diary in the format provided by yoga teacher. The same shall be brought to the classes.

Online reference sources:

- Yoga for beginners part 1: https://www.youtube.com/watch?v=VwPeThpwfWI
- Yoga for beginners part 2: https://www.youtube.com/watch?v=s_pnJTcOp8A
- Suryanamaskar: https://www.youtube.com/watch?v=nUdlucNd6go&t=133s
- Yoga for anxiety and stress: https://www.youtube.com/watch?v=hJbRpHZr_d0
- Common yoga protocol: https://www.youtube.com/watch?v=Av5ib_XRKT4
- Relevance of yoga in modern times:www.youtube.com/watch?v=HUzBCts7BTo

Course Assessment & Evaluation:

1. A committee consisting of Yoga Instructors will be formed to observe and evaluate the students for CIE in each semester.
2. Students shall follow the schedules, rules, and regulations as prescribed by the Committee.
3. Students shall mandatorily have 85% attendance to be eligible for evaluation.
4. All the Sessions and evaluation processes will be common for all semesters of the academic year.
5. The final result will be reflected on the grade card of 6th Semester.
6. The final marks shall be calculated after scaling down CIE to 50 marks & combining it with 50 marks for SEE.

Scheme of SEE:

Practical Demonstration	30 marks
Write-up	10 marks
Viva	10 marks
Total	**50 marks**

NATIONAL SERVICE SCHEME	
Course Code: NS69	**Credits: NCMC**
Prerequisite: Nil	
Course Coordinator: Dr. Puttabore Gowda & Dr. Siddaraju C.	

Course Content

Course Learning Objectives:

1. To introduce students to the importance of national service
2. To harness values and skills like leadership, teamwork and sacrifice.
3. To serve society through educational services and health
4. To work towards rural and local development through technological services
5. To inculcate in students, the ability to handle socially relevant projects.

Students shall involve in activities related to national and regional technical and non-technical services, as listed below.

- Serving society by bringing awareness on education and cleanliness.
- Blood donation camps
- Developing technologies for rural masses.
- Conduction and participation in camps for a social cause.
- Educating towards health and well-being of individuals/society.
- Cultural and educational programs for society.
- Contributing towards the improvement of civil services and bringing certain shortcomings to the notice of higher authorities for suitable remedial actions.
- Contribution towards traffic management and other public services.
- Clean up and development of water sources around public places.
- Services during a disaster or other needy situations.
- Camps for the rejuvenation of lakes and water bodies.
- Serving nature and agriculture.
- Awareness programs on health and food adulteration.
- Presenting papers/talks in various fora on the above topics.
- Developing technologies for rural masses beyond academic requirements.
- Plantation programs.
- Conducting programs for self-sustainability, and human and national development.
- Contribution towards orphans and challenged individuals through well-recognized organizations.
- Carrying out designated activities in villages.
- Development and implementation of strategies for solid waste, E-waste etc.
- Education towards pollution control and traffic management.
- Production of documentaries and short films/videos for motivating people on any of the above causes.

Course Outcomes (COs):

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

1. Understand the importance of national service.
2. Gain skills like leadership and teamwork.
3. Volunteer towards educational services and health.
4. Contribute to rural and local development through technical services.
5. Comprehend socially relevant projects

Contact Sessions:

The students shall attend the review and contact sessions as scheduled by the course coordinator.

Course Assessment & Evaluation:

1. The candidates shall maintain a record of activities in a Diary, and get them endorsed during

   the contact sessions at least 3 times in a semester.
2. A detailed project report should be submitted during the last fortnight of the semester
3. Evaluation will be done during each semester based on the nature of the contribution.
4. The final marks shall be calculated after scaling down CIE to 50 marks & combining with 50 marks for SEE

ADDITIONAL MATHEMATICS – I	
Course Code: AM31	**Credits: 0:0:0**
Prerequisite: Nil	**Contact Hours: 42**
Course Coordinator: Dr. Shashi Prabha Gogate S.	

(For Lateral Entry Diploma Students)

Unit I

Differential Calculus: Successive differentiation, nth derivatives of some standard functions, Leibnitz theorem, Polar curves. Angle between the radius vector and the tangent, angle between curves, length of the perpendicular from pole to the tangent, pedal equations. Taylor's and Maclaurin's expansions.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit II

Integral Calculus: Introduction, Reduction formula, Reduction formula for $\int Sin^n x\ dx$, $\int Cos^n x\ dx$ and $\int Sin^n x\ Cos^m x\ dx$. Evaluation of double and triple integrals.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links ➢ https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit III

Vector Algebra: Scalar and vectors. Vector addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple product-simple problems. Vector functions of a single variable. Derivative of a vector function, geometrical interpretation. Velocity and acceleration.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit IV

Vector Differentiation: Scalar and vector fields, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector. Laplace's operator. Vector identities connected with gradient, divergence and curl.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit V

First Order Differential Equations: Solution of first order and first degree differential equations, variable separable methods, homogeneous equations, linear and Bernoulli's equations, exact differential equations.

- Pedagogy / Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation
- Links: ➢ https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/59742/295

Text Books:

1. **B.S. Grewal -** Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig -**Advanced Engineering Mathematics, Wiley Publication, 10th Edition, 2015.

Reference Books:

1. **H. K. Dass** - Higher Engineering Mathematics, S Chand Publications, 1998.
2. **B. V. Ramana** - Engineering Mathematics, Tata McGraw-Hill Publishing Co. Ltd., India 2008.

Course Outcomes

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

1. Solve problems related to nth derivative to some standard functions, polar curves and power series expansions. (PO-1,2)
2. Apply the concept of reduction formula to determine the length, area, volume of revolution of an arc of the curve. (PO-1,2)
3. Solve the problems related to velocity and acceleration. (PO-1,2)
4. Apply vector differentiation to identify solenoidal and irrotational vectors. (PO-1,2)
5. Apply the concept of various methods to solve first order first degree differential equations. (PO-1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5

IV SEMESTER

AEROSPACE STRUCTURES - I	
Course Code: AS41	**Credits: 3:0:1**
Prerequisite:	**Contact Hours: 45L + 30P + 45S**
Course Coordinator: Dr. Senthamilselvi A	

Course Content

Unit I

Statically Determinate & Indeterminate Structures: Plane truss analysis, method of joints, method of section, 3-D trusses, Clapeyron's three moment equation and Moment distribution method for indeterminate beams.

- Pedagogy/Course delivery tools: -Chalk and talk

Unit II

Energy Methods: Strain energy in axial, bending, torsion and shear loadings Castigliano's theorems and their applications. Energy theorems, dummy load and unit load methods, energy methods applied to statically determinate and indeterminate beams, frames, ring & trusses.

- Pedagogy/Course delivery tools:-Chalk and talk

Unit III

Columns: Euler's column curve, inelastic buckling, effect of initial curvature, the Southwell plot, columns with eccentricity, use of energy methods, theory of beam columns, beam columns with different end conditions, stresses in beam columns.

- Pedagogy/ Course delivery tools:-Chalk and talk

Unit IV

Failure Theories: Ductile and brittle materials, maximum principle stress theory, maximum principle strain theory, maximum shear stress theory, maximum strain energy theory, distortion energy theory, Octahedral shear stress theory.

- Pedagogy/ Course delivery tools:-Chalk and talk

Unit V

Induced Stresses: Thermal stresses, Impact Loading, Fatigue, Creep, Stress Relaxation.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Strength of Materials, R.K. Bansal, Laxmi Publications, 2018.
2. Strength of Materials, S. Ramamrutham, Dhanpat Rai Publications, 2006.
3. Mechanics of Materials, Ferdinand Beer & Russell Johnston, Tata McGraw Hill, 2003.

Reference Books:

1. Mechanics of Materials, Ferdinand Beer & Russell Johnston, Tata McGraw Hill, 2003.
2. Mechanics of Materials, James M. Gere, Thomson, 2004.
3. Strength of Materials, R.K. Rajput, S. Chand, 2018.
4. Strength of Materials Part I & II, Stephen Timoshenko, CBS Publishers, 1990.

List of Experiments:

1. Determination of member forces in a plane truss by method of joints
2. Determination of member forces in a plane truss by method of sections
3. Verification of Clapeyron's three-moment equation for a continuous beam
4. Verification of moment distribution method for an indeterminate beam
5. Determination of deflection of a beam using Castigliano's theorem
6. Determination of joint displacement in a truss using unit load (dummy load) method
7. Determination of Euler critical buckling load for slender columns with different end conditions
8. Construction of Southwell plot to estimate critical load and study inelastic buckling effects
9. Evaluation of failure criteria (Maximum principal stress, Maximum shear stress, Distortion energy) under combined tension–torsion
10. Study of induced stresses: thermal stress in composite/compound bars, impact energy (Charpy/Izod), rotating bending fatigue (S–N curve), and creep with stress relaxation

Course Outcomes (COs):

1. Apply classical methods (method of joints, method of sections, Clapeyron's three-moment equation, moment distribution) to analyze statically determinate and indeterminate structures such as trusses and beams.
2. Utilize energy methods (strain energy, Castigliano's theorem, unit load method to determine deflections and displacements in beams, frames, rings, and trusses.
3. Evaluate the stability and buckling behavior of columns under various end conditions, eccentric loading, and initial imperfections using Euler's theory and Southwell plots.
4. Distinguish and apply different failure theories (Maximum Principal Stress, Maximum Shear Stress, Distortion Energy, Octahedral Shear Stress) to predict material behavior under complex stress states.
5. Analyze induced stresses due to thermal effects, impact loading, fatigue, creep, and stress relaxation in engineering components, and interpret their influence on design and service life.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE- THEORY) : 50 Marks		
Assessment tool	Marks	Course outcomes addressed
Internal Test-I	30	CO1, CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Lab components- 20 Marks		
Experiment conduction and record writing	10	CO1 to CO5
Lab CIE	10	CO1 to CO5
Semester End Examination (SEE): 100 Marks		
Course end examination (Answer any one question from each unit – Internal choice)	100	CO1 to CO5

FINITE ELEMENT ANALYSIS	
Course Code: AS42	**Credits: 2:1:0**
Prerequisite:	**Contact Hours: 30L + 15T + 30S**
Course Coordinator: Dr. Radhakrishnan P M	

Course Content

Unit I

Introduction: General Description of Finite Element Method, Principle of minimum potential energy. Introduction to Rayleigh-Ritz and Galerkin methods. Convergence criteria, Pascal's triangle, geometric isotropy, shape functions of linear simplex element: 1D element, coordinate systems, strain matrix, stiffness matrix and load vector by potential energy approach

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit II

1D element - Elimination approach and Penalty approach of handling boundary conditions, temperature effect and related problems.

Quadratic 1D element -shape functions, strain matrix, stiffness matrix and load vector

Truss Element: Local and Global coordinate systems, stiffness matrix, stress, Problems on trusses.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, Animated videos

Unit III

2D element - CST element - Shape functions, strain matrix and load vector.

Four node quadrilateral element- shape function and strain matrix, stiffness matrix, stress

Higher order 2D elements - Lagrangian interpolation functions, six nodes triangular element, eight nodes quadrilateral element. 9-noded Quadrilateral element, Numerical Integration using one, two- and three-points Gaussian quadrature formula.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Beam element: Beam element, Hermite shape function, Stiffness matrix, Load vector, Shear force and Bending moment, Problems on beams.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit V

Dynamics of Finite Elements: Equation of motion for 1D element, derivation of element mass and stiffness matrices, Eigen value and Eigen vector problems for bar subjected to vibration.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Finite Element in Engineering, Chandrupatla T.R., 4th Edition, Pearson, 2012.
2. The Finite Element Method in Engineering, S.S. Rao, 4th Edition, Elsevier, 2006

Reference Books:

1. Text book of Finite Element Analysis, P.Seshu, PHI India, 2004
2. Finite Element Method, J.N. Reddy, McGraw- Hill International Edition.
3. Finite Element Analysis, C.S. Krishnamurthy, Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1995

Course Outcomes (COs):

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

1. Apply concepts of theory of elasticity, principle of minimum potential energy variational and weighted residual methods and describe finite element method. (PO-1, PO-2, PO-4, PO-5, PO-11)
2. Explain and evaluate one dimensional bar and truss problems.(PO-1, PO-2, PO-4, PO-5, PO-11)
3. Apply fundamentals of two-dimensional elements and higher order elements and develop skill to solve related problems. (PO-1, PO-2, PO-4, PO-5, PO-11)
4. Apply the fundamentals of Beam elements and have skill to solve beam related problems. (PO-1, PO-2, PO-4, PO-5, PO-11)
5. Describe and evaluate dynamic problems of vibrating one dimensional members. (PO-1, PO-2, PO-3, PO-4, PO-5, PO-11)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) - 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO-1 &CO-2
Internal test-II	30	CO-3, CO-4 & CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz/Case Study/Mini Project/Surprise Test/ Presentation	10	CO-1, CO-2, CO-3, CO-4, CO-5
Assignment	10	CO-1, CO-2, CO-3, CO-4, CO-5
Semester End Examination (SEE) - 100 Marks		
Semester End Examination	100	CO-1, CO-2, CO-3, CO-4 & CO-5

AEROSPACE PROPULSION	
Course Code: AS43	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L + 45S**
Course Coordinator: Dr. Anand M Raikar	

Course Contents

Unit I

Aircraft Propulsion Basics: Classification of power plants. Methods of aircraft propulsion. Thrust and power concepts. Propulsive efficiency. Specific fuel consumption. Factors affecting thrust and power.

Gas Turbine and Air-Breathing Engines: Working principle of gas turbine engine. Characteristics and applications of turbojet, turbofan, turboprop engines. Introduction to ramjet and scramjet engines. Methods of thrust augmentation.

- Pedagogy/Course delivery tools:- Chalk and talk, animated videos
- Links: https://nptel.ac.in/courses/101104084

Unit II

Rocket Propulsion Principles: Introduction and applications of rockets. Reaction principle. Thrust equation. Performance parameters. Classification of rockets based on propellants: solid, liquid, and hybrid. Comparative performance.

Electric Propulsion Systems: Introduction to electric propulsion. Classification: electrothermal, electrostatic, and electromagnetic thrusters. Ion thrusters-geometries and beam/plume characteristics. Hall thrusters. Basic performance parameters.

- Pedagogy/Course delivery tools:- Chalk and talk, animated videos

Unit III

Liquid Rocket Engine Systems: Types of liquid propellants. Propellant tanks. Feed systems-gas pressure feed and turbopump feed systems. Tank pressurization. Rocket engines for maneuvering and orbit adjustment.

Liquid Propellants and Combustion: Propellant properties. Liquid oxidizers, fuels, monopropellants, and gaseous propellants. Safety and environmental considerations. Combustion process and combustion instability.

- Pedagogy/Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Solid Rocket Engine Performance and Grain Design: Basic relations. Propellant burning rate. Performance issues. Grain configuration. Grain stress and strain. Altitude control and side manoeuvres.

Solid Propellants and Manufacturing: Classification and characteristics of solid propellants. Propellant ingredients. Hazards and safety aspects. Liners, insulators, and inhibitors. Propellant processing, ignition, and combustion instability.

- Pedagogy/Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Nozzle Theory: Review of thermodynamic relations. Ideal rocket propulsion system. Isentropic flow through nozzles. Nozzle configurations. Real nozzle effects. Over-expanded, under-expanded, and optimum expansion.

Thrust Chambers and Thrust Vector Control: Injectors and injection characteristics. Heat transfer in thrust chambers. Starting and ignition. Life of thrust chambers. Basic thrust chamber design analysis. Thrust vector control using single and multiple nozzles. Integration with vehicle.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Gas Turbines, V. Ganesan, Tata McGraw-Hill, 2010
2. Gas Turbine Theory, Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H, Longman, 1989.
3. G.P.Sutton, "Rocket Propulsion Elements" John Wiley & Sons Inc, New York, 5th Edition, 1986.
4. Cumpsty, Jet propulsion, Cambridge University Press, 2003.

Reference Books:

1. G.C Oates, "Aerothermodynamics of Aircraft Engine Components ", AIAA Education Series, 1985.
2. William H. Heiser and David T. Pratt, Hypersonic Airbreathing propulsion.
3. Mathur and Sharma R.P. "Gas turbine, Jet and Rocket Propulsion standard publishers and Distributors Delhi, 1988.

Course Outcomes (COs):

1. Identify basic aircraft propulsion concepts and gas turbine engines.
2. Outline rocket propulsion principles and electric propulsion systems.
3. Interpret liquid propellant rocket engine systems and combustion behavior.
4. Summarize solid propellant rocket engines and grain characteristics.
5. Apply nozzle flow concepts to thrust chamber fundamentals.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE):50Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1 & CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components - 20 Marks		
Assignment	10	CO1 to CO5
Quiz	10	CO1 to CO5
Semester End Examination (SEE): 100 Marks		
Semester End Examination (SEE):	100	CO1 to CO5

LOW SPEED AERODYNAMICS	
Course Code: AS44	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L + 45S**
Course Coordinator: Dr. Inamul Hasan	

Course Content

Unit I

Introduction: Introduction to Aerodynamics - Airfoil geometry and nomenclature, Experimental characteristics of airfoil - Wing geometrical parameters, Aerodynamic Forces and Moments, Center of pressure - Aerodynamic center, Control Volume approach – Continuity, Momentum and Energy equation in Integral and Differential forms, Circulation, Stream function, velocity potential and its relationship.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit II

Two Dimensional Inviscid Incompressible Flow: Uniform flow, Source flow, Sink flow, Combination of a uniform flow with source and sink. Doublet flow. Nonlifting flow over a circular cylinder. Vortex flow. Lifting flow over a circular cylinder, D-Alembert's paradox, Magnus Effect, The Kutta Condition, Kelvin‟s circulation theorem and the starting vortex. Flow over smooth and rough cylinder.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit III

Airfoil Theories: - Thin airfoil theory assumptions and limitations – Aerodynamic characteristics of thin symmetrical airfoil – Aerodynamic characteristics of thin unsymmetrical airfoil- High lift devices - Aerodynamic characteristics of thin Flapped airfoil.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Incompressible Flow over Finite Wings: Downwash and induced drag on wings, Vortex Filament, Biot- Savart law and Helmholtz‟s theorems, Prandtl‟s classical lifting line theory, Elliptical Lift Distribution, Effect of Aspect Ratio, Lifting surface theory, Three dimensional source and doublet. Vortex Filament, Biot – Savart Law.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Subsonic Compressible flow over airfoils: The Velocity Potential equation, Linearized Velocity Potential equation, Prandtl – Glauert Compressibility correction, Critical Mach number & Drag divergence Mach number, Effect of Swept Wings, Area Rule, Supercritical airfoil.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Anderson, J.D., Fundamentals of Aerodynamics, McGraw-Hill Education; 5th edition, 2010.

2. Houghton E. L. & Carruthers N. B., "Aerodynamics for Engineering students", Edward Arnold Publishers Ltd., London, 1989.

Reference Books:

1. Clancy, L J., Aerodynamics, Shroff publishers 2006
2. John J Bertin., Aerodynamics for Engineers, Prentice Hall publishers, 6th edition, 2013.
3. Milne Thomson, L.H., Theoretical Aerodynamics, Macmillan, 1985.

Course Outcomes (COs):

1. Understand fundamental aerodynamic concepts including airfoil geometry, aerodynamic forces, moments, and basic flow governing equations.
2. Analyze two-dimensional inviscid incompressible flows and explain flow behavior around cylinders using circulation and vortex concepts.
3. Apply thin airfoil theory to evaluate aerodynamic characteristics of symmetrical, unsymmetrical, and flapped airfoils.
4. Evaluate finite wing aerodynamics with respect to lift distribution, induced drag, and three-dimensional flow effects.
5. Illustrate subsonic compressible flow effects on airfoils using compressibility corrections and high-speed aerodynamic concepts.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1 &CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Assignment	10	CO1 to CO5
Quiz	10	CO1 to CO5
Semester End Examination (SEE): 100 Marks		
Semester End Examination (SEE):	100	CO1 to CO5

NON DESTRUCTIVE TESTING	
Course Code: ASAEC46	**Credits: 1:0:0**
Prerequisite:	**Contact Hours: 15L**
Course Coordinator: Dr. Radhakrishnan P M	

Course Contents

Unit I

Introduction to NDT: Definition and objectives of Non-Destructive Testing, Advantages and limitations of NDT, Comparison between destructive and non-destructive testing, Classification of NDT methods, Applications of NDT in aerospace & defense, Role of NDT in quality assurance and structural integrity.

Visual Testing – Introduction, Optical Aids, Application, Advantages & Disadvantages

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit II

Surface Inspection Methods: Liquid Penetrant Testing - Principle and procedure, Visible and fluorescent penetrants, Types, Application, Advantages, Disadvantages and Sensitivity; Magnetic Particle Testing - Principle, Procedure, Equipment, Magnetizing Technique, Application, Advantages, Disadvantages and Sensitivity.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated video

Unit III

Subsurface and Internal Defect Detection: Ultrasonic Testing – Principle, Procedure, Sources, Techniques, Types, Application, Advantages and Disadvantages; Radiographic Testing – Principle, Source: X-ray and gamma-ray, Procedure, Techniques, Application, Advantages, Disadvantages, Safety and Sensitivity.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Electrical and Thermal Based NDT Methods: Eddy Current Testing – Principle, Procedure, Equipment, Techniques, Application, Advantages, Disadvantages and Sensitivity; Infrared Thermography - Principle, Procedure, Techniques, Application, Advantages and Disadvantages; Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit V

Advanced and Emerging NDT Techniques: Acoustic Emission Testing, Structural health monitoring, Laser Shearography, Phased Array Ultrasonic Testing, Time of Flight Diffraction.

- Pedagogy/Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Raj, B., Jayakumar, T., and Thavasimuthu, M. Practical Non-Destructive Testing, Narosa Publishing House, New Delhi, 2002.R.
2. Hellier, C., Handbook of Nondestructive Evaluation, McGraw-Hill Education, New York, 2013.

Reference Books:

1. Baldev Raj and Jayakumar, T., Non-Destructive Testing and Evaluation, Tata McGraw-Hill Publishing Company, New Delhi, 2007.

2. Bray, D. E., and McBride, D. Nondestructive Testing Techniques, John Wiley & Sons, New York, 1992.
3. ASM International, ASM Handbook, Volume 17: Nondestructive Evaluation and Quality Control, ASM International, Ohio, 2002.

Course Outcomes (COs):

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

1. Explain the fundamentals of Non-Destructive Testing, its objectives, advantages, limitations, classification, and applications.
2. Describe the principles and procedures of surface inspection methods such as Liquid Penetrant Testing and Magnetic Particle Testing.
3. Explain the principles and applications of subsurface defect detection methods including Ultrasonic Testing and Radiographic Testing.
4. Describe the working principles and applications of Eddy Current Testing and Infrared Thermography.
5. Explain the concepts and applications of advanced NDT techniques

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE) - 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO-1 & CO-2
Internal test-II	30	CO-3, CO-4 & CO-5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Quiz/Case Study/Mini Project/Surprise Test/ Presentation	10	CO-1, CO-2, CO-3, CO-4, CO-5
Assignment	10	CO-1, CO-2, CO-3, CO-4, CO-5
Semester End Examination (SEE) - 50 Marks		
Semester End Examination	50	CO-1, CO-2, CO-3, CO-4 & CO-5

FINITE ELEMENT ANALYSIS LAB	
Course Code: ASL47	**Credits: 0:0:1**
Prerequisite:	**Contact Hours: 15P**
Course Coordinator: Dr. Radhakrishnan P M	

Course Content

1. Perform stress analysis of a cantilever beam subjected to specified loading conditions.
2. Carry out stress analysis of a simply supported beam under prescribed loads.
3. Model a stepped bar and evaluate the stresses for given loading conditions.
4. Conduct structural modelling and load analysis of truss systems subjected to external loads.
5. Determine shear force and bending moment distributions in beams with various support and loading configurations.
6. Analyse the stress distribution in a rectangular plate with a circular hole subjected to axial loading.
7. Perform buckling analysis of an I-section column under compressive loads.
8. Develop a structural model of a fuselage bulkhead frame and evaluate the stress response under applied loads.
9. Conduct modal analysis of a beam for specified boundary conditions.
10. Perform structural modelling and stress analysis of an aircraft wing torsion box.

Course Outcomes (COs):

Students will be able to:

1. Analyse stresses and internal forces in structural elements under various loading conditions (PO-1, PO-2, PO-3, PO-4, PO-5, PO-11).
2. Perform structural modelling and advanced analyses using modern computational tools (PO-1, PO-2, PO-3, PO-4, PO-5, PO-11).
3. Evaluate thermal and dynamic behaviour of structures under given boundary conditions (PO-1, PO-2, PO-3, PO-4, PO-5, PO-11).

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment	30	CO1, CO2 & CO3
Practical Test	20	CO1, CO2 & CO3
Semester End Examination (SEE)	50	CO1, CO2 & CO3

AEROSPACE PROPULSION LAB	
Course Code: ASL48	**Credits: 0:0:1**
Prerequisite:	**Contact Hours: 15P**
Course Coordinator: Dr. Anand M Raikar	

List of Experiments

1. Identification of various parts and their functions in a micro gas turbine jet engine
2. Measurement of micro-gas turbine engine characteristics at various rpm
3. Estimation of propeller performance using a propeller test rig
4. Estimate the performance of a diffuser.
5. Evaluate the performance of cascade turbine blades
6. Analyse the flow behavior through a nozzle
7. Determination of calorific value of solid, liquid and gaseous fuels
8. Evaluate the self-sustaining speed and performance characteristics of a micro-gas turbine
9. Calculate the compressor-exit efficiency using a micro gas turbine
10. Calculate the turbine-exit efficiency using micro gas turbine
11. Calculate the nozzle-exit efficiency using micro gas turbine
12. Demonstrate stall and surge phenomena of a micro-gas turbine

Text Book:

1. Aerospace Propulsion Lab Manual by the Department of Aerospace Engineering, RIT

Course Outcomes (COs):

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

1. Identify the components of a jet engine and estimate their performance (PO1, PO2, PO3, PO4, PO5)
2. Assess the properties of different fuels used in aviation (PO1, PO2, PO3, PO4, PO5)
3. Evaluate the propulsion characteristics of a micro-gas turbine (PO1, PO2, PO3, PO4, PO5)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment	30	CO1, CO2 & CO3
Practical Test	20	CO1, CO2 & CO3
Semester End Examination (SEE)	50	CO1, CO2 & CO3

AERODYNAMICS LAB	
Course Code: ASL49	**Credits: 0:0:1**
Prerequisite:	**Contact Hours: 15P**
Course Coordinator: Dr. Inamul Hasan	

Course Content

1. Measurement of Turbulence Intensity in subsonic wind tunnel.
2. Calculation of Aerodynamic Parameters from Pressure Distribution over a Circular Cylinder and Verification of D'Alembert's Paradox.
3. Calculation of Aerodynamic Parameters from Pressure Distribution over a Two-Dimensional Symmetrical Airfoil.
4. Calculation of Aerodynamic Parameters from Pressure Distribution over a Two-Dimensional Cambered Airfoil
5. Calculation of Aerodynamic Parameters from Pressure Distribution over a Two-Dimensional Leading-Edge Serrated Airfoil
6. Study of the Effects of Turbulence Intensity Variation on Various Aerodynamic Models
7. Measurement of Forces and Moments Using a Six-Component Balance for Various Aerodynamic Models
8. Laser Flow Visualization Studies on Various Aerodynamic Models
9. Calculation of Total drag of various aerodynamic models using pitot static probe wake survey.
10. Experimental Investigation of Flapping-Wing Aerodynamics Using a Six-Component Force Balance

Course Outcomes (COs):

Students will be able to:

1. Perform wind tunnel experiments to determine aerodynamic parameters using pressure distribution and turbulence measurements.
2. Evaluate aerodynamic forces, moments, and drag characteristics of various models using force balance and wake survey methods.
3. Interpret flow behavior around aerodynamic models using flow visualization techniques and advanced experimental investigations

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course Outcomes addressed**
Weekly evaluation of laboratory journals/ reports after the conduction of every experiment	30	CO1, CO2 & CO3
Practical Test	20	CO1, CO2 & CO3
Semester End Examination (SEE)	50	CO1, CO2 & CO3

ADDITIONAL MATHEMATICS – II	
Course Code: AM41	**Credits: 0:0:0**
Prerequisite: Nil	**Contact Hours: 42**
Course Coordinator: Dr. Veena B N	

(For Lateral Entry Diploma Students)

Unit I

Differential Calculus - I: Partial differentiation, Euler's theorem, total differential coefficient, differentiation of composite and implicit functions.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit II

Differential Calculus- II: Jacobian and Properties. Taylor's theorem for function of two variables, maxima and minima for functions of two variables.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links ➢ https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030
  ➢ https://a.impartus.com/ilc/#/course/59742/295

Unit III

Vector Integration: Line integrals, surface integrals and volume integrals. Green's theorem, Stokes' and Gauss divergence theorem (without proof) and problems, orthogonal curvilinear coordinates.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105134/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit IV

Higher Order Differential Equations: Higher order linear differential equations, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations.

- Pedagogy / Course delivery tools: ➢ Chalk and talk
- Links: ➢ https://nptel.ac.in/courses/111/105/111105134
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/107625/1030

Unit V

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability- illustrative examples. Bayes theorem – examples.

- Pedagogy / Course delivery tools:
  - Chalk and talk, PowerPoint Presentation
- Links:
  - https://nptel.ac.in/courses/111/105/111105121/
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/59742/295

Text Books:

1. **B.S. Grewal -** Higher Engineering Mathematics, Khanna Publishers, 44th edition, 2017.
2. **Erwin Kreyszig -**Advanced Engineering Mathematics, Wiley Publication, 10th Edition, 2015.

Reference Books:

1. **H. K. Dass** - Higher Engineering Mathematics, S Chand Publications, 1998.
2. **B. V. Ramana** - Engineering Mathematics, Tata McGraw-Hill Publishing Co. Ltd., India 2008.

Course Outcomes

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

1. To carryout differentiation of function of several variables. (PO-1,2)
2. Solve the problems related to Jacobians, the extreme values of a function and Taylors series. (PO-1,2)
3. Exhibit the interdependence of line, surface and volume integrals using integral theorems. (PO-1,2)
4. Find the solution of second and higher order ODEs with constant and variable coefficients. (PO-1,2)
5. Solve the problems on conditional probability and Baye's theorem. (PO-1,2)

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3
Assignment	10	CO3, CO4, CO5

AEROSPACE SYSTEMS & INSTRUMENTATION	
Course Code: ASE451	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L**
Course Coordinator: Dr. Senthamilselvi A	

Course Content

Unit I

Aircraft Systems: Hydraulic Systems, components, controllers modes. Pneumatic Systems and Landing Gear, including shock absorbers and retraction mechanisms.

- Pedagogy/Course delivery tools: - Chalk and talk, PowerPoint presentation, animated videos.

Unit II

Airplane Control Systems: Conventional Systems, fully powered flight controls, Power actuated systems, Modern control systems, Digital fly-by-wire systems, autopilot system active control Technology.

- Pedagogy/Course delivery tools: - Chalk and talk, PowerPoint presentation, animated videos.

Unit III

Engine Systems: Fuel systems for Piston and jet engines, Components of multi engines. lubricating systems for piston and jet engines - Starting and Ignition systems - Typical examples for piston and jet engines.

- Pedagogy/ Course delivery tools: - Chalk and talk, PowerPoint presentation, animated videos.

Unit IV

Auxiliary System: Basic Air cycle systems, Vapour Cycle systems, Evaporative vapour cycle systems

- Pedagogy/ Course delivery tools: - Chalk and talk, PowerPoint presentation, animated videos.

Unit V

Aircraft Instruments: Flight Instruments and Navigation Instruments, Gyroscope, Accelerometers, Air speed Indicators, TAS, EAS, Mach Meters, Altimeters, Principles and operation, Study of various types of engine instruments, Tachometers, Temperature gauges, Pressure gauges, Operation and Principles.

- Pedagogy/ Course delivery tools: -Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Ian Moirand Allan Seabridge, Aircraft Systems: Mechanical, Electrical and Avionics-Subsystem Integration, Wiley India Pvt Ltd, 3rd edition, 2012.
2. Lalit Gupta and OP. Sharma, Aircraft Systems (Fundamentals of Flight Vol. IV), Himalayan Books, 2006.
3. Craig Lawson & David Judt, Aircraft Systems: A Design and Development Guide, Wiley, 2025.

Reference Books:

1. William A Neese, Aircraft Hydraulic Systems, Himalayan Books, 2007
2. SR. Mujumdar, Pneumatic Systems, Tata McGraw Hill Publishing Co, 1st Edition, 2001
3. Allan Seabridge, Aircraft Systems Classifications: A Handbook of Characteristics and Design Guidelines, Wiley, 2021.

Course Outcomes (COs):

1. Identify the main components and working principles of aircraft hydraulic, pneumatic, and landing gear systems
2. Describe different aircraft flight control systems, including powered controls, fly-by-wire systems, and autopilot systems
3. Analyze the basic fuel, lubrication, starting, and ignition systems used in piston and jet engines.
4. Apply the principles of air-cycle and vapour-cycle systems used for aircraft environmental control.
5. Interpret the working principles and applications of flight, navigation, and engine instruments used in aircraft.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1 &CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Assignment	10	CO1 to CO5
Quiz	10	CO1 to CO5
Semester End Examination (SEE): 100		
Semester End Examination (SEE):	100	CO1 to CO5

AIRCRAFT MAINTENANCE, REPAIR AND OVERHAUL	
Course Code: ASE452	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L**
Course Coordinator: Dr. Inamul Hasan	

Course Content

Unit I

Fundamentals of Maintenance & Certification: Types of maintenance, Redesign, Failure rate pattern, Other maintenance considerations. Aviation industry certification requirements, Type certificate (FAA form 8110.9), Airworthiness certificate (FAA form 8100-2), Aviation maintenance certifications, General, Airframe, Power plants and Avionics certifications.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit II

Documentation for Maintenance: Manufacturer's documentation, Airplane maintenance manual, Fault insulation manual, Illustrated parts catalogue, structural repair manual, wiring diagram manual, Master minimum equipment list, Federal Aviation regulation (FAR), Advisory circulars, Airworthiness directives, ATA document standards, Technical policies and procedure manuals (TPPM).

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit III

Aircraft Management Maintenance: Structure, Role of aviation management, Line supervisory management, Management areas of concern in airlines, Manager of overhaul shops, Line maintenance control centre flight line (preflight & post-flight), Aircraft Logbook, Maintenance crew skill requirements

- Pedagogy/ Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Hangar Maintenance (on Aircraft) & Material Support: Introduction, organization of hangar maintenance, Non- routine item, parts availability, cannibalization, Types of shops- sheet metal shop, Aircraft interior shop, Engine shop, Avionics shop, ground support equipment, outsourcing of shop maintenance work, operation of overhaul shops, Material support, Material management inventory control, Support functions of material, Parts ordering, Storage, Issue, control and handling, Parts receiving quality control, calibration program, stock level adjustments, shelf life, exchanges, warranty & modifications of parts.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Maintenance Safety & Troubleshooting: Safety regulations, occupational safety and health standards maintenance safety program, Airline safety management, General safety rules, Accident & injury reporting, Hazardous materials storage and handling aircraft furnishing practices troubleshooting, Knowledge of malfunctions

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Aviation Maintenance Management, Harry A Kinnison, Tariq Siddiqui, Mc Graw Hill education, 2012, ISBN: 9780071805032
2. Aircraft maintenance and repair, Kroes, Watkins, Delp, Mc Graw Hill, 2013 McGraw-Hill Education, 7th edition, 2013, ISBN: 978-0071801508

Reference Books:

1. Aircraft Repair Manual, Larry Reithmaier, Palmar Books, Marquette, 1992, ISBN: 978-0932882028.
2. Aircraft Maintenance, Brimm. DJ, Bogges, HE, Pitman publishing corp, London, 1952, ASIN:B000NQ539E

Course Outcomes (COs):

1. Understand core principles and regulations for aircraft maintenance and certification
2. Comprehend skills for effective documentation in compliance with industry standards
3. Demonstrate knowledge of aircraft maintenance management, line and overhaul operations, aircraft logbook usage, and maintenance crew skill requirements.
4. Apply knowledge to ensure safety, troubleshoot, and maintain airworthiness
5. Acquire expertise in hangar maintenance procedures, including facility upkeep, equipment management, and safety protocols to support efficient aircraft maintenance operations

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1 &CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Assignment	10	CO1 to CO5
Quiz	10	CO1 to CO5
Semester End Examination (SEE): 100 Marks		
Semester End Examination (SEE):	100	CO1 to CO5

AIR TRANSPORTATION: AN OVERVIEW	
Course Code: ASE453	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L**
Course Coordinator: Dr. Inamul Hasan	

Course Content

Unit I

Introduction to Air Transportation System: Role of air transportation in global and national economy, Evolution and growth of civil aviation, Overview of global civil aviation infrastructure, Components of air transport ecosystem, Airlines, Airports, Air Traffic Management, Regulatory bodies, Current status of Indian aviation sector, Career opportunities in air transportation.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit II

Airlines and Airline Economics: Airline business models (Full-service, Low-cost, Charter), Airline organizational structure, Basics of airline economics, Cost structure and revenue streams, Airline yield management concepts, Pricing strategies and demand forecasting, Airline alliances and code-sharing.

- Pedagogy/Course delivery tools:-Chalk and talk, animated videos

Unit III

Airline Operations and Fleet Planning: Airline scheduling principles, Aircraft routing and crew scheduling, Disruption management in airline operations, Fleet planning concepts, Aircraft selection criteria, Impact of range, payload, and fuel efficiency, Introduction to sustainability in airline operations.

- Pedagogy/ Course delivery tools: Chalk and talk, PowerPoint presentation, animated videos

Unit IV

Airports: Airport classification and functions, Airport layout and components, Runways, taxiways, aprons, Terminal planning concepts, Airport lighting, marking, and signage, Environmental impact of airport development, Overview of heliports and vertiport.

Air Traffic Management: Introduction to ATM, Airspace structure, Navigation systems, Surveillance systems, Communication systems, Human factors in ATM, Overview of Urban Air Mobility (UAM)

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Unit V

Global Aviation Regulations and Emerging Trends: International aviation organizations – ICAO, IATA, FAA, DGCA (India), Regulatory frameworks and safety standards, Operational procedures and global standards, Human factors in aircraft maintenance, Modern developments in air transportation systems. Emerging concepts: Sustainable aviation, Buoyancy-based transport, Future air mobility concepts.

- Pedagogy/ Course delivery tools:-Chalk and talk, PowerPoint presentation, animated videos

Text Books:

1. Air Transportation: A Management Perspective, John G. Wensveen, Wiley, 9th Edition, 2021.
2. Airline Operations and Management, Gerald N. Cook & Bruce Billig, McGraw-Hill Education, 2017.
3. Air Traffic Management: Economics, Regulation and Governance, edited by Vincent J. B. & Nabil A., Routledge, 2019.

Reference Books:

1. Airline Marketing and Management, Stephen Shaw, Ashgate, 7th Edition, 2016.
2. Aviation: An Introduction to Business & Technology, Mohammad Shah Kamal & Peter Harris, Routledge, 3rd Edition, 2020.
3. Air Law: Cases, Laws and Related Sources, Havelock McLean, Routledge, 2nd Edition, 2015.

Course Outcomes (COs):

1. Understand the structure, evolution, and significance of the global air transportation system and its role in economic and societal development.
2. Explain airline business models, cost structures, and basic economic principles governing airline operations.
3. Analyze airline operational processes including scheduling, fleet planning, and disruption management
4. Describe airport planning concepts and air traffic management systems with emphasis on operational efficiency and safety.
5. Interpret global aviation regulatory frameworks and assess emerging trends such as sustainable aviation and future air mobility systems.

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1 &CO2
Internal Test-II	30	CO3, CO4 & CO5
Average of the two internal tests will be considered for evaluation of 30 Marks		
Other components- 20 Marks		
Assignment	10	CO1 to CO5
Quiz	10	CO1 to CO5
Semester End Examination (SEE):		
Semester End Examination (SEE):	100	CO1 to CO5

PROBABILITY & STATISTICS	
Course Code: ASE454	**Credits: 3:0:0**
Prerequisite:	**Contact Hours: 45L**
Course Coordinator: Dr. B Azghar Pasha & Dr. G Kalpana	

Course Content

Unit I

Statistics: Curve fitting by the method of least squares, fitting linear, quadratic and geometric curves, correlation, regression and multiple regression. Engineering applications.

Fundamentals of Probability: Random experiments, sample space and events, axioms of probability. Addition and multiplication theorems, conditional probability, Bayes' theorem. Engineering Applications.

- Pedagogy/Course delivery tools:
  - Chalk and talk, PowerPoint Presentation
- Links:
  - https://nptel.ac.in/courses/102101056
  - https://nptel.ac.in/courses/111107119
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/96127/452

Unit II

Random Variables: Discrete and continuous random variables, probability mass function, probability density function, cumulative distribution function, joint probability mass function, joint probability density function, marginal distributions, conditional distributions, conditional expectation, independence of random variables, covariance of two random variables

- Pedagogy/Course delivery tools:
  - Chalk and talk, PowerPoint Presentation
- Links:
  - https://nptel.ac.in/courses/111105035
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/96127/452
  - https://a.impartus.com/ilc/#/course/132243/636
  - https://a.impartus.com/ilc/#/course/119635/593

Unit III

Discrete Probability Distributions: Binomial distribution, Poisson distribution.

Continuous Probability Distributions: Uniform distribution, Exponential distribution and Normal distributions. Engineering Applications.

- Pedagogy/Course delivery tools:
  - **Chalk and talk, PowerPoint Presentation, Videos**
- Links:
  - https://nptel.ac.in/courses/111105035
- Impartus recording:
  - https://a.impartus.com/ilc/#/course/96127/452
  - https://a.impartus.com/ilc/#/course/132243/636
  - https://a.impartus.com/ilc/#/course/119635/593

Unit IV

Theory of Reliability: Concept of Reliability, Weibull distribution, Analysis of failure of data, Hazard rate, Mean time to failure (MTTF), Mean time between failure (MTBF), Hazard models – Linear Hazard model, non-linear failure model (Weibull failure law), exponential failure model.

- Pedagogy/Course delivery tools:
  - Chalk and talk, PowerPoint Presentation

Unit V

Sampling and Statistical Inference: Sampling distributions, central limit theorem, concepts of standard error and confidence interval, level of significance, type I and type II errors, one tailed and two tailed tests, Z-test: for single mean, for single proportion and for difference between means, Student's t –test: for single mean and for difference between two means, F – test for equality of two variances, Chi-square test: for goodness of fit and for independence of attributes.

- Pedagogy/Course delivery tools: ➢ Chalk and talk, PowerPoint Presentation, Videos
- Links: ➢ https://nptel.ac.in/courses/111/107/111107119/
- Impartus recording: ➢ https://a.impartus.com/ilc/#/course/96151/1112

Text Books:

1. **R.E. Walpole, R. H. Myers, R. S. L. Myers and K. Ye** – Probability and Statistics for Engineers and Scientists – Pearson Education – Delhi – 9th edition – 2012.
2. **Sheldon M. Ross** – Probability models for Computer Science – Academic Press, Elsevier, 2009.
3. **Charles E. Ebeling -** An introduction to Reliability and maintainability Engineering, Waveland Press, Inc., 3rd edition, 2019

Reference Books:

1. **Erwin Kreyszig -** Advanced Engineering Mathematics-Wiley-India publishers, 10th edition, 2015.
2. **Johnson, Miller -** Miller & Freund's Probability and Statistics for Engineers, 8th edition, Pearson Education India, 2015.
3. **Murray R Spiegel, John Schiller & R. Alu Srinivasan** – Probability and Statistics, Schaum's outlines, 4th edition, 2012.

Course Outcomes:

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

1. Fit a least squares curve to a given data and the relation between the variables (**PO–1,2 & PSO–1, 2)**
2. Analyse random variables and joint probability distribution to determine marginal and conditional distributions. (**PO–1,2 & PSO–1, 2)**
3. Solve problems using appropriate probability distributions. (**PO–1,2 & PSO–1, 2)**
4. Analyse component and system reliability using reliability measures and probabilistic failure models (**PO–1,2 & PSO–1, 2)**
5. Choose an appropriate test of significance and make inference about the population from a sample. **(PO–1,2 & PSO–1, 2)**

Course Assessment and Evaluation:

Continuous Internal Evaluation: 50		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test – I	30	CO1,CO2,CO3
Internal test – II	30	CO3,CO4,CO5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1,CO2,CO3
Assignment	10	CO3,CO4,CO5
Semester End Examination (SEE)	100	CO1,CO2,CO3,CO4,CO5