# ANNASAHEB DANGE COLLEGE OF ENGINEERING AND TECHNOLOGY, ASHTA

## AN AUTONOMOUS INSTITUTE

(Affiliated to Shivaji University, Kolhapur)

## SECOND REVISION CURRICULUM

## BACHELOR OF TECHNOLOGY IN

## AERONAUTICAL ENGINEERING

# Annasaheb Dange College of Engineering and Technology Ashta

## Department of Aeronautical Engineering

### Teaching and Evaluation Scheme

**S. Y. B. Tech Semester IV**

| Course Code | Course Name | Teaching Scheme | | | | THEORY | | | | | | | PRACTICAL | | | | | | GRAND TOTAL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | ISE | | MSE+ ESE | | | Total | Min | ISE | | MSE + ESE | | Total | Min | |
| | | L | T | P | Credits | Max | Min | MSE | ESE | Min | | | Max | Min | Max | Min | | | |
| 2AEPC211 | Low Speed Aerodynamics | 2 | 1 | 2 | 4 | 40 | 16 | 30 | 30 | 24 | 100 | 40 | 50 | 20 | - | - | 50 | 20 | 150 |
| 2AEPC212 | Aircraft Structures | 2 | 1 | 2 | 4 | 40 | 16 | 30 | 30 | 24 | 100 | 40 | 50 | 20 | - | - | 50 | 20 | 150 |
| 2AEPC213 | Airbreathing Propulsion | 2 | 1 | 2 | 4 | 40 | 16 | 30 | 30 | 24 | 100 | 40 | 50 | 20 | - | - | 50 | 20 | 150 |
| 2AEPE2** | Professional Elective - I | 2 | - | - | 2 | 50 | 20 | - | - | - | 50 | 20 | - | - | - | - | - | - | 50 |
| 2AEVS218 | Grid Generation using HyperMesh | - | - | 2 | 1 | - | - | - | - | - | - | - | 25 | 10 | 25 | 10 | 50 | 20 | 50 |
| 2AEVS219 | Professional and Business Communication | - | - | 2 | 1 | - | - | - | - | - | - | - | 25 | 10 | 25 | 10 | 50 | 20 | 50 |
| 2AEEL220 | Innovation/Prototype | - | - | 2 | 1 | - | - | - | - | - | - | - | 25 | 10 | 25 | 10 | 50 | 20 | 50 |
| 2AEHS221 | Psychology | 1 | 1 | - | 2 | - | - | - | - | - | - | - | 50 | 20 | - | - | 50 | 20 | 50 |
| 2AECC223 | Aptitude and Reasoning Part - II | - | - | 2 | 1 | - | - | - | - | - | - | - | 50 | 20 | - | - | 50 | 20 | 50 |
| 2******* | Minor Stream Course I | 2 | - | - | 2 | 40 | 16 | 30 | 30 | 24 | 100 | 40 | - | - | - | - | - | - | 100 |
| | | 11 | 4 | 14 | 22 | | | | | | | | | | | | | | 850 |
| | Total Contact Hours/Week | 29 | | | | | | | | | | | | | | | | | |

| Professional Elective - I | |
|---|---|
| 2AEPE214 | Introduction to Finite Element Analysis |
| 2AEPE215 | Introduction to Computational Fluid Dynamics |
| 2AEPE216 | Introduction to Unmanned Aerial Vehicles |
| 2AEPE217 | Introduction to Aircraft Maintenance |

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**DOCUMENT NUMBER: ADCET/ACAD/5, Rev:00, 01/01/2020**

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPC211 - Low Speed Aerodynamics** |
| Prerequisite | 2AEPC203 - Fluid Mechanics |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/01/02 |
| Credits | 04 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. Provide students with a fundamental understanding of the physical principles governing low speed aerodynamics and propellers, enabling them to analyze and predict their performance.
2. Effectively communicate technical concepts related to low speed aerodynamics and propellers in written and oral presentations, and Present analysis results and conclusions clearly and concisely

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPC211_1 | Define, illustrate and explain the key terms related to aerodynamics, propellers, wing design parameters and propeller design variables and Explain the effect of airfoil and wing geometry on lift, drag, and pitching moment. |
| 2AEPC211_2 | Analyze ideal flow over a circular cylinder, including understanding D'Alembert's paradox and the Magnus effect and Compare real and ideal flow over smooth and rough cylinders. |
| 2AEPC211_3 | Demonstrate the use of Kutta-Joukowski theorem and methods like superposition, thin airfoil theory, source and vortex methods for airfoil analysis and Analyze potential flow over lifting wings using lifting line theory, vortex lattice method, slender body theory, and panel method. |
| 2AEPC211_4 | Analyze the effect of subsonic compressible flow on airfoils and wings: critical Mach number, drag divergence Mach number, supercritical airfoils, sweepback influence, area rule and Apply Prandtl-Glauert compressibility corrections. |
| 2AEPC211_5 | Calculate boundary layer thickness, displacement thickness, momentum thickness, energy thickness, and shape parameter, and Analyze boundary layer growth over a flat plate, understanding critical Reynolds number and Blasius solution. |
| 2AEPC211_6 | Apply Froude's momentum theory and blade element theory to predict propeller performance and Analyze common propeller types and their characteristics. |

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**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Introduction to Aerodynamics** | **04 + 02 + 04** |
| Flow regimes (Reynolds Number and Mach No), Airfoils, Wings and their nomenclature, Lift, Drag and Pitching moment coefficients, Center of pressure and Aerodynamic center. Flow over cylinder and aerofoil. | | |
| **Unit 2** | **Potential Flow Theory** | **04 + 02 + 04** |
| Streamline, stream function, irrotational flow, potential function, Equipotential lines, Elementary flows and their combinations. D'Alembert's paradox, Magnus effect, Kutta Joukowski's theorem, starting vortex, Kutta condition, real flow over a smooth and rough cylinder. | | |
| **Unit 3** | **Aerofoil Theory** | **05 + 02 + 04** |
| Scalar and vector fields, velocity potential, line, surface and volume integrals, Green's lemma and Stoke's theorem, Kelvin's theorem, Circulation and lift generation, Kutta-Joukowski theorem. Method of superposition, thin airfoil theory, source, and vortex methods. | | |
| **Unit 4** | **Subsonic Wing Theory** | **04 + 02 + 04** |
| Vortex filament, Biot and Savart law, bound vortex and trailing vortex, horseshoe vortex, Potential flow over lifting wing, lifting line theory and its limitations, vortex lattice method, slender body theory, panel method. Subsonic compressible flow past airfoils, Critical Mach number, drag divergence Mach number, supercritical airfoils, effect of sweep, area rule. Prandtl-Glauert compressibility corrections. | | |
| **Unit 5** | **Boundary Layer Theory** | **04 + 02 + 04** |
| Boundary layer and boundary layer thickness, displacement thickness, momentum thickness, energy thickness, shape parameter, boundary layer equations for a steady, two-dimensional incompressible flow, boundary layer growth over a flat plate, critical Reynolds number, Blasius solution, basics of turbulent flow. | | |
| **Unit 6** | **Propeller Theory** | **04 + 02 + 04** |
| Propeller Nomenclature, Tip Speed and Helical Motion, Thrust and Torque, Forces Acting on a Propeller, Propeller Design Variables, Types of Propellers, Froude's Momentum Theory, Blade Element Theory | | |

**Text Books:**

| Sl.No | Title | Authors | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Fundamentals of Aerodynamics | John Anderson | McGrawHill | 07th | 2024 |
| 2 | Aerodynamics for Engineering students | Steven H. Collicott, Daniel T. Valentine, E. L. Houghton, P. W. Carpenter | Butterworth-Heinemann | 07th | 2016 |

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| Sl.No | Title | Authors | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 3 | Theoretical Aerodynamics | Ethirajan Rathakrishnan | John Wiley | 01st | 2013 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Low-Speed Aerodynamics | Joseph Katz Allen Plotkin | Cambridge University Press | 2nd | 2012 |
| 2 | Aerodynamics, Aeronautics, and Flight Mechanics | Barnes W. McCormick | John Wiley & Sons | 2nd | 1994 |
| 3 | Fluid Mechanics | Frank M. White Henry Xue | McGrawHill | 9th | 2022 |

**Reference Papers:**

1. Liu, Tianshu, Shizhao Wang, Hao Liu, and Guowei He. "Engineering perspective on bird flight: Scaling, geometry, kinematics and aerodynamics." *Progress in Aerospace Sciences* (2023): 100933.
2. Shyy, Wei, Hikaru Aono, Satish Kumar Chimakurthi, Pat Trizila, C-K. Kang, Carlos ES Cesnik, and Hao Liu. "Recent progress in flapping wing aerodynamics and aeroelasticity." *Progress in Aerospace Sciences* 46, no. 7 (2010): 284-327.
3. Gennaretti, Massimo, and Riccardo Giansante. "Kutta–Joukowski theorem for unsteady linear aerodynamics." *AIAA Journal* 60, no. 10 (2022): 5779-5790.
4. Conlan-Smith, Cian, Néstor Ramos-García, Ole Sigmund, and Casper Schousboe Andreasen. "Aerodynamic shape optimization of aircraft wings using panel methods." *AIAA Journal* 58, no. 9 (2020): 3765-3776.
5. Su, Yumin, Mitsuhisa Ikehata, and Hisashi Kai. "A numerical method for designing a three-dimensional wing based on the surface panel method." *Journal of the Society of naval architects of Japan* 1997, no. 182 (1997): 39-47.
6. Russo, Lorenzo, Renato Tognaccini, and Luciano Demasi. "Box wing and induced drag: compressibility effects in subsonic and transonic regimes." *AIAA Journal* 58, no. 6 (2020): 2398-2413.
7. Quadrio, Maurizio, Alessandro Chiarini, Jacopo Banchetti, Davide Gatti, Antonio Memmolo, and Sergio Pirozzoli. "Drag reduction on a transonic airfoil." *Journal of Fluid Mechanics* 942 (2022): R2.
8. Finnigan, John, Keith Ayotte, Ian Harman, Gabriel Katul, Holly Oldroyd, Edward Patton, Davide Poggi, Andrew Ross, and Peter Taylor. "Boundary-layer flow over complex topography." *Boundary-Layer Meteorology* 177 (2020): 247-313.
9. Hövelmann, Andreas, Andreas Winkler, Stephan M. Hitzel, Kai Richter, and Michael Werner. "Analysis of vortex flow phenomena on generic delta wing planforms at transonic speeds." In *New Results in Numerical and Experimental Fluid Mechanics XII: Contributions to the 21st STAB/DGLR Symposium, Darmstadt, Germany, 2018*, pp. 307-316. Springer International Publishing, 2020.
10. Wald, Quentin R. "The aerodynamics of propellers." *Progress in Aerospace Sciences* 42, no. 2 (2006): 85-128.

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**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | 20 | 16 | 40 % |
| 2 | ISE : TA | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | 20 | | |
| 3 | ISE : PA | ☑ | ☑ | ☑ | ☑ | ☑ | ☑ | 50 | 20 | |
| 4 | MSE | ☑ | ☑ | ☑ | ☐ | ☐ | ☐ | 30 | 24 | 60 % |
| 5 | ESE | ☐ | ☐ | ☐ | ☑ | ☑ | ☑ | 30 | | |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| 2 | 3 | 2 | - | - | 2 | - | - | - | 3 | 3 | - | - | 2 | 2 |
| 3 | 3 | 2 | - | - | 2 | - | - | - | 3 | 3 | - | - | 2 | 2 |
| 4 | 3 | 2 | 2 | - | 2 | - | - | - | 3 | 3 | - | - | 3 | 3 |
| 5 | 3 | 2 | 2 | 1 | 2 | - | - | - | 3 | 3 | - | - | 3 | 3 |
| 6 | 3 | 2 | 2 | 1 | 2 | - | - | - | 3 | 3 | - | - | 3 | 3 |
| **Avg** | **3** | **2** | **2** | **1** | **2** | **-** | **-** | **-** | **3** | **3** | **-** | **-** | **3** | **3** |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPC212 - Aircraft Structures** |
| Prerequisite | 2AEPC202 - Solid Mechanics |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/01/02 |
| Credits | 04 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. To equip students with the knowledge and skills necessary to contribute to the design, analysis of aircraft structures.
2. To develop students problem-solving and analytical skills by presenting them with real-world aircraft structural challenges.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPC212_1 | Interpret the behavior of aircraft structural component cross-sections and sketch the bending stress distribution under bending loads, including the evaluation of section moduli, product of inertia, and centroidal axes. |
| 2AEPC212_2 | Explain shear flow and its role in structural stability and load transfer in wing spars and box beams, including the determination of shear flow distribution and calculation of shear center location. |
| 2AEPC212_3 | Develop critical thinking, problem-solving, and analytical skills through the application of structural idealization in stress analysis concepts to real-world engineering problems related to wing and fuselage structures. |
| 2AEPC212_4 | Fabricate and Evaluate laminated thin-walled composite structures including understanding the behavior of open and closed sections which is influenced by the geometry and material properties. |

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**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Unsymmetrical bending of beams** | **04 + 02 + 02** |
| Loads on Aircrafts - Symmetrical bending, Anticlastic bending - Unsymmetrical bending - Calculation of Non-homogenous section properties - Generalized 'K' method – Position of Neutral axis - Principal axes for beam cross section - Direct stress on thin walled section. | | |
| **Unit 2** | **Shear of thin walled beams** | **05 + 02 + 04** |
| Shear flow and shear center of thin walled open section beams – Symmetrical and Unsymmetrical thin walled beam cross section - Shear flow distribution in Channel section using any programming language. | | |
| **Unit 3** | **Box beams** | **04 + 02 + 04** |
| Multicell structure subjected to torque - Shear and Torsion of thin walled box beam structures - Shear center of box beam using any programming language. | | |
| **Unit 4** | **Structural Idealization** | **05+ 02 + 02** |
| Structural Idealization – Shear flow and shear center of Symmetrical and Unsymmetrical beam cross section – Beams with variable stringer areas - Tapered wing spars - Tension field beam. | | |
| **Unit 5** | **Stress Analysis of wing and fuselage** | **04 + 02 + 04** |
| Bending of a fuselage - Torsion of a fuselage – Shear of fuselage - Bending of wing – Torsion of wing – Stresses on experimental model. | | |
| **Unit 6** | **Thin walled composite beams in Aircraft Structural components** | **04 + 02 + 04** |
| Bending of unsymmetrical composite beam cross section - Shear of composite beam cross section - Application of composite in Aeronautical Industries - Fabrication of composite laminate - Material properties. | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Aircraft Structures for Engineering Students | Megson, T.M.G | Elsevier | 5th | 2012 |
| 2 | Analysis of Aircraft Structures – An Introduction | Donaldson, B.K | McGraw-Hill | 2nd | 2012 |

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**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Aircraft Structures | D.J. Peery | McGraw Hill | 2nd | 1995 |
| 2 | Analysis and Design of Flight Vehicle Structure | E.F. Bruhn | Tristate Offset Co | - | 1980 |

**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☐ | ☐ | ☑ | ☐ | ☐ | 20 | 16 | 40 % |
| 2 | ISE : TA | ☑ | ☑ | ☑ | ☑ | ☐ | ☐ | 20 | | |
| 3 | ISE : PA | ☑ | ☑ | ☑ | ☑ | ☐ | ☐ | 50 | 20 | |
| 4 | MSE | ☑ | ☑ | ☐ | ☐ | ☐ | ☐ | 30 | 24 | 60 % |
| 5 | ESE | ☐ | ☐ | ☑ | ☑ | ☐ | ☐ | 30 | | |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 2 | 1 | 2 | 2 | - | - | - | 3 | 3 | - | - | 1 | - |
| 2 | 3 | 2 | 1 | 2 | 2 | - | - | - | 3 | 1 | - | - | - | - |
| 3 | 3 | 2 | 1 | 1 | 2 | - | - | - | 3 | - | - | 1 | 2 | - |
| 4 | 3 | 2 | - | - | - | - | - | - | 3 | 3 | - | 1 | 2 | 2 |
| **Avg** | **3** | **2** | **1** | **1** | **2** | **-** | **-** | **-** | **3** | **2** | **-** | **1** | **2** | **2** |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPC213 - Air Breathing Propulsion** |
| Prerequisite | 2AEPC204 - Applied Thermodynamics |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/01/02 |
| Credits | 04 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. To gain in-depth knowledge of various types of air breathing engines working principles, advantages, and limitations of each type of propulsion systems.
2. To learn about the analysis of flow phenomenon and estimation of thrust developed by aircraft engines.
3. To apply the fundamental thermodynamic concepts in jet engine combustion chambers, compressors and turbines.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPC212_1 | Identify the various components of an IC engine and GT Engine and working principles. |
| 2AEPC212_2 | Choose the types of diffusers and nozzles for different types of engines using flow measurement procedures. |
| 2AEPC212_3 | Derive force conservation equation (Thrust Equation) to estimate the forces produced by aircraft propulsion systems |
| 2AEPC212_4 | Apply ideal and actual cycle analysis to a gas turbine engine to relate thrust and fuel burn to component performance parameters. |
| 2AEPC212_5 | Analyze engine performance data by performing performance analysis of airbreathing engines with the parameters of thrust calculations, specific fuel consumption, thermal efficiency, and propulsive efficiency. |
| 2AEPC212_6 | Calculate the performance of various compressor and turbine by using velocity triangle |

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**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Principles of Air Breathing Engines** | **04 + 02 + 02** |
| Gas turbine engine - Construction, working, Brayton Cycle, Thrust equation - Factors affecting thrust, Methods of thrust augmentation, After burner Characteristics of turboprop, turbofan, and turbojet-Performance characteristics; Working Principle of RAM jet, SCRAM Jet. | | |
| **Unit 2** | **Jet Engine Intakes** | **04 + 02 + 04** |
| Internal flow and Stall in subsonic inlets - Major features of external flow near a subsonic inlet - Relation between minimum area ratio and external deceleration ratio - Diffuser performance - Supersonic inlets - Starting problem on supersonic inlets - Shock swallowing by area variation. | | |
| **Unit 3** | **Compressors** | **05 + 02 + 04** |
| Principle operation of centrifugal and axial compressor – Work done and pressure rise – velocity diagrams – degree of reaction – performance parameters axial flow compressors– stage efficiency. | | |
| **Unit 4** | **Combustion Chamber** | **04+ 02 + 02** |
| Classification of combustion chambers - Important factors affecting combustion chamber design - Combustion process - Combustion chamber performance - Effect of operating variables on performance - Flame tube cooling - Flame stabilization - Use of flame holders. | | |
| **Unit 5** | **Turbines** | **04 + 02 + 04** |
| Principle of operation of axial flow turbines– Work done and pressure rise – Velocity diagrams – degree of reaction – performance parameters of axial flow turbine– turbine blade cooling methods – stage efficiency calculations. | | |
| **Unit 6** | **Engine Exhaust and Nozzles** | **05 + 02 + 04** |
| L: Theory of flow in isentropic nozzles - Convergent nozzles and nozzle choking - Nozzle throat conditions - Nozzle efficiency - Losses in nozzles - Over expanded and under expanded nozzles - Ejector and variable area nozzles - Interaction of nozzle flow with adjacent surfaces - Thrust reversal. | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Gas Turbine | V.Ganesan | MC Graw Hill | 3rd | 2016 |
| 2 | Aircraft Propulsion | Saeed Farokhi | Wiley | 2nd | 2014 |
| 3 | Aircraft Propulsion and Gas Turbine Engines | Ahmed F. El-Sayed | CRC Press | 2nd | 2017 |

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**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Elements of Propulsion: Gas Turbines and Rockets | Jack D. Mattingly (Author), Keith Boyer | American Institute of Aeronautics & Astronautics; Second edition | 2nd | 2017 |
| 2 | Gas Turbine Theory | H. Cohen , G.F.C. Rogers, Paul Straznicky, H.I.H. Saravanamuttoo, Andrew Nix | Pearson | 7th | 2017 |
| 3 | Mechanics and Thermodynamics of Propulsion | Philip Hill, Carl Peterson | Pearson | 2nd | 2009 |

| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 1 | NPTEL - IC engines and Gas turbines | https://nptel.ac.in/courses/112103262 |
| 2 | MIT Opencourseware - Introduction to propulsion systems | https://ocw.mit.edu/courses/16-50-introduction-to-propulsion-systems-spring-2012/ |
| 3 | The Gas turbine Handbook | https://www.academia.edu/8075953/Gas_Turbine_Handbook_Principles_and_Practices |
| 4 | Purdue school of Aeronautics and Astronautics | https://engineering.purdue.edu/~propulsi/propulsion/ |
| 5 | NPTEL - Introduction to Airbreathing propulsion | https://nptel.ac.in/courses/101104084 |

**List of Equipments**

| Sl.No | Equipment | Specification | Quantity | Experiment No |
|---|---|---|---|---|
| 1 | Reciprocating Engine | Multi cylinder | 1 | 1 |
| 2 | Gas Turbine Engine. | Turbo Jet | | 2 |

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| | | | | |
|---|---|---|---|---|
| 3 | IC Engine Performance Measurement setup | Four Stroke, Diesel Engine | 1 | 3 |
| 4 | Free Jet and Wall Jet flow measurement setup | Subsonic | 1 | 4,5 |
| 5 | Propeller performance measurement setup | Subsonic | 1 | 6 |
| 6 | Ansys Workbench | 2023R2 | 30 | 7,8 |

**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☐ | ☑ | ☑ | ☐ | 20 | 16 | 40 % |
| 2 | ISE : TA | ☐ | ☑ | ☑ | ☑ | ☐ | ☑ | 20 | | |
| 3 | ISE : PA | ☑ | ☑ | ☐ | ☐ | ☑ | ☑ | 50 | 20 | |
| 4 | MSE | ☑ | ☑ | ☑ | ☐ | ☐ | ☑ | 30 | 24 | 60 % |
| 5 | ESE | ☐ | ☑ | ☐ | ☑ | ☑ | ☑ | 30 | | |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | 2 | 1 | - | - | - | - | - | 3 | 1 | - | 1 | 1 | 1 |
| 2 | 2 | 2 | 1 | - | - | - | - | - | 3 | 2 | - | - | 2 | 2 |
| 3 | 3 | 2 | 1 | 1 | 2 | - | - | - | 3 | - | - | 1 | 2 | - |
| 4 | 3 | 2 | 2 | 1 | 2 | - | - | - | 3 | 3 | - | - | 1 | 2 |
| 5 | 3 | 2 | 2 | - | 2 | - | - | - | 3 | 3 | - | - | 2 | 3 |
| 6 | 3 | 2 | 2 | 1 | 2 | - | - | - | 3 | 3 | - | - | 2 | 3 |
| **Avg** | **3** | **2** | **2** | **1** | **1** | - | - | - | **3** | **2** | | **1** | **2** | **2** |

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Annasaheb Dange College of Engg & Tech ASHTA 416 301

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**Annasaheb Dange College of Engineering and Technology, Ashta**
**DEPARTMENT OF AERONAUTICAL ENGINEERING**
An Autonomous Institute

**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPE214 - Introduction to Finite Element Analysis** |
| Prerequisite | 2AEPC202 - Solid Mechanics |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To learn and apply finite element solutions to structural, thermal, dynamic problems to develop the knowledge and skills needed to effectively evaluate finite element analyses.
2. To learn the theory and characteristics of finite elements that represent engineering structures.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPE214_1 | Develop a solid foundation in the principles and concepts of Finite Element Analysis in engineering design and to recognize the limitations and assumptions inherent in FEA. |
| 2AEPE214_2 | Apply FEA techniques to the design and analysis of engineering structures and components with selection of appropriate modeling techniques based on design requirements. |
| 2AEPE214_3 | Use FEA software for mesh generation, analysis, and post-processing for various engineering problems. |
| 2AEPE214_4 | Develop critical thinking skills in identification and analysis of errors in FEA results. |
| 2AEPE214_5 | Interpret and validate results through comparison with analytical solutions or experimental data. |

**Course Contents:**

| **Unit 1** | **Introduction to Finite Element Analysis** | **06** |
|---|---|---|
| FEA for design Engineers - Objective & limitation - Past, Present and Future of FEA - Formulation and selection of method to solve any engineering problem (Mathematical model) - Finite Element model - Formulation of FE equations - Errors in FEA results. | | |

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| | | |
|---|---|---|
| **Unit 2** | **Concept of the Finite Element Model & Errors Analysis** | **07** |
| General steps of the finite element analysis - Discretization - Approximation of Errors - Various measures of errors - Convergence process & problems - Exercise on tensile strip with a circular hole, L-shaped bracket. | | |
| **Unit 3** | **Finite Element Mesh and Modeling** | **06** |
| Meshing technique - Mesh compatibility - Meshing problems - Exercise on Beam in bending, Hollow cantilever bracket.<br>Modeling steps - Modeling techniques - Exercise on Cantilever bracket with Anti-symmetry boundary conditions, Shaft in torsion, Pin supported link. | | |
| **Unit 4** | **Analysis & Post Processing Techniques** | **07** |
| Nonlinear Analysis - Modal Analysis - Buckling Analysis - Dynamic Analysis - Exercise on slender cantilever beam in bending, Round membrane under pressure, Tuning fork, Unsupported and Hinge supported beam, Beam in compression.<br>Validation & Check Accuracy of the Result - How to View Results - Interpretation of Results and Design Modifications, CAE Reports. | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Finite Element Analysis for Design Engineers | Paul M. Kurowski | SAE International | - | 2004 |
| 2 | Introduction to Finite Element Method | J N Reddy | Tata Mc Graw Hill | 2nd | - |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Fundamentals of Finite Element Analysis | David Hutton | McGraw Hill | - | 2017 |
| 2 | A First Course in the Finite Element Method | Daryl L. Logan | Thomson | 4th | - |

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**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | 20 | 50 % |
| 2 | ISE : PA | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | | 50 % |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 1 | 1 | - | - | 3 | - | - | 1 | - | 2 | - | - | - | 2 |
| 2 | 2 | 1 | 1 | - | 3 | - | - | 1 | - | 3 | - | - | 2 | 2 |
| 3 | 2 | 2 | 1 | - | 3 | - | - | 1 | - | 3 | - | - | 2 | - |
| 4 | 2 | 1 | - | - | 3 | - | - | 1 | - | - | - | 1 | - | - |
| 5 | 3 | 2 | - | 2 | 3 | - | - | 1 | - | 3 | - | 1 | - | - |
| **Avg** | **2** | **1** | **1** | **2** | **3** | - | - | 1 | - | **3** | - | **1** | **2** | **2** |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPE215 - Introduction to Computational Fluid Dynamics** |
| Prerequisite | 2AEPC203 - Fluid Mechanics |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To develop proficiency in grid generation techniques, turbulence models to effectively model, analyze, and preprocess data for aerodynamics simulations relevant to job roles in Aerospace engineering.
2. To train students to proficiently with modern software tools for mesh generation, analysis, and pre-processing specifically tailored for addressing aerodynamics problems to enhance their job opportunities

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPE215_1 | Develop a solid foundation in the principles and familiarize with the governing equations, concepts of Computational fluid dynamics |
| 2AEPE215_2 | Choose appropriate turbulence modeling and grid generation for the analysis of fluid flow problems with selection of appropriate boundary conditions. |
| 2AEPE215_3 | Use modern tools for mesh generation, analysis, and pre-processing for various engineering and Aerodynamics problems. |
| 2AEPE215_4 | Analyze and Validate simulation results against experimental data and gain proficiency in post-processing, using visualization tools to interpret and communicate simulation results effectively. |

**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Introduction to CFD** | **06** |
| Governing Equations- Continuity , Momentum and Energy equations, CFD Terminology, | | |
| **Unit 2** | **Meshing** | **07** |
| Different types of meshes: structured, unstructured, hybrid. Element types: tetrahedral, hexahedral, prism, wedge, etc., Mesh quality metrics and their importance: aspect ratio, skewness, cell volume ratios, etc. | | |

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| | | |
|---|---|---|
| Impact of mesh quality on CFD accuracy and solution convergence | | |
| **Unit 3** | **Pre - Processing** | **06** |
| Boundary Conditions:Defining the inlet, outlet, wall, and symmetry boundary conditions.Specifying appropriate boundary conditions for temperature, pressure, velocity, and other relevant parameters. | | |
| **Unit 4** | **Solver & Post - Processing** | **07** |
| steady-state or transient analysis ,solver settings like turbulence models, discretization schemes, and convergence criteria. Post Processing :Visualization Contours plots, Vector fields, Report generation: simulation results, including tables, charts, and image, Validation and Comparison of experimental results, Errors and Uncertainty | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Computational Fluid Dynamics: The Basics with Applications | John D. Anderson | McGraw-Hill | Second Edition | 1995 |
| 2 | An Introduction to Computational Fluid Dynamics | H K Versteeg and W Malalasekera | pearson Prentice hall | Second Edition | 2007 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Computational Fluid Dynamics: principles and Applications | J. Blazek | ELSEVIER | Second Edition | 2001 |
| 2 | Computational Fluid Dynamics:An Introduction | John F. Wendt | Springer | Third Edition | 2009 |

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**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | 25 | 20 | 50 % |
| 2 | ISE : PA | ☑ | ☑ | ☑ | ☑ | 25 | | 50 % |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 2 | 2 | 2 | 2 | 2 | - | - | 1 | - | - | - | - | - | - |
| 3 | 2 | 2 | | 2 | 2 | 2 | - | 1 | - | - | - | - | 2 | - |
| 4 | 2 | - | - | 2 | 2 | - | - | 1 | 2 | 2 | - | 2 | 2 | 2 |
| **Avg** | **2** | **2** | **2** | **2** | **2** | **2** | - | 1 | **2** | **2** | - | **2** | **2** | **2** |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPE216 - Introduction to Unmanned Aerial Vehicles** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. Equip students with a solid understanding of UAV fundamentals, including classifications, applications, and payloads, emphasizing the basic parts, specifications, and varied uses of UAVs.
2. Foster a mastery of DGCA rules, regulations, and guidelines governing UAVs, covering categories based on weight, type certification, and the regulatory processes for registration, certification, and pilot licensing.
3. Explore the practical applications of UAVs in industrial engineering, addressing the specific needs in areas such as powerline and telecom structure inspection, radiation measurement, and envisioning future engineering applications, ensuring students are well-prepared for the evolving landscape of UAV technology.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPE216_1 | Explain the Drone rules, regulations, guidelines of DGCA and various systems which applicable in drone industry & technology by using the current active gazettes of indian government & scientific research journals knowledge |
| 2AEPE216_2 | Classify and experiment the category, class, assembly & manufacturing techniques, testing & operating methods and its industrial applications aligned with drone technology by the active government gazette or scientific articles / book data |
| 2AEPE216_3 | Identify the sensors and MEMS to the drone for various flying conditions/ applications by using drone's application details |

**Course Contents:**

| **Unit 1** | **Introduction to UAV, DGCA Rules, Regulation & Guidelines** | **06** |
|---|---|---|
| Motivation - Types of UAV – Characteristics – Fixed Wing – Rotary Wing – Flapping Wing – Basic Parts of UAV – Specifications – Applications – Pay loads of UAV<br>Drone Categories Based on All-up weight – Type Certification of UAVs - DGCA Rules for UAV Registration, Certification and Pilot Licensing - Remote Pilot Training Organization (RPTO) – Flying Zones - Drone Training | | |

| | | |
|---|---|---|
| Circulars & Certification Scheme of Unmanned Aircraft Systems | | |
| **Unit 2** | **Industrial and Future Engineering Applications of UAVs** | **07** |
| Need of UAVs for Industrial Applications - Development of UAVs for Powerline Inspection - Telecom Structure Inspection and Radiation Measurement – Bridge and Heritage Structure Inspection – Collection of Seaweeds using UAV – Future Engineering Applications of UAVs. | | |
| **Unit 3** | **Introduction to Avionics for UAV** | **06** |
| Types of missions - Mandatory sensors - Control of UAVs based on mandatory sensors - Role of sensors in Drones - Mission specific sensors - Category based sensors - Additional equipment & sensors | | |
| **Unit 4** | **Design, Assembly & Ground Testing for Drones** | **07** |
| Design of Quadcopter – Selection of Sub Systems - Airframe Assembly – Integration of Electronic Systems Introduction to Ground Control Station – Flight Simulation – Autonomous Flight Path Planning – Testing of Quadcopter | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Unmanned aircraft systems: UAVS design, development and deployment | Austin, R. | John Wiley & Sons. | 1st | 2011 |
| 2 | Introduction to UAV systems | Fahlstrom P, Gleason T | Wiley, UK | 4th | 2012 |
| 3 | Build your own quadcopter | Norris D | McGraw-Hill Education, New York | 1st | 2014 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Handbook of unmanned aerial vehicles | Valavanis K. P. Vachtsevanos, G. J., eds | Springer reference | 1st | 2015 |
| 2 | A first course in aerial robots and drones | Sebbane, Y. B. | CRC Press | 1st | 2022 |

**Online Reference Materials:**

| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 1 | Swayam | https://onlinecourses.swayam2.ac.in/nti24_ed12/preview |

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| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 2 | Digital Sky Platform | https://www.dgca.gov.in/digigov-portal/jsp/dgca/homePage/viewPDF.jsp?page=InventoryList/headerblock/drones/Drone%20Rules%202021.pdf |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | 25 | 20 | 50 % |
| 2 | ISE : PA | ☑ | ☑ | ☑ | 25 | | 50 % |

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | 2 | 1 | 1 | - | 3 | 3 | 3 | - | 3 | - | 3 | 2 | 1 |
| 2 | 3 | 3 | 2 | 3 | 1 | - | 1 | - | 3 | 3 | 3 | 1 | 2 | - |
| 3 | 2 | 2 | 1 | - | - | - | - | - | - | - | - | 2 | - | - |
| Avg | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 1 |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEPE217 - Introduction to Aircraft Maintenance** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To familiarize students with the fundamental concepts and components of aircraft maintenance, ensuring they can identify and describe the main components of an aircraft and understand their functions.
2. o emphasize the importance of safety procedures and regulations in aircraft maintenance, enabling students to articulate the significance of adhering to safety protocols and regulations to ensure safety and reliability in aircraft operations.
3. To provide students with a comprehensive understanding of aircraft systems, including hydraulic, pneumatic, powerplant, and electrical systems, equipping them with the knowledge and skills to identify, explain, and troubleshoot system components and operations effectively.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEPE217_1 | Identify and describe the main components of an aircraft and their functions, ensuring accuracy, when presented with visual aids, diagrams, and aircraft models |
| 2AEPE217_2 | Articulate the importance of aircraft maintenance in ensuring safety and reliability and demonstrate understanding by adhering to safety procedures with 100% compliance during practical demonstrations, based on case studies and real-life examples. |
| 2AEPE217_3 | Accurately identify and explain the functions of the components of hydraulic and pneumatic systems during a practical assessment, when provided with hydraulic and pneumatic system schematics, diagrams, and real components |
| 2AEPE217_4 | Demonstrate proficiency in identifying and explaining the operation principles of key power plant components with accuracy, when presented with detailed illustrations, models, and interactive simulations of aircraft powerplant systems. |
| 2AEPE217_5 | Effectively diagnose and rectify electrical system faults within specified timeframes when given access to aircraft electrical system schematics, diagnostic tools, and simulated troubleshooting scenarios. |

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**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Basic of Aircraft Structure and Safety** | **06** |
| Introduction to the importance of aircraft maintenance in ensuring safety and reliability, Overview of the main components of an aircraft and their functions. Introduction to aircraft materials and construction methods.Discussion on the importance of understanding aircraft structures for maintenance purposes. Safety procedures and regulations in aircraft maintenance | | |
| **Unit 2** | **Aircraft Control System, Hydraulic and pneumatic Systems** | **07** |
| Conventional control system, its components, Power-assisted control system, Fly by wire system Components of hydraulic and pneumatic systems, Its operation functions and utility | | |
| **Unit 3** | **Aircraft Power plant, Staring Systems, and Electrical Systems** | **06** |
| Introduction to aircraft powerplant components. Basics of aircraft engine operation, Engine maintenance procedures, and safety precautions. Starting systems for piston engine and jet engine aircraft Understanding aircraft electrical components and circuits. Maintenance and troubleshooting of aircraft electrical systems | | |
| **Unit 4** | **Troubleshooting and Diagnostics** | **07** |
| Procedural Maintenance Routines and Comprehensive Documentation Management, Use of diagnostic tools and equipment, | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Aircraft Maintenance and Repair | Michael Kroes, William Watkins | McGraw-Hill Education | 7th | 2018 |
| 2 | "Aviation Maintenance Technician Handbook: General" | FAA | Aviation Supplies & Academics | 1st | 2012 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Introduction to Aircraft Maintenance | J J Daley | McGraw-Hill Education | 3rd | 2003 |
| 2 | Aircraft Maintenance and Repair with Study Guide | Michael Kroes, William Watkins | McGraw-Hill Education | 6th | 2013 |

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**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | 20 | 50 % |
| 2 | ISE : PA | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | | 50 % |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment, TA - Tutorial Assessment, PA - Practical Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | 1 | 1 | | 1 | | | | 2 | 1 | | 1 | 2 | |
| 2 | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 |
| 3 | 2 | 1 | 1 | | 1 | | | | 1 | 1 | | 1 | 2 | |
| 4 | 2 | 1 | 1 | | 1 | | | | 1 | 1 | | 1 | 2 | |
| 5 | 2 | 1 | 1 | 1 | 1 | | | | 2 | 1 | 1 | 1 | 2 | |
| **Avg** | **2** | **1** | **1** | **1** | **1** | **1** | **1** | **1** | **2** | **1** | **1** | **1** | **2** | **2** |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEVS218 - Grid Generation using HyperMesh** |
| Prerequisite | 2AEVS206 - Parametric Modeling and Assembly |
| Teaching Scheme: Lecture/Tutorial/Practical | 00/00/02 |
| Credits | 01 |
| Evaluation Scheme : ISE/ESE | 25/25 |

**Course Objectives:**

1. Explain the importance of meshing in FEA and understand different mesh types (tetrahedral, hexahedral, etc.).
2. Master basic meshing tools and techniques in HyperMesh, including geometry selection, element sizing, and meshing methods (automatic, manual, etc.)

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEVS218_1 | Independently generate high-quality meshes for various geometries using HyperMesh. |
| 2AEVS218_2 | Choose the appropriate meshing techniques based on the specific FEA application. |
| 2AEVS218_3 | Apply advanced meshing techniques for complex geometries and optimize meshes for efficiency and accuracy. |
| 2AEVS218_4 | Evaluate the quality of meshes using built-in tools and visual inspection. |
| 2AEVS218_5 | Use mesh controls to refine specific areas of the mesh for improved accuracy. |

**List of Experiments:**

| Sl.No | Title of the Exercises |
|---|---|
| 1 | **Introduction:**<br>• Overview of Finite Element Analysis (FEA) and the role of meshing<br>• Introduction to HyperMesh as a pre-processing tool for FEA<br>• User interface and basic navigation |

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| Sl.No | Title of the Exercises |
|---|---|
| 2 | **Geometry Preparation:**<br>• Geometry Clean-up<br>• Importing and Repairing CAD Geometry<br>• Generating a Midsurface<br>• Simplifying Geometry |
| 3 | **1D Meshing:**<br>• Creating beams and rods<br>• Assigning material properties |
| 4 | **2D Meshing:**<br>• Shell meshing techniques (quads, tris, mapped meshing)<br>• Setting element size and quality parameters<br>• Mesh refinement and cleanup |
| 5 | **3D Meshing:**<br>• Tetrahedral and hexahedral meshing techniques<br>• Automatic and manual meshing<br>• Advanced meshing options (sweeping, morphing)<br>• Mesh quality checks and improvement |

**Online Reference Materials:**

| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 1 | Altair HyperMesh | https://2021.help.altair.com/2021/hwdesktop/hm/topics/tutorials/hm/meshing_r.htm |
| 2 | Skill-Lync | https://skill-lync.com/student-projects/3d-meshing-using-hypermesh-3 |
| 3 | IFS Academy | https://ifsacademy.org/assets/images/pdf/Finite-Element-Analysis-using-Hypermesh-ANSYS.pdf |

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**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Max | Min | |
| 1 | ISE : PA | ☑ | ☑ | ☑ | ☑ | 15 | 10 | 50% |
| 2 | ISE : VCC | ☑ | ☑ | ☑ | ☑ | 10 | | |
| 4 | ESE : OE | ☑ | ☑ | ☑ | ☑ | 15 | 10 | 50% |
| 5 | ESE : PE | ☑ | ☑ | ☑ | ☑ | 10 | | |

- ISE - In-Semester Examination, ESE - End-Semester Examination
- PA - Pactical Assessment, VCC - Vocational Course Certification
- OE - Oral Examination, PE - Practical Examination

CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 1 | - | - | - | 3 | - | - | 1 | 1 | 3 | - | - | 2 | - |
| 2 | 1 | - | - | - | 3 | - | - | 1 | 1 | 3 | - | - | 2 | - |
| 3 | 1 | - | - | - | 3 | - | - | 1 | 3 | 3 | - | 3 | 2 | - |
| 4 | 1 | - | - | - | 3 | - | - | - | - | 3 | - | - | 2 | - |
| 5 | 1 | - | - | - | 3 | - | - | - | - | 3 | - | - | 2 | - |
| Avg | 1 | - | - | - | 3 | - | - | 1 | 2 | 3 | - | 3 | 2 | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEVS219 - Professional and Business Communication** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 00/00/02 |
| Credits | 01 |
| Evaluation Scheme : ISE/MSE/ESE | 25/00/25 |

**Course Objectives:**

1. The student should able to use the professional documentation tools/platforms
2. The students should able to create and enhance the professional documents and able to communicate effectively as per the business/ industrial requirements
3. The Students should efficiently able to be use digital platform/ tools for verbal and non-verbal communication
4. To deliver content through Assessment Based Learning for providing industrial exposure to the students

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEVS219_1 | Prepare the technical documentation for verbal, nonverbal communications using modern digital platform in engineering discipline |
| 2AEVS219_2 | Automize the use of appropriate tools for classification clustering, segregation of data sets to prepare visual document/file for project/business contents |
| 2AEVS219_3 | Perform a survey for various societal,environmental issues, engineering data using an online platform |
| 2AEVS219_4 | Create multimedia presentations to disseminate/present the informations collected using appropriate tools/software with professionalism |

**List of Experiments:**

| Sl.No | Title of the Exercises |
|---|---|
| 1 | Organizing tasks/events and managing using Google Calendar |
| 2 | Formulating a professional body/content in Email |
| 3 | Managing, Storing and Organizing the files and documents in Cloud based Storage Service |
| 4 | Create and enhance the document using Google Docs for Report writing |
| 5 | Create and enhance the document using Google Sheets for Project management/Bill of materials |

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| Sl.No | Title of the Exercises |
|---|---|
| 6 | Create and enhance the Presentation using Google Slides |
| 7 | Conduct and organize the professional online meeting using online platform with host management |
| 8 | Generate the online form to collect data/ information regarding project/ survey |
| 9 | Apply advanced formatting tools to perform tabulation, calculations and visualize data using Google Sheets |
| 10 | Use all tools for preparing a manuscript in view for technical journal publication |
| 11 | Design a professional poster/brochure/flier for an event/product/business using designing platform |
| 12 | Make a promotion/advertisement video for an event using video editing tool |
| 13 | Using AI Tools/Online Tools for professional documentation |

**Online Reference Materials:**

| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 1 | Google Cloud Skills Boost | https://cloud.google.com/learn/training/workspace |
| 2 | Udemy | https://www.udemy.com/share/1068fG/ |
| 3 | Udemy | https://www.udemy.com/share/101YRg/ |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Max | Min | |
| 1 | ISE : PA | ☑ | ☑ | ☑ | ☑ | 15 | 10 | 50% |
| 2 | ISE : VCC | ☑ | ☑ | ☑ | ☑ | 10 | | |
| 4 | ESE : OE | ☑ | ☑ | ☑ | ☑ | 15 | 10 | 50% |
| 5 | ESE : PE | ☑ | ☑ | ☑ | ☑ | 10 | | |

- ISE - In-Semester Examination, ESE - End-Semester Examination
- PA - Pactical Assessment, VCC - Vocational Course Certification
- OE - Oral Examination, PE - Practical Examination

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CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | - | - | 2 | - | 1 | - | - | 3 | 3 | 3 | - | 3 | - | - |
| 2 | - | - | 2 | 1 | 1 | - | - | 3 | 3 | 3 | - | 3 | - | - |
| 3 | - | - | 2 | - | 1 | - | - | 3 | 3 | 1 | - | 3 | - | - |
| 4 | - | - | 1 | 1 | 1 | - | - | 3 | 3 | 3 | - | 3 | - | - |
| Avg | - | - | 2 | 1 | 1 | - | - | 3 | 3 | 3 | - | 3 | - | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEEL220 - Innovation/Prototype** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 01/01/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To develop students' understanding of the **innovation process**, from **idea generation** to **prototyping and testing**.
2. To develop students **critical thinking and problem-solving skills** to identify and address challenges in innovative ways.
3. To create awareness among students on **IPR Filing and Startup Policies**.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEEL220_1 | Understand the innovation process, from idea generation to prototyping and testing and the role of prototyping in the innovation process and its different techniques and tools. |
| 2AEEL220_2 | Apply the critical thinking and problem-solving skills to identify and address challenges in innovative ways. |
| 2AEEL220_3 | Use the skills to prototype ideas quickly and efficiently, using a variety of methods and materials |
| 2AEEL220_4 | Develop an innovative mindset and become more open to new ideas and approaches. |
| 2AEEL220_5 | Foster a collaborative spirit and be able to work effectively in teams. |

**Course Contents:**

1. Introduction to Innovation
2. Methodologies for building an Innovation Framework
3. Introduction to Prototyping
4. Prototyping Tools and Techniques
5. Introduction to Product Life Cycle
6. Product Development Cost Estimation
7. Business Plan Preparation
8. Introduction to IPR
9. IPR Filing for an Innovation
10. Startup Policies and Opportunities

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**Course Execution:**

Week 1 : Course Orientation to all students

Week 2 : Identifying Innovative Problems (Students & Faculty)

Week 3 : Final Allotment of Innovative Problems to Students and Faculty Mentors

**Week 4 : Assessment on Innovativeness**

Week 5 : Brainstorming on Prototyping

Week 6 : Prototyping Stage 1

Week 7 : Prototyping Stage 2

**Week 8 : Assessment on Prototyping**

Week 9 : Product Cost Estimation

Week 10 : Business Plan for Product

Week 11 : IPR Filing

**Week 12 : Assessment on Commercialization of the Innovation**

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Max | Min | |
| 1 | ISE : CAS | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | 10 | 50 % |
| 2 | ESE : POE | ☑ | ☑ | ☑ | ☑ | ☑ | 25 | 10 | 50 % |

- ISE - In-Semester Examination, CAS - Continuous Assessment
- ESE - End-Semester Examination, POE - Practical Oral Examination

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 3 | 3 | - | - | 2 | 3 | 3 | - | 3 | - | - | - | - | - |
| 2 | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | - | 3 | - | 2 | 3 |
| 3 | - | - | - | - | 3 | - | - | - | 3 | - | 3 | - | 2 | 3 |
| 4 | 3 | 3 | 2 | 1 | - | 3 | 3 | 3 | 3 | - | 3 | 3 | 2 | 3 |
| 5 | - | - | - | - | - | - | - | - | - | 3 | - | - | - | - |
| Avg | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEHS221 - Psychology** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 01/01/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To develop students' psychological ability to handle the emotions, time and manage stress levels.
2. To create awareness among students on procrastination and stress management.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEHS221_1 | Identify types of emotions, domains of emotional intelligence and their effects on individual and group behavior for fostering empathy and positive relationships. |
| 2AEHS221_2 | Explain human behavior, cognition, and emotions by psychological theories in real-life scenarios and contexts. |
| 2AEHS221_3 | Discuss effective time management strategies to overcome time-related challenges. |
| 2AEHS221_4 | Interpret psychological factors that contribute procrastination to recognize the situational triggers. |
| 2AEHS221_5 | Apply the A-B-C model to manage stress for well-being. |

**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Psychology** | **02** |
| Definition of Psychology, Different fields of Psychology, Introduction and Need of psychology | | |
| **Unit 2** | **Emotional Intelligence (EI) - Part I** | **04** |
| Role of Emotions, Types of Emotions, Emotions/ stress and performance | | |
| **Unit 3** | **Emotional Intelligence (EI) - Part II** | **06** |
| .Definition of Emotional Intelligence, Key signs of emotional Intelligence, How EI helps students, Marshmallow Experiment, Five domains of Emotional Intelligence | | |

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| | | |
|---|---|---|
| **Unit 4** | **Time Management** | **04** |
| Definition of Time Management, Need and importance of Time management for an individual, Effective steps/ strategies of Time Management, Obstacles of Time Management | | |
| **Unit 5** | **Procrastination** | **05** |
| .Definition of Procrastination, Types of Procrastination excuses , How to work on excuses, Why Do People Procrastinate?, Procrastination Cycle, Challenging Your assumptions, techniques to beat Procrastination | | |
| **Unit 6** | **Stress Management** | **05** |
| Definition of Stress, A-B-C model for Stress, Identifying Stressful Thoughts and identifying cognitive distortions, Restructuring, Behavioral Coping Strategies | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Organizational Behavior- An Evidence-Based Approach | Fred Luthan | McGraw-Hill/Irwin | 12th | 2011 |
| 2 | Essentials of Organizational Behavior | Stephen P. Robbins Timothy A. Judge Katherine E. Breward | Pearson | - | 2018 |
| 3 | Essentials of organizational Behavior | Stephen P. Robbins | Prentice Hall | 7th | 2002 |
| 4 | Understanding and Managing Organizational Behavior | Jennifer M. George Gareth R. Jones | Pearson | 6th | 2012 |
| 5 | Emotional Intelligence at Work A Professional Guide | Dalip Singh | Response Books A division of Sage Publications | 3rd | 2006 |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Max | Min | |
| 1 | ISE : CAS | ☑ | ☑ | ☑ | ☑ | 50 | 20 | 100 % |

- ISE - In-Semester Examination, CAS - Continuous Assessment

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**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | - | - | - | - | - | - | - | - | 1 | 2 | - | - | - | - |
| 2 | - | - | - | - | - | - | - | 1 | 1 | 2 | - | - | - | - |
| 3 | - | - | - | - | - | - | - | - | 1 | 2 | - | - | - | - |
| 4 | - | - | - | - | - | - | - | - | 1 | 2 | - | - | - | - |
| Avg | - | - | - | - | - | - | - | 1 | 1 | 2 | - | - | - | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AECC223 - Aptitude and Reasoning Part II** |
| Prerequisite | 2AECC210 - Aptitude and Reasoning Part I |
| Teaching Scheme: Lecture/Tutorial/Practical | 00/00/02 |
| Credits | 01 |
| Evaluation Scheme : ISE/MSE/ESE | 50/00/00 |

**Course Objectives:**

1. To develop students quantitative reasoning skills, such as the ability to solve mathematical problems, interpret data and make predictions.
2. To prepare students for various competitive examinations and job interviews that require aptitude and reasoning skills.

**Course Outcomes (CO's):**
After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEAV201_1 | Solve problems based on HCF, LCM, Interest, Clock, Cubes and Puzzles |
| 2AEAV201_2 | Solve problems based on Coding and Decoding, Seating Arrangements and Venn diagrams. |
| 2AEAV2011_3 | Solve problems based on Ratio Proportion, Partnership, Allegation, Divisibility and Number Theory |
| 2AEAV201_4 | Demonstrate presentations using concepts delivered on confidence building and time management skills. |

**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | HCF LCM, Simple Interest, Compound Interest | 4 |
| **Unit 2** | Coding- Decoding, Seating Arrangement Venn Diagrams | 4 |
| **Unit 3** | Clocks, Cubes, Puzzles, | 4 |
| **Unit 4** | Ratio Proportion, Partnership | 4 |
| **Unit 5** | Confidence Building, Time Management | 4 |
| **Unit 6** | Allegation, Divisibility and Number Theory | 4 |
| | Self-Study Module | 6 |

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**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | R.S. Agarwal (Quantitative aptitude) | R.S.Agarwal | S Chand | - | 2019 |
| 2 | R.S. Agarwal (Verbal & Non-verbal Reasoning) | R.S.Agarwal | S Chand | - | 2010 |
| 3 | Wren & Martin (Verbal, Grammar) | P.C.Wren | S Chand | - | 2017 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | APTIPEDIA (Quantitative, Logical, Verbal Aptitude) | Face | Wiley | - | 2017 |
| 2 | Wiley (Quantitative Aptitude) | P.A.Anand | Maestro | - | 2015 |
| 3 | Arun Sharma (Verbal Ability) | Meenakshi Upadhyay | McGraw Hill | - | 2020 |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | Max | Min | |
| 1 | ISE : CAS | ☑ | ☑ | ☑ | ☑ | 25 | 20 | 50 % |
| 2 | ISE : Quiz | ☑ | ☑ | ☑ | ☑ | 25 | | 50 % |

- ISE - In-Semester Examination, CAS - Continuous Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 3 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | - | - |
| 4 | 2 | - | - | - | - | - | - | - | - | 2 | - | - | - | - |
| Avg | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEUV201 - Introduction to Unmanned Aerial Vehicles (UAVs)** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. Cultivate a solid grasp of UAV fundamentals, encompassing types, characteristics, components, motivations, specifications, applications, payloads, and an exploration of aerodynamics.
2. Develop proficiency in DGCA rules, drone categorization, type certification, and regulations for UAV operations, including registration, certification, and pilot licensing, coupled with knowledge of RPTO, flying zones, DTCs, and CSUAS.
3. Merge theoretical and hands-on knowledge by researching the industrial applications of UAVs, understanding aerodynamics, and gaining practical skills in Quadcopter design, assembly, manufacturing, and ground testing, covering Ground Control Station, flight simulation, autonomous flight path planning, and testing.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEUV201_1 | Explain the Drone rules, regulations, guidelines of DGCA and various systems which applicable in drone industry & technology by using the current active gazettes of indian government & scientific research journals knowledge |
| 2AEUV201_2 | Classify and experiment the category, class, assembly & manufacturing techniques, testing & operating methods and its industrial applications aligned with drone technology by the active government gazette or scientific articles / book data |
| 2AEUV201_3 | Identify the forces and moments acting on the drone for various flying conditions/ applications by using fundamental physical principles and theories |

**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Introduction, Classifications, Applications and Payloads of UAV** | **04** |
| Motivation - Types of UAV – Characteristics – Fixed Wing – Rotary Wing – Flapping Wing – Basic Parts of UAV – Specifications – Applications – Pay loads of UAV | | |
| **Unit 2** | **DGCA Rules, Regulation & Guidelines** | **04** |
| Drone Categories Based on All-up weight – Type Certification of UAVs - DGCA Rules for UAV Registration, Certification and Pilot Licensing - Remote Pilot Training Organization (RPTO) – Flying Zones - Drone Training Circulars & Certification Scheme of Unmanned Aircraft Systems | | |

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| | | |
|---|---|---|
| **Unit 3** | **Industrial and Future Engineering Applications of UAVs** | **05** |
| Need of UAVs for Industrial Applications - Development of UAVs for Powerline Inspection - Telecom Structure Inspection and Radiation Measurement – Bridge and Heritage Structure Inspection – Collection of Seaweeds using UAV – Future Engineering Applications of UAVs. | | |
| **Unit 4** | **Aerodynamics of UAV** | **04** |
| Basics of Aerodynamics – Angle of Attack - Lift and Drag – Bernoulli Theories and Equations - Peculiarities of Multicopters - Stability – Turning Flight – Stall conditions | | |
| **Unit 5** | **Design, Assembly Processes & Manufacturing Techniques of Quadcopter** | **05** |
| Design of Quadcopter – Selection of Sub Systems - Airframe Assembly – Integration of Electronic Systems | | |
| **Unit 6** | **Ground Testing for Drones** | **04** |
| Introduction to Ground Control Station – Flight Simulation – Autonomous Flight Path Planning – Testing of Quadcopter | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Unmanned aircraft systems: UAVS design, development and deployment | Austin, R. | John Wiley & Sons. | 1st | 2011 |
| 2 | Introduction to UAV systems | Fahlstrom P, Gleason T | Wiley, UK | 4th | 2012 |
| 3 | Build your own quadcopter | Norris D | McGraw-Hill Education, New York | 1st | 2014 |

**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Handbook of unmanned aerial vehicles | Valavanis K. P.; Vachtsevanos, G. J., eds | Springer reference | 1st | 2015 |
| 2 | A first course in aerial robots and drones | Sebbane, Y. B. | CRC Press | 1st | 2022 |

**Online Reference Materials:**

| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| 1 | Swayam | https://onlinecourses.swayam2.ac.in/ntr24_ed12/preview |
| 2 | Digital Sky Platform | https://www.dgca.gov.in/digigov-portal/jsp/dgca/homePage/viewPDF.jsp?pag |

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| Sl.No | Source/Platform | Link to contents |
|---|---|---|
| | | e=InventoryList/headerblock/drones/Drone%20Rules%202021.pdf |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | 40 | 16 | 40% |
| 4 | MSE | ☑ | ☑ | ☐ | 30 | 24 | 60% |
| 5 | ESE | ☐ | ☑ | ☑ | 30 | | |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2 | 2 | 1 | 1 | - | 3 | 3 | 3 | - | 3 | - | 3 | - | - |
| 2 | 3 | 3 | 2 | 3 | 1 | - | 1 | - | 3 | 3 | 3 | 1 | - | - |
| 3 | 3 | 3 | 2 | 2 | 1 | - | - | - | - | - | - | 2 | - | - |
| Avg | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | - | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEAT201 - Introduction to Air Transportation** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. To familiarize students with the dynamics of the air transportation system, including the operations, management, and regulations governing air travel.
2. To equip students with the ability to understand and apply real-world scenarios such as safety and security, environmental concerns, marketing principles, and technological advancements.

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEAT201_1 | Gain insights into the operational functions of aerospace and air transportation entities to assess the role of governmental policies, network structure, management, market forces, environmental concerns, business models, and consumer preferences that help in shaping the air transportation landscape. |
| 2AEAT201_2 | Discuss legal frameworks governing international aviation, including treaties, conventions, and regulatory bodies such as ICAO, IATA, and national regulatory authorities, and their roles in promoting safety, security, and cooperation. |
| 2AEAT201_3 | Identify and compare different organizational structure and airline business models strategic positioning, operational characteristics, cost structures with the effects of deregulation on market competition, alliances, service quality, route and consumer choice. |
| 2AEAT201_4 | Apply marketing principles and strategies tailored to the unique characteristics of the air transportation industry and utilize market research techniques to identify customer needs, preferences, and competitive positioning opportunities |
| 2AEAT201_5 | Explore future directions by considering the ethical, social, and environmental implications of aerospace and air transportation activities for sustainable growth within the industry. |

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**Course Contents:**

| | | |
|---|---|---|
| **Unit 1** | **Aerospace Industry** | **03** |
| Characteristics of the industry - Economic profile of the Industry - Civil Aviation market - Factors affecting commercial transport sales - General Aviation. | | |
| **Unit 2** | **Air Transportation Industry** | **04** |
| Characteristics of the commercial air transport industry - Contribution to economy and efficient conduct of business - Economic and Social Benefits & Impacts - Basic Scheduling and Network structure. | | |
| **Unit 3** | **International Law, Regulators and Associations** | **06** |
| Air law and Aviation law - International Air law - Sovereignty of territorial Airspace - Chicago Convention - Freedom of Air - Warsaw convention - Montreal Convention - ICAO - FAA - NTSB - IATA - EASA - DGCA - AAI - other International Associations. | | |
| **Unit 4** | **Management and Organization** | **04** |
| Alliances - Deregulation and impact in airline industry - Organizational Structure – Types of Airline Personnel – Organizational Culture. | | |
| **Unit 5** | **Marketing for Air Transportation** | **05** |
| Business model - Principles of air transport marketing - Stages in the Application of Marketing Principles - Principles of engagement marketing – Market segmentation – PESTE Analysis. | | |
| **Unit 6** | **Air Transport and the Environment** | **04** |
| Introduction - Limiting Aviation's Environmental Impact: The role of Regulatory bodies - Airport Water Quality Control - Noise - Surface Air Quality - Impact of Aviation on Climate. | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Air Transportation - Management Perspective | John G Wensveen | Ashgate | 7th | 2011 |
| 2 | Air Transport Management - An International Perspective | Lucy Budd and Stephen Ison | Routledge | - | 2017 |

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**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Airline Marketing and Management | Stephen Shaw | Ashgate | - | - |
| 2 | The Global Airline Industry | Peter Belobaba<br>Amedeo Odoni<br>Cynthia Barnhart | Wiley | 1st | 2009 |

**Assessment Modes:**

| Sl. No | Method/ Technique | Course Outcomes | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | ☐ | 20 | 16 | 40 % |
| 2 | MSE | ☑ | ☑ | ☐ | ☐ | ☐ | 30 | 24 | 60 % |
| 3 | ESE | ☐ | ☐ | ☑ | ☑ | ☑ | 30 | | |

- ISE - In-Semester Examination, MSE - Mid-Semester Examination, ESE - End-Semester Examination
- ABA - Activity Based Assessment

**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | - | - | - | - | - | 2 | 1 | 1 | - | - | 1 | - | - | - |
| 2 | 1 | - | - | - | - | 2 | - | 1 | - | - | - | - | - | - |
| 3 | 1 | - | - | - | - | 1 | - | - | - | - | 1 | - | - | - |
| 4 | 1 | - | - | - | - | - | - | 1 | - | - | 1 | - | - | - |
| 5 | 1 | - | - | - | - | 1 | 3 | 1 | - | - | - | - | - | - |
| **Avg** | **1** | - | - | - | - | **2** | **2** | **1** | - | - | **1** | - | - | - |

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**Course Details:**

| | |
|---|---|
| Class | S.Y B.Tech., Sem - IV |
| Course Code and Course Name | **2AEAV201- Introduction to Flight and Avionics** |
| Prerequisite | NIL |
| Teaching Scheme: Lecture/Tutorial/Practical | 02/00/00 |
| Credits | 02 |
| Evaluation Scheme : ISE/MSE/ESE | 40/30/30 |

**Course Objectives:**

1. Provide students the fundamental knowledge on the Verticals of Aeronautical Engineering – Aerodynamics, Propulsion, and Structures
2. Make student understand the basic components, systems & subsystems of the Aircraft and their functions
3. Describe the different types of avionics subsystems and how they work together

**Course Outcomes (CO's):**

After successful completion of this course, the student will be able to,

| | |
|---|---|
| 2AEAV201_1 | Explain the historical developments in the Aeronautical Engineering, Current Trends in the Aviation Industry |
| 2AEAV201_2 | Comment & Explain in detail the basic components, systems & subsystems of the Aircraft and their functions |
| 2AEAV2011_3 | Comment & Explain in detail the basics of Air Transportation & Airport Operations |
| 2AEAV201_4 | Illustrate cockpit and display technologies of civil and fighter airplanes |
| 2AEAV201_5 | Interpret the concept of Flight Control Systems from an earlier era to advanced Technologies. |

**Course Contents:**

| **Unit 1** | **Introduction to Flying vehicles** | **05** |
|---|---|---|
| History of Aviation(Global & India Perspective), Early Concepts, Wright Brothers Era, First World War Period, Second World War Period, Modern Developments, Classification of Flying Vehicles, Anatomy of (Basic Parts & Their Function), Buoyancy Lift Vehicles(Airships, Aerostats, Hot Air Balloons), Dynamic Lift Vehicles(Aircrafts), Powered Static Lift Vehicles(Helicopters), Reaction Lift Vehicles(Launch & Re-entry Vehicles), Parachutes & Para gliders, Control Surfaces & Their Functions | | |

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| | | |
|---|---|---|
| **Unit 2** | **Aircraft Propulsion System** | **04** |
| Air Breathing Propulsion - Principle of Operation , Components Piston Engines , Jet Engines, Turbo Jet, Turbo Fan, Turbo Prop, Turbo Shaft, Ramjet, Scramjet, Station Numbering - Flight Envelope - Non-Air Breathing Propulsion, Rocket Propulsion - Types and Classification | | |
| **Unit 3** | **Aircraft Maintenance and Repair** | **04** |
| General Aircraft Repairs- A, B, C, D Checks - Starting procedures of Turbo Prop, Turbo Fan and Turbojet Engines- Flight Inspection Procedures - Tools used in Aircraft Maintenance- MRO Sector - Indian MRO Sector - Various job roles involved in the maintenance sector. | | |
| **Unit 4** | **Air Transportation and Regulations** | **04** |
| History of Aviation - Regulatory bodies - ICAO, IATA, FAA, EASA, DGCA- Airlines Management in brief - Airport Operations - ARFF - Airport Nomenclature - Air Traffic Control Operations - Airline Ticketing- Job roles involved in the Aviation Sector - Flight Scheduling in brief. | | |
| **Unit 5** | **Introduction to Avionics and Instrumentation** | **05** |
| Need for avionics in civil and military aircraft and space systems, integrated avionics and weapon systems, typical avionics subsystems, Introduction to digital computer and memories.Avionics system architecture, data buses – MIL-STD-1553B – ARINC – 420 – ARINC – 629, Control and display technologies: CRT, LED, LCD, EL and plasma panel, Touch flight display – Direct voice input (DVI), Civil and Military Cockpits: MFDS, HUD, MFK, HOTAS | | |
| **Unit 6** | **Flight control systems** | **04** |
| Principles of flight controls, Flight control surfaces, Control surface actuation, Flight control linkage systems, Trim and feel, Power control, Mechanical, Direct drive, Electromechanical, Electro-hydrostatic actuation, Auto pilot system, Fly by wire system, fly by optics system, Autonomous taxi, Neural sensing | | |

**Text Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Introduction to Flight | Anderson, J.D | McGraw-Hill | 7th | 2011 |
| 2 | Aircraft Systems: Mechanical, Electrical and Avionics Subsystems Integration | Moir, I. and Sea bridge, A | AIAA (American Institute of Aeronautics and Astronautics) | - | 2001 |
| 3 | Avionics Training Systems, Installation and Troubleshooting | Len Buckwalter | Avionics Communications Inc | - | - |

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**Reference Books:**

| Sl.No | Title | Author | Publisher | Edition | Year |
|---|---|---|---|---|---|
| 1 | Aerodynamics, Aeronautics and Flight Mechanics | McCormick, B.W. | John Wiley | 2nd | 1995 |
| 2 | Gas Turbines and Jet and Rocket Propulsion | Mathur M L and Sharma R P | Standard Publisher | 3rd | 2014 |
| | Aircraft Structures for Engineering Students | Megson, T.H.G | Elsevier | 4th | 2007 |

**Assessment Modes:**

| Sl.No | Method/Technique | CO's | | | | | Marks | | Weightage |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | Max | Min | |
| 1 | ISE : ABA | ☑ | ☑ | ☑ | ☑ | ☑ | 40 | 16 | 40% |
| 2 | MSE | ☑ | ☑ | ☑ | ☐ | ☐ | 30 | 24 | 60% |
| 3 | ESE | ☐ | ☐ | ☐ | ☑ | ☑ | 30 | | |

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**CO's - PO's & PSO's Mapping: ( Low - 1, Medium - 2, High -3, No Correlation - "-")**

| CO's | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 1 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| 2 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| 3 | 2 | - | - | - | - | - | - | - | - | - | - | 1 | - | - |
| 4 | 3 | - | - | - | - | - | - | - | - | 1 | - | - | - | - |
| 5 | 3 | - | - | - | - | - | - | 3 | 2 | 1 | - | | - | - |
| Avg | 2 | - | - | - | - | - | - | 3 | 2 | 1 | - | 1 | - | - |

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# Program Articulation Matrix for S.Y B.Tech., Sem - IV

| Sl.No | Course | | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Code | Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2AEPC211 | Low Speed Aerodynamics | 3 | 2 | 2 | 1 | 2 | - | - | - | 3 | 3 | - | - | 3 | 3 |
| 2 | 2AEPC212 | Aircraft Structures | 3 | 2 | 1 | 1 | 2 | - | - | - | 3 | 2 | - | 1 | 2 | 2 |
| 3 | 2AEPC213 | Airbreathing Propulsion | 3 | 2 | 2 | 1 | 1 | - | - | - | 3 | 2 | - | 1 | 2 | 2 |
| 4 | 2AEPE214 | Introduction to Finite Element Analysis | 2 | 1 | 1 | 2 | 3 | - | - | 1 | - | 3 | - | 1 | 2 | 2 |
| 5 | 2AEPE215 | Introduction to Computational Fluid Dynamics | 2 | 2 | 2 | 2 | 2 | 2 | - | 1 | 2 | 2 | - | 2 | 2 | 2 |
| 6 | 2AEPE216 | Introduction to Unmanned Aerial Vehicles | 2 | 2 | 1 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| 7 | 2AEPE217 | Introduction to Aircraft Maintenance | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 2 |
| 8 | 2AEVS218 | Grid Generation using HyperMesh | 1 | - | - | - | 3 | - | - | 1 | 2 | 3 | - | 3 | 2 | - |
| 9 | 2AEVS219 | Professional and Business Communication | - | - | 2 | 1 | 1 | - | - | 3 | 3 | 3 | - | 3 | - | - |
| 10 | 2AEEL220 | Innovation/Prototype | 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| 11 | 2AEHS221 | Psychology | - | - | - | - | - | - | - | 1 | 1 | 2 | - | - | - | - |
| 12 | 2AECC222 | Aptitude and Reasoning Part - II | 2 | 2 | - | - | - | - | - | - | - | 2 | - | - | - | - |
| | | **Average** | 2.2 | 1.9 | 1.7 | 1.6 | 2.1 | 3.0 | 3.3 | 2.4 | 3.1 | 3.0 | 4.5 | 3.1 | 2.0 | 2.2 |
| | | **No of Courses Mapped** | 10 | 9 | 9 | 9 | 10 | 4 | 3 | 8 | 10 | 12 | 4 | 8 | 9 | 8 |
| | | **Weighted Average** | 1.8 | 1.4 | 1.3 | 1.2 | 1.7 | 1.0 | 0.8 | 1.6 | 2.6 | 3.0 | 1.5 | 2.1 | 1.5 | 1.5 |

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## Program Articulation Matrix for S.Y B.Tech., Sem - IV (Minor Stream Course 1)

| Sl. No | Course | | PO's | | | | | | | | | | | | PSO's | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Code | Name | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 1 | 2 |
| 1 | 2AEUV201 | Introduction to Unmanned Aerial Vehicles | 3 | 3 | 2 | 2 | 1 | 3 | 2 | 3 | 3 | 3 | 3 | 2 | - | - |
| 2 | 2AEAT201 | Introduction to Air Transportation | 1 | - | - | - | - | 2 | 2 | 1 | - | - | 1 | - | - | - |
| 3 | 2AEAV201 | Introduction to Flight and Avionics | 2 | - | - | - | - | - | - | 3 | 2 | 1 | - | 1 | - | - |

**( Low - 1, Medium - 2, High -3, No Correlation - "-")**

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