



Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Unmanned Aerial Vehicles (UAV) Technology

Programme Code : UV

With Effect From Academic Year: 2023 - 24

Duration of Programme: One Year (Two Semesters)

Pattern : Semester (Full Time)

Duration: 16 Weeks

Semester : First

Scheme : I

| S. N. | Course Title | Course Abbreviation | Course Code | Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | Grand Total | |
|--------------|--|---------------------|-------------|-----------------|-----------|-----------|----------------|--------------------|------------|-----------|-----------|-----------|------------|-----------|------------|-----------|------------|-----------|------------|-------------|------------|
| | | | | L | T | P | | Theory | | | | | | Practical | | | | | | | |
| | | | | | | | | ESE | | PA | | Total | | ESE | | PA | | Total | | | |
| | | | | | | | | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | | |
| a | b | c | d | e | f | g | h(e+f+g) | i | j | k | l | m | n(j+l) | o | p | q | r | s | t(p+r) | u | v(n+t) |
| 1 | UAV Regulations and Anatomy of UAV | URA | 28134 | 3 | -- | 4 | 7 | 1.5 | 70*# | 35 | 30* | 00 | 100 | 50 | 50@ | 25 | 50 | 25 | 100 | 50 | 200 |
| 2 | Remotely Piloted Aircraft (RPA) Operator | RPA | 28050 | 3 | -- | 4 | 7 | -- | -- | -- | -- | -- | -- | -- | 50@\$ | 25 | 50 | 25 | 100 | 50 | 100 |
| 3 | UAV operations and maintenance | UOM | 28051 | 3 | -- | 4 | 7 | -- | -- | -- | -- | -- | -- | -- | 50#\$ | 25 | 50 | 25 | 100 | 50 | 100 |
| 4 | Applications of UAV | AVF | 28135 | 3 | -- | 6 | 9 | 1.5 | 70*# | 35 | 30* | 00 | 100 | 50 | 50@ | 25 | 50 | 25 | 100 | 50 | 200 |
| Total | | | | 12 | -- | 18 | 30 | -- | 140 | -- | 60 | -- | 200 | -- | 200 | -- | 200 | -- | 400 | -- | 600 |

Student Contact Hours Per Week: **30 Hrs.** **Theory and practical periods of 60 minutes each.** Medium of Instruction: **English** Total Marks : **600**

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# Online Examination

* The average of 2 test to be taken during the semester for the assessment.

#\$ External PR ESE and average of 2 Skill tests / Practicals.

@\$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

- **Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester.**
- **During the Internship and Project period students shall attend Institute one day a week to meet the mentor and appraise about the progress. The log book,**
- **Project Diary, and Internship performance shall be recorded by the mentor for progressive assessment.**





Maharashtra State Board of Technical Education, Mumbai

Teaching and Examination Scheme

Programme Name : Advanced Diploma in Unmanned Aerial Vehicles (UAV) Technology

Programme Code : UV

With Effect From Academic Year: 2023 - 24

Duration of Programme: One Year (Two Semesters)

Pattern : Semester (Full Time)

Duration: 16 Weeks

Semester : Second

Scheme : I

| S. N. | Course Title | Course Abbrviation | Course Code | Teaching Scheme | | | Credit (L+T+P) | Exam Duration in Hrs. | Examination Scheme | | | | | | | | | | Grand Total | | | |
|--------------|-----------------------------|--------------------|-------------|-----------------|-----------|-----------|----------------|-----------------------|--------------------|-----------|-----------|-----------|-----------|-----------|-----------|------------|-----------|------------|-------------|------------|-----------|------------|
| | | | | L | T | P | | | Theory | | | | | Total | | ESE | | Practical | | Total | | |
| | | | | | | | | | h | e | f | g | h(e+f+g) | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | | Min Marks | Max Marks | Min Marks |
| 1 | Advance developments in UAV | ADU | 28099 | 1 | -- | 4 | 5 | -- | -- | -- | -- | -- | -- | -- | -- | 50@\$ | 25 | 50 | 25 | 100 | 50 | 100 |
| 2 | Project | PUV | 28100 | -- | -- | 6 | 6 | -- | -- | -- | -- | -- | -- | -- | 50# | 25 | 50 | 25 | 100 | 50 | 100 | |
| 3 | Industrial Training | IAT | 28701 | -- | -- | 20 | 20 | -- | -- | -- | -- | -- | -- | -- | 100# | 50 | 100 | 50 | 200 | 100 | 200 | |
| Total | | | | 01 | -- | 30 | 31 | -- | -- | -- | -- | -- | -- | -- | -- | 200 | -- | 200 | -- | 400 | -- | 400 |

Student Contact Hours Per Week: 31 Hrs. Theory and practical periods of 60 minutes each. Medium of Instruction: English Total Marks : 400

Abbreviations: ESE- End Semester Exam, PA- Progressive Assessment, L - Lectures, T - Tutorial, P - Practical

@Internal Assessment, # External Assessment, *# On Line Examination

*** The average of 2 test to be taken during the semester for the assessment.**

#\$ External PR ESE and average of 2 Skill tests / Practicals.

@\$ Internal PR ESE and average of 2 Skill tests / Practicals.

If student remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE.

> Candidates not securing minimum marks for passing the "PA" part of practical of any course is declared as "Detained" for that semester. During the Internship and Project period students shall attend Institute one day a week to meet the mentor and appraise about the progress. The log book, Project Diary, and Internship performance shall be recorded by the mentor for progressive assessment.

Note : The Institute is required to sign MOU with related local industries with DGCA Approval for Industrial Training



PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY

PROGRAMME CODE : UV

SEMESTER : FIRST

COURSE TITLE : UAV REGULATIONS AND ANATOMY OF UAV

COURSE CODE : 28134

1. RATIONALE

According to new rules by MoCA - Drone Rules 21, various regulations have been implemented for civilian's native of India. An unmanned aerial vehicle (UAV), commonly known as a drone, is an aircraft without any human pilot, crew, or passengers on board. UAVs are a component of an unmanned aircraft system (UAS), which includes adding a ground-based controller and a system of communications with the UAV. Various nomenclature of UAV are being used by various organizations of different countries. The modern UAVs utilize state of the art airframe structures, efficient aerodynamic design, efficient propulsion systems, innovative electro optical sensors, long range communication devices and the latest computers technology.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- Understanding the UAV regulations and study the anatomy of different drones.

3. COURSE OUTCOMES

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

After completion of this course, the students will be able to:

- Understand the historical development of unmanned aerial vehicles.
- Describe the UAV rules and regulations.
- Explain the classification of UAV.
- Identify the electrical and mechanical components of UAV.
- Identify the Electronics and Communication Components of UAV.
- Construct a UAV drone.

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | |
|-----------------|----|---|-------------------|--------------------|--------|-----|-------|-----|-----|-----|-----------|-----|-------|-----|-----|----|
| L | T | P | | Paper Hrs. | Theory | | | | | | Practical | | | | | |
| | | | ESE | | PA | | Total | | ESE | | PA | | Total | | | |
| | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | |
| 3 | -- | 4 | 7 | 1.5 | 70*# | 35 | 30* | 00 | 100 | 50 | 50@ | 25 | 50 | 25 | 100 | 50 |



(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

| Sr. No. | Name of Practical/ Exercise/ Assignment/ Case Study |
|---------|--|
| 1 | Prepare a report on the evolution of UAV. |
| 2 | Prepare a report on the history of the Aviation industry in India. |
| 3 | Prepare a comparative report on drone rules from 2018 to current. |
| 4 | Prepare a report on ICAO Annexure 1 (limited to drones). |
| 5 | Prepare chart on salient features of Drone Rules 2021. |
| 6 | Prepare a report on different types of drones and classify them as per drone rules 2021. |
| 7 | Case study on VLOS and BVLOS. |
| 8 | Prepare a model/mockup on Fixed/ Rotary/ Hybrid Drone. |
| 9 | Identify different mechanical components of UAV. |
| 10 | Identify different electrical components of UAV. |
| 11 | Identify different electronics components of UAV. |
| 12 | Identify different communication components of UAV. |
| 13 | Assembly of different parts of fixed wing UAV. |
| 14 | Assembly of different parts of Rotor UAV. |

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| Sr. No. | Equipment Name with Broad Specifications |
|---------|---|
| 1 | Computer system with internet connectivity. |
| 2 | Any office software and browser |
| 3 | Materials for ming UAV model/mockup such as polystyrene, foam, balsa wood and fiberglass. |
| 4 | Drone Kit / Unassembled drone parts / Set of payloads |

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

| Unit | Topic and contents | Hours | Marks |
|--------------|--|-----------|-----------|
| I | 1. History 1.1 History of aviation 1.2 History of UAV | 02 | 10 |
| II | 2. UAV Regulations 2.1 Aircraft Rules 1937. 2.2 Nomenclature 2.3 The Drone Rules, 2021 and Amendments 2.4 National Unmanned Aircraft System Traffic Management (UTM) Policy Framework 24th October 2021 2.5 Wireless Planning Commission (WPC) | 08 | 12 |
| III | 3. Definition And Classification of UAV 3.1 Definition of UAV or RPAS 3.2 Classification of UAV - Weight 3.3 Classification of UAV - Design 3.4 Classification of UAV - Range | 10 | 12 |
| IV | 4. Mechanical and Electrical Components of UAV 4.1 Mechanical Components of UAV 4.2 Electrical Components of UAV | 10 | 12 |
| V | 5. Electronics and Communication Components of UAV 5.1 Electronics Components of UAV 5.2 Communication Components of UAV | 10 | 12 |
| VI | 6. Assembly of UAV 6.1 Fixed Wing UAV 6.2 Rotary Wing UAV 6.3 Hybrid UAV | 08 | 12 |
| Total | | 48 | 70 |



8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|--------------|---|----------------|------------------------------|-----------|-----------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| I | History | 02 | 04 | 04 | 02 | 10 |
| II | UAV Regulations | 08 | 04 | 04 | 04 | 12 |
| III | Definition And Classification of UAV | 10 | 06 | 04 | 02 | 12 |
| IV | Mechanical and Electrical Components of UAV | 10 | 02 | 06 | 04 | 12 |
| V | Electronics and Communication Components of UAV | 10 | 02 | 04 | 06 | 12 |
| VI | Assembly of UAV | 08 | 02 | 04 | 06 | 12 |
| Total | | 48 | 20 | 26 | 24 | 70 |

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)

Note: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/subtopics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities..
- Video programs/YouTube may be used to teach various topics and sub topics.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different books and websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in the Lab
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various UAV actions

10. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---------|---|---|--|
| 1 | Unmanned Aerial Vehicles An Introduction | P. K. Garg | Mercury Learning and Information |
| 2 | Drone Law and Policy Global Development, Risks, Regulation and Insurance | Anthony A. Tarr, Jeffrey Ellis, Julie-Anne Tarr, Maurice Thompson | Routledge, Taylor & Francis Group |
| 3 | Introduction to Unmanned Aircraft Systems | Douglas M. Marshall, Eric Shappee, R. Kurt Barnhart | CRC Press |
| 4 | UAVs and Urban Spatial Analysis An Introduction | Tony H. Grubestic, Jake R. Nelson | Springer International Publishing |
| 5 | Unmanned Aerial Vehicles | Nicholas Barrera | Nova Science Publishers, Incorporated |

11. SOFTWARE/LEARNING WEBSITES

- <https://digitalsky.dgca.gov.in/home>
- <https://egazette.nic.in/WriteReadData/2021/229221.pdf>
- <https://egazette.nic.in/WriteReadData/2022/232917.pdf>
- https://www.civilaviation.gov.in/sites/default/files/National-UTM-Policy-Framework-2021_24_Oct_2021.pdf

PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY

PROGRAMME CODE : UV

SEMESTER : FIRST

COURSE TITLE : REMOTELY PILOTED AIRCRAFT (RPA) OPERATOR

COURSE CODE : 28050

1. RATIONALE

Remotely Piloted Aircraft (RPA) means an unmanned aircraft that is piloted or operated from a remote pilot station with the means of a drone pilot or operator. A drone pilot is responsible for operating a drone, which is sometimes called an unmanned aerial system (UAS). Drones are operated remotely, which is why drone pilots are also known as remote pilots. A drone pilot controls a drone, causing it to take off, stay on course, and land safely. Also, drone pilots conduct safety tests, oversee vehicle performance, and assess drone systems' capabilities. They may also operate cameras or other equipment (payloads) the drone carries.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- Obtain training and learn to fly RPA (Drone) in controlled environments following DGCA regulations and guidelines.

3. COURSE OUTCOMES

- Understand basic principles of flight.
- Understand propulsion and vertical motion.
- Understand basic maneuvers of flying, weather and meteorology.
- Understand command control and communication (C3) and mission planning
- Apply emergency procedures, and perform risk assessment.
- Select suitable payloads for different applications.

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|-----------------|----|---|-------------------|--------------------|--------|-----|-------|-----|-----|-----|-----------|-----|-------|-----|-----|
| L | T | P | | Paper Hrs. | Theory | | | | | | Practical | | | | |
| | | | ESE | | PA | | Total | | ESE | | PA | | Total | | |
| | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | -- | 4 | 7 | -- | -- | -- | -- | -- | -- | 50@ | 25 | 50 | 25 | 100 | 50 |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P – Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination



5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

| Sr. No. | Name of Practical/ Exercise/ Assignment/ Case Study |
|---------|---|
| 1 | Prepare a report on aero foil selection for a given configuration. |
| 2 | Prepare a report on 4 forces acting on any flight. |
| 3 | Prepare a report on different types of propellers. |
| 4 | Prepare a comparative study on different types of motors and engines. |
| 5 | Prepare a report on the effect of weather flight. |
| 6 | Prepare a report on motion of flight along the axis. |
| 7 | Prepare a report on different frequencies and related equipment used for communication. |
| 8 | Prepare a report on different flight modes to be used during mission planning. |
| 9 | Prepare a report on the requirements of RPTO. |
| 10 | Prepare a report on pre-flight and post-flight check. |
| 11 | Prepare a report on the type of payload used for a given scenario. |
| 12 | Prepare a report on calculation of payload. |
| 13 | Prepare a report on RPC training. |
| 14 | Pilot profile creation on digital sky platform. |

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| Sr. No. | Equipment Name with Broad Specifications |
|---------|---|
| 1 | Computer system with internet connectivity. |
| 2 | Any office software and browser |

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

| Unit | Topic and contents | Hours |
|------|--|-------|
| I | 1. Basic Principles Of Flight 1.1 Fixed-wing Operations and Aerodynamics 1.2 Rotorcraft Operations and Aerodynamics 1.3 Hybrid Operations and Aerodynamics 1.4 Differential thrust theory 1.5 Aerofoil selection | 08 |
| II | 2. Propulsion and vertical motion 2.1 Types of engines 2.2 Types of motors 2.3 Propeller anatomy and types | 10 |
| III | 3. Basic maneuvers of flying, weather and meteorology 3.1 Takeoff, laning, turns, ascend, descend, combination 3.2 Circuit pattern and phases of flight. | 06 |



| Unit | Topic and contents | Hours |
|--------------|---|-----------|
| | 3.3 The standard atmosphere 3.4 Measuring air pressure 3.5 Heat and temperature 3.6 Wind 3.7 Moisture, cloud formation, icing and its effects 3.8 Effect of atmosphere on RPAS operation & hazardous weather avoidance 3.9 Met Terminal Aviation Routine Weather Report (METAR) | |
| IV | 4. Command, Control and Communication (C3) and mission planning 4.1 C2 link and GCS controls. 4.2 Introduction to QGCS and mission planner 4.3 Survey, mapping, surveillance, precision agriculture | 06 |
| V | 5. Emergency Procedures, Risk Assessment & Analysis - Safety Management/ Emergency Procedures 5.1 Specific operation risk mitigation (SORA) 5.2 JARUS theory and sail score calculation. 5.3 Types of emergencies 5.4 Remedial actions to be taken 5.5 Human performance and pilot incapacitation 5.6 Fail safe features | 08 |
| VI | 6. Payload, Installation and Utilization and intro to data analysis 6.1 Payload physics 6.2 Types of payload. 6.3 Feasibility of payload as per the application. 6.4 Types of payload data output 6.5 Introduction to data analysis software | 10 |
| Total | | 48 |

8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/subtopics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Video programs/YouTube may be used to teach various topics and sub topics.



- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different books and websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in the Lab
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various UAV actions

9. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---------|---|-------------------|---|
| 1 | The Drone Pilot's Handbook | Colin J. Fischer | Outskirts Press |
| 2 | UAV PILOT LOGBOOK Pro The Complete Drone Flight Logbook for Professional Drone Pilots - Log Your Flights Like a Pro! | Michael L. Rampey | Parhelion Aerospace GmbH |
| 3 | Ultimate Uas / Drone Pilot Logbook Safety Checklist, Flight Logbook, Repair Logbook, & Maintenance Logbook | Ty Justice | CreateSpace Independent Publishing Platform |
| 4 | Drones Mastering Flight Techniques | Brian Halliday | CreateSpace Independent Publishing Platform |
| 5 | Drones The Professional UAV Pilot's Flight Time and Maintenance Logbook | Brian Halliday | CreateSpace Independent Publishing Platform |

10. SOFTWARE/LEARNING WEBSITES

- <https://digitalsky.dgca.gov.in/home>
- https://www.faa.gov/uas/commercial_operators/become_a_drone_pilot
- <https://www.dgca.gov.in/digigov-portal/>



PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY
PROGRAMME CODE : UV
SEMESTER : FIRST
COURSE TITLE : UAV OPERATIONS AND MAINTENANCE
COURSE CODE : 28051

1. RATIONALE

The objective of this subject is to train the students pertaining various measurements and their processes, assembly practices. There are quite a few factors in UAV maintenance process that determine its flying quality and safety. Students are required to execute various maintenance processes which may lead to executing different service activities. The students will understand SOPs, contingency plans and accident incident reporting.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Understanding various flight operations.
- Maintenance and services of drones.

3. COURSE OUTCOMES

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

After completion of this course, the students will be able to:

- Understand and examine different UAV operations.
- Understand the maintenance requirements for UAV.
- Perform drone maintenance on Mechanical and Electrical components and understand its challenges.
- Perform drone maintenance on Electronics and Communication components and understand its challenges.
- Perform the maintenance and Service on Firmware and Ground Control Station Software UAV.
- Perform the maintenance and Service of UAV payloads.

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit | Examination Scheme | | | | | | | | | | | | |
|-----------------|----|---|---------|--------------------|--------|-----|-----|-----|-------|-----|-----------|-----|-----|-----|-------|-----|
| L | T | P | (L+T+P) | Paper Hrs. | Theory | | | | | | Practical | | | | | |
| | | | | | ESE | | PA | | Total | | ESE | | PA | | Total | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| 3 | -- | 4 | 7 | -- | -- | -- | -- | -- | -- | -- | 50#\$ | 25 | 50 | 25 | 100 | 50 |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(\$#) or (@\$) : Under the practical ESE - 50 Marks (100%)



1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

| Sr. No. | Name of Practical/ Exercise/ Assignment/ Case Study |
|---------|---|
| 1 | Prepare a report on flight safety measures along with contingency plans. |
| 2 | Prepare an accident incident report. |
| 3 | Identify different components as per their maintenance category. |
| 4 | Prepare a propeller and motor maintenance report. |
| 5 | Prepare an airframe maintenance report. |
| 6 | Analyze the discharge profile of the battery. |
| 7 | Prepare a report on safety procedures and disposal procedure of battery. |
| 8 | Prepare a report on calibration of the flight controller. |
| 9 | Prepare a report on connection of different sub components to FC and their outputs. |
| 10 | Analyze different frequencies emitted by different communication devices. |
| 11 | Calculate range of different communication systems. |
| 12 | Troubleshooting firmware update. |
| 13 | Servicing of different payloads. |
| 14 | Calibrating payload and setting their controls post servicing. |

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| Sr. No. | Equipment Name with Broad Specifications |
|---------|---|
| 1 | Computer system with internet connectivity. |
| 2 | Any office software and browser |
| 3 | Drone Kit / Unassembled drone parts / Set of payloads |
| 4 | Multiple Output DC regulated power supply |
| 5 | SMD Technology Kit |
| 6 | Mixed Signal Oscilloscope |
| 7 | Handheld Digit Multimeter |
| 8 | Spectrum Analyzer |
| 9 | Laptop latest configuration |
| 10 | RF source |
| 11 | Battery Management System |
| 12 | BLDC (Brushless DC) Motor Training System |



7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

| Unit | Topic and contents | Hours |
|------|---|-------|
| I | 1. UAV operations 1.1 Standard operating procedures. 1.2 Contingency plans. 1.3 Human performance. 1.4 Accident Incident reporting. 1.5 Humanitarian code. 1.6 Crew resource management. 1.7 Insurance. 1.8 Flight safety. | 12 |
| II | 2. Introduction to Maintenance 2.1 Preventative maintenance 2.2 Scheduled maintenance 2.3 Line Replacement Unit | 02 |
| III | 3. Maintenance and Service of Mechanical and Electrical Components of UAV 3.1 Mechanical Components of UAV Frame Propeller 3.2 Electrical Components of UAV Battery Charger Motor | 10 |
| IV | 4. Maintenance and Service of Electronics and Communication Components of UAV 4.1 Electronics Components of UAV Flight Controller Speed Controller Power Distribution Board Li-Po Checker On board sensors Anti-Collision Lights Connectors, Solder Contacts and Wiring 4.2 Maintenance and Service Maintenance and Service Communication Components of UAV Transmitter Receiver GCS Antenna C2- data link GPS Module | 12 |
| V | 5. Maintenance and Service of Firmware and Ground Control Station Software UAV 5.1 Firmware Maintenance 5.2 Ground Control Station Software | 01 |



| Unit | Topic and contents | Hours |
|--------------|--|-----------|
| VI | 6. Maintenance and Service of UAV Payloads (Agriculture, Photography, Inspection, Delivery) 6.1 Payload assembly (Fixed or Swappable Payload) 6.2 Spraying systems 6.3 Multispectral Camera Thermal Camera Day Camera 6.4 Gimbal 6.5 Cargo | 11 |
| Total | | 48 |

8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/subtopics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Video programs/YouTube may be used to teach various topics and sub topics.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different books and websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in the Lab
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various UAV actions

9. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---------|---|---------------------------------|---|
| 1 | Guide to Drone Maintenance | Todd Kishpaugh, Russ Flahive | Todd Kishpaugh, Russ Flahive |
| 2 | Ultimate Uas / Drone Pilot Logbook Safety Checklist, Flight Logbook, Repair Logbook, & Maintenance Logbook | Ty Justice | CreateSpace Independent Publishing Platform |
| 3 | Drones | Brian Halliday | CreateSpace Independent Publishing Platform |



| Sr. No. | Title of Book | Author | Publication |
|---------|--|------------|-------------|
| | The Professional UAV Pilot's Flight Time and Maintenance Logbook | | |
| 4 | Unmanned Aircraft Systems: UAVS Design, Development and Deployment | Reg Austin | Wiley |

10. SOFTWARE/LEARNING WEBSITES

- https://www.bhphotovideo.com/lit_files/269277.pdf
- https://dl.djicdn.com/downloads/DJI_Air_2S/DJI_Air_2S_User_Manual_v1.0_en1.pdf
- <https://www.zero-x.com.au/media/manual/swift-plus-manual.pdf>
- <https://www.dronefly.com/the-anatomy-of-a-drone>



PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY

PROGRAMME CODE : UV

SEMESTER : FIRST

COURSE TITLE : APPLICATION OF UAV

COURSE CODE : 28135

1. RATIONALE

Unmanned aerial vehicles are used across the world for civilian, commercial, as well as military applications. In fact, Drone Industry in India is growing exponentially in different sectors including agriculture, energy, construction, security, environment, engineering, mining etc.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences.

- Different applications of UAV technology.

3. COURSE OUTCOMES

- Understanding the use UAV technology in agriculture
- Understanding the use UAV technology in Environmental Conservation and Monitoring
- Applications of UAV in the field of Security and Surveillance
- Applications of UAV in the field of Engineering Sector
- Applications of UAV in the field of Energy Sector
- Understanding the use UAV technology for specialized applications

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | |
|-----------------|----|---|-------------------|--------------------|--------|-----|-------|-----|-----|-----|-----------|-----|-------|-----|-----|----|
| L | T | P | | Paper Hrs. | Theory | | | | | | Practical | | | | | |
| | | | ESE | | PA | | Total | | ESE | | PA | | Total | | | |
| | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | |
| 3 | -- | 6 | 9 | 1.5 | 70*# | 35 | 30* | 00 | 100 | 50 | 50@ | 25 | 50 | 25 | 100 | 50 |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination



5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

| Sr. No. | Name of Practical/ Exercise/ Assignment/ Case Study |
|---------|---|
| 1 | Prepare a case study on drones used in agriculture sector for crop spraying application. |
| 2 | Prepare a case study on drones used in agriculture sector for crop monitoring, yield estimation and crop damage assessment application. |
| 3 | Prepare a case study on use of drones in environmental conservation and monitoring |
| 4 | Prepare a case study on use of drones in security and threat identification and analysis. |
| 5 | Prepare a case study on use of drones in facility and asset monitoring. |
| 6 | Prepare a case study on use of drones in the engineering sector for telecommunication tower monitoring. |
| 7 | Prepare a case study on use of drones in the engineering sector for transmission line tower monitoring. |
| 8 | Prepare a case study on use of drones in the engineering sector for solar site inspection. |
| 9 | Prepare a case study on use of drones in the engineering sector for wind turbine inspection. |
| 10 | Prepare a case study on use of drones in urban planning. |
| 11 | Prepare a case study on use of drones in the field of energy sector for oil and gas leak detection and oil and gas fields patrolling. |
| 12 | Prepare a case study on use of drones in the field of energy sector for mining site surveying, mapping and stockpile volume tracking. |
| 13 | Prepare a case study on use of drones for disaster management. |
| 14 | Prepare a case study on use of drones in film and television industry. |
| 15 | Prepare a case study on use of drones in special events and entertainment applications. |
| 16 | Prepare a case study on use of drones in last mile delivery. |

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| Sr. No. | Equipment Name with Broad Specifications |
|---------|---|
| 1 | Computer system with internet connectivity. |
| 2 | Any office software and browser |

7. THEORY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

| Unit | Topic and contents | Hours | Marks |
|------|--|-------|-------|
| I | 1.Agriculture Sector 1.1 Crop Spraying 1.2 Crop Monitoring and Yield Estimation. 1.3 Crop Damage Assessment. 1.4 Land Surveying | 05 | 10 |
| II | 2.Environmental Conservation and Monitoring 2.1 Animal Population monitoring 2.2 Habitat management and Pattern | 05 | 12 |



| Unit | Topic and contents | Hours | Marks |
|--------------|--|-----------|-----------|
| | 2.3 Migration Tracking 2.4 Conservation Efforts 2.5 Flood Assessment | | |
| III | 3.Applications of UAV in the field of Security and Surveillance 3.1 Border Security. 3.2 Threat Identification and Analysis. 3.3 Facility and Asset monitoring. 3.4 Search and Rescue. 3.5 Restricted Area. | 08 | 12 |
| IV | 4.Applications of UAV in the field of Engineering Sector 4.1 Telecommunications 4.2 Solar site inspection. 4.3 Wind Turbine inspection. 4.4 Site and Logistic Planning. 4.5 Transmission line Tower Monitoring. 4.6 Urban Planning. 4.7 Other Engineering Sector | 10 | 12 |
| V | 5.Applications of UAV in the field of Energy Sector 5.1 Oil and Gas Leak Detection. 5.2 UAV patrolling of oil and gas fields. 5.3 Mining Site Mapping and Surveying. 5.4 Stockpile volume tracking. 5.5 Other Energy Sectors. | 08 | 12 |
| VI | 6.Specialized applications of UAV 6.1 Disaster Management 6.2 Film and Television 6.3 Special Events and Entertainment 6.4 Weather and Forecast. 6.5 Drone Delivery | 12 | 12 |
| Total | | 48 | 70 |

8. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|----------|---|----------------|------------------------------|---------|---------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| I | Agriculture Sector | 05 | 04 | 04 | 02 | 10 |
| II | Environmental Conservation and Monitoring | 05 | 04 | 06 | 02 | 12 |
| III | Applications of UAV in the field of Security and Surveillance | 08 | 04 | 06 | 02 | 12 |
| IV | Applications of UAV in the field of Engineering Sector | 10 | 04 | 06 | | 12 |



| Unit No. | Unit Title | Teaching Hours | Distribution of Theory Marks | | | |
|--------------|---|----------------|------------------------------|-----------|-----------|-------------|
| | | | R Level | U Level | A Level | Total Marks |
| V | Applications of UAV in the field of Energy Sector | 08 | 04 | 06 | 02 | 12 |
| VI | Specialized applications of UAV | 12 | 04 | 06 | 02 | 12 |
| Total | | 48 | 24 | 34 | 12 | 70 |

Legends: R-Remember, U-Understand, A-Apply and above (Bloom's Revised taxonomy)

Note: The actual distribution of marks at different taxonomy levels (of R, U and A) in the question paper may vary from above table.

9. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/subtopics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities.
- Video programs/YouTube may be used to teach various topics and sub topics.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different books and websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in the Lab
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various UAV actions

10. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---------|--|---|--|
| 1 | E-agriculture in action: Drones for agriculture | Food and Agriculture Organization of the United Nations | Food & Agriculture Org |
| 2 | Drones for Biodiversity Conservation and Ecological Monitoring | Ricardo Díaz-Delgado, Sander Múcher | MDPI AG |
| 3 | The Good Drone | Kristin BergtoraSandvik, Maria GabrielsenJumbert | Kristin BergtoraSandvik, Maria GabrielsenJumbert |
| 4 | Drones Applications | George Dekoulis | Intech Open |



| Sr. No. | Title of Book | Author | Publication |
|---------|---|--------------|------------------|
| 5 | Drone Futures UAS in Landscape and Urban Design | Paul Cureton | Taylor & Francis |

11. SOFTWARE/LEARNING WEBSITES

- <https://ag.dji.com/>
- <https://asteria.co.in/solutions-defence-hl-security-surveillance/>
- <https://aerialphoto.in/drone-survey-in-india/>
- <https://www.wipro.com/business-process/the-future-of-delivery-with-drones-contactless-accurate-and-high-speed/>



PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY

PROGRAMME CODE : UV

SEMESTER : SECOND

COURSE TITLE : ADVANCE DEVELOPMENTS IN UAV

COURSE CODE : 28099

1. RATIONALE

Intelligent unmanned autonomous systems are systems that are man-made and capable of carrying out operations or management by means of advanced technologies without human intervention. Since ancient times, humans have created countless kinds of unmanned systems. The technological level of unmanned systems has gradually increased with the growth of human knowledge. The recent remarkable advances in artificial intelligence (AI) have taken unmanned autonomous systems to a more advanced level. Therefore, there is a need for an extended and detailed discussion of the development trends in intelligent unmanned autonomous systems.

2. COMPETENCY

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences:

- Advancement in drone technology using AI.

3. COURSE OUTCOMES

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

After completion of this course, the students will be able to:

- Analyze the data collected and use that information for 3D mapping.
- Apply Artificial Intelligence technology in UAV.
- Apply Machine Intelligence technology in UAV.
- Apply Deep Learning technology in UAV.
- Use of Big Data Analytics in UAV.
- Understand Ad-hoc UAV Networks and UAV Swarm.

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | | |
|-----------------|----|---|-------------------|--------------------|-----|-----|-----|-----|-------|-----------|-------|-----|-----|-----|-------|-----|--|
| L | T | P | | Theory | | | | | | Practical | | | | | | | |
| | | | | Paper Hrs. | ESE | | PA | | Total | | ESE | | PA | | Total | | |
| | | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | |
| 1 | -- | 4 | 5 | -- | -- | -- | -- | -- | -- | -- | 50@\$ | 25 | 50 | 25 | 100 | 50 | |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@\$) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE



2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination

5. LIST OF PRACTICALS/ EXERCISES/ASSIGNMENTS/CASE STUDIES

| Sr. No. | Name of Practical/ Exercise/ Assignment/ Case Study |
|---------|---|
| 1 | Prepare a report on UAV data acquisition. |
| 2 | Make a survey map of the data acquired by using UAV for outdoor environments. |
| 3 | Make a survey map of the data acquired by using UAV for indoor environments. |
| 4 | Prepare a report on use of Artificial Intelligence technology in UAV. |
| 5 | Prepare a report on AI-based algorithm to detect structural defect and structural irregularities. |
| 6 | Prepare a report on use of Machine Learning technology in UAV. |
| 7 | Prepare a report on ML-based algorithm for mobility/flow prediction. |
| 8 | Prepare a report on use of Deep Learning technology in UAV. |
| 9 | Prepare a report on DL-based algorithm for drone navigation and path planning. |
| 10 | Prepare a report on use of big data analytics in UAV. |
| 11 | Prepare a report on big data analytics techniques for inspection and maintenance. |
| 12 | Prepare a report on drone swarm. |
| 13 | Prepare a report on use of various algorithms for drone swarm formation and coordination. |
| 14 | Prepare a report on flying Ad-hoc network (FANET). |
| 15 | Prepare a report on use of various algorithms for UAV network formation and connectivity. |
| 16 | Prepare a report on various routing and mobility models used in flying ad-hoc network (FANET). |

6. MAJOR EQUIPMENT/ INSTRUMENTS REQUIRED

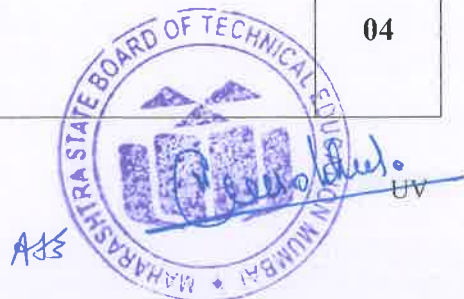
The major equipment with broad specification mentioned here will usher in uniformity in conduct of experiments, as well as aid to procure equipment by authorities concerned.

| Sr. No. | Equipment Name with Broad Specifications |
|---------|---|
| 1 | Computer system with internet connectivity. |
| 2 | Any office software and browser |

7. THOERY COMPONENTS

The following topics/subtopics should be taught and assessed in order to attain the identified competencies.

| Unit | Topic and contents | Hours |
|------|---|-------|
| I | 1.UAV Data Acquisition Processing Analysis 1.1 Data Acquisition 1.2 Data Processing 1.3 Data Analysis | 04 |



| Unit | Topic and contents | Hours |
|--------------|--|-----------|
| II | 2.Use of Artificial Intelligence in UAV 2.1 Introduction to AI 2.2 Different AI Technique 2.3 Use of AI for Inspection and Maintenance | 02 |
| III | 3.Use of Machine Learning in UAV 3.1 Introduction to Machine Learning 3.2 Use of Machine Learning for Mobility Prediction | 02 |
| IV | 4.Use of Deep Learning in UAV 4.1 Introduction to Deep Learning 4.2 Use of Deep Learning for Navigation | 02 |
| V | 5.Use of Big Data Analytics in UAV 5.1 Introduction to Big Data Analytics 5.2 Use of Big Data Analytics for Inspection and Maintenance | 02 |
| VI | 6.Ad-hoc UAV Networks and UAV Swarm 6.1 Ad-hoc UAV Networks 6.2 UAV Swarm 6.3 Routing and Mobility Models | 04 |
| Total | | 16 |

8. SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various learning outcomes in this course:

- Massive open online courses (MOOCs) may be used to teach various topics/subtopics.
- 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- About 15-20% of the topics/subtopics which are relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the COs through classroom presentations (see implementation guideline for details).
- With respect to item No.10, teachers need to ensure to create opportunities and provisions for co-curricular activities..
- Video programs/YouTube may be used to teach various topics and sub topics.
- Demonstrate students thoroughly before they start doing the practice.
- Encourage students to refer to different books and websites to have a deeper understanding of the subject.
- Observe continuously and monitor the performance of students in the Lab
- Use proper equivalent analogy to explain different concepts.
- Use Flash/Animations to explain various UAV actions.

9. SUGGESTED LEARNING RESOURCES

| Sr. No. | Title of Book | Author | Publication |
|---------|--|---|-----------------------------------|
| 1 | Robots, Drones, UAVs and UGVs for Operation and Maintenance | Diego Galar, Uday Kumar, and Dammika Seneviratne | CRC Press |
| 2 | Intelligent Autonomous Drones with Cognitive Deep Learning | David Allen Blubaugh, Steven D. Harbour, Benjamin Sears, Michael J. Findler | Apress |
| 3 | Computational Intelligence for Unmanned Aerial Vehicles Communication Networks | Inam Ullah Khan, Mariyam Ouaisa, Syed Bilal Hussain Shah, Zakaria Boulouard | Springer International Publishing |
| 4 | UAV Swarm Networks: Models, Protocols, and Systems | Dong Xiu Ou, Fei Hu, Xin-lin Huang | CRC Press |

10. SOFTWARE/LEARNING WEBSITES

- https://www.youtube.com/watch?v=aOd4-T_p5fA
- <https://www.youtube.com/watch?v=VAEy0NltoFQ>
- <https://www.youtube.com/watch?v=m7FS41zJn6c>
- <https://www.youtube.com/watch?v=TjGyLUeEbkM>
- https://www.youtube.com/watch?v=--pp-_xtm_U



PROGRAMME NAME : ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY

PROGRAMME CODE : UV

SEMESTER : SECOND

COURSE TITLE : PROJECT

COURSE CODE : 28100

1. RATIONALE

The main aim of the preparation of project is to judge the knowledge gained by the students during their tenure of the programme, the transfer of learning to useful socially relevant application. The Student should also make a brief presentation about the project and the salient observations and findings.

2. COMPETENCY

This will develop various skills such as Personal, social, professional and lifelong learning. The students will be benefited lot by this exercise of preparation of project on their experiences which will certainly add values in their attitudes such as value for health, work commitment, hardworking, honesty, problem solving, and punctuality, loyalty and independent study.

3. COURSE OUTCOMES

The student will be able to

- Perform manufacturing operations pertaining to UAV making
- Gain operational knowledge of UAV
- Gain expertise in thinking as to enhance innovations in the field of UAV

4. TEACHING AND EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | |
|-----------------|----|---|-------------------|--------------------|--------|-----|-------|-----|-----|-----|-----------|-----|-------|-----|-----|
| L | T | P | | Paper Hrs. | Theory | | | | | | Practical | | | | |
| | | | ESE | | PA | | Total | | ESE | | PA | | Total | | |
| | | | | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min |
| -- | -- | 6 | 6 | -- | -- | -- | -- | -- | -- | 50# | 25 | 50 | 25 | 100 | 50 |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#\$) or (@\$) : Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical – ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T – Tutorial/Teacher Guided Theory Practice, P –Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination



5. IMPLEMENTATION STRATEGY

Candidate should be assigned Project preferably individually or if at all not possible can form a group of maximum 3 members. Every candidate must maintain the weekly progress diary and the guide should review the progress and sign the diary regularly.

Every candidate has to submit **Synopsis Report** (of pages not more than 10) and deliver Two Presentations for the completion of the Project.

First Presentation of Synopsis - to the Internal Guide tentatively during Third Week of the Academic Term.

Second Presentation on complete Project - to be given to the Internal Guide during Second Class Test schedule.

Contents of the Synopsis - It should include the following points

1. Cover Page of the Synopsis (Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai)
2. Index
3. Introduction
4. Need of the Project and Objectives
5. Problem Definition
6. Methodology
7. Action Plan

Evaluation of Practical-PA will be the average of two presentations, synopsis report and weekly progress diary maintained by the candidate.

There should not be any sort of typographical, diagrammatic and any other mistake/s in the final bound copy of the project report submitted by the candidate.

PROJECT REPORT CONTENTS

The Project report should essentially consists of the following details.

- COVER PAGE OF THE PROJECT
- CERTIFICATE FROM THE INSTITUTE
- ACKNOWLEDGEMENT
- TABLE OF CONTENTS
- ABSTRACT
- INTRODUCTION
- METHODOLOGY OF PROJECT
- RESULTS
- CONCLUSION AND FUTURE SCOPE
- ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)
- REFERENCES / BIBLIOGRAPHY



GUIDELINES FOR PREPARING THE PROJECT REPORT

Project work is a basic requirement for the award of Advanced Diploma. Project should be prepared based on any one of the subjects of the Programme. The project work should be comprehensive and cover all aspects of the management.

COVER PAGE OF THE PROJECT

The Cover Page of the Project Report must include Title of the Project, Student and Guide Details, Institute Name, Academic Year, Maharashtra State Board of Technical Education, Mumbai.

CERTIFICATE FROM THE INSTITUTE

Certification from Project Guide, HOD, Principal and signature of external examiner during final examination.

ACKNOWLEDGEMENT

It should appear on the third page and the report writer should acknowledge the guidance provided by the project guide. Here the author may also acknowledge other persons who might have rendered help or supplied the required data or information for completion of the project. It should be brief and crisp. Generally, one page should suffice for acknowledgement.

TABLE OF CONTENTS

It must consist columns Chapter No., Name of the Chapter and Page Number.

ABSTRACT

Abstract should describe the entire project work with its aim, objectives and methodology and conclusion. The abstract should be limited to one or two pages.

INTRODUCTION

Give brief description of need, significance and applications of the Project. It is recommended to limit the description to about 2 to 5 pages.

METHODOLOGY OF PROJECT

This is the most important part of the project and forms the main body of the project report. It needs very comprehensive coverage of all aspects.

It will be prudent to mention the methodology used for the project work, e.g., collecting information of various types of equipment/components, questionnaires, detailed study, working principle, operations, block diagram, structure, material used for designing of technical specifications, results etc. thereafter, detail procedure to achieve the project output.

Write-up can include mainly on some of the following areas:

1. The use of drones in search and rescue missions: A study of their effectiveness and potential improvements.
2. The impact of drone technology on the agricultural industry: An analysis of current applications and future possibilities.
3. The development and implementation of regulations for drone usage: An investigation into the ethical and legal implications.



4. Drone delivery services: An exploration of the benefits and challenges of using drones for package delivery.
5. The use of drones in disaster management: A case study of their deployment during natural disasters and emergencies.
6. The use of drones in the film industry: A study of their role in cinematography and storytelling.
7. Drone racing: An analysis of the technology and techniques used in competitive drone racing.
8. Drone swarm technology: An exploration of the capabilities and potential applications of drone swarms.
9. The use of drones in construction: An investigation into their use in surveying, mapping, and monitoring construction sites.
10. The role of drones in environmental monitoring and conservation: A study of their use in tracking wildlife, monitoring deforestation, and measuring pollution levels.

RESULT

It should content the experimentation results of the project.

CONCLUSION AND FUTURE SCOPE

Based on the project work, draw inferences, and mention future scope. The future scope should be specific, relevant and practically implementable.

ABOUT THE ORGANISATION / COMPANY (IN CASE OF INDUSTRY BASED PROJECTS)

Should mention organizational structure, product / services (limit 1 to 2 pages).

REFERENCES / BIBLIOGRAPHY

Mentions books, research papers, web sites referred in the report and in this section.

PROJECT REPORT FORMAT

- | | |
|-----------------------------|---|
| Paper Size | - A4 |
| Printing | - Only on one side of the sheet |
| Line Spacing of Paragraph | - 1 ½ |
| Font Face | - Times New Roman |
| Font Size | - 12 for Normal text, 14 for Sub-headings and 16 for Headings |
| No of Project Report copies | - Two |
| Binding | - Hard bound copies with Black cover (Golden Embossing) |



PROGRAMME NAME : **ADVANCED DIPLOMA IN UNMANNED AERIAL VEHICLES (UAV) TECHNOLOGY**

PROGRAMME CODE : **UV**

SEMESTER : **SECOND**

COURSE TITLE : **INDUSTRIAL TRAINING**

COURSE CODE : **28701**

1. RATIONALE

Industrial training course is introduced to all Advance diploma programmers with the aim to imbibe the industry culture and professional practices in the students before they enter into world of work. By exposing and interacting with the real life industrial setting, student will appreciate and understand the actual working of an industry, best practices adopted in industry and other requirements in the industry or their chosen field of training. The industrial needs such as the soft skills, life skills and hands-on practices are intended to be inculcated in the students through this training. This short association with the industry will be instrumental in orienting the students in transforming them to be industry ready after completion of diploma programme.

2. COMPETENCY

This course is intended to develop the following competencies:

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.

3. COURSE OUTCOMES

The industrial training is intended to acquire the competencies as mentioned above to supplement those attained through several courses up to fourth semester of the program:

- Communicate effectively (verbal as well as written) to execute the work.
- Prepare the industry report of the executed work.
- Exercise time management and safety in the work environment.
- Work in teams for successful completion of projects assuring quality.
- Work on case studies/live projects.



4. SUGGESTED TEACHING & EXAMINATION SCHEME

| Teaching Scheme | | | Credit (L+T+P) | Examination Scheme | | | | | | | | | | | | | |
|-----------------|-----|-----|-------------------|--------------------|--------|-----|-----|-----|-------|-----|-----------|------|-----|-----|-------|-----|-----|
| L | T | P | | Paper Hrs. | Theory | | | | | | Practical | | | | | | |
| | | | | | ESE | | PA | | Total | | ESE | | PA | | Total | | |
| Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | Max | Min | | |
| -- | -- | 20 | 20 | -- | -- | -- | -- | -- | -- | -- | -- | 100# | 50 | 100 | 50 | 200 | 100 |

(*): Under the theory PA, 30 marks is the average of 2 class tests of 30 marks each to be taken during the semester for the assessment.

(#) or (@): Under the practical ESE - 50 Marks (100%)

1) 30 Marks (60%) - For Practical - ESE

2) 20 Marks (40%) - Average of 2 Skill tests / Practicals of 30 marks each is to be conducted during the semester, and then should be converted to 20 marks.

Note: If student Remaining absent in PR-ESE shall be considered as ABSENT in PR-ESE

Legends: L-Lecture, T - Tutorial/Teacher Guided Theory Practice, P -Practical, ESE -End Semester Examination, PA - Progressive Assessment

@Internal Assessment, #External Assessment, *#Online Examination

5. GENERAL GUIDELINES FOR INDUSTRIAL TRAINING

The Industries/Organizations can be Government/Public limited/hospital/Salon/or Private family enterprises.

- Duration of Industrial Training:** 8 weeks in Final Semester as per the credits of the programme.
- Training Area:** Students should be trained in Large and Medium scale Industry / Organization. However, despite the best efforts by the Institute, if large and medium scale Industry / Organization are not available to all students then, students can also be placed in Small scale Industry / Organization.
- Skill Knowledge Partner(SKP) :** To be identified by the Institute as per their programme areas like
 - The Bombay Flying Club, Mumbai
 - PBC Aerohub Pune
 - Any other relevant organization

6. EXPECTATIONS FROM Skill Knowledge Partner (SKP)

Helping institute in developing the following competencies among students

- Soft Skills i.e. Communication, Presentation and others.
- Life Skills i.e. Time management, Safety, Innovation, Entrepreneurship, Team building and others
- Hands-on Practices i.e. Shop floor Implementation and Quality Assurance aspects.

7. ROLE OF PARENT DEPARTMENT OF THE INSTITUTE

- Collecting information about Industry / Organization available for training along with capacity.
- Institutions have to enter in to MOU with number of SKPs(Industries/ Organizations) for accommodating all the enrolled students for the mandatory
- Student and mentor allocation as per the slots available for in-.plant training (Desirable mentor- student ratio is 1:15).
- Communication with Industry / Organization available for training along with capacity and its confirmation
- Student enrollment for training.



- Issuing letter to the Industry / Organization for the training along with details of students and mentors.
- Principal/ HOD/ Faculty should address students about industrial safety norms, rules and discipline to be maintained in the Industry/ Organization during the training before relieving students for training.
- The faculty member during the visit to Industry/ Organization will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
- Mentors to carry out progressive assessment of the students during the training through Progressive Assessment (PA).
- End Semester Examination(ESE) assessment by mentor along with Industry / Organization expert as external examiner.

8. ROLES AND RESPONSIBILITIES OF THE STUDENTS

Following should be informed to students in the letter deputing them for the training, an undertaking for this should also be taken from them

- Students would interact with the mentor to suggest choices for suitable Industry / Organization. If students have any contact in Industry / Organization (through their parents, relatives or friends) then same may be utilized for securing placement for themselves and their peers.
- Students have to fill the forms duly signed by authorities along with training letter and submit it to training officer in the industry on the first day of training. Student should also carry with him/her the Identity card issued by institute during training period.
- He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the Industry / Organization and safety procedures to be followed. Student is expected to observe these rules, regulations, procedures.
- Students should know that if they break any rule of industry or do not follow the discipline then industry can terminate the training and send back the student.
- It is the responsibility of the student to collect information from Industry / Organization about quality assurance methods/specifications of machines and raw materials/maintenance procedures/ production planning/work ethics/professional practices/organizational structure etc.
- During the training period students have to keep daily record of all the useful information in Log book
- Maintain the Diary/Logbook and get it signed from mentor as well as Industry / Organization Training in-charge.
- In case they face any major problem in industry such as an accident or any disciplinary issue then they should immediately report the same to the institute.
- Prepare final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from mentor as well as Industry / Organization training in-charge.

9. FORMAT FOR TRAINING REPORT

Following is the suggestive format for the training report, actual format may differ slightly depending upon the nature of Industry / Organization. The training report may contain the following

- Title page
- Certificate
- Abstract
- Acknowledgement
- Content Page



- Chapter 1. Organizational structure of Industry / Organisation and General Lay Out
- Chapter 2. Introduction of Industry / Organisation (Type of products and services, history, turn over and number of employees etc.)
- Chapter 3. Types of major equipment/instruments/ machines used in Industry/ Organization with their specification, approximate cost and specific use and their routine maintenance.
- Chapter 4. Manufacturing Processes along with production planning and control methods and standard Operating procedures.
- Chapter 5. Testing of raw materials, components and finished products along with quality assurance procedures.
- Chapter 6. Major material handling product and procedures.
- Chapter 7. Safety procedures followed
- Chapter 8. Particulars of Practical Experiences in Industry / Organisation if any in Production/ Assembly/ Testing/Maintenance.
- Chapter 9. Short report/description of the project (if any done during the training)
- Chapter 10. Special/challenging experiences encountered during training if any (may include students liking & disliking of work places)

• REFERENCES /BIBLIOGRAPHY

10. SUGGESTED LEARNING STRATEGIES

Students should visit the website of the industry/Private firm where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc. They should also refer the handbooks of the major machines and operation, testing, quality control and standard operating procedures and practices used in the industry. Students may also visit websites related to other similar industries as their learning resource. The training activity may vary according to nature and size of Industry / Organization. The details of activities to be completed during 8 weeks should be planned appropriately. The evaluation of Industrial training will be done on the basis of skills acquired by the student during this 8 weeks period.

ASSESSMENT SCHEME FOR INDUSTRIAL TRAINING

| Training duration | PROGRESSIVE ASSESSMENT (Weekly report of all 8 week and attendance) | | END SEMESTER ASSESSMENT (Seminar and Oral) | | Total marks | |
|-------------------|--|------------|--|------------|-------------|------------|
| | Max. marks | Min. marks | Max. marks | Min. marks | Max. marks | Min. marks |
| Eight Weeks | 100 | 50 | 100 | 50 | 200 | 100 |



EVALUATION SHEET FOR PA OF INDUSTRIAL TRAINING

| Sr. No. | Enrollment Number | Name of Student | Marks by Mentor & Industry Supervisor jointly | Marks by Industry Supervisor | Marks by Mentor Faculty | Total Marks |
|---------|-------------------|-----------------|---|------------------------------|-------------------------|--------------------|
| | | | Out of 40 (A) | Out of 30 (B) | Out of 30 (C) | Out of 100 (A+B+C) |

DISTRIBUTION OF END-SEMESTER-EXAMINATION (ESE) MARKS OF INDUSTRIAL TRAINING

| Marks for Industrial Training Report | Marks for Seminar/Presentation | Marks for Oral/Viva-voce | Total ESE marks |
|--------------------------------------|--------------------------------|--------------------------|-----------------|
| 25 | 25 | 50 | 100 |

| Sr. No. | Enrollment Number | Name of Student | Marks by Mentor & Industry Supervisor jointly | Marks by Industry Supervisor | Marks by Mentor Faculty | Total Marks |
|---------|-------------------|-----------------|---|------------------------------|-------------------------|-------------|
| | | | | | | |

