

**OBAFEMI AWOLOWO UNIVERSITY,
ILE-IFE, NIGERIA**



**DEPARTMENT OF AEROSPACE
ENGINEERING**

2024

SECTION ONE
MEMBERS OF STAFF

ACADEMIC STAFF

S/N	NAME	AREA OF SPECIALIZATION	QUALIFICATIONS	RANK	EMPLOYMENT STATUS
1	Prof. A.O. Oluwajobi	Advanced Manufacturing Technologies, Nanotechnology, Mechatronics, Unmanned Aerial Vehicles (UAV)	B.Sc. (Ife), M.Sc. (Ibadan), MBA (Ife), MS (Pavia), PhD (Huddersfield)	Professor and Head of Department	Full Time
1	Prof. O.A. Koya	Applied Mechanics & Machine Design <i>(Advanced mechanisms, developmental design & manufacturing)</i>	B.Sc., M.Sc., Ph.D. (Ife)	Professor	Full Time
2	Prof. S.O. Obayopo	Thermofluids <i>(Computational fluid dynamics)</i>	B.Sc., M.Sc.(Ife), Ph.D.(Pretoria)	Professor	Full Time
3	Dr. B.O. Malomo	Materials Design & Structural Mechanics <i>(Advanced composites/ amorphous & nanocrystalline alloys)</i>	B.Eng. (Akure), M.Sc., Ph.D.(Ife).	Reader	Full Time
4.	Dr. A.O. Muritala	Computational Fluid Dynamics	BSc.(Ife), MSc. (Ife), PhD (Witwaterstrand)	Reader	Full Time
5	Dr. B.Z. Adewole	Combustion & Energy <i>(Gas dynamics & turbomachinery)</i>	B.Eng.(Akure), M.Sc., Ph.D.(Ife)	Senior Lecturer	Full Time
6	Dr. O.K. Ajayi	Solid Mechanics & Modelling <i>(Control systems&dynamics)</i>	B.Sc., M.Sc.(Ib), Ph.D.(Ib.)	Senior Lecturer	Full Time
7	Mr. A. A. Fadairo	Energy <i>(Propulsion and instrumentation)</i>	B.Sc., M.Sc.(Ife),	Lecturer II	Full Time

List of Core Technical Staff for the Programme

S/ N	NAME OF STAFF	SPECIALISATION	QUALIFICATION	AFFLIATION	RANK	EMPLOYMENT STATUS
1	Mr. T. O. Olasunkanmi	Production	HND	OAU,ILE-IFE	Technologist I	Full Time
2	Mr. R. R. Aminu	Refrigeration and Air-Conditioning	HND	OAU,ILE-IFE	Principal Technical Officer II	Full Time

Administrative Staff

S/ N	NAME OF STAFF	SPECIALIZATION	QUALIFICATION	AFFLIATION	RANK	EMPLOYMENT STATUS
1	Mrs. H. T. Obasanmi	Administration	B.Tech (FUTA), MSc (FUNAAB)	OAU, ILE-IFE	Senior Executive Officer	Full Time

TABLE 2.3 LIST OF ASSOCIATE ACADEMIC STAFF

S/ N	NAME OF STAFF	SPECIALIZATION	QUALIFICATION	AFFLIATION	RANK	EMPLOYMENT STATUS
1	Prof. A. A. Asere	Thermo-fluid and Combustion	B.Sc., M.Sc., Ph.D	OAU, ILE-IFE	Associate Professor	Full Time
2	Prof. L. E. Umoru	Material Science & Engineering <i>(Corrosion & materials characterization)</i>	B.Tech.(Owerri), M.Sc., Ph.D.(Ife)	OAU,ILE-IFE	Professor	Full Time
3	Prof.A.O. Oluwatope	Computer Engineering <i>(Computer networks & Artificial Intelligence)</i>	B.Sc., M.Sc., Ph.D.	OAU,ILE-IFE	Professor	Full Time
4	Prof. F. A. Soyoye	French &Linguistiquee Appliquee. <i>(French linguistics)</i>	B.A. (Hons), M.A., D.E.A., Ph.D.	OAU,ILE-IFE	Professor	Full Time

5	Prof. O. S. Oyelade	International & Aviation Law	LLB, LLM, M.Phil., Ph.D.	OAU, ILE-IFE	Professor	Full Time
6.	Prof. E. A. Ariyibi	Earth and Space Physics	BSc. MSc., PhD	OAU, ILE-IFE	Professor	Full Time
7,	Dr. G. A. Akinlade	Atmospheric and Environmental Physics	BSc., MSc. PhD	OAU, ILE-IFE	Senior Lecturer	Full Time
8	Dr. J. Oloukoi	Geoinformatics & Environmental Study	B.Sc., M.Sc., Ph.D.	AFRIGIST	Reader	Full Time
9.	Dr. C. O. Oluwadare	Geoinformatics and Land Administration	B.Sc., M.Sc., Ph.D.	OAU, ILE-IFE	Lecturer I	Full Time
10	Captain B. Jubrin	Space Mission & Reconnaissance	B. Sc	OAU, ILE-IFE	Associate Staff	Full Time
11	Mr. Douglas Egere	Aviation Management (<i>Avionics & Aviation transport</i>)	B.Sc., M.Sc.	NCAA	Lecturer I	Full Time

List of Associate Technical Staff for the Programme

S/N	NAME OF STAFF	SPECIALIZATION	QUALIFICATION	AFFLIATION	RANK	EMPLOYMENT STATUS
1	Mr. M. Saibu	Foundry	NATEB	OAU, ILE-IFE	Workshop Supervisor	Full Time
2	Mr. A. O. Adesina	Elect	NATEB	OAU, ILE-IFE	Snr. Tech. Officer	Full Time

<p style="text-align: center;">SECTION TWO BRIEF HISTORY OF THE UNIVERSITY, FACULTY AND DEPARTMENT</p>

OBAFEMI AWOLOWO UNIVERSITY (OAU)

OAU is one of the best Universities in the country. The University has the best-developed Information and Communication Technology (ICT) system in the country, with its own VSAT access to the Internet and very efficient Intranet. The University has embarked on the progressive application of ICT to all its functions and services- academic, research and administrative. The Current Strategic Plan of the University emphasizes the provision of academic programmes that will produce graduates who are highly employable and are able to employ themselves. The University is continually evolving in response to the needs of the Nation and the outside world. So whether you are considering an undergraduate or graduate program, the university has the capability in terms of facilities and also highly experienced staff to provide you with a qualitative education experience.

With over 60 degree awarding departments in the university, a prospective undergraduate student has more than enough options to select from. The requirements for admission into undergraduate programmes of the University include some general requirements that apply to all programmes and other requirements that are department specific.

The University has a postgraduate student enrolment of 2,500 and offers postgraduate programmes in all faculties, comprising 16 postgraduate Diplomas, 106 Masters (including professional degrees), 32 master of Philosophy and 80 Doctor of philosophy degree programmes.

FACULTY OF TECHNOLOGY

The faculty is in the forefront with respect to the provision of qualitative engineering education and production of high calibre graduates. Furthermore, the Faculty is a pillar of engineering and technology resource and competence within engineering and technology Nigeria and all over the world. The staff and students in the eight academic departments and one research unit are well mixed and poised for greater feats than hitherto achieved.

The vision of the faculty leadership encompasses:

- *the creation and fostering of networks on research collaboration and initiatives*
- *the pursuit and promotion of staff development programmes through sourcing of endowments, grants, fellowships, scholarships and similar funding in cash and kind*

- *equipping/upgrading/setting up laboratories with particular emphasis on advanced computer laboratory to complement existing facilities*
- *establishing partnerships with the private sector, the industries alumni in Nigeria and the Diaspora*
- *Increased publicity and development of research break-through*
- *Continued pursuance with vigour the establishment of the Technology Centre of excellence Foundation*
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The Faculty of technology was established in 1970 with the following Departments:

Department of Agricultural Engineering
Department of Chemical Engineering
Department of Computer Science
Department of Electronic and Electrical Engineering
Department of Estate Management
Department of Food Science & Technology

The growth of the Faculty during the first ten years of its life may appear tremendous on cursory examination. It is therefore necessary to explain the philosophy and the need for the growth.

At the time the faculty of Technology at Ife came into existence, the University set itself the goal of developing areas of engineering and technology that were not adequately covered by existing University programmes in the country. This was why it started by first developing programmes in Agricultural Engineering, Chemical Engineering, Computer Science, Electronic Engineering, Food Science and Technology and Estate Management.

It was however realized from the beginning that by the time the programme in Agricultural Engineering is fully developed, considerable amount of equipment would have been accumulated for teaching the science and practice of Civil and Mechanical Engineering. Furthermore, for the development of postgraduate courses in Agricultural Engineering, it is necessary to have well developed Departments of Mechanical and Civil Engineering. It thus became clear that these traditional areas of Engineering needed be developed. In 1977 the University decided to nurture Civil Engineering in the Department of Agricultural Engineering and Mechanical Engineering in the Department of Chemical Engineering.

The Department of Electronic and Electrical Engineering offered initially a programme in Electronic Engineering. It was decided that in order to strengthen this programme it is necessary to develop the heavy current Electrical Engineering programme.

The demand for metallurgical Engineers and Scientists in the country increased tremendously due to the very rapid growth of the metallurgical and allied industries and the progress in the industrialization of the country. Also, the search for minerals in various parts of the country had gained momentum in recent years and the need for local expertise in the evaluation and exploitation of minerals became very urgent. These needs informed the establishment of the Department of Metallurgical and Materials Engineering in 1978. The Department cooperates

with other Departments in the teaching and research on building materials and electrical/electronic materials.

The Technology Planning and Development Unit (now African Institute for Science Policy and Innovation-AISPI) was established in 1974 primarily to conduct policy research on how to harness Science and Technology for Economic Development. Its establishment underscored the critical need for research capability and advisory capacity to assist government and other policy making bodies in reaching decisions about the allocation and monitoring of resources for the development of scientific and technological capabilities in Nigeria and in other less developed countries.

By 1981/82 the then Department of Estate Management was developed into a separate Faculty of Environmental Design and Management, leaving the Faculty since then to be consisted of the following Departments and Unit:

Department of Agricultural Engineering
 Department of Chemical Engineering
 Department of Civil Engineering
 Department of Computer Science and Engineering
 Department of Electronic and Electrical Engineering
 Department of Food Science & Technology
 Department of Mechanical Engineering
 Department of Metallurgical and Materials Engineering,
 Technology Planning and Development Unit (now African Institute for Science Policy and Innovation- AISPI)

All the departments have now revised their programmes in line with current needs of the nation and global challenges

DEANS OF THE FACULTY

S/N	NAME	FROM	TO
1	Prof. G. R. Howanrt	August 1971	July 1975
2	Prof. V. A. Williams	August 1975	July 1977
3	Prof. G. A. Makanjuola	August 1977	July 1979
4	Prof. S. A. Sanni	August 1979	July 1983
5	Prof. S. B. Jaiyesimi	August 1983	July 1985
6	Prof. A. A. Afonja	August 1985	July 1989
7	Prof. M. O. Ogedengbe	August 1989	July 1991
8	Prof. G. O. Ajayi	August 1991	December 1991
9	Prof. M. T. Ige	August 1992	August 1995
10	Prof. O. O. Ajibola	August 1995	July 1998
11	Prof. L. O. Kehinde	August 1998	July 2000
12	Prof. G. A. Adegboyega	August 2000	July 2002
13	Prof. M. O. Faborade	August 2002	July 2006
14	Prof. O. Taiwo	August 2006	July 2008

15	Prof. T. A. Kuku	August 2008	July 2012
16	Prof. F. A. Akeredolu	August 2012	July 2014
17	Prof. K. A. Taiwo	August 2014	July 2016
18	Prof. B. I. Imasogie	August 2016	Date

SECTION THREE

MISSION, VISION OBJECTIVES OF THE UNIVERSITY

OAU MISSION

To create a teaching and learning community for imparting appropriate skills and knowledge behaviour and attitude, advance frontiers of knowledge that are relevant to national and global development, engender a sense of selfless public service; and promote and nurture the African culture and Tradition.

OAU VISION

The vision is of a top rated University in Africa, ranked among the best in the world, whose product occupy leadership positions in the public and private sectors of the Nigerian and global economy, that has harnessed modern technology, social, economy, financial strategies, built strong partnership and linkages within and outside Nigeria and whose research contributes a substantial proportion of innovation to the Nigerian economy.

OAU STRATEGIC OBJECTIVES

- i. To produce graduates of international standard, with appropriate knowledge and skills in their field of study, who will be highly employable and able to employ themselves.
- ii. To provide high quality research and development activities that will promote the development of the Nation and enhance the image of the University and the researchers.
- iii. To harness modern technology especially ICT and modern social, economic and financial strategies to run a cost of efficient and effective academic programme and institutional management.
- iv. To provide services that has relevance to and impact on the local community and the nation
- v. To provide conditions of study, work and living in the University Community that are of appropriate standard
- vi. To expand access to tertiary education in the face of unmet demand
- vii. To operate as an equal opportunity educational institution, sensitive to the principle of gender equity and non-disciplinary disability.

<p style="text-align: center;">SECTION FOUR ROLL OF HONOURS FOR STUDENTS</p>
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Senate at a special meeting held on Wednesday, 1st November, 2006 decided that Roll of Honours for students be instituted in the University to enhance discipline and good performance among students. All students are enjoined to strive to be on the Honours Roll.

- a) The approved Roll of Honours for students is at three levels:
 - i. Departmental Honours roll
 - ii. Provosts/Dean Hours Roll
 - iii. University/Vice-Chancellor's Roll
- b) The beneficiaries must have a minimum CGPA of 4.00 for Departmental Honours Roll, 4.25 for Deans/Provost Honours Roll in all the Faculties except the Faculty of Pharmacy and College of Health Sciences where the candidates are expected to have a cumulative average of 60% and 62% respectively.
- c) The beneficiary must maintain this grade annually to continue to enjoy the award.
- d) The recommendations are processed along with the results of Rain Semester examinations
- e) The student must be of good conduct
- f) He/she must have outstanding or carry over courses and must not be repeating the year.
- g) No student on Leave of Absence shall enjoy the Annual Roll of Honours Award.
- h) No student that has a disciplinary problem shall enjoy that award
- i) The award shall be based on recommendation of the Departmental of Examiners and the Faculty Board of examiners, while that pertaining to the Vice-Chancellor/University shall be processed through the Committee of Deans.
- j) The names of beneficiaries shall be displayed as follows:
 - i. Departmental Honours- Departmental Notice Board
 - ii. Deans/Provost Honours-Faculty Notice Board
 - iii. Vice-Chancellor/University Honours-Floor "O"
- k) All beneficiaries shall be given a certificate each

SECTION FIVE

INFORMATION ON FACILITIES

DIVISION OF STUDENTS' AFFAIRS

1. Guidance and Counselling Unit

The division of Student Affairs has Professional Counsellors who are committed to helping students grow in self-understanding in the process of integrating their personal and academic experiences. The services are free to students and are confidential (i. e. not used as part of his/her other University records). The services include personal counselling, group counselling, study skills improvement, tests anxiety reduction, personal crises intervention, psychological testing, career and occupational counselling and settlement of grievances between students. Where necessary, consultations are made with campus organizations, specialist and academic Departments, to ensure that students' problems are resolved satisfactorily.

The Counsellors can be contacted in Rooms 9 & 10 Division of Student Affairs between 10:00am and 2.00pm. Monday to Friday.

2. Scholarship and Financial Assistance:

The Division of Students' Affairs serves as a link between students and sponsoring authorities, both within and outside Nigeria. Students are advised to check Notice boards in their respective faculties as well as those at the Division of Student Affairs Building for advertisements and other relevant information.

Liaison is also maintained between students and governments at various levels for scholarship and bursaries.

HEZEKIAH OLUWASANMI LIBRARY

PLAN OF THE LIBRARY

The Library consists of the North and South wings, which are connected by walkways on two levels.

MEMBERSHIP

Membership of the Library is available, on completion of a registration card, to all students, members of the senior staff of the University and such other persons as may be determined by the Library Committee or the University Librarian on behalf of it.

Such students are required to renew their registration at the beginning of each academic year. Library Cards and Borrower's Tickets are not transferrable; books issued on them remain the responsibility of the person whose name appears on them.

A lost Library Card or Borrower's Ticket may be replaced on submission of a written application.

THE LIBRARY COLLECTION

Hezekiah Oluwasanmi Library now contains over 380, 000 volumes. It consists of two main areas:

- The Undergraduate Areas, and
- The Research Areas.

a) Serial Collection

The Serials Collection consists of:

- (i) Current journals, the most current issues of which are shelved in the display in the display section of the Serials Room
- (ii) Latest backfile i.e journals which are on open access to registered senior staff and postgraduate students.
- (iii) Older backfiles i.e. journals older than ten years are on closed access to all categories of reads who must obtain and complete request forms at the serials hatch.

b) Africana Special Collection

The Africana Special Collection is a collection of rare and other books of primary interest to people whose fields of interest are in African Studies. Staff publications and these submitted for higher degrees of the University as well as of other Universities are also housed there. The collection is closed access.

c) Documents Collection

The Documents Collection includes official publications of the Federal Government of Nigeria, the old regional governments, the present state governments and the Federal

Capital Territory. It also includes publications of other African governments and international organizations.

d) **Reference Collection**

Dictionaries, encyclopedias, handbooks, directories, atlases, university calendars, etc. are shelved in the Reference Room. Bibliographies, indexes and abstracts are available in the Bibliography Room. Reference books do not ordinarily circulate.

A newspaper clippings file (post-October, 1985) and a vertical file of reprints and other pamphlet type material is kept in the Reference Room.

e) ***Reserve Collection***

i) **Day Reserve Collection**

Multiple copies of textbooks, particularly some of those recommended for specific courses, are shelved in the Reserve Books Room on Floor 3 North Wing East.

ii) **Two-Hour Reserve**

Some other materials, periodical articles in particular, are placed on 2-hour reserve. These may be obtained on request (signature and seat number required) and retained for a period of two hours at a time, subject to renewal, provided other readers have not demanded the materials.

f) ***Recent accessions***

A selection of books added to the Library stock is normally displayed for several days before being put in the main collection. The books may not be borrowed while on display but may be reserved at the Loans Desk.

CATALOGUES

A library catalogue is a finding list of books and other materials available in the Library. The following catalogues can be found in the Catalogue Hall:

- i. *The Author/Title Catalogue*
- ii. *The Subject Catalogue*
- iii. *The Shelf List*
- iv. *The Serial Catalogue*

HOW TO BORROW A BOOK

When you have found the book you want to borrow, you will be required to sign your name and address on the book card provided in duplicate. You must surrender a Borrower's Ticket for each book borrowed.

When you return a book, you must ensure that you receive your Borrower's Ticket back immediately.

RESERVATION

A book can be reserved by filling a reservation slip; in which case, it will not be renewed for the present borrower when returned, and, if it already overdue, it will be recalled at once.

INTER-LIBRARY LOAN

If the book you require is not stock, it is often possible to borrow it from another library. This service is dependent on the goodwill and co-operation between libraries; readers who benefit from it are required to observe the regulations applying to each loan.

PHOTOCOPYING SERVICES

Within the limitations imposed by copyright, the library is able to supply readers with photocopies of periodicals articles and parts of books at moderate charges.

PENALTIES FOR OVERDUE OR LOST BOOKS

Penalties for overdue books will be imposed as follows:

- i) 5.00 per day for the first 30 days; thereafter, all loan privileges will stop
- ii) Books specially recalled by the University Librarian will attract a fine of N10:00 per day after the third day from the date of recall.
- iii) Books lost or damaged will attract a fine five times the current cost of the books.
- iv) No students will be allowed to attend the Graduation Ceremony or receive his/her certificate without a clearance certificate from the University Library to the effect that no book or fine is outstanding against him or her.

<p style="text-align: center;">SECTION SIX RELEVANT SECTIONS OF UNIVERSITY EXAMINATION REGULATION</p>
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a) REGISTRATION FOR UNIVERSITY EXAMINATIONS

- i. A candidate for a University examination must have registered for the courses in the prescribed format not later than the closing date prescribed for registration for such courses. Any candidate who fails to register for courses at the appropriate time as prescribed by Senate will not be allowed to take any examination taken without registration shall be null and void.
- ii. Students who register for courses are committed to take the number of units registered for and are expected to take the number of units registered for and are expected to take examinations in such courses. If a student failed to take an examination, he would be scored '0F' for the number of units he had registered for and in which he had failed to take the prescribed examination.
- iii. Any student who does not have any course or courses to offer in a particular semester should apply for leave of absence.
- iv. A candidate who has less than 15 units in a particular semester to graduate should apply to his/her Faculty Board for permission to register for less than 15 units. Failure to do so constitutes a breach of regulation which may result in the non-processing of the candidate's results.
- v. A candidate, who cannot register for courses during the prescribed period for registration because of an illness, must ensure that medical report on his illness is forwarded by him or his parents/sponsors to reach the Dean of his Faculty not later than four weeks after the end of the normal registration period as scheduled in the University Calendar. Such a medical report should be forwarded for authentication by the Director of Medical and Health Services for it to be considered valid. Such a candidate shall be exempted from the

penalties of late registration. All applicants should be routed through the Head of Department.

- vi. Students must attend a minimum of 75% of course instructions including lectures, tutorials and practicals where required to qualify to sit for examination in many course.
- viii. A candidate for a university examination in a particular degree programme should not be a regular candidate for another degree in this or any other University concurrently. Any candidate so discovered shall forfeit his/her studentship.

b) ABSENCE FROM EXAMINATIONS

Candidates must present themselves at such University examinations for which they have registered. Candidates who fail to do so for reason other than illness or accident shall be bound by the following regulations:

- (a) Any student who fails register for courses during one semester without permission should be deemed to have scored “0F” in the minimum number of units required for full time student (i.e. 15 units.)
- (b) Candidates, who registered for courses, attended classes regularly, did all practicals and tests but did not take required Semester examinations should be given a continuous assessment grade in each of the affected courses and a grade of “0” in the examination which they should have taken, but which they did not take.
- (c) Candidates who have less than 15 units to graduate but who fail to take the required examinations should be deemed to have scored “0 F” in the outstanding courses only provided such candidates obtained permission to register for less than 15 units.
- (d) Any candidate who on account of illness, is absent from a University examination may be permitted by the Senate on the recommendation from the appropriate Faculty Board, to present himself for such examination at the next available opportunity provided that:
 - i. A full-time student in the University shall report any case of illness to the University Health Centre at all times.
 - ii. When a student falls ill during examination he should first report to the Director, Medical and Health Services before attending any hospital outside the University. A report of sickness should be made to the Registrar within a week and a medical certificate for validation of his illness within three weeks.
 - iii. When a student falls ill during an examination he shall be under an obligation to send a medical report countersigned by the Director, Medical and Health Services within one week of such illness. Any time outside this period shall be considered on its own merit.

- iv. The Director of Medical and Health Services should within 48 hours submit a medical report on a candidate who is ill during an examination and is taken to the hospital for treatment.
- v. A candidate applying for leave of absence on medical grounds must forward his application together with a medical report to the Dean of his Faculty through his Head of Department. The Medical report must be countersigned by the Director of Medical and Health Services. All applications must be taken by the appropriate Faculty Board.

c) EXAMINATIONS OFFENCES AND PENALTIES

EXAMINATION OFFENCES

- a) A candidate shall not be allowed during an examination to communicate by word or otherwise with any other candidates nor shall he leave his place except with the consent of an invigilator. Should a candidate act in such a way as to disturb or inconvenience other candidates, he shall be warned and if he persists he may, at the discretion of the invigilator, be excluded from the examination room. Such an action by the invigilator must also be reported in writing through the head of Department to the Vice-Chancellor within 24 hours.
- b) It shall be an examination offence for any student, staff or any University found guilty under this regulation shall be subjected to disciplinary action by the appropriate authority of the University. The candidate impersonated shall be also be liable to an infraction of this regulation where it is established directly from circumstantial evidence that the impersonation is with his knowledge or connivance.
- c) No candidate shall take into an examination room, or have in his possession during an examination any book or paper or printed or written documents, whether relevant to the examination or not, unless specifically authorized to do so. An invigilator has authority to confiscate such documents.
- d) Mobile phones are not allowed in examination halls.
- e) A candidate shall not remove from an examination room any papers, used or unused, except the question paper and such book and papers, if any, as he is authorized to take into the examination room.

- f) Candidates shall comply with all “direction to candidates” set out on an examination answer book or other examination materials supplied to them. They shall also comply with direction given to them by an invigilator.
- g) Candidates shall not write on any paper other than the examination answer books. All rough work must be done in the answer books and crossed out neatly. Supplementary answer books, even if they contain only rough work must be tied inside the main answer books.
- h) When leaving the examination room, even if temporarily, a candidate shall not leave his written work on the desk but he shall hand it over to an invigilator. Candidates are responsible for his proper return of their written work.
- i) Smoking shall not be permitted in examination room during examination sessions.
- j) Any candidates or staff who attempts in any way to unlawfully have or give pre-knowledge of an examination question or to influence the marking scripts or the award of marks by the University examiner shall be subjected to disciplinary action by the appropriate authority of the University.
- k) If any candidate is suspected of cheating, receiving assistance or assisting other candidates or of infringing any other examination regulation, a written report of the circumstance shall be submitted by the invigilator to the Vice-Chancellor within 24 hours of the examination session. The candidate concerned shall be allowed to continue with the examination.
- l) Any candidate suspected of examination malpractice shall be required to submit to the invigilator a written report immediately after the paper. Failure to make a report shall be regarded as a breach of discipline. Such report should be forwarded along with the invigilator’s report to the Vice-Chancellor.
- m) Where a Head of Department fails to forward a report on examination malpractice to the Vice-Chancellor, such action would be considered as misconduct.
- n) Where the Vice-Chancellor is satisfied on the basis of the reports forwarded to him that any candidate has a case to answer, he shall refer the case to the Central Committee on Examination Malpractice.

PENALTIES FOR EXAMINATION MALPRACTICE AND OTHER OFFENCES

- a) Any examination offence would attract appropriate penalty including outright dismissal from the university.
- b) Where the Vice-Chancellor has reason to believe that the nature of any question or the content of any paper may have become known before the date and time of the examination to any persons other than examiners of the paper, the Board of Examiners, and any official of the University authorized to handle the paper, he may order the suspension of the examination or the cancellation of the paper or setting of a new paper and shall report the matter to the senate. The Vice-Chancellor shall also take any disciplinary measure against any student or students involved as he may deem appropriate.
- c) If in the opinion of an invigilator, circumstances arise which render the examination unfair to any candidate, he must report the matter to the Vice-Chancellor within 24 hours.
- d) Any candidate or member of staff may complain to the Vice-Chancellor that an examination has been improperly conducted. The Vice-Chancellor shall investigate the complaint and report the result of his investigations to the Senate which shall take such action as it may deem appropriate, including with-holding a result or deprivation of the award of a degree, diploma etc. as laid down in Statue 17. However where it is shown to the satisfaction of the Committee of Deans that any alteration or amendment of a University regulation involving a change in a course of study or in examination requirements has caused hardship to a candidate in any examination, the Committee of Deans shall make such provisions as it thinks fit for the relief of such hardship and report same to Senate.

SECTION SEVEN THE COURSE UNIT SYSTEM AND THE COMPUTATION OF CUMULATIVE GRADE POINT AVERAGE (CGPA)
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(A) DEFINITION OF TERMS

- (i) **Student Workload:** This is defined in terms of course units. One unit represents one hour of lecture or one hour of Tutorial or 2-4 hours of practical work per week throughout a semester. Thus for example, a course in which there are 2 hours of lectures and 1 hour of Tutorial per week is a 3 unit course.

- (ii) **Total Number of Units (TNU):** This is the total number of course units carried by a student in a particular semester. It is the summation of the load Units on all courses carried during the semester. For example, a student who is carrying 6 courses of 3 units each has a TNU of 18 for the semester. No student shall be allowed to carry (i.e. register for) or be examined in more than 24 units in any particular semester.

- (iii) **Cumulative Number of Units (CNU):** This is the summation of total number of units over all the semesters from the beginning to date. A student who is prone to repeating courses will most likely require a longer time to complete the requirements for the award of Degrees.

- (iv) **Level of Performance Rating:** This is the rating of grades obtained in terms of per load unit. The rating used is as follows:

LEVEL OF PERFORMANCE		RATING (CREDIT POINTS PER UNIT)
A	70-100 %	5

B	60-69 %	4
C	50-59 %	3
D	45-49 %	2
E	40-44 %	1
F	0-39 %	0

Based on the above, a student who obtained a grade of 'A' in a 4-unit course has scored 20 credit points, and one who obtained a grade of C in that course has scored 12 credit points.

- (v) **Total Credit Points (TCP):** This is the sum of the products of the course units and rating in each course, for the entire semester period. For example, consider a student who took 4 courses of 5 units each. Let's say the grade obtained in the four courses were C. B. F. D. Respectively. The TCP of this student is obtained as $(5 \times 3) + (5 \times 4) + (5 \times 0) + (5 \times 2) = 45$.
- (vi) **Cumulative Credit Point (CCP):** This is the summation of Total Credit Points over all semesters from beginning to date.
- (vii) **Grade Point Average (GPA):** This is the total credit points (TCP) divided by the total units (TNU). For example, consider the student's scores referred to above. His TCP IS 45, and of course, his TNU is 20 (i.e. 4 courses at 5 units each, for the semester). The highest GPA that can be earned is 5.0 and that is when a student has earned a grade of 'A' in every course during the semester. The lowest GPA obtainable is 0.0 and this would happen if the student has F all round during the semester.
- (viii) **Cumulative Grade Point Average (CGPA):** This is the summation of TCPs for all semester, divided by the summation of TNUs for the semesters. Like the CGPA obtainable ranges from 0 to 5.

(B) GPA AND CGPA SAMPLE COMPUTATION

Sample Computations:

Consider a student, Oladejo K. A (MEE/2005/001), who has enrolled in a course programme designated as MEE and has just completed 2 full semesters in the University. His course programme and his GPA and CPA could be as follows:

SEMESTER 1

1	2	3	4	5	6	7	8
	L	T	P	UNITS		RESULTS	
COURSE CODE					GRADES	CREDIT POINTS	CPA/CGPA
MEE 101	1	0	0	1	78% (A)	1 x 5 = 5	GPA = 29/18+1.61
MEE 103	3	0	2	4	60% (B)	4 x 4 = 16	CCP = 29 + 0 =29
MEE 105	3	0	3	4	45% (D)	4 x 4 = 8	CNU = 18 + 0 = 18
MEE 107	3	1	5	6	38% (F)	6 x 0 = 0	CGPA = 29/18 =1.61
MEE 109	2	1	0	3	27% (F)	3 x 0 = 0	
				18		29 (TCP)	In this case the TCP, TNU and GPA will be the same for CCP, CNU andCGPA

SEMESTER 11

1	2	3	4	5	6	7	8
	L	T	P	UNITS		RESULTS	
COURSE CODE					GRADES	CREDIT POINTS	CPA/CGPA
MEE 102	2	0	0	2	66% (B)	2 x 4 = 5	GPA = 52/18=2.89
MEE 104	3	0	2	4	72% (A)	4 x 5 = 20	CCP = 29 + 52 =81
MEE 106	3	0	3	4	47% (D)	4 x 2 = 8	CNU = 18 + 18 = 36
MEE 108	3	1	0	4	53% (C)	4 x 3 = 12	CGPA = 81/36 = 2.25
MEE 110	2	1	3	4	42% (E)	4 x 1 = 4	
				18 (TNU)		52 (TCP)	

(C) WITHDRAWAL FROM THE UNIVERSITY**(i) Voluntary Withdrawal**

A student may withdraw voluntarily from the University in writing for specified reasons, for example, if he/she is leaving the country.

(ii) Poor Academic Performance

A student will be withdrawn from the University on account of poor performance if his/her CGPA is less than 1.00 in two consecutive semesters.

(iii) Termination of Studentship

A candidate studentship will be deemed to have terminated if he/she fails to register for two consecutive semesters irrespective of his/her present CGPA.

(iv) Disciplinary Action

A student may be rusticated or dismissed from the University on account of misconduct if so recommended by the Disciplinary Committee of the University.

(D) FINAL ASSESSMENT AND AWARD OF DEGREES

- (i) A student's workload is defined in term of course units. One unit represents one hour of lecture or one hour of tutorial, or 2-4 hours of practical work per week throughout a semester. All courses shall run for one semester or a full session of one semester or a full session of two semesters.
- (ii) The final award and the class of the degree shall be based on the Cumulative Grade Point Average (CGPA) obtained by each candidate in all prescribed courses approved by the University. The final cumulative grade point average shall be calculated on the basis of the total number of credit points and the total number of course units registered for during the course of student's programme. In the case of a failed course, the candidate must repeat the course at the next available opportunity. If the course is an elective, the candidate may substitute another course and shall not be required to pass the failed elective course. If the course is a restricted elective, substitution can only be made from the list of restricted electives. The failed grade would however be reflected in the transcript.
- (iii) A candidate who has satisfactorily completed all requirements for the degree with an overall grade point average of not less than 1.50 shall be awarded the honors degree as indicated below:

First Class	4.50-5.00%
Second Class (Upper Division)	3.50-4.49%
Second Class (Lower Division)	2.40-3.49%
Third Class	1.50-2.39%
Pass	1.00-1.49%

- (iv) Passes in 12 units of Special Electives is a requirement for graduation.
- (v) A candidate who score a cumulative grade point average point average (CGPA) of less than 1.00 in two consecutive semesters shall be required to withdraw from the University.

DEPARTMENT OF AEROSPACE ENGINEERING

FACULTY OF TECHNOLOGY

OBAFEMI AWOLowo UNIVERSITY, ILE-IFE

1. Background Information & History

Aerospace Engineering (AER) is the engineering that deals with the development of aircraft and spacecraft. Originally this field was lumped into one and was referred to as Aeronautical Engineering. However as this engineering field grows and vehicles went into space the name changed from its original name to Aerospace Engineering. Aerospace Engineering has two major overlapping branches :(a) aeronautical engineering and (b) astronautical engineering. Aeronautical Engineering is the branch of engineering that focuses and deals with the design, production and maintenance of aircraft while astronautical engineering deals with spacecraft and space products. The founding father of the Department of Mechanical Engineering in the Obafemi Awolowo University (OAU), Prof. O. O. Mojola who holds a Ph.D. degree in Aeronautical Engineering, mooted the idea of establishing a Department of Aeronautical Engineering in the then University of Ife (now OAU) in the 1970s. However, securing adequate funding for such a capital intensive academic programme was a major challenge to actualizing this idea then. Thus, Prof. Mojola could not realize this dream until he retired in 2007.

In the days of the administration of Prof. M. O. Faborode (who is an Engineer) as the Vice-Chancellor of the University, the idea came alive again in the meeting that the Vice-Chancellor had in 2008 with OAU Alumni in San Francisco, USA. When he came back, he constituted the *OAU Aviation Institute Planning Committee* with Prof. A. A. Asere as the Chairman and five others - Prof. L. O. Adekoya, Dr. K. T. Oladepo, Dr. K. O. Osotimehin, Dr. A. O. Oluwatope and Mr. K. P. Ayodele - as members.

A report was submitted by the Committee to the Vice-Chancellor then and a presentation of the Engineering course structure was made to the Department of Mechanical Engineering. The enthusiasm for this Engineering Department after that administration waned for various reasons. However, because the establishment of the Department of Aerospace Engineering is one of the cardinal campaign points of Prof. Eyitope Ogunbodede before being appointed as the Vice-chancellor, from the very first day of his inauguration, his administration has been very passionate

and committed to the smooth take-off of the Department soonest. Hence the revival of activities towards establishing of the Department. Thus the *Strategic Planning and Course Development Committee* of the Department of Mechanical Engineering under the leadership of Prof. A. A. Asere was then saddled with the responsibility of reviewing the course structure for the B.Sc. (Aerospace Engineering) programme, ensuring that it satisfies the National University Commission Benchmark Minimum Academic Standard for Aerospace Engineering.

During the preparation for this work the committee took the advantage of the existing Memorandum of Understanding (MOU) between the Regional Centre for Training in Aerospace Surveys (RECTAS) {now African Regional Institute for Geospatial Information Science and Technology (AFRIGIST)}, Ile-Ife, Nigeria and Obafemi Awolowo University (OAU), Ile-Ife to collaborate on issues within the confines of the MOU.

Airport is an important component of Aerospace Engineering. This will play two rolls. The first part of it is to serve as a practical training ground for the Engineers to be. The other aspect for the airfield is for commercial flight to take place. This second part will be profitable to the University by generating funds. Also it will allow for the running of certificate and diploma courses on Aeronautical and Astronautical Engineering and sister fields for outsiders through which the University will also be able to make money. On a long term bases the Airfield will consist of hangars where outside aircraft may be kept, serviced or undergo repairs which will also avail the University another source of income.

2. Vision

A world-class programme for teaching and research in aerospace science and engineering, whose students are trained to be outstanding using state-of-the-art techniques directed towards creativity and entrepreneurial development.

3. Mission Statement

To disseminate knowledge of the latest theoretical and practical engineering principles, provide students with a sound foundation in the mathematical, scientific and engineering fundamentals necessary to formulate, solve and analyze aerospace problems; train professional in the development and maintenance of aero vehicles and related systems; promote and encourage creativity; and strong leadership qualities.

4. Objectives

The objectives of the programme are:

- (i) To produce graduates who will be creative, ethical and active participants in building a knowledge-driven economy;
- (ii) To develop students' ability to synthesize data and technical concepts for application to aerospace product design;

- (iii) To achieve outstanding, revolutionary and cutting-edge engineering solutions, novelties and innovations in the aerospace industry;
- (iv) To create an intellectually-challenging and engaging learning environment that prepares students for the stringency and sophistication of the aerospace industry; and
- (v) To produce graduates who are competent, resourceful, seasoned and primed for leadership and excellence.

5. Rationale/Justification

As the population of Nigeria continues to increase, transportation by road, rail, seas and air becomes increasingly important for the movement of people from place to place for business and other purposes. There are many road net-works in Nigeria. However rail net-work is restricted to specific routes (Lagos-Ibadan-Kaduna, Kano-Port-Harcourt; lately, Kaduna - Abuja). Indeed, for years now, the rail has been of no use until about two years ago. The Sea route, on the other hand, is of limited application to the population's movement and business use. Hence travelling in the country has been concentrated on road and air services.

However, many Nigerian roads have failed and fallen into a deplorable state of disrepair. Thus, for quick business that need shuttling between major cities, business people and those that can afford it have opted for air travel. For this reason, air travel has continued to expand. In response to the growth of her wealth of human and other untapped natural resources, the Nigerian nation is fast becoming a key player in the global Aviation Industry. The technologies at our airports and geo-informatics are currently state-of-the-art. Indeed, the country is in short supply of skilled Engineers for design, maintenance and handling of other engineering requirements of aircrafts available in the country and the general management of air transport to guarantee safety. Required routine maintenance that runs into trillions of Naira every year has to be done overseas.

Further, the Aerospace industry is an important sector in a world of rapid economic growth, transportation and infrastructure development. This is a place where goods, services and people are needed to meet deadlines in the distribution and delivery of such goods and services around the globe. The availing opportunities are promising for national economic growth and development in the face of stringent regulations enforcing innovations, competition and safety. The Aerospace Engineer is key to the design and operation of aircraft to transport these goods, people and services around the globe to those places that require them in a most effective, safe and timely manner. He is responsible for the planning and supervision of the design, development, manufacture, modification and maintenance of all types of flight vehicles.

To meet up with present-day challenges occasioned by the global and local expansion in transportation by air, Nigeria needs to start producing competent highly skilled personnel to service the aviation industry and ensure air transport safety. It is not out of place also to say that the Nigerian Air Force should begin to work towards building her own planes and drones for security and surveillance purposes, if not for major wars.

Currently, Kwara State University (KWASU), Lagos State University (LASU), Afe Babalola University and the Airforce Institute of Technology run the Aeronautical & Astronautical Engineering degree programme in Nigeria. The few experts found in the Nigerian aviation industry today are mostly trained overseas. With regard to the huge potentials that are available in terms of facilities and resources, it is incumbent on more Nigerian Universities, in response to the ideals of manpower development and the pursuit of the local content policy, to establish world-class Aerospace Engineering degree programmes. It is on this premise that the establishment of the B.Sc.(Hons) Aerospace Engineering degree programme in Obafemi Awolowo University, Ile-Ife, being one of the most prestigious Universities in Nigeria that others are looking up to, is being proposed.

6. Admission Requirements

(i) Unified Tertiary Matriculation Examination (UTME)

Prospective are required to have credits in five subjects at the Senior Secondary School Certificate (SSSC) or National Examination Council (NECO) or West African School certificate (WASC) level (or at GCE 'O' level including English Language, Mathematics, Physics, Chemistry and Further Mathematics (Pure and Applied Mathematics) at two sittings. Candidates are also required to meet the stipulated UTME/Post-UTME cut-off points for the programme.

(ii) Direct Entry

Candidates who are holders of National Diploma (ND) and Higher National Diploma (HND) in appropriate Engineering Disciplines at minimum of lower credit level are eligible for consideration for admission into 200 and 300 levels respectively. A prospective candidate must also satisfy the 'O' level UTME admission requirements.

7. Duration of Programme

The duration of Bachelor's Degree (B.Sc.) Aerospace Engineering shall be a minimum of 10 Semesters for UTME candidates and a minimum of 8 Semesters for Direct Entry candidates.

8. Requirements for the Award of Degree (B.Sc., Aerospace Engineering)

The B.Sc. Aerospace Engineering programme is a 5 year (10-semester) programme. The students' workload is defined in term of course units. One unit represents one hour of lecture, one hour of tutorial, or three hours of practical work per week through a semester. Each student registers for between 15 and 24 units of courses each semester.

Undergraduate Aerospace Engineering students are required to partake in the Student Industrial Work Experience Programme at three different levels, to acquire requisite practical knowledge in the aviation industry. The First, being the Students Work Experience Programme (SWEP) is

undertaken by Part II students for three months during the long vacation at the end of the second year. The Part II SWEP is a 3-credit unit load on-campus programme where the students are exposed to the practical aspects of various engineering subjects. The Second one is called the Student Industrial Work Experience Scheme I (SIWES I). It is a 3-credit unit industry based programme organized for part III students during their long vacation for a period of three months. Thirdly, is the Student Industrial Work Experience Scheme II (SIWES II) organized for Part IV students of the Department. This, unlike the others, is a second semester based course and is fully attended to in the industry for a period of six months. The programme attracts 9 credit units. In all, the three industrial training programmes carry 15 units with adequate Industrial enhancement of the Department programme.

In totality, the minimum requirement for the award of B.Sc. (Hons.) Aerospace Engineering is the satisfactory completion of not less than 215 units of course work for candidates admitted through UTME and 184 units for candidates admitted through Direct Entry (DE). In addition, at least 12 units of special electives must be passed. It is also mandatory for DE candidates to register and pass AER 101, AER 103 and AER 104, during the course of their study. The Bachelor's Degree in Aerospace Engineering can only be awarded to candidates who have met and fulfilled these stated requirements.

(i) Course Structure Requirements

The followings represent the various categories of courses in the Aerospace Engineering programme

- a. 10 Units of Chemistry Courses (CHM);
- b. 20 Units of Mathematics Courses (MTH);
- c. 10 Units of Physics Courses (PHY);
- d. 5 Units of Technology Planning and Development Courses (TPD);
- e. 12 Units of Special Electives Courses (SE);
- f. 87 Units of Aerospace Engineering Courses (AER);
- g. 9 Units of Chemical Engineering Courses (CHE);
- h. 5 Units of Computer Science and Engineering Courses (CSC);
- i. 9 Units of Electronics and Electrical Engineering Courses (EEE);
- j. 36 Units of Mechanical Engineering Courses (MEE);

- k. 3 Units of Material Science and Engineering Courses (MSE);
- l. 4 Units of Agricultural and Environmental Engineering Courses (AEE);
- m. 5 Units of Civil Engineering Courses (CVE); and

Table 1. Classification of Courses according to structure of the programme

Level	Faculty Compulsory Courses	Faculty Restricted Courses	Departmental Core Courses (AER)	Courses from Cognate Faculties	Special Electives
100	1	-	5	32	8
200	32	-	7	8	2
300	31	-	15	-	2
400	8	-	23	-	-
500	4	-	37	-	-
Total	76 units	-	87 units	40 units	12 units

9. Course Distribution by Semester

PART 1

HARMATTAN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
CHM 101	Introductory Chemistry I		3-1-0	4
CHM 103	Experimental Chemistry I		0-0-3	1
MTH 101	Elementary Mathematics I		4-1-0	5
PHY 101	General Physics I		3-1-0	4
PHY 107	Experimental Physics IA		0-0-3	1
TPD 101	Engineers in Society		1-0-0	1
AER 101	Basic Communication in French I		1-0-0	1
AER 103	Earth & Space Physics		2-0-0	2
SE	Special Electives		4-0-0	4

TOTAL	18-3-6	23
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RAIN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER104	Basic Communication in French II	AER 101	2-0-0	2
CHM 102	Introductory Chemistry II		3-1-0	4
CHM 103	Experimental Chemistry II		0-0-3	1
MTH 102	Elementary Mathematics II		4-1-0	5
MTH 104	Vectors		2-0-0	2
PHY 102	General Physics II		3-1-0	4
PHY 108	Experimental Physics IB		0-0-3	1
SE	Special Electives		4-0-0	4
TOTAL			18-3-6	23

PART 2

HARMATTAN

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 201	French for Engineers I	AER 104	1-0-0	1
AER 203	Introduction to Aerospace Systems I		1-0-0	1
CHE 201	Engineering Thermodynamics		2-1-0	3
CSC 201	Computer Programming I		2-0-3	3
EEE 201	Applied Electricity I	PHY 102	2-0-0	2
EEE 291	Applied Electricity Lab I		0-0-3	1
MEE 203	Engineering Drawing I		1-0-3	2
MEE 205	Engineering Mechanics I		2-1-0	3
MSE 201	Elements of Engineering Materials		2-0-3	3
MTH 201	Mathematical Methods I		3-1-0	4
TOTAL			16-3-12	23

RAIN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AEE 202	Workshop Practice		1-0-3	2
AER 202	French for Engineers II	AER 201	2-0-0	1
AER 204	Introduction to Aerospace Systems II	AER 203	1-0-0	1
CSC 208	Computer Technology	CSC 201	1-0-3	2
CVE 202	Strength of Materials	MEE 205	2-0-3	3
EEE 202	Applied Electricity II	EEE 201	2-0-0	2
EEE 292	Applied Electricity Lab. II	EEE 291	0-0-3	1
MEE 204	Engineering Drawing II	MEE 203	1-0-3	2
MEE 206	Engineering Mechanics II	MEE 205	2-1-0	3
MTH 202	Mathematical Methods II	MTH 201	3-1-0	4
SE	Special Elective		2-0-0	2
TOTAL			17-2-15	23

LONG VACATION

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 200	Student Work Experience Programme (SWEP)		0-0-9	3
TOTAL			0-0-9	3

PART 3

HARMATTAN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 301	Aircraft Materials and Spacecraft Structures	MSE201	2-0-0	2
AER 303	Aircraft Flight Principles I		1-0-3	2
AER 309	Manufacturing Processes	AEE 202	1-0-3	1
CHE 305	Engineering Analysis I	MTH 202	2-1-0	3
EEE 303	Electrical Machines I	EEE 202	2-0-3	3
MEE 301	Machine Drawing	MEE 204	0-0-3	1
MEE 303	Fluid Mechanics I	MEE 205	2-0-3	3
MEE 305	Mechanics of Machines I	MEE 206	2-0-0	2
MEE 307	Applied Thermodynamics	CHE 201	1-1-0	2
MEE 395	Mechanics of Machines Lab. I	MEE 206	0-0-3	1
SE	Special Elective			2

TOTAL		13-2-18	22
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RAIN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AEE 302	Statistics for Engineers		2-0-0	2
AER 302	Aircraft Flight Principles II	AER 303	2-0-0	2
AER 304	Aircraft Structural Analysis	CVE 202	2-0-0	2
AER 306	Computational Fluid Dynamics	MEE 303	2-0-3	3
CHE 306	Engineering Analysis II	CHE 305	2-1-0	3
MEE 304	Fluids Mechanics II	MEE 303	2-0-0	2
MEE 306	Mechanics of Machines II	MEE 305	2-0-0	2
MEE 308	Mechanical Measurements and Instrumentation	EEE 202	1-0-3	2
MEE 312	Control Systems	MEE 305	2-0-3	3
MEE 394	Fluids Mechanics Lab.	MEE 303	0-0-3	1
MEE 396	Mechanics of Machines Lab. II	MEE 395	0-0-3	1
TOTAL			17-1-15	23

LONG VACATION

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 300	Student Industrial Work Experience Scheme (SIWES) I		0-0-9	3
TOTAL			0-0-9	3

PART 4

HARMATTAN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 401	Airframe Design	AER 309, MEE 301	2-0-3	3
AER 403	Aircraft Structural Integrity	AER 304	2-0-0	2
AER 405	Aircraft Aerodynamics	AER 303	2-0-3	3

AER 407	Computer Aided Manufacturing	MEE 204, MEE 301	2-0-2	2
AER 409	Computing and Numerical Analysis	CSC 208, CHE 306	1-1-0	2
AER 411	Aviation Law		2-0-0	2
CVE 401	Technical Report Writing		2-0-0	2
MEE 403	Heat Transfer	MEE 307	2-0-0	2
MEE 407	Mechanical Vibrations	MEE 306	2-0-3	3
MEE 493	Heat Transfer Lab	MEE 304	0-0-3	1
TOTAL			17-1-14	22

RAIN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 400	Student Industrial Work Experience Scheme (SIWES) II		0-0-9	9
TOTAL			0-0-9	9

PART 5

HARMATTAN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 501	Aircraft and Spacecraft Aerodynamics I	AER 405	2-1-0	3
AER 503	Flight Controls & Dynamics	AER 405	2-0-0	2
AER 505	Aerospace Vehicle Design I	MEE 302, MEE 307	2-0-3	3
AER 507	Aircraft Performance	AER 405	2-0-0	2
AER 509	Propulsion and Turbo-machinery	MEE 307, MEE 306	2-0-3	3
AER 511	Final Year Project I		0-0-9	3
AER 513	Air Transport Management		2-0-0	2
TPD 501	Industrial Economics		2-0-0	2
TOTAL			14-1-15	20

RAIN SEMESTER

COURSE CODE	COURSE TITLE	PRE-REQUISITE	L-T-P	UNITS
AER 502	Aircraft and Spacecraft Aerodynamics II	AER 501	2-1-0	3

AER 504	Avionics Systems Engineering	AER 405, MEE 308	2-1-0	3
AER 506	Aerospace Vehicle design II	AER 505	2-1-0	3
AER 508	Computational Mechanics	AER 409	2-0-0	2
AER 510	Aircraft Maintenance Management	AER 401, AER 507	2-0-0	2
AER 512	Final Year Project		0-0-9	3
AER 514	Production Management & Reliability		2-1-0	2
AER 516	Energy Resources for Aerospace Industry		1-0-0	1
TPD 502	Technology policy		2-0-0	2
TOTAL			15-4-9	21

10. Course Content/ Description

AER 101: Basic Communication in French I (1 unit)

The course is an introduction to the French language for beginners. Emphasis will be laid on the rapid acquisition of oral competence through the basic communication skills. Students will be taught using video based communicative approach. At the end of the course students will be expected to be able to speak and understand basic French language.

AER 103: Earth & Space physics (2 units)

Basic concept of earth and space physics as a medium of aircraft motion:

Evolution process on the forming of the earth, earth motion and geometry, earth atmosphere layer and field, earth gravitational and electromagnetic field.

Global navigation satellite systems and different types of Altitudes.

Phenomena that happen in earth atmosphere which are related to aeronautics like wind, weather and air turbulence.

Aircraft and Spacecraft operation limitation when operating in earth atmosphere field (flight envelope) will also be introduced in this lecture.

AER 104: Basic Communication in French II (2 units)

This course is a continuation of ASE 101. At the end of the course students are expected to be able to read, understand and write simple French passages. Conscious effort will be made to develop the vocabulary of the students.

AER 201: French for Engineers I (1 unit)

Introduction to the acquisition of language skills required for various purposes as well as the understanding of scientific, technical and engineering write-ups in French. Documents from different engineering related disciplines are to be considered for use in class. The course will be adapted especially to the need of aeronautic engineering students.

AER 202 French For Engineers II (2 units)

This course is a continuation of ASE 201. At the end of the course students are expected to be able to read, understand and write basic engineering write-ups and reports in French. They are expected to be able to translate basic engineering materials.

AER 203: Introduction to Aerospace System I (1 Unit)

Overview of Aerospace Engineering Industry, Differing Job Roles for Aerospace Maintenance Staff, Training Opportunities and Job Progression, License, Examination, Qualification, Airworthiness Regulation, Aircraft Maintenance, Safety Culture.

AER 204: Introduction to Aerospace System II (1 Unit)

Introduction to Aerodynamics, Review of Atmosphere Physics, Elementary Aerodynamics, Flight Forces, Aircraft Loading, Flight Stability and Dynamics, Aircraft Control and Controllability.

AER 301: Aircraft and Spacecraft Materials (2 Units)

Materials properties and selection for aircraft structures. Survey of available materials and +properties availability, fabricability. Basic mechanical requirements and materials selection. Materials selection maps.

High strength steels: steels for shafts, gears and undercarriages. Types, heat treatment and properties.

Aluminium alloys: wrought aluminium alloys. 2xxx and 7xxx series and Li containing alloys, heat treatment and properties.

Titanium alloys: types, properties and applications. Emergent materials: metal matrix composites and hybrid laminates, types, properties and applications.

Yield criteria and stress strain behavior: Yield criteria, work hardening, necking and superplasticity; effects of temperature and strain rate. Reversed plasticity, shakedown and low cycle fatigue.

Fatigue: Mechanism of fatigue failure, crack initiation and growth. S-N curves, effect of mean stress, stress concentration, stress rate, cumulative damage.

Fracture: introduction to linear elastic fracture mechanics, application to Paris law of fatigue crack growth rate, fracture toughness in plain strain and plain stress.

Creep: nature of creep deformation and fracture, relation between stress, creep rate and temperature, correlation of creep data by Larson-Miller parameter.

Oxidation and corrosion: electrochemical principles of oxidation and corrosion, anode and cathode reactions. Corrosion in metals and alloys, localized corrosion, stress corrosion and hydrogen embrittlement.

Review of Mechanical, physical and other properties of the various material classes including metals, polymers, ceramics, composites and sandwiches. Focus on composites; processing, applications, issues, failure criteria and fracture. Highlight the new developments in materials engineering.

General methodology to materials selection (Ashby methods) and the formulation of merit indices. Consider the effect of shape, environment and the use of penalty functions for materials selection.

Presentation of a range of case studies over different materials types and industrial sectors. Materials issues in industrial design. Failure analysis and prevention.

AER 303: Aircraft Flight Principles I (2 Units)

Review of underlying concepts: newton's laws, isa and imperial engineering systems of units, hydrostatic, pressure manometry, work, energy, vector addition and resolution forces on an aircraft (regarded as a particle) in non-accelerated flight. Nature of aerodynamic force: pressure and viscous force, definitions of lift and drag, concept of an aerofoil lifts; drag ratio, glide angle coefficients of lift and drag, calculation of properties of the international standard atmosphere: use of isa tables in isa and imperial engineering units.

AER 309 Manufacturing Process (1 unit)

Fabrication Processes: Sheet metals: bending, pressing, drawing, spinning, stretch-forming etc., material limitations and tolerances; super-plastic forming and diffusion bonding; chemical etching; extrusions; forging and casting methods; integral machining; numerical control of machining, riveting etc.

Joining Methods: welding, tungsten, inert gas, electron beam, laser; adhesive bonding surface pre-treatment, autoclave techniques, adhesive behaviour; relative cost of various processes and dependence on component size.

Non-destructive testing, monitoring, inspection and repair methods for metals and composites in service. Extensive use will be made of films to illustrate the above.

Fibre composites: Typical Properties; hand lay-up and automated techniques for flat and cylindrical components; laser and water-jet cutting; moulding techniques (open and closed mould); specific methods used by selected aircraft builders. Applications; reasons for selecting composites.

AER 302 Aircraft Flight Principles II (2 Units)

Altitude and rate of climb measurement: static, dynamic and total pressure, Bernoulli's incompressible. Principle applied to air speed measurement using both pitot-static and venturi methods: air speed indicator, indicated (ias), equivalent (eas) and true air speed (tas), knots, principle of the gyroscope and basic flight instrumentation: basic concepts of classical aerodynamics for incompressible flow, using the 2-d circular cylinder model : significance of inviscid assumption and incompressible approximation: the use of the continuity principle to provide surface velocity distribution, the link between surface velocity and pressure distribution, symmetrical velocity and pressure distributions, and alembert's paradox, viscosity (dynamic and kinematic), boundary layer (qualitative treatment); characteristics of laminar and turbulent Boundary Layer Velocity Profiles; skin friction (including simple calculations). Form and profile drag: cause and nature of boundary layer separation and methods, effect of delaying separation. Lift: concept of circulation; magnus effect; 2-d aerofoil as a lifting, vortex, importance of sharp trailing edge. Aerofoil terminology and characteristics (based on naca conventions), leading edge. Trailing edge and deep stalls; causes, effects and means of recovery, incipient spin. Lift augmentation; requirement for lift augmentation, lift curve, extension methods; camber-enhancing methods.

AER 304 Aircraft Structural Analysis (3 Units)

Analysis of thin walled structures: bending, shear stress distribution, shear centre, torsion of single and multi-celled sections, combined bending and torsion, idealized section analysis. Introduction to energy methods: unit load method, strain energy. Principle of virtual work, Castigliano's theorems, application to deflection problems, statically indeterminate structures buckling: buckling of struts, buckling of thin plates, use of energy methods for calculating buckling loads in columns, buckling of sheets in shear and end loads. Introduction to aircraft composite structure: introduction of carbon fiber composites, other types of composite, overview of manufacturing process, basic method of stress analysis, mechanical properties and applications in the aircraft industry.

AER 306 Computational Fluid Dynamics (3 Units)

Introduction governing equations conservative/integral form. Reduced models and range of applicability and limitations.

Classification of model equations: (Elliptic, parabolic and hyperbolic) and their relation to fluid problems. Construction of model, 1D problems (linear advection-diffusion equations).

Construction of Basic Numerical Schemes: Finite Differences (FD), Finite Volume (FV) and Finite Elements (FE).

Analysis and solution of finite difference schemes: order, truncation error and consistency of a scheme using Taylor expansions. Solution of algebraic systems (direct and basic iterative methods).

Explicit and implicit time integration. Courant-Friedrichs-Lewy condition and diffusive time step restrictions. Lax theorem: consistency, stability and convergence. Von Neumann linear analysis for stability and dispersion/diffusion properties.

Non-linear conservation laws: 1D theory. Examples of (1D) hyperbolic conservation laws. Characteristics. Discontinuities and jump conditions. Weak solutions and entropy condition. Linear versus non-linear advection.

Systems of conservation laws: Jacobian matrices, linearized equations, conservative and characteristic variables. Rankine – Hugoniot jump conditions. Entropy condition for systems (Lax).

Boundary Conditions.

Numerical representation of discontinuities: requirements on numerical schemes. Conservative discretisation: Lax-Wendroff theorem. First versus second order schemes. Representation of discontinuities: physical aspects, shock fitting/capturing.

Numerical schemes for non-linear conservation laws: one-step and two-step Lax Wendroff, MacCormack predictor-corrector. Artificial dissipation. Upwind schemes: flux vector and flux difference splitting. Monotone schemes: Godunov and Harten theorems. Exact and approximate.

Riemann solvers. High – order upwind schemes: the TVD property. The construction of TVD scheme using slope and flux limiters.

Numerical schemes for multi-dimensional problems: finite differences and finite volume. Computational domain and boundary conditions. Discretization of viscous terms.

CFD Code Validation and Assessment: A practical guide.

AER 401 Airframe Design (1 unit)

Design to civil and military airworthiness requirements. Use of flight envelope to demonstrate interaction between design, aerodynamics and stress. Conceptual design of major structural assemblies.

Synthesis of two-dimensional and three-dimensional mechanisms: flaps, undercarriages, aileron, swing wing etc.

Detail design of fatigue prone components such as root fittings, spar boom splices, windows etc. Production assembly and maintenance considerations discussed where relevant. Practical fail safe and safe life design.

Survey of data sources: AGARD material properties, ESDU data sheets relating to structural strength, stability and fatigue.

A number of lectures will be devoted to structural design aspects of the Group Design project. Identifying Problem Requirements, Generating and Evaluating Design Concepts, Design and Fabrication, Design Control Software. Testing and Debugging of Systems. Documentation of Design and Results.

Occasional lectures may be given by visitors from industry.

AER 403 Aircraft Structural Integrity (2 Units)

Non destructive testing methods of detecting cracks in materials: Oil and chalk, dye and fluorescence method, ultra-sonic method, eddy current method, electro-magnetic flaw detection method. Linear Elastic Fracture Mechanics (LEFM): Aircraft material properties data, significance of a fracture mechanics, modes of failure, Griffith energy balance approach, Irwin's stress intensity approach, fracture toughness as a function of materials thickness, stress distribution at the crack tip. Von Mises Field Criterion, plastic zone radius and correction, fracture toughness testing using compliance method, plane strain and plane stress conditions at the crack tip, crack resistance concept and derivation Fatigue: fatigue loading cycles, Aircraft loading spectrum, limit load, effect of stress concentration, typical aircraft materials S-N curves, miner's cumulative damage rule, low cycle fatigue, fatigue incubation concept, fatigue crack propagation (FCP), Paris equation, fatigue life estimation, analysis of factors affecting fatigue strength of the aircraft structures, fatigue fractography. Creep: creep crack growth, stress-rupture test, structural changes during creep, low temperature creep, concept of

Power distribution systems and means for system emergency provision. Circuit protection fuses, circuit breakers, cut out relays, over voltage protection of both AC and DC generating systems. Aircraft Motors and Actuators: principle of operation, construction, control and Actuators: Principle of operation, construction, control and protection of DC/AC motors including, induction, synchronous, stepper and multi-phase cage motors: linear and rotary actuators. Aircraft application of motors and actuators.

ASE 405 Aircraft Aerodynamics (3 Units)

Introduction to boundary layer: boundary layer transition, dynamic similarity, reynolds number, force and moment scaling and scale effect, critical Reynolds numbers, transition, fixing boundary layer; boundary layer analysis; velocity profile modelling; displacement thickness; effective body;

momentum thickness; relationships between skin friction coefficient, boundary layer thickness and local results, normal shock relations; quasi –i-d flow; variable area stream tube, propelling nozzles, pitot intakes, supersonic airspeed measurement. Underlying principles of lift: lift reduction, down force generation and drag reduction in road vehicles, wing planform considerations (qualitative only), 3-d lifting line model, principle of biot-savart’s laws, stalling and platforms: structural and stalling characteristics of rectangular, elliptical, tapered, swept-back and swept-and-tapered wing, tip-stalling solutions. Leading edge vortices. Characteristics of forward swept wing, gust response to step input, dependence on aspect ratio, sweep – back wing, loading and flight condition.

AER 407 Computer – Aided Manufacturing (2 Units)

Computer aided manufacturing: operation and sequence planning, machine definition, nc sequences, post processing. Finite element analysis: mesh types constraints, loads processing, interpretation of results. Data transfer: iges, step, dxf, product data management: overview of the role of pdm and research through ‘case studies’ rapid prototyping, overview of methods and applications, manufacturing techniques.

AER 409 Computing and Numerical Analysis (2 units)

Advanced matlab programming: arrays and matrices. M-files. Functions. Input and output. Graphics, improving code efficiency.

Brief introduction to: computer arithmetic. How numbers are manipulated and stored in a computer and the implications to numerical computations.

Root finding of non-linear equations: bisection method, newton-raphson method for functions, and newton’s method of multi-dimensions. Numerical solution of ordinary differential equations (odes) classification: initial-value problems (ivp) and boundary-value problems (bvp). Numerical solution of ivp: taylor series and runge-kutta methods, accuracy, convergence and stability analysis. Numerical solution of bvp: shooting method and approximation by finite differences (fd). Application of the method of fd to linear and non-linear bvp.

Finite differences for partial differential equations (pdes) (introduction only): types of equations, up winding for hyperbolic equations.

Interpolation: Lagrangian polynomials, Runge phenomenon. Spine interpolation.

Integration: introduction to general methods of numerical integration (Gaussian quadrature). Numerical integration of functions with singularities.

AER 411 Aviation Law (2 units)

This course covers general law and foundations of law. The course will also examine the major international law rules and case law that govern the carriage by air of passengers, baggage and

cargo. The course focuses on the laws that determine liability in the event of an air ‘accident’ involving injury to or assault of passengers, or where damage to or loss of cargo or baggage occurs. The course includes a close examination of the Montreal, Chicago, Rome and Warsaw Conventions and topical issues such as aviation security, Deep Vein Thrombosis, DVT claims and incidents of air rage.

AER 501 Aircraft Spacecraft Aerodynamics 1 (2 units)

Introduction: The need for numerical methods. Equations of motion: derivation of 3D, incompressible, Navier Stokes equations. Reynolds stresses. Review of small perturbation theory: hierarchy of small disturbances. Numerical solution of incompressible, potential flow. Effects of thickness and camber.

Surface singularity methods. Surface source method (A.M.O. Smith).

Introduction to boundary layers: the thin-shear-layer, approximation. Blasius solutions Laminar.

Thwaites’ approximate method. Turbulent boundary layers, Reynolds stresses, the concept of eddy-viscosity, the law of the wall.

Lifting line theory: wings of large aspect ratio: basis of theory for wings of finite span. Downwash and induced drag. Prandtl’s theory. Use of lifting line theory: solution method. Elliptic loading. Solutions for general planforms- collocation and iteration methods.

Swept wings in incompressible flow. Introduction to Kuchemann’s index method: modifications to lifting-line theory to account for the effects of sweep. Comparison with/without sweep: the use of taper.

Separated flow and stall.

Slender wing theory: wings of small aspect ratio. Definition of a slender wing or body. Classical attached flow theory: Separated flow on slender wings.

ASE 503 Flight Control and Dynamics (3 Units)

Flight dynamic: aircraft response and stability: concept of state and dynamics stability in translational and rotational systems. Conflicting requirement of aircraft stability and control. Definition and conventions of stability axes and of kinematic parameters. Flight speed stability. And the total drag curve. Longitudinal trim and state stability equation and analysis. Centre of pressure. Aerodynamic centre. Trim drag conventional tailplane. Tail-less and canard aircraft compared. Relaxed static stability, lateral and directional static. Effects of dihedral, sweepback. High keel and fin surface. Wing-fuselage junction height and wing shielding. Description of the short period pitching oscillation. Rhizoid heading mode. Dutch roll and spiral dive mode in terms

of physical cause and effect using the terminology of aerodynamic derivatives and inertia terms of physical cause and effect using the terminology of aerodynamic derivatives and inertia terms aircraft control and response. Uses and abuses of conventional controls- ailerons, rudder and elevator control problems and limitations. Low dynamic pressure, compressibility flutter control in the normal plane of symmetry. Elevator angle stick force to trim. Use of elevator and throttle. Tabs and other devices for trimming aircraft handling. Gust alleviation, active flutter suppression and autopilot concepts.

Aircraft Control: Concepts in Control open and Closed-Loop Systems. Accuracy and Stability, Examples – Electric Motor and Engine Speed Control Governor. Temperature Control and Servomechanism (position Control). Differential Equation Models. The Laplace Transform. Transfer Functions, Block Diagrams and Signal Flow. Definition of terms for closed-loop systems, Controls Variable Response: Time Response of Typical Control Systems. Accuracy and Stability. Servomechanism Step Response with variable damping. Natural Frequency and damping Ratio. Viscous and Coulomb Friction Damping. Undamped Response, Use of Velocity Feedback Damping. Proportional-Plus-Derivative Control for Servo Stability Proportional-plus-integral for accuracy of typically Speed Control force. Balance Accelerometer. Aircraft Control and Response: Longitudinal, Lateral and Yaw Control and Response Equations for small Perturbations about Aircraft Axes, Power Control Units and their Interfacing, rate Gyro Sensors, Explanation and analysis of Auto-stabilization Systems, Pitch Rate and Roll Rate Command Loops, Use of Control Laws in these loops.

AER 505 Aerospace Vehicle Design I (2 Units)

Design process and tools: Description of all the aircraft project development phases, with particular emphasis on the design process and tools.

Aerospace vehicle types and roles: standard classifications of aerospace vehicle types and role definitions.

Design and use of aeronautical maps and charts.

Design criteria and constraints; role-specific, aircraft properties, practical and environmental constraints.

Airworthiness requirements and standards; an overview of existing civil airworthiness requirements and military standards, highlighting items which influence the initial design and operational safety of a new aircraft.

Design target Specification: Essential contents and detailed explanations.

Baseline configuration development: design advantages and disadvantages of the possible arrangement and relative location of major aircraft assemblies for both conventional and unconventional configurations, with emphasis on operational effectiveness, safety and sustainable development.

Initial sizing process: fight profile based estimation of weight target values for maximum take – off, empty aircraft, fuel and payload.

Powerplant Selection: Engine types, selection criteria, design point based sizing and selection. Alternative fuel considerations.

Powerplant-airframe integration: intake and nozzle design, installed performance estimation. Powerplant noise reduction technologies. Safety design criteria.

Systems packaging: aircraft systems operation and installation requirements, including redundancy design, reliability targets and assessment methodologies.

Fuselage design: Design procedure and criteria, external shape optimization, cabin, cockpit and cargo hold layouts, including design provisions for safety and emergency evacuation.

Flying surface design: aerofoil selection, design point sizing, geometric definition. High-Lift device selection and design; types, applicability, design characteristics, selection criteria and sizing. Device complexity, drag and noise considerations.

AER 507: Aircraft Performance (3 Units)

Introduction, review of aircraft aerodynamics: pressure plots, lift curves, drag polars, wing downwash, and wing sweep. Climb and descent: climb path force analysis, rate of climb, time to climb, non-accelerated and accelerated climb. Take-off and landing estimation: take-off run estimation – including ground and airborne distance, airborne-transition before and after the screen height. Landing distance estimation, in terms of the flare angle and distance to touch-down. Turning performance: banked turns, load factor, turn rate, limitations, and turning performance. Engine selection: number of engines ratings, turbojet engine. Sizing, propeller propulsion system characteristics: turbofan, turbo-prop, piston propulsive characteristic including specific fuel consumption; power characteristics and propulsive efficiency, thrust efficiency and altitude limitation. Cruise performance and optimization: fuel flow rate, true airspeed, equivalent airspeed, specific range, specific endurance, breguet range and endurance equations. Introduction to helicopter performance: momentum theory in hover, vertical and forward flight, azimuth angle and rotor blade relative velocity. Performance in hover, vertical and forward flight, maximum

theory in requirements. Introduction to aircraft design: aircraft purpose and payload, cruise and maximum speed, normal cruise altitude; range and endurance. Take-off and landing distance estimation and cost of purchase: preliminary estimate of take-off and weight: fuel fraction estimates and take-off weight analysis.

AER 509 Propulsion and Turbomachinery (3 Units)

Introduction to aircraft propulsion.

Gas turbine cycle; review of the Brayton Cycle. Effects of component losses: compressor and turbine losses, combustion chamber losses, mechanical losses. Cycle calculation: design point calculation.

Combustion: air-fuel ratio and heat output, combustion efficiency.

Aircraft Engines: Jet propulsion; propulsion efficiency, overall efficiency. Intakes: subsonic and supersonic intakes, intake efficiency. Tailpipes and nozzles: efficiencies, tailpipe nozzle choking condition. Method for presenting the performance of engines. Twin spool and fan engines; mechanical layout, definition of bypass ratio, combination of the bypass and core engine components, fan performance, overall performance.

Reheat: description of components, analysis of effect on engine performance.

Compressors: Introduction: types of machines, stators and rotors, description of mechanical arrangements. Aerodynamics of axial flow machines: cascade theory, notation, flow through cascade, lift and drag, efficiency, aerodynamic performance of blade sections. Pitch line design of a compressor stage: assumptions, repeating stages, reaction, flow angles in fixed and moving frames of reference.

Performance of compressor stage: stage loading and flow co-efficients, their relationship to flow angles, influence of value of the design point reaction on loading/flow co-efficients. Performance of a real stage: losses and efficiency, operating characteristics, surge limit and maximum efficiency, complete compressor characteristic. Sample calculation.

Introduction: operational principles, facts and figures, engine type, engine-station designation, efficiencies, thermodynamic relations.

Global thermodynamic analysis of gas-turbine cycles-A Revision: intake and exhaust nozzles, simple generic cycles for turbojet and turbofan engines.

Engine components: operational aspects of fan, axial core-compressor, radial compressor and turbine, mean-line analysis of blading, combustor characteristics and design:

Three-dimensional aspects: origin and nature of 3D features in blade passages, radial equilibrium analysis and application to radial flow-angle distribution in compressor and turbine geometries. Non-dimensional engine-variable groups and related component matching: definition of groups and their meaning, use in matching the operation of components.

Heat transfer: relevance to cooling, the energy equation, conduction, convection, global heat-transfer correlations.

Rocket Propulsion: Liquid, solids and hybrid propellants. Consideration of nozzle flows, propellant feed, thermo chemistry, real gas effects, heat transfer, combustion and structural constraints. Velocity requirements, velocity increments and staging for rocket flight. Applications of rocket propulsion.

AER 513 Air Transport Management (2 Units)

Introduction to Transport: General characteristics of supply and demand. The Air transport Industry: structure of the Industry, specific characteristics of air transport, organizational roles, hardware operating considerations, freight operations, client base, passenger perceptions and expectations, trend monitoring, international organizations and competitions. Airline Organisation: Ownership, organization structures, buying versus leasing airframes, the market for air transport. Merges and alliances, code-sharing franchising, route networks. The Legal and regulatory Framework; organizations and conventions; international law and agreements, air safety, economic regulation and deregulation. Aircraft Operation: Structural and operational limitations, flight planning, flight operations, slot allocation issues. Air Traffic Control: regulations, safety considerations, use of emerging technology, airline involvement and other current issues. Aircraft Movements and airfield Safety Considerations; Effects of terrorism, unruly passengers and the need for increased security, on airline operations and planning Strategic planning: budgeting and forecasting, investment planning, performance measurement Customer Service; Standards, requirements, communications, care loyalty and marketing.

AER 502 Aircraft and Spacecraft Aerodynamics II (2 units)

Governing equations. Normal and oblique shock waves. Prandti-Meyer expansion waves. Shock expansion theory. Method of characteristics. Unsteady jump conditions. Characteristic equations and compatibility conditions.

Examples: simple and non-simple regions. Shock tube problem. Steady 2D irrotational isentropic flow. Governing equations. Characteristic lines. Compatibility conditions. Example: nozzle design. Aerodynamic analysis methods for compressible flow.

Introduction: characteristics of flight at different regimes. Small perturbation analysis for isentropic irrotational flows. Governing equations. Boundary conditions. Linearised pressure coefficient. Similarity rules for 2D aerofoils (infinite wing). Prandti-Glauert rule. Critical Mach number. Other similarity relations: Karman-Tsien, Laitonde. Aerofoils in supersonic flow: Ackeret's rule. Spreiter's rule for transonic flow. Similarity rules for 3D wings (finite wing). Gothert's rule (subsonic/supersonic). Critical Mach number for swept back wings. Transonic wings (geometry only). Area rule for wing/body combinations. Numerical solution of the TSP equation.

Review of approximation by finite differences. Numerical solution of the Laplace and wave equation. The method of Murman and Cole for the TSP equation.

Bluff-body aerodynamics: mainly steady flow around 2D and 3D obstacles, separation from sharp edges and continuous surfaces. Unsteady flow around fixed 2D bluff bodies, in particular circular and rectangular cylinders. Flow stability and effect of Reynolds number. Vortex shedding and wake flow. Variation of force coefficients and Strouhal number.

Fluid-structure interaction: causes of flow-induced vibration. Equation of body motion, fluid inertia and fluid damping. Vortex shedding response and lock – in, spanwise correlation. Galloping and flutter. Buffeting and effect of turbulent onsent flow.

Wind flow and building aerodynamics: The structure of the neutral atmospheric boundary layer and the nature of strong winds. General principles of wind flow around buildings for pedestrian comfort and loading

Stratified flow: Buoyancy force, Hydrostatic approximation. Wave propagation on sloping beaches. Hydraulic in river flows. Deep water waves, dispersion. Boussinesq approximation. Internal gravity waves, group and phase velocity. Wave emission by flow over mountains.

Rotating Flow: Dynamical equations in a rotating frame. Rotating shallow-water equations. Geostrophic balance. Interpreting isobars and winds on weather maps. Hurricane dynamics. Quasi-geostrophic equations. Rossby waves and propagation of large scale atmosphere and ocean structures. Geostrophic adjustment.

AER 504 Avionic System Engineering (2 Units)

The role of avionics and the avionic environment; weight, temperature, vibration, high 'g', electromagnetic compatibility. Head-down, Head-up, and Helmet-mounted displays. Air data systems. Sensors, data acquisition and computing. Inertial sensors and systems. Dynamically-tuned gyroscope, use in the stable platform and in the torque balance rate gyro. Ring-laser and fibre-optic gyros. Force-balance accelerometer. Operation of attitude/heading reference systems.

Navigation Systems. Navigation by dead reckoning. Air data base. Doppler/heading reference, inertial navigation system and Doppler/inertial navigation system. Navigation by position fixing.

Radio navigation by VOR/DME and TACAN Hyperbolic radio navigation by LORAN C, OMEGA, AND DECCA. Satellite navigation by GPS and GLONASS. Terrain reference navigation systems. Airborne computers data-bases. Electrical Power-Direct Current Power Supplies: Aircraft generator principles, characteristics, outputs and construction.

Regulation and control of generator outputs including paralleling, load sharing and voltage control. Aircraft batteries, battery systems and charging. Alternating Current Power Supplies: Review of fundamental principles of single phase and three-phase AC. The aircraft three-phase generator characteristics, outputs and construction; star and delta interconnections, real and apparent power. Frequency wild and constant frequency generator systems; voltage regulation and load-sharing. Power Conversion, Distribution and Control; Principles and construction of aircraft, rectifiers, and transformers, rotary and static inverters. Typical external and auxiliary power and their interconnection into main power distribution system; typical twin and four-engine activation energy for steady state creep, high temperature creep, Analysis of the main factors affecting creep behavior of the aircraft structures.

AER 506 Aerospace Vehicle Design II (3 Units)

Flight control surface design: direct and mixed modes, control surface geometry, sizing, deflections adverse effects, reversal and oscillations.

Undercarriage layout and design: Optimum layout, ground stability, single – wheel and bogie arrangement, loads, tire characteristics and selection, LCN and wheel spacing calculations, strut and absorber sizing, brakes, steering and retraction. Gear complexity, drag and noise considerations.

Aerodynamic analysis: Estimation of the overall aircraft aerodynamic lift and drag characteristics, including high-lift and aerodynamic centre changes. Aerodynamic efficiency optimization. Structural layout, loads and aero elastics: Major structural component layout, optimum load paths, materials and aero elastic criteria, fall-safe design and safety factors.

Weight and balance estimations: Aircraft weight breakdown prediction, CG and CG shift. Weight reduction and weight growth management techniques.

Stability and Control, handling qualities; neutral point and static margin calculations, trim analysis, lateral stability requirements and aircraft handling quality assessment.

Performance estimation: Field, mission and point performance estimation. Energy methods for minimum fuel consumption and range optimization policies.

Cost: Cost drivers and cost reduction techniques.

Optimization process: purpose and overview of available methods.

AER 508 Computational Mechanics (2 Units)

Linear Mechanics

Formulation methods: Governing equations, virtual work, potential energy and associated variational techniques e.g. Hellinger-Reissner, illustrated using 1D element modeling.

Isoparametric elements: eight node isoparametric plate element revisited. This will be followed by the formulation of an eight node bending element leading to an elementary shell element.

Kinematically equivalent loading: representation of in-plane, edge and normal loading using their principle of kinematic equivalence.

Modelling strategies: builds on strategies introduced in the ANE403 Finite Element course to develop effective finite element models.

Non-Linear Mechanics

Geometric non-linearity via truss elements: out of balance force vector, tangent stiffness matrix, shallow truss theory, Green – strain approach, buckling.

Basic Solution procedures: incremental, Newton-Raphson, modified Newton-Raphson, initial stress.

Total and updated Lagrangian formulations for truss elements.

Finite elements and plasticity yield formation, flow rules, hardening, forward Euler procedure, sub-increments, backward Euler procedure, consistent tangent.

Eigenvalue analysis

Buckling analysis: determining the buckling load and corresponding mode shape using eigenvalue analysis.

Dynamic analysis: determining the natural frequencies and corresponding modes for a vibrating structure using eigenvalue analysis.

Boundary element method

An introduction to the boundary element method: Overview of the boundary element method, main difference from the finite element method. Boundary element method for 2D potential problems: derivation of the boundary element method, fundamental solutions, discretisation strategy, infinite and semi-infinite regions. Boundary element method for 2D elastostatic problems; derivation of the boundary element method, fundamental solutions, evaluation of boundary and interior stresses.

Boundary element method for 2D acoustic problems: derivation of the boundary element method, fundamental solutions, eigenvalue analysis.

AER 510 Aircraft Maintenance management (2 units)

Maintenance Programmes: Requirement and purpose of maintenance. Maintenance Review Board and MSG-2 and 3 logic applied to aircraft systems, power plant and structures, Hard-time, On condition and Condition Monitored Maintenance. Data collection, component history and statistical information sources. Reporting procedures, occurrence reporting and corrective action methodology. Minimum equipment list and acceptable differed defects. Production of maintenance schedules and programmes. Aircraft maintenance and Reliability: Airworthiness requirements and documentation. Safety standards and safety assessment, including reliability assessment. Failure modes and failure analysis. Reliability mathematics directly associated with aircraft maintenance. Predicting system, engine and structural reliability and effect on reliability of scheduled and non-scheduled maintenance. Reliability and economics. Maintenance Planning and Scheduling: maintenance facilities. Provisioning and supply systems. Maintenance tasks, Task development and analysis, downtime, repair, replacement, rectification and modification. Use of project planning methods such as CPM, PERT and computer programmes, to allocate timely physical and human resources. Special considerations when planning and scheduling maintenance for geriatric aircraft. Technological aids to maintenance. Future of aircraft maintenance, third party maintenance, whole life maintenance packages.

Human Factors in Aircraft Maintenance: Effect on maintenance planning of human performance and limitations. Analyzing human errors in aircraft management, case studies, and safety considerations investigation of the SHELL and reason models of human interaction. Production of a management plan, designed to limit human error in the execution of aircraft maintenance activities.

AER 514 Production Management and Reliability (2 units)

Materials and information flows within a company; providing practical experience for all employees involved in lean production projects, inventory minimization as an important basis for increased productivity, the principle of pull production control, advantages compared to conventional production control methods, types and function of different pull production control methods, application of methods, Kanban – the classic pull principle. Introduction to Value Stream Mapping (VSM). Lean manufacturing, flow production, throughput time and inventories while increasing flexibility, analysis of workplaces with the Standard Operation Sheet, adjusting the cycle times of individual workplaces, flow and takt time production, avoidance of material transport with linear and U layouts, Structure and development of open plan production, Line back system, integration of logistic processes with Kanban, flexible employee systems; relay and caravan systems, multi machine operations. Quality control.

Principle of Quality: Product quality, Statistical quality control; and Combination of Probabilities. Principles of Reliability: The meaning of reliability; Practical Reliability Definition; The meaning of Availability; Instantaneous Failure rate and its Relation to Reliability; Typical Forms of Hazard Rate Function. Reliability of Systems: Series Systems, Parallel Systems, General Series-parallel Systems, Minority Parallel Systems, Standby Redundancy, Common Mode Failures, Availability of systems with Repair, Fault Tolerant Systems. Failure rate data and models: Failure rate data, factors influencing rate, Failure rate models, calculation of equipment failure rate from component failure rate data. Software reliability, Human reliability, Quality and reliability in design and manufacture: The achievement of quality, Economics of quality and reliability, Design for quality, Quality in manufacture, Testing of finished product. Design Summary and Trade study.

AER 516 Energy Resources for Aerospace Industry (1 Unit)

Possible Future Scenarios for Energy from Conventional to Renewable Sources, Energy Conservation Principles, Energy Distribution and System Integration, Solar Energy, Hydro, wind and Geothermal Energies, Biofuels and Biomass, Energy Storage Options in form of Hydrogen, Batteries, Liquid Fuels, Compressed Gas by the use of Heat Exchangers, Sustainability.