

# **PROGRAMME GUIDE**

(PROSPECTUS –2011)

**B. Tech. (Aerospace Engineering)**

**(BTAE)**



**SCHOOL OF ENGINEERING AND TECHNOLOGY  
INDIRA GANDHI NATIONAL OPEN UNIVERSITY  
MAIDAN GARHI, NEW DELHI – 110 068**

**&**



**AERONAUTICAL ENGINEERING & RESEARCH  
ORGANISATION (AERO) PUNE - 411023**

### **IMPORTANT NOTES FOR B.TECH (AEROSPACE ENGINEERING)**

- This Programme Guide is applicable for July 2011 course & may be reviewed for subsequent courses
- B. Tech (Aerospace Engineering) is delivered in face to face mode at respective IGNOU approved Training Institutes. Minimum attendance of 75% is mandatory. This course is not available in distance learning mode.
- Like any other Universities, the practicals and project work will have to be completed as a part of the curriculum.
- The degrees will be awarded by Indira Gandhi National Open University.

### **IMPORTANT DATES**

- Last date for receipt of Application - 30<sup>th</sup> June, 2011
- Display of Merit List - 05<sup>th</sup> July, 2011
- Admission Dates - 05<sup>th</sup> – 20<sup>th</sup> July, 2011
- Course Commences on - 21<sup>st</sup> July, 2011

**Note: The merit list will be displayed on the websites of the training institutes and on IGNOU website.**

#### **Program Coordinator**

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(Self Note: The page numbers change depending upon the matter. This page must be made after all the matter is typed.)

### RECOGNITION

**IGNOU is a National University established by an Act of Parliament in 1985 (Act No. 50 of 1985), IGNOU Degrees/Diplomas/Certificates are recognized by all the members of the Association of Indian University (AIU) and are at par with Degrees/Diplomas/Certificates of all Indian Universities/Deemed Universities/ Institutions vide UGC circular No. F1-52/2000 (CPP-II) dated 5<sup>th</sup> May, 2004; and AIU Circular No. EV/B (449)/94/176915-177115 dated January, 1994 and AICTE circular No. AICTE/Academic/Nov-Dec/2005 dated 13<sup>th</sup> May, 2005.**

**GUIDANCE** : Prof. VN Rajasekharan Pillai, Vice Chancellor, IGNOU.  
Mr. Anshul Sharma, Chairman, AERO, Shastri Group of Institutes.

**SUPPORT & COOPERATION** : Prof. Ajit Kumar, Director, SOET, IGNOU  
Mr. Ajay Kumar, Advisor, AERO

**INFORMATION COMPILATION** : Prof. Subhasis Maji, Program Coordinator, IGNOU  
Prof. Muralidhar Patkar, Director, IIAEIT.

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# 1. THE UNIVERSITY

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## 1.1 Introduction

Indira Gandhi National Open University was established in September, 1985 by an Act of Parliament, with a view to democratize education so that it covers large segments of population, vocations and professions. The primary emphasis is on innovation, flexibility and cost effectiveness. Thus, it is a unique university with difference. It is also considered as a largest university with its presence in other countries. Some of the important features program specific are enumerated below.

### **Some of the major objectives of the University are:**

- Democratizing higher education by taking it to the doorstep of the learners,
- Providing access to high quality education to all those who seek it irrespective of age, and region.
- Offering need-based academic programs at affordable cost in emerging engineering, professional and vocational areas, and

### **The salient features of this system of education are:**

- Study according to your own pace and convenience.
- Study at your own chosen place.
- Flexibility in choosing wide range of elective courses.
- Use of modern and appropriate educational and communication technology,
- Use of internet mediated technologies.
- Providing education through dedicated TV channel, Gyan Darshan.
- Providing education through educational FM radio, Gyan Vani,
- Developing learning Anytime Anywhere Programs (LAAP) initiatives.

Student support services are provided by the University through a network of IGNOU approved Training Institutes in major cities. Training Institutes are the actual focal points to enable you to receive regular information and learning support. Each of the Training Institutes provides you with library, audio and video facilities to further help you in the learning process. Senior and experienced academicians are engaged in face-to-face, regular full time training at the Training Institutes. The Training Institutes are generally located in existing educational institutions. Every Training Institute is supervised by a Coordinator. Regional Centers have been set up in different parts of the country to coordinate the functioning of the Training Institutes.

## 1.2 The Schools of Studies

With a view to develop interdisciplinary studies, the University operates through Schools of Studies. Each School is headed by a Director who arranges to plan, supervise, develop and organize its academic programs and courses in coordination with the School staff and the different academic, administrative service wings of the University. The emphasis is on providing a wide choice of courses at different levels.

The School of Studies in operation currently are as follows:

- School of Computer and Information Sciences.
- School of Continuing Education.
- School of Education.
- **School of Engineering and Technology**

- School of Health Sciences
- School of Humanities
- School of Management Studies
- School of Sciences
- School of Social Sciences
- School of Agriculture
- School of Law

BTech Aerospace Engineering program is coordinated by the School of Engineering and Technology at IGNOU.

### 1.3 Academic Programs Ongoing

The University offers both short-term and long-term programs leading to Certificates, Diplomas or Degrees, covering conventional as well as innovative programs. Most of these programs have been developed after an initial survey of the demand for such studies. They are launched with a view to fulfill the student's needs for :

- Certification,
- Improvement of skills
- Acquisition of professional qualification,
- Continuing education and professional development at work place,
- Self-enrichment, and
- Diversification of knowledge, etc.

**So far the University has launched the following programs in respect of engineering related subjects:**

1. Bachelor of Technology in Civil (Construction Management) (BTCM)
2. Bachelor of Technology in Civil (Water Resources Engineering) (BTWRE)
3. **Bachelor of Technology in Aerospace Engineering (BTAE)**
4. BSc (Nautical Science)
5. Post Graduate Diploma in Industrial Safety, Health and Environment Management
6. Diploma in Civil Engineering (Army Personnel) (DCLE)
7. Diploma in Electrical and Mechanical Engineering (Army Personnel) (DEME)
8. Diploma in Civil Engineering DCLE (G)
9. Diploma in Mechanical Engineering (DME)
10. Diploma in Industrial Safety, Health and Environment Management (DISHEM)
11. Advanced Certificate in Power Distribution Management (ACPDM)
12. Post Graduate Certificate in Project Management (PGCPM)

It is against the backlog of development of these programs, the University has launched programs in engineering areas developed by its School of Engineering and Technology. BTech Aerospace Engineering program is developed in joint efforts of SOET and Aeronautical Engineering and Research Organization (AERO).

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## 2. AERONAUTICAL ENGINEERING AND RESEARCH ORGANIZATION (AERO), PUNE

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Aeronautical Engineering and Research Organization (AERO) was established in March 2008 under the aegis of P S D Shastri Educational Foundation, Registered as Charitable Trust vide Registration No. F-9150/20/10/2003 under Society Registration Act 1860 (Rule 21 of 1860 Act) to promote education, training, research, development, collaborations with industry in all fields of aviation in India and abroad. AERO is part of the well-known Shastri Group of Institutes Pune, which has been in the forefront of aviation training since 2001 The Group has three fixed wing aircrafts, one Helicopter, gas turbines & various aircraft systems like avionics, instrumentation, engines both piston and jet, for better

comprehension of the aviation learning & training. These assets, undoubtedly the best in Pune and many other parts of the country, would be of much use to the undergraduate students pursuing their career in Aerospace Engineering.

Realising the immense opportunities in the aviation and aeronautical field, AERO is focussing initially in the areas of education & human resource training. The present B Tech programme in Aerospace Engineering in full time, face to face mode in association with IGNOU is one such major initiative. On the anvil are post graduate courses & flying training in collaboration with foreign universities and IGNOU.

AERO is also forging alliances to give expertise to the industries through industry-institution partnership by knowledge sharing. This relationship would be of much relevance to the student community as well as the industry. AERO has pooled up resources of knowledge, expertise & facilities for better utilisation. AERO would be making significant forays into Research & Development activities in the field of aerospace engineering.

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### **3. INSTRUCTIONAL SYSTEM**

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The University follows multi-media as well as Face to Face approach for imparting instruction to its learners. B Tech (Aerospace Engineering) is in full time, face to face mode. The instructional package comprises a combination of one or more of the following:

- Self-instructional print materials
- Audio and video cassettes
- Telecast/broadcasts through the dedicated education channel of Doordarshan (Gyan Darshan) and the All India Radio (Gyan Vani) Channel
- Face-to-face teaching at Training Institutes.
- Assignments
- Technical and field visits
- Project work including work-related projects
- Guided Practical Training in the laboratories.

#### **3.1 COURSE PREPARATION**

The University prepares the self-instructional print material and audio-video programs in participation with AERO, academia, R & D and practicing personnel. In particular, print materials for Engineering and Technology courses are being specially prepared by the in-house faculty of the University in assistance with course preparation project teams drawn from IITs, Engineering Colleges, Universities, R & D institutions, Industries and Professional bodies from all over the country. In special reference to Aerospace Engineering program, AERO is facilitating the preparation of course material. In the process, these materials are scrutinized by the content experts, supervised by the instructional unit designers and edited by the language experts at IGNOU before they are sent for printing.

Similarly, audio and video programs are produced in consultation with the course-writers, other technical experts, in-house faculty and producers and wherever feasible in assistance with other universities, R & D institutions and industries. These programs are reviewed by the faculty as well as outside media experts and edited or modified suitably, wherever necessary, before they are dispatched to the Training Institutes and Doordarshan for broadcast.

#### **3.2 CREDIT SYSTEM**

The University follows the “Credit System” for its programs. Each credit in IGNOU system amounts to 30 hours of study comprising all learning activities. Thus, a four-credit course involves 120 study hours. This helps the student to understand the academic effort one has to put in, in order to successfully

complete a course. Completion of an academic program requires successful clearing of both the assignments and the term end examination of each course in the program.

### 3.2 ATTENDANCE

A student with less than 75% of attendance in the laboratory practicals / theory course topics will not be considered for evaluation.

Finally, following is a conceptual schematic of educational organization aggregating all the student support services discussed in last few sub-sections, for imparting engineering education.

**In the face to face, full time program of BTech (Aerospace Engineering), the tutorial , assignments & lab work would be a continuous process and the Training Institutes shall schedule these, in commensurate with credits, in consultation with Project Coordinator /AERO.**

### 3.2 MEDIUM OF INSTRUCTION

Medium of Instruction is English.

## 4. PROGRAM ON OFFER (BTech Aerospace Engineering)

### 4.1 OBJECTIVES

BTech. Aerospace Engineering is designed to provide training and education and professional knowledge to take up work in the area of Aerospace Engineering. Theoretical knowledge is coupled with ample practical knowledge so as to make the students proficient in the field of aerospace engineering. He would be employable by the time he completes his program.

### 4.2 PROGRAM STRUCTURE

**PROGRAM CODE- BTAE**

**DURATION OF THE COURSE IS MINIMUM 4 YEARS AND MAXIMUM 8 YEARS**

#### FIRST YEAR-FIRST SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	ET-101A	Mathematics –I	4	Theory
2	BAS-001	Applied Physics	4	Theory
3	BAS-002	Applied Chemistry	4	Theory
4	BAS-003	Technical Writing & Communication Skill	4	Theory
5	BME-016	Engineering Mechanics	4	Theory
6	BASL-001	Lab-1, (Applied Science Lab for Physics & Chemistry)	3	Practical
8	BASL-002	Lab-2 (Engg. Mechanics)	3	Practical
<b>Total</b>			26	

#### FIRST YEAR- SECOND SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	ET-101 B	Mathematics -II	4	Theory
2	BAS-004	Workshop Technology	4	Theory
3	BAS-005	Engineering Drawing	4	Theory
4	BME-021	Principles of Electrical and Electronic Science	4	Theory

5	BAS-006	Computer Fundamentals	4	Theory
6	BASL-003	Lab-3 (Workshop Practical)	3	Practical
7	BASL-004	Lab-4 (Engineering Drawing)	3	Practical
8	BASL-005	Lab-5 (Electrical & Electronics)	3	Practical
9	BASL-006	Lab-6 (Computer Fundamentals)	3	Practical
<b>Total</b>			32	

### SECOND YEAR-THIRD SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	BAS-007	CNS- ATM Systems	4	Theory
2	BAS-008	Strength of Materials	4	Theory
3	BME-018	Material Science	4	Theory
4	ET-201 A	Mechanics of Fluid	4	Theory
5	BAS-009	Introduction to Aeronautics	4	Theory
6	BASL-007	Lab-7 (CNS- ATM systems)	3	Practical
7	BASL-008	Lab-8 (Fluid Mechanics)	3	Practical
8	BASL-009	Lab-9 (Aero-Modeling)	3	Practical
9	BASL-010	Lab-10 (Material Science)	3	Practical
<b>Total</b>			32	

### SECOND YEAR- FOURTH SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	BAS-010	Machine Design	4	Theory
2	ET-201 B	Thermodynamics	4	Theory
3	BAS-011	Aircraft Systems & Airworthiness Requirements	4	Theory
4	BAS-012	Aerodynamics-I	4	Theory
5	BAS-013	Propulsion –1	4	Theory
6	BASL-011	Lab-11 (Thermodynamic)	2	Practical
7	BASL-012	Lab-12 (Aerodynamics Lab)	3	Practical
8	BASL-013	Lab-13 (Machine Design)	2	Practical
9	BASL-014	Industrial Training of 3 weeks during vacation	4	Practical
<b>Total</b>			31	

### THIRD YEAR-FIFTH SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	ET-102	Mathematics-III	4	Theory
2	BAS-014	Aircraft Structures	4	Theory
3	BAS-015	Aerodynamics- II	4	Theory
4	BAS-016	Propulsion – II	4	Theory
5	BAS-017	Flight Mechanics	4	Theory
6	BASL-015	Lab-14 (Propulsion – II)	3	Practical
7	BASL-016	Lab-15 (Aerodynamics- II)	3	Practical
8	BASL-017	Lab-16 (Aircraft Structures)	3	Practical
<b>Total</b>			29	

### THIRD YEAR- SIXTH SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	ET-524	Principles of Engineering Management & Economics	4	Theory
2	BAS-018	Aircraft Safety and Maintenance Engineering	4	Theory
3	BAS-019	Aircraft Instruments	4	Theory
4	BAS-020	Basic Control Theory	4	Theory
5	BASL-018	Lab – 17 (Basic Control Theory)	3	Practical
	BASL-019	Lab – 18 (CAD-CAM )	3	Practical
6	BASL-020	Professional Training / Report Writing / Presentation	6	Practical
<b>Total</b>			28	

### FOURTH YEAR -SEVENTH SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	BAS-021	Environmental Science	4	Theory
2	BAS-022	Composite Materials	4	Theory
3	BME-006	Mechatronics	4	Theory
4	BME-007	Quality Engineering	4	Theory
5	BMEL-001	Lab-19 (Mechatronics)	3	Practical
6	BASP-001	Project	9	Project
<b>Total</b>			28	

#### FOURTH YEAR -EIGHTH SEMESTER

S. No	Course Code	Course Title	Credit	Nature of the Course
1	BAS-023	Aircraft Design / Launch Vehicle / Rocket Design	4	Theory
2	BAS-024	Introduction to Rockets & Missiles	4	Theory
3	BAS-025	Space Dynamics	4	Theory
4	Please refer table below	Elective	4	Theory
5	BASP-002	Project on Aircraft Design /Launch Vehicle or Rocket System Design	10	Project
<b>Total</b>			26	

#### COURSE CODE FOR THE ELECTIVE COURSES

Sl. No.	Course Code	Course Title	Credit	Nature of the course
1	BASE-001	Helicopter Engineering	4	Theory
2	BASE-002	Rocket Propulsion	4	Theory
3	BASE-003	High Speed Aerodynamics	4	Theory
4	BASE-004	Flight Testing	4	Theory
5	BASE-005	Introduction to Computational Fluid Dynamics	4	Theory
6	BASE-006	Finite Elements Methods	4	Theory
7	BASE-007	Microprocessor	4	Theory
8	BASE-008	Applied Industrial Aerodynamics	4	Theory

### 4.3 ADMISSION ELIGIBILITY

Candidates eligible for admission to BTAE should possess the following qualifications:

- 10 + 2 in Science stream or higher-with min 55% marks in PCM aggregate.
- Students with B Sc having Physics, Chemistry and Mathematics with min 55% marks in aggregate.
- Candidates with Diploma in engineering with 55% aggregate from a university or equivalent.
- For SC/ST/OBC categories the admission criteria is minimum 50% marks in PCM aggregate for 10+2, and for other courses it would be minimum 50% marks aggregate.

Note - No rounding off would be done to arrive at minimum marks

### 4.4 ADMISSION

Admission to this program will be based on merit. If required, the interview will be conducted at the training institute where application form is submitted. However, interview can be waived off at the discretion of Project-Coordinator (IGNOU-AERO) / AERO.

### 4.4 ADMISSION PROCEDURE

- Application form, completed in all respects duly filled in shall be submitted to the training center where he/she wishes to take admission.

- Two sets of attested copies of 10<sup>th</sup> and 10+2 mark sheets and Transfer Certificate shall be attached with the application form.
- In case of reserved category students, Caste Certificate, Caste Validity Certificate shall also be submitted in duplicate duly attested by Gazetted Officer.
- All students shall pay Registration fee through Demand draft of Rs. 10,000/- drawn in favor of IGNOU payable at New Delhi and shall be attached to the application forms. This is Registration fee and will be refunded to those students who are denied admission from IGNOU.
- Last date for receipt of application forms at the training centers would be 30<sup>th</sup> June, 2011.
- Merit List would be displayed on IGNOU website and the website of respective training institute on 5<sup>th</sup> July, 2011.
- Students whose names appear in the merit list should submit a Demand Draft of Rs. 60,000 drawn in favor of IGNOU payable at New Delhi for confirmation of admission. The admission dates would be from 5<sup>th</sup> -19<sup>th</sup> July, 2011, both days inclusive. If the student does not confirm his admission by paying the demand draft of the said amount before 19<sup>th</sup> July 2010, the seat will be offered to the next student in the waiting list.
- The classes commence from 21<sup>st</sup> July, 2011.
- The students and parents are bound by the rules, regulations, terms and conditions laid down by the University/Training Institute/AERO from time to time.

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## **5. FEE STRUCTURE/REFUND POLICY**

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### **5.1 REGISTRATION FEE**

A student has to pay Registration fee of Rs 10000/- while applying for the course. This fee is payable only in the first year for students seeking admission to the first year on the basis of 10+2 / Diploma / B Sc. The Registration fee is to be paid by DD drawn on any nationalized bank in favor of IIAEIT payable at PUNE.

### **5.2 COURSE FEE**

In first year the course fee DD for Rs. 60000 drawn in favor of IIAEIT payable at PUNE will be submitted to the training institute to confirm the admission after the merit list is announced. For subsequent years the student has to pay Rs. 60000/- towards course fee for each year in advance before the start of the academic year by DD drawn on any nationalized bank in favor of IIAEIT payable at PUNE. The DD will be submitted to the training institute where the student is studying.

### **5.2 REFUND POLICY**

1. Registration fee of Rs 10,000/- would be refunded to the students who are not granted admission by IGNOU. However, if the student does not join even after granted admission, or cancels his admission, the registration fee will not be refunded.
2. No refund of the registration fee (Rs.10,000) or course fee (Rs. 60,000) would be permitted after the commencement of the course.

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## **6. EVALUATION SYSTEM**

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### **6.1 SALIENT FEATURES OF EVALUATION SYSTEM**

6.1.1 The students will be awarded marks in continuous assessment and term end components as given below:

- (a) **Laboratory Courses (Practicals)**
- |                    |   |
|--------------------|---|
| Guided Component   | 70% (Assessment through out the semester) |
| Unguided Component | 30% (Term end practical examination)      |
- (b) **Theory Courses**
- |                       |   |
|-----------------------|---|
| Continuous Assessment | 30% (Assessment through out the semester) |
| Term End Examination  | 70% (Term end theory examination)         |

6.1.2 Thus, a student will receive marks for Continuous Evaluation part (Periodic Assignment) and for Term End Examination part for each theory course. To clear a course, a student will have to clear both the segments of the course. Similarly, for laboratory course, one has to clear separately the guided and unguided components. Following table gives minimum percentage of marks required for the clearance of the course:

Evaluation Component's part for the Course	% of marks for clearance
Continuous Evaluation	≥ 45%
Term-end Examination	≥ 45%
Guided Component	≥ 45%
Unguided Component	≥ 45%
Overall Performance	≥ 50%

6.1.3) **Overall performance:** To facilitate statement of overall performance at any point of time during the program or at the end of the program, the calculation of overall percentage will be based on the weighted average system and the precision will be up to the one point after the decimal. Calculations will be carried out using the following scheme:

$$\text{Overall Percentage} = \frac{C_1P_1 + C_2P_2 + C_3P_3 + \dots}{C_1 + C_2 + C_3 + \dots}$$

where  $C_1, C_2 \dots$  denote credits associated with courses taken by the student and  $P_1, P_2 \dots$  denote the percentage of marks awarded in respective courses.

**6.1.4 Awarding the Division:** The divisions will be decided as follows:

- Second division will be at 50% and up to less than 60%.
- First division will be at 60% and up to less than 75%
- Distinction with First division will be at 75% and above.

6.1.5 **Awarding Grades:** If needed, the grades for each subject can be awarded on the basis of percentage marks obtained as given below :

- A Grade for 80% and above,
- B Grade for 70% and above,
- C Grade for 60% and above,
- D Grade for 50% and above, and
- E Grade for less than 50%.

## 6.2 ASSIGNMENTS

Assignments constitute the continuous evaluation components of a course/course-topic. Continuous Evaluation for a course/course-topic carries 30% weightage, while 70% weightage is given to the term-end examinations. The marks that you get in your Continuous Evaluation Components will be counted

in your final result. **Therefore, you are advised to take your Continuous Evaluation Components seriously.**

**More specifically, you have to attempt the assignments compulsorily. You will not be allowed to appear for the term-end examination for a course if you do not submit all assignments in time for that course.**

The main purpose of assignments is to test your comprehension of the teaching & learning process.

### **6.3 EVALUATION FOR LABORATORY COURSES**

- (a) Laboratory courses is same as other course/course topic in Engineering and Technology
- (b) The method for evaluation is as given below :  
Evaluation of Laboratory Courses will be done in two components.  
Component (i) 70% marks will be allotted for a set of guided experiments to be carried out by students. These experiments would be marked by the Training Centre as per the marking scheme prepared by the training Centre  
Component (ii) 30% marks will be allotted for a set of (one or more) assigned unguided experiments to be carried out by the students at the end of the laboratory course/course topic session after the completion of all guided experiments.
- (c) Faculty and /or external examiners will be there for evaluation of assigned unguided experiments.
- (d) The requirement of assignments will be deleted in case of laboratory courses.
- (e) The total marks awarded in a laboratory course topic will be by adding marks obtained in two components mentioned above in accordance with the weightage attached. For success in the laboratory course/course topic, one has to score at least 45% marks in each component along with an overall marks of 50%.
- (f) A student with less than 75% of attendance in the laboratory course topic will not be considered for evaluation.

### **6.4 TERM END EXAMINATION**

As stated earlier, term-end examination is another component of the evaluation system. Term End Examination carries 70% weightage in the final result.

The University conducts term-end examinations twice a year, i.e. in June and December. You can take the examination after the completion of the course. In the **first year** you can take the examination in December, failing which you can take the same in June and December, of subsequent years within the total span of the program. Similarly, in the case of **second year courses** you can take the examinations in December, failing which you can appear in June or December of subsequent years. Same pattern will apply to third year courses, where applicable.

In case you fail to score 45% marks in the Term End Examination part of a course-topic, you will be eligible to reappear at the next Term End Examination for that course-topic as and when it is held, within the total span of the program.

**To be eligible to appear in the term-end examination in any course/course-topic in a given year, you are required to fulfill the following four conditions:**

- (i) You should have registered in that course/course-topic in the given year.
- (ii) You should have paid the registration fees for the course/course-topic in that year.
- (iii) You should have completed the submission of assignments for the respective course/course-topic.
- (iv) You should have submitted the examination form in time

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## 7. AWARDS AND SCHOLARSHIPS

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### 7.1 GOLD MEDAL

The University awards gold medals and certificates to the passing out topper students in each year of the program, who have secured the highest aggregate in their program in the minimum time duration and have cleared all the courses in one attempt.

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## 8. REGISTRATION PROCEDURES, UNIVERSITY RULES AND OTHER USEFUL INFORMATION

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Some of the important information is given below.

### 8.1 IGNOU NEWS LETTERS

The University publishes news letter three times a year in English as well as in Hindi. It is mailed to each student free of cost. All the important information relevant to the students is published in this news letter.

### 8.2 RESERVATION

The University provides reservation of seats for Scheduled Castes, Scheduled Tribes, Other Backward Classes, Wards of Para Military Forces and Physically Handicapped students as per the Government of India Rules.

### 8.3 SCHOLARSHIPS AND REIMBURSEMENT OF FEES

Reserved Categories, viz. Scheduled Castes, Scheduled Tribes and Physically Handicapped students have to pay the fee at the time of admission to the University along with other students.

Reserved category students admitted to IGNOU are eligible for Government of India scholarships. They are advised to collect blank scholarship forms from the respective State Government Directorate of Social Welfare or Office of the Social Welfare Officer and submit the filled-in forms back to them through the Training Institute and Regional Director concerned for reimbursement of program fee.

### 8.4 VALIDITY OF ADMISSION LISTS

Candidates who are offered admission have to join on or before the due dates specified by the University. In case they want to seek admission for the next session, they have to apply afresh and go through the admission process again.

### 8.5 INCOMPLETE AND LATE APPLICATIONS

Incomplete and late applications forms, wrong options of courses or electives, furnishing false information will be summarily rejected without any intimation to the candidates. The candidates are, therefore, advised to fill the relevant columns carefully and enclose all the attested copies of the necessary certificates asked for, and submit the form to the Training Institute concerned on or before the due date. In this regard no correspondence will be entertained.

### 8.6 CREDIT TRANSFER AND EXEMPTION

Program of the University have defined program structures. If at the time of admission itself, a student comes having completed some of the courses (from the program structure) from a recognized/accredited university of the country, then, **on a case by case basis**, the student will be given credit for those courses as per the modalities detailed below :

#### DEFINITIONS

- (i) “**Credit transfer**” means allowing a student of another university to get admitted to IGNOU for completing any equivalent degree/diploma program on the basis of credits obtained by him/her from that University. A student thus admitted need not write IGNOU examinations for such courses which are found equivalent to and for which appropriate credits would be deemed to have been acquired for and purposes of fulfilling the IGNOU requirements for award of a degree/diploma.
- (ii) “**Exemption**” means “exemption from course work/studies only”, i.e. if a student is allowed “exemption” in a particular course, he/she is not required to take the course (those

courses) as other students do but he/she will have to sit for the examinations in that course/those courses and clear it/them successfully.

## **8.7 ELIGIBILITY**

The credit transfer scheme is applicable only to those candidates who have not completed their degree from any other recognized university yet willing to complete through IGNOU as per rules provided.

## **8.8 MODALITIES**

- (i) Normally credit transfer or exemption will be applicable only from a diploma to an equivalent post graduate degree.
- (ii) Credit transfer will be permissible only in the case of students coming from institutions established by an Act of Parliament or by an Act of State Legislature; or an institution “deemed to be university”, or an “institution of national importance”, or institutions recognized by statutory bodies like AICTE, ICMR, ICAR, CSIR, etc.
- (iii) Credit transfer can be done only on the basis of individual courses and not on the basis of year-to-year courses as in conventional institutions.
- (iv) In order to get a diploma/degree from IGNOU a student will be required to earn at least 50% credits from IGNOU. For example, a B. Tech. Student should earn at least 64 credits out of 128 credits from IGNOU for an IGNOU’s degree.
- (v) The degree certificate or the marks list thus given to the students will specifically indicate the credits earned in IGNOU and those obtained from other institution.
- (vi) Students exempted from studying the courses may take the examination for the exempted courses during any of the two Term-end-Examinations.

## **8.9 RULES AND REGULATIONS**

- (i) Students who want to avail credit transfer shall get registered with IGNOU for the program they want to study. All the applications for this purpose should invariably be addressed to **Dy. Registrar (Student Registration and Evaluation Division), IGNOU, Maidan Garhi, New Delhi – 110 068.**
- (ii) The students have the choice to opt the electives of second year in the first year and third year in second year of their studies.
- (iii) The students by opting the courses in such a way to complete the balance credits can reduce the period of study prescribed for the completion of the degree program and thereby avail no payment of fees to the period not covered. The student availing credit transfer would be allowed to complete the program early provided they do not offer more than 32 credits in a year.
- (iv) IGNOU “program” and “courses” are “subjects” or “papers” respectively of conventional universities.
- (v) Students seeking exemption and allowed permission to take their examinations may be supplied with study material/Audio-Video material from the university on payment, if they so wish.
- (vi) Students seeking exemption should apply directly to the Dy. Registrar (SRE&D), Block 12, IGNOU, Maidan Garhi, New Delhi – 110 068, enclosing a Demand Draft for Rs. 50/- per course drawn in the name of IGNOU and payable at New Delhi, attested copies of Marks Sheet and attested copies of syllabus of such courses, covered by them. Such cases will be examined separately by the Equivalence Committee at the Headquarters of the University. This process will take a minimum period of three months from the date of receipt of such requests with all the relevant documents by the above concerned officer.

## **8.10 DISPUTES ON ADMISSION AND OTHER UNIVERSITY MATTERS**

The place of jurisdiction for filing of a Suit if necessary will be only at New Delhi/Delhi. Students / Guardians will also be bound by other terms and conditions of IGNOU issued from time to time

## **8.11 COURSE SPECIFIC RULES AND REGULATIONS**

While most of the rules mentioned above are general and applicable to most of the ordinary programs and courses. B Tech Aerospace Engineering is categorized as highly technical in a face to face, full

time course and hence the general rules mentioned above should be judicially applied after seeking clarifications from IGNOU on a case-to-case basis.

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## 11. DETAILED SYLLABUS OF COURSES FOR B. TECH (AEROSPACE ENGINEERING)

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### FIRST SEMESTER

#### ET-101 A MATHEMATICS -1

- 1 **DIFFERENTIAL CALCULUS:** Functions of One Variable, Limit, Continuity and Differentiability, Mean Value Theorems, Applications, Partial Differentiation.
- 2 **INTEGRAL CALCULUS:** Indefinite Integrals, Definite Integrals, Applications, First Order Differential Equations
- 3 **VECTOR CALCULUS:** Vector Algebra, Vector Differential Calculus, Line and Surface Integrals, Volume Integral.
- 4 **MATRICES:** Linear Equations and Euclidean Spaces, Linear Transformation and Linear Equations, Matrices and Determinants, Eigenvalues and Eigenvectors, Canonical Forms

#### BAS 001 APPLIED PHYSICS

- 1 **OSCILLATIONS & WAVES:** Oscillation: Simple Harmonic Motion, Simple pendulum, combination of Harmonic oscillator, superposition of SHM of same frequency, beat phenomena, Lissajous figures, Damped oscillations, equation of motion/power loss/ of damped oscillator, forced oscillation and resonance.
- 2 **WAVES:** Oscillator as a source of wave, Propagation of plane wave, Uniform train of SHM waves, waves in two and three dimensions, examples of wave motion.
3. **SUPERPOSITION OF WAVES:** standing waves , group velocity , superposition of many waves, wave equation and superposition
- 4 **INTERFERENCE & DIFFRACTION– :** Principle of interference , Young’s double slit experiment, interference from thin films , Newton’s Rings ,Diffraction from a single-slit
- 5 **POLARIZATION:** Transverse waves and polarization, Polarization by reflection, Polarization by transmission, Polarization by scattering.
- 6 **WAVES & PARTICLES:** Wave and particle duality of radiation, De-broglie concept of matter-waves, properties of matter waves, GP Thomson experiment, Heisenberg uncertainty principle , Experimental illusions of uncertainty principle , Equation of motion of matter waves.
7. **MODERN PHYSICS:** Atomic Structure : Bohr’s Atom Model, Bohr’s Theory of Hydrogen atom, Electron Energy level in hydrogen atom, Spectral series of hydrogen atom, Bohr’s quantum condition from de-Broglie hypothesis, vector atom model, orbital angular momentum, electron spin , total angular momentum of electron , magnetic moment of an orbital electron, magnetic moment due to electron spin, Pauli’s exclusion principle , types of spectra
8. **LASERS :** Explanation of stimulated and spontaneous emission, absorption, population inversion, principle, construction, working of Ruby laser, Helium-Neon Laser, Applications of lasers, properties of lasers
9. **THEORY OF RELATIVITY:** Frame of reference Galilean transformation, Micheleson Morley experiment, Einstein’s theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Additional velocities, Variation of mass with velocity, Equivalence of mass and energy

#### BAS 002: APPLIED CHEMISTRY

1. **ATOMS AND MOLECULES :** Atomic Structure I& II: Introduction , electromagnetic waves, parts of an atom, atomic structure : scattering of alpha particles, Bohr’s atomic model, emission of spectral lines, atomic orbital, their shapes and sizes.

- 2        **MOLECULAR STRUCTURE:** Introduction, multiple bonding, bonding in metals.
- 3        **EQUILIBRIA & ELECTROCHEMISTRY:** Chemical Equilibrium: Introduction, the equilibrium constant, the relation between  $K_c$ ,  $K_p$  &  $K_x$  and  $K_n$ , the degree of dissociation.
- 4        **ELECTROCHEMICAL CELLS :** Introduction, types of electrodes, electromotive force and its measurements, standard electrode potentials and its uses, corrosion and its prevention, protective measures against corrosion, dry cell, nickel cadmium batteries, fuel cells.
- 5        **INORGANIC CHEMISTRY :** Overview: Introduction, periodic table, electron configuration of elements, ionization energy, electron affinity and electro negativity, size relationships, metallic character, oxidation states, nonstoichiometric compounds.
- 6        **CHEMISTRY OF NON-TRANSITION ELEMENTS:** introduction, hydrogen and properties of its bonds, compounds and isotopes, Group 1 (A) the Alkali metals, properties, compounds, and commercially important compounds, Group 2 (II A) the Alkaline earth metals compounds, hard water, Group 13 (III A) complexes of boron and aluminum, Group 14 (IV A) carbon, binary compounds of metals, Group 15 (V A) nitrogen, phosphorous and their compounds, Group 16 (VI A) oxygen, sulphur, Group 17 (VII A) inert gases,
- 7        **CHEMISTRY OF TRANSITION ELEMENTS:** Introduction, properties, scandium family, titanium family, vanadium family, chromium family, manganese family, The iron triad (3d) iron, cobalt, nickel, light platinum triad (4d), ruthenium, rhodium, palladium, heavy platinum triad (5d), osmium, Iridium, Platinum, the copper family, the zinc family, transition metal complexes, types of ligands, stereochemical nonrigidity, properties and bonding of lanthanide and actinide elements.
- 8        **INDUSTRIAL ORGANIC CHEMISTRY:** introduction, industrial gases, nitric and sulphuric acids.
- 9        **ORGANIC CHEMISTRY:** overview : introduction .
- 10       **INDUSTRIAL ORGANIC CHEMISTRY**, Petroleum, ethylene, propylene, benzene and xylene, methane derivatives.
- 11       **MACROMOLECULES :** Introduction, Classification, copolymers, addition polymerization, free radical vinyl polymerization, propagation and termination of polymerization, telomerization, thermosetting plastic, silicones and other polymers, physical behavior of polymers, energy utilization-combustion

### **BAS 003: TECHNICAL WRITING & COMMUNICATION SKILL**

- 1        **TECHNICAL WRITING-**Introduction, aspects of technical writing, Technical writing styles, types of letters & their formats, notices, Agenda, Minutes of Meeting, e-mails, summary, reports & proposals,
- 2        **READING SKILLS-** Scanning, understanding meaning
- 3        **ORAL PRESENTATIONS:** Verbal, non verbal (body language), power point presentation
- 4        **GRAMMAR:** Vocabulary development, formation of words and phrases
- 5        Précis writing., essay writing and comprehending antonyms, synonyms, homonyms & one word substitution etc. It will also include the grammar: A brief review of essay forms of tenses (present indefinite, present continuous, present perfect, and present perfect continuous, past indefinite, past continuous, past perfecta continuous and future indefinite).
- 6        ‘What are Communication Skills?’ – Importance of communication skills, public speaking, group discussion and general issues and aspects. Developing communication skills with the help of techniques such as extempore speech, delivering a prepared speech, taking part in debates and group discussions will be emphasized upon.

## **BME-016: ENGINEERING MECHANICS**

- 1        **STATICS** : Coplanar And Non- Coplanar forces , Equilibrium , Free Body Diagrams, Friction  
Centre of Gravity and Moment of Inertia
- 2        **DYNAMICS:** Kinematics, Kinetics of Particles, Kinetics of Rigid Bodies, Impulse Momentum,  
Work and Energy
- 3        **STRUCTURAL MECHANICS:** Virtual work, Analysis of Trusses, Analysis of statically  
indeterminate trusses: area moment method, graphical integration method ,Axial Stresses and Strains,  
frames

## **BASL 001 Lab-1 (APPLIED SCIENCE LAB FOR PHYSICS & CHEMISTRY)**

### **Physics Practical ( any five experiments of the following )**

1. Study of damped oscillations using torsional pendulum
2. To determine speed of transverse waves in a stretched string
3. To find the wavelength of sodium light by Newton's rings experiment
4. To find wavelength of various colors of white light with the help of a plane transmission diffraction grating
5. Diffraction pattern with laser
6. To find acceleration due to gravity using compound pendulum
7. To estimate error , Gaussian distribution applied to simple pendulum

### **Chemistry Practical (Any five experiments of the following )**

1. To determine flash point & fire point of an oil by Pensky - Marten's flash point Apparatus
2. Determination of alkalinity of water sample
3. To prepare Phenol – formaldehyde and urea formaldehyde resin
4. Electrolysis of ionic salts in electrolysis cell units as per the Faraday's Laws
5. Determination of strength of HCL solution by titrating
6. Study of corrosion of metal in medium of different pH
7. Determination of viscosity of lubricant by Red Wood viscometer

## **BASL 002 Lab-2 (ENGINEERING MECHANICS)**

- 1        **Statics [Any three practicals.]**  
(a)Reactive forces in Simple and Compound Beams  
(b)Belt friction in Flat belts  
(c) Concurrent/ parallel force system in space  
(d)Worm geared pulley block/ western differential block  
(e)Pulley block
- 2        **Dynamics**  
(a)Curvilinear motion  
(b)Moment of inertia of fly wheel  
(c)Graphical solution of problems based on equilibrium, Coplaner and non Coplaner forces and  
center of gravity

## **SECOND SEMESTER**

### **ET 101 B MATHEMATICS –II**

- (a)        **PROBABILITY CONCEPTS:** Introduction to Probability, Theorems of Probability, Discrete Distributions
- (b)        **DISTRIBUTION THEORY:** Continuous Distributions, Multivariate Distributions, Sampling Distributions  
and Approximations of Distributions
- (c)        **ESTIMATION AND TESTS OF HYPOTHESIS:**  
Point Estimation, Interval Estimation & Testing of Hypothesis, Standard Statistical Tests

### **BAS 004. WORKSHOP TECHNOLOGY**

1.        **MATERIALS** : Materials used for Manufacturing , Manufacturing processes , cold & hot working,

production processes

2. **WORKSHOP PRACTICE** : Machines for manufacturing , Machine tools : operation of lathe, drilling machine , shaping machine, milling machine, gear cutting machine , Hand tools used in carpentry, sheet metal working and forging Measuring equipments , including fits, tolerance and instruments
- 3 **PROCESSES** : Welding technology: Arc welding, shielded arc welding and gas welding , molding and casting practice , NC / CNC machine application

#### **BAS 005 ENGINEERING DRAWING**

- 1 **INTRODUCTION TO DRAWING** : Basics: Instruments, Lines, lettering and dimensioning, Sheet layout (as per BIS code) ,  
**ENGINEERING CURVES**: Ellipse, Hyperbola, Parabola, cycloid, Involute  
**ORTHOGRAPHIC PROJECTIONS** : First angle & third angle method, sectional views
- 2 **ISOMETRIC PROJECTIONS** : Isometric scale, views,  
**SURFACE DEVELOPMENT** : Development of cylinder, cone, pyramid, prism, sphere
- 3 **FREE HAND SKETCHES** : Threads, Locking arrangements, Riveted joints, Bearings , Couplings
- 4 **MACHINE DRAWING**: Details & assembly drawings
- 5 **AUTO-CAD**- Introduction

#### **BME- 021. PRINCIPLES OF ELECTRICAL AND ELECTRONICS SCIENCE**

- 1 **ELECTRICAL**: Properties of conductors and insulators, electro magnetism, DC circuits ,AC circuits , AC machines, requirement & typical layout of aircraft power distribution system
- 2 **ELECTRONICS**: Semiconductors device, Electronics circuits, Digital electronics

#### **BAS 006 COMPUTER FUNDAMENTALS**

1. **INTRODUCTION TO PERSONAL COMPUTERS**: Evolution and history of computers, different generation of computers, microprocessor, software, block diagram, memory, CPU, input devices, output devices, auxiliary storage device, CDROM , hard disks , configuration, care of hardware Do's and don'ts , care of hardware, beware of virus
2. **OPERATING SYSTEM**: Linux, windows
3. **MS WORD** : Introduction , functions of word, menu & other components of display, opening menu, cursor movement keys, creating document file, saving, quitting, recalling the file, making block, moving block, hiding block, formatting , find & replacing, function keys, spell check, print document, mail merge
4. **DATABASE MANAGEMENT SYSTEM**: Introduction, creating database, fields, records, file & database, function of DBMS , fields types or data types, inputting data records, insert record, edit, display , delete, calculation using functions
5. **NUMBERING SYSTEM** : Binary System, Octal, Hexadecimal and decimal
6. **C PROGRAMMING** : Introduction to programming language, data types, character set, syntax with some inbuilt functions, looping, conditional statement, array, string, function, introduction to pointer
7. **SPREAD SHEETS** : Introduction, creating spreadsheets, information about menu, how to use formula bar , functions in excel

#### **BASL 003 Lab-3 (WORKSHOP PRACTICAL)**

1. One job of fitting using minimum two operations [i.e. cutting, drilling, tapping etc.)
2. One job on lathe performing operations like turning, boring and threading & knurling

3. Different machines operation, demonstration & practice.
4. Workshop book should include description with sketches of all demonstration of various operations on above trade.

**BASL 004 Lab-4 (ENGINEERING DRAWING)**

- 1 Orthographic Projections-two objects – one by first angle and one by third angle Method including sectioning
- 2 Isometric Views [2 problems]
- 3 One sheet on Development of surfaces.
- 4 One sheet on Assembly and Details of simple assemblies like Tail stock, Stop Valve etc.
- 5 One sheet on free hand sketches of six machine elements

**BASL 005 Lab-5 (ELECTRICAL & ELECTRONICS)**

1. To study voltage current characteristic for common emitter, common collector and common base connection of a N-P-N transistor
2. To study and plot frequency response of R-C coupled amplifier
3. To study AM and FM modulation and measure their modulation index
4. To study NAND, NOR, EX OR circuits and verify their truth table
5. To study OP-AMP and measure CMRR
6. To study characteristics of synchronous motors
7. To study and find out characteristics of given alternator
8. Measurement of power using energy meter
9. To study three phase star-delta connections and measurement of phase and line voltages
10. To study electrical system of a light aircraft and understand functioning of various components

**BASL 006 Lab-6 (COMPUTER FUNDAMENTALS)**

1. Introduction to Computer Hardware
2. Study of operating system LINUX & Windows, network commands.
3. Write a program in C to generate and display a table of n and n<sup>2</sup>, (for integer values of n ranging from 1 to 10.)
4. Write a program in C to reverse the digits of a given integer.
5. Write a program in C to read an integer and display each of the digits of the integer in English.
6. To prepare a computer based presentation. The presentation will make use of graphs, audio-video clips, layouts and backgrounds, slide transitions etc.
7. To prepare a document using a word processing application to make use of major facilities such as tables, figures, images headers and footers, pages number, fonts, bullets, special symbols etc. Prepare a spreadsheet using a spreadsheet application.

**THIRD SEMESTER**

**BAS 007 CNS- ATM SYSTEMS.**

**COMMUNICATION, NAVIGATION, SURVEILLANCE- AIRCRAFT TRAFFIC MANAGEMENT SYSTEM**

1. Basic concept of air traffic management
2. Airfield & aircraft cockpit layouts
3. Radar
4. Analog & digital communication theory
5. Concept of ground Controller Assisted take off / Landing
6. Airfield & Aircraft emergencies
7. Organization of ICAO, AAI, DGCA
8. ATC Towers

9. DME, NDB, TACAN, GPS
10. Route Navigation, Satellite Network of Airfields

### **BAS 008 STRENGTH OF MATERIALS**

1. **STRESSES IN SOLIDS** : Basic Concepts: Rigid and Deformable Solids, Stresses and Strain, Tensile, Compressive and Shear Stresses, Complimentary shear stress , Mechanical Behavior of Materials : Stress-Strain Curves, Hooke's Law and Elastic Limit, Elastic Constants , Deformation of Bars Bars of Uniform Sections, Bars of Varying Cross Section , Bars of Uniform Strength , Composite Bars: Modular Ratio, Equivalent Area of a Composite Section, Stresses in Composite Bars and Load Carrying Capacity of Composite Bars , Relationship between Elastic Constants : Relationship between E and K , Relationship between E and G , Significance of the Relationships.  
**THERMAL STRESSES:** Effect of Temperature on Bodies, Thermal Stresses in Bodies, Uniform Bars, Stepped Bars: Fully Restrained Stepped Bar, Partially Restrained.  
**PRINCIPAL STRESSES AND STRAINS:** State of Stress, Normal and Shear Stresses, Stress Components on an Arbitrary Plane, Principal Stresses and Principal Planes: Expressions of Principal Planes and Principal Stresses, Maximum Shear Stress, Circular Representation of State of Stress, Mohr's Circle for the Analysis of State of Stress, State of Stress in Combined Bending and Shear.  
**CONCEPT OF FAILURE AND EQUIVALENT STRESSES** : Theories of Failure, A Comparison of Different Theories of Failure, Equivalent Stress, Factors of Safety and Design
  
2. **SHEAR FORCES AND BENDING MOMENTS DIAGRAM:** Beams: Types of Support, Types of Beam, Types of Loading, Shear Force and Bending Moment: Definitions, Sign Conventions, Relation between Loading, Shear Force and Bending Moment, Maximum Value of Bending Moment, Shear Force and Bending Moment Diagrams, Beams Subjected to Couples, Beams Subjected To Oblique Loading Forces and stresses in beams.  
**STRESSES IN BEAMS** : Introduction Objectives, Simple Bending or Pure Bending: Assumptions, Theory of Simple Bending , Neutral Axis and Neutral Plane , Moment of Resistance, Bending Stress Distribution, : Evaluation for Extreme Stresses, Design for Bending, Evaluation of Load Bearing Capacity  
**STRESS DISTRIBUTION IN BEAMS** : Section Modulus Rectangular Section : Circular Section, and T-Sections , Triangular Section , Analysis of Partial Beam Section : Normal Force, Moment of Normal force, flitch beam , moment of resistance , Equivalent Section , Beams of Uniform Strength, Shear Stress Distribution in Beams  
**DIRECT AND BENDING STRESSES** : Axial Load and Bending Moment,  
**STRAIN ENERGY** :Potential Energy , Concept of Strain Energy: Strain Energy in Axial Loading, Strain Energy in Shear, Strain Energy in Bending, Strain Energy in Torsion, Suddenly Applied Loads : Impact Loads, Stresses Due to Axial Loads , Stresses Due to Bending Loads, Castigliano's Theorem: Application of Castigliano's Theorem to Angular Movements, Application to Truss Problems, Application to Beam Problems  
**SPRINGS**

### **BME-018- MATERIAL SCIENCE**

1. Mechanical properties
2. Ferrous & Non ferrous alloys
3. Non metallic materials, Ceramic, refractory, plastics, rubber
4. Study of microstructure of steel, Iron – Carbide diagram, heat treatment of steel and aluminum alloys
5. Corrosion & surface treatment
6. Materials for high temperature use
7. Material for aircraft components

## ET201A FLUID MECHANICS

- 1 **FLUID STATIC** – Hydrostatic force on submerged surface, buoyancy, metacentric height, stability of submerged & floating bodies, liquid in a container subjected to acceleration and rotation
- 2 **FLUID KINEMATICS** : Fluid flow types, Ideal fluid flow, fluid flow analysis, flow field, stream line, stream tube, path line, streak line, motion of fluid elements, circulation in flow
- 3 **FLUID DYNAMICS** : Euler’s and Bernoulli’s equations (generalized for compressible and other processes ), Navier stokes equation-exact solution , integral momentum equation, angular momentum equation ,application to jet engines & propeller action
- 4 **FLOW MEASUREMENTS**: Measurements of static dynamic & stagnation pressure & velocity, measurement of discharge through pipe by venture meter, flow nozzle & an orifice meter, measurement of velocity by pitot tube, prantl tube , hot wire anemometer flow, flow visualization techniques
- 5 **LAMINAR FLOW** : Laminar flow through pipe, between parallel plates, between co-axial rotating cylinders, Hagen Poiseuille flow between parallel plates ,couette flow, Couette flow from Navier stories equation , combined Hagen Poiseuille & Couette flows, Couette flow in cylindrical coordinates , steady flow motion around a sphere
- 6 **TURBULENT FLOW**: Reynolds criterion and Rouse’s criterion for transition from laminar to turbulent flow. Eddy viscosity and mixing length concepts
- 7 **PIPE FLOW** :Energy & hydraulic gradient line, Darcy- Weisbach equation , major and minor losses in pipe flow, Fanno lines in flow analysis
- 8 **BOUNDARY LAYER ANALYSIS**: Boundary layer thickness, Prandtl’s boundary layer equation. Hydrodynamically smooth and rough boundaries, velocity distribution near smooth and rough boundaries, boundary shear for laminar & turbulent boundary layer.
- 9 **DRAG AND LIFT**: separation, drag on immersed bodies, deformation, friction and form drags, drag on sphere, cylinder, flat plate. Airfoil Examples, circulation in irrotational flow, Magnus effect. Lift force , lift on aerofoil, examples, Introduction to water hammer & surge.
- 10 **DIMENSIONAL ANALYSIS AND SIMILITUDE**: Dimensionless groups, Buckingham theorem, Group method, similitude. modeling criteria.

## BAS 009 INTRODUCTION TO AERONAUTICS

- 1 **HISTORY OF FLYING**-Mankind’s desire to fly. Various efforts in Pre-Wright Brothers era - brief historical sketch, Wright flyer. Earlier types of flying machines. Development of aeronautical science in America and Europe. Progress in Aircraft design, aerospace applications.  
**INTRODUCTION**: Aircraft definitions and classifications as per features & Aircraft Act,  
**CURRENT STATUS**: Different types of heavier than air vehicles, along with prominent features. Airplane. Helicopter. Hovercraft, V/STOL machines, modern developments
- 2 **ATMOSPHERE** : Introduction to standard atmosphere , calculations of stratosphere , calculations of troposphere , relative density , stability of atmosphere, aircraft altimeter ( true and equivalent speed)
- 3 **AIRPLANE AERODYNAMICS**: Nomenclature used in Aerodynamics, NACA designations of aerofoil ,Laminar & Supercritical aerofoil, Different parts of airplane and constructions, Wing as lifting surface, Types of wing planforms, Aerodynamic features like aerofoil pressure distribution & measurement in wind tunnel, Aerodynamic forces and moments. Lift and Drag. Drag polar, L/D ratio, high lift devices, active and passive boundary layer control devices, Compressibility effects on aerodynamic coefficients(without derivation) Critical Mach number. Lift and drag divergence. Sweep back effects. Tip effects. Area rule, V-n diagram

- 4            **PROPELLER:** Use of propellers to produce forward thrust and their various categories
- 5            **CRUISE, TAKE-OFF, LANDING AND OPTIMUM PERFORMANCE:** Airplane performance like Thrust / Power available, climb and glide hodograph , maximum range and endurance, take off and landings, Brequet range and endurance equation ,

**BASL 007 Lab-07 (CNS- ATM SYSTEMS).**

**COMMUNICATION, NAVIGATION, SURVEILLANCE- AIRTRAFFIC MANAGEMENT SYSTEM**

**Practical on following-**

1.            To study typical aircraft cockpit layout
2.            To study airfield and aircraft emergencies and steps taken by various agencies
3.            Study project on any CNS-ATM related system

**ET-574-Lab-08 (FLUID MECHANICS- ANY FIVE)**

- 1            Measurement of viscosity
- 2            Proving Bernoulli's theorem
- 3            Performance characteristics of free jets
- 4            Study & experiment on flow meter
- 5            Fully developed flow through pipes
- 6            Flow around a circular cylinder
- 7            Development of turbulent pipe flow.

**BASL 009 Lab-09 (AERO-MODELING )**

1.            Making of paper & Thermocol models of aircraft
2.            Model flights and flight path corrective methods

**BASL 010 Lab-10 (MATERIAL SCIENCE –ANY FIVE)**

1.            Tensile testing on mild steel specimen on UTM
2.            Hardness testing by any method..
3.            Izod impact test.
4.            Magna flux testing, Die penetration test,
5.            Ultrasonic testing.
6.            Study and drawing of microstructures of various steels, non-ferrous metals .
7.            Jominy and quench test.

**FOURTH SEMESTER**

**BAS 010. MACHINE DESIGN**

1.    **BASIC PRINCIPLES** : Stress Analysis , factors for design consideration
2.    **DESIGN OF MECHANICAL ELEMENTS-** Riveted & welded joints, screw fasteners, power screws.

**DESIGN CONCEPT OF MACHINE PARTS** : Machine elements-, shafts, keys , springs, bearing, cams and followers , power transmission systems ,belt drives, gear drives , clutches, brakes & coupling , tribology

3.    **DESIGN CONSIDERATION:** Selection of material, manufacturing considerations, Vibrations, Ergonomics and environment in design

**ET-201B THERMODYNAMICS**

- 1            **FUNDAMENTAL CONCEPT** : Thermodynamics properties, system, cycle, equilibrium, process on PV diagram , work heat, Zeroeth Law of thermodynamics

- 2           **FIRST LAW OF THERMODYNAMICS** : Statement, internal energy, enthalpy, applications to steady flow processes, numerical problems
- 3           **SECOND LAW OF THERMODYNAMICS**: Kelvin planks, Clausius statements, heat engine, heat pump, reversible & irreversible process, Carnot theorem, Refrigerator thermodynamics temperature scale
- 4           **ENTROPY**: Definition, calculations of change in entropy for different process, T-S and h-s diagram, Helmholtz and Gibbs function, Clausius clapeyron equation
- 5           **PROPERTIES OF PURE SUBSTANCES (STEAM TABLES)** : Internal Energy, Enthalpy, Phase change, PVT surface, Maxwell relations, T-ds relations
- 6           **IDEAL & REAL GAS** : Deviation of real gas compressibility chart, Vander wall's equation of state
- 7           **GAS POWER CYCLE** : Carnot, Otto, Diesel, Dual cycle, Gas turbine cycles, reheating and regeneration, gas turbine for jet propulsion
- 8           **ENGINEERING APPLICATIONS** : Refrigeration, Reciprocating compressors ,
- 9           **FUELS & INTRODUCTION TO CHEMICAL THERMODYNAMICS**: solid , liquid , gaseous fuels
- 10          **ENERGY MANAGEMENT**: Fuels and combustions efficiencies

#### **BAS 011 AIRCRAFT SYSTEMS & AIRWORTHINESS REQUIREMENTS**

- 1           **AIRCRAFT SYSTEMS**- Introduction & necessity of aircraft systems.
- 2           **HYDRAULIC SYSTEM**: Types of circuits - Advantages and disadvantages, actuators, reservoirs, accumulators, contamination control: filters: tubing and hose pipes, valves. under -carriage system.
- 3           **PNEUMATIC SYSTEMS**: Air-conditioning and pressurization systems, deicing systems, heat exchangers, valves, filters, air bottles, capsules and bellows,
- 4           **OXYGEN SYSTEMS**.
- 5           **FUEL SYSTEMS**: Types of fuels: colour codes: pumps: fuel transfer systems: fuel tanks
- 6           **LUBRICATION SYSTEMS**: Types of lubrication systems: lubricants: cleaning agents;
- 7           **FIRE PROTECTION SYSTEMS**: Fire detection systems: Fire extinguishing systems.
- 8           **INTRODUCTION TO AIRCRAFT RULES** related to airworthiness and safety of aircraft (Airworthiness requirements for civil and military aircraft MIL, CAR, CAA, FAA, JAR and ICAO regulations).

#### **BAS 012 AERODYNAMICS-I**

- 1           **INTRODUCTION**: Aerodynamics as a branch of fluid mechanics & fundamental gas laws, fluid statics and dynamics – Lagrangian , Eulerian approach . Bernoullis generalized equations , Navier stoke exact solution.
- 2           **TWO DIMENSIONAL IDEAL FLUID FLOWS**: Circulation and vorticity. Irrotational flows. Stream and potential functions for uniform flows, sources, sink, vortex flows and combinations. Mapping of flow fields and determination of pressure and velocity distributions. Lift on rotating cylinder in uniform flow , Kutta- Joukowski theorem ( $L = \rho U \Gamma$ ), Magnus effect, paradox of d' Alembert.
- 3           **COMPLEX POTENTIAL**: Its properties and applications to various flows, Conformal transformation, Joukowski transformation. Circular arcs, Symmetrical and cambered airfoils. General expressions for lift and moment.
- 4           **2-D INCOMPRESSIBLE THIN AIRFOIL THEORY**: Lift and pitching moment coefficient of flat and curved plates and airfoils, effects of flap on aerodynamic coefficients
- 5           **EXPERIMENTAL METHODS** : Types of wind-tunnels and measuring techniques

#### **BAS 013 PROPULSION –1**

- 1           **CYCLES AND PROCESSES**: Otto Cycle, Diesel Cycle, Dual Cycle - their comparison

Brake thermal, mechanical, overall & volumetric efficiencies, torque and mean effective pressure , specific fuel consumption.

2        **AIRCRAFT POWER PLANTS:** Brief description & principles, Propeller, Jet, turboprop, bypass jet & ramjet. Internal combustion engines, types, process , working of spark ignition and compression ignition, 4-stroke and 2-stroke engines, functions of their parts and materials, combustion processes, abnormal combustion various types of arrangements for multi cylinder aircraft engines. Intake and Exhaust manifolds. IHP, BHP and SHP Engine performance,

3        **AIRCRAFT SI ENGINES-** Special features like light weight, ignition system, effect of altitude and speed, power required and power available. Super charging, types of super chargers.

4        **ENGINE PERFORMANCE:** IHP, BHP and SHP Engine performance,., corrections factors , variables speed and constant speed test.

5        **ELEMENTS OF HEAT TRANSFER: CONDUCTION:** Heat Transfer process, Heat conduction, Thermal conductivity, General equation of heat conduction in 1-D and 2-D. Convection and Radiation Heat Transfer: Convection process, free convection heat transfer from vertical flat plate, planes, cylinder and sphere, free convection. Thermal Radiation and Emissive power. Planck's distributive law, Radiation properties.

6        **CARBURETION :** Fuel air ratio requirements , calculation of venturi and fuel orifice size ,typical carburetor elements

7        **LUBRICATION AND COOLING SYSTEMS:** Types of lubrication systems (petrol , splash, semi-pressure, pressure and dry-pump system) , properties of engine lubricants and additives. Types of cooling systems (air cooling , pressure cooling , steam cooling )

#### **BASL 011 Lab-11 (THERMODYNAMICS- ANY FIVE EXPERIMENTS)**

- 1        Experiment on compressor to find pressure ratio, mass flow rate,  $\eta_{\text{isentropic}}$  ,  $\eta_{\text{polytropic}}$  .
- 2        Trial on petrol/ diesel engine at constant load to plot (i) speed Vs BP , (ii) speed Vs specific fuel consumption (iii) Speed vs brake thermal efficiency
- 3        Trial on Vapor compression Refrigeration test rig
- 4        To find calorific value of fuel using Bomb calorimeter
- 5        Exhaust gas analysis by CO/HC meter
- 6        Study of aircraft IC engine
- 7        Study of aircraft air-conditioning system

#### **BASL 012 LAB-12 (AERODYNAMICS LAB)**

- 1        Study of wind tunnel and measuring techniques
- 2        Wind tunnel test showing pressure distribution on circular cylinder.

#### **BASL 013 LAB-13 (MACHINE DESIGN)**

1.        One full imperial size sheet on spur gear design

2. One full imperial size sheet on Screw jack

### **BASL 014 INDUSTRIAL TRAINING-**

Industrial Training of three weeks at the end of fourth semester during vacation period. The students will be required to submit report of their training.

## **FIFTH SEMESTER**

### **ET 102 MATHEMATICS-III**

1. **SERIES:** Real Numbers, Sequences and Infinite Series of Positive Terms, Infinite Series and Arbitrary Terms, Series of Functions and Power Series, Fourier Series
2. **COMPLEX VARIABLES:** Functions of a Complex Variable, Complex Integration, Classification of Singularities and Calculus of Residues, Evaluation of Certain Definite and Improper Integrals, Conformal Mapping.
3. **DIFFERENTIAL EQUATIONS:** First Order Ordinary Differential Equations, Higher Order Linear Differential Equations, Series Solutions of Linear Equations, Partial Differential Equations (PDEs), Applications of Partial Differential Equations
4. **LINEAR SYSTEMS ANALYSIS:** Laplace Transform and Applications, Basics of Linear Systems, Control System Analysis

### **BAS 014 AIRCRAFT STRUCTURE**

1. **INTRODUCTION TO AIRCRAFT STRUCTURE:** Flight envelope for different flying conditions (salient features of V-n diagram) for the loads acting on aircraft, structural function and constructions of different aircraft components - wings, fuselage (monocoque, semi monocoque, truss type, power plant (nacelles))
2. **DEFLECTION OF BEAMS :** Different Methods : Governing Equation for Deflections, Sign Conventions The Boundary Conditions, Deflections of Simply Supported Beams (SS Beams) : SS Beams with Central Point Load, SS Beams with a Point Load anywhere on Span, SS Beams with UDL, SS Beams with Triangular Load, SS Beams with a Couple, SS Beams with an End Couple, SS Beams with Equal End Couples, Examples, Deflection of Cantilever Beams : Cantilever Beams with Single Concentrated Load at Free End, Cantilever Beams with a Central Point Load, Cantilever Beams with a UDL, Cantilever Beam with a UDL on Some Portion, Cantilever Beams with a Triangular Load, Cantilever Beams with an End Couple, Examples, Deflection of Overhang Beams, Application of Deflections of Beams, Introduction to the concept of Shear centre and centre of twist, tension field beam

**TORSION :** Circular Shafts : Theory of Torsion, Torsional Displacements, Shearing Stress

**THICK AND THIN CYLINDERS :** Thin Cylinders: Assumptions, Stresses, Strains, Wire Wound Pipes, Thick Cylinders : Assumptions, Stresses, Compound Cylinders

**SHELLS :** Thin Spherical Shells : Stresses, Strains,

3. **COLUMNS :** Eulers formulae with end conditions, Rankine Gordon formulae columns & struts
4. **EXPERIMENTAL STRESS MEASUREMENTS :** Strain gauges, load cells, Brittle lacquer, Torque wrenches

### **BAS 015 AERODYNAMICS- II**

1. **FINITE WING IN INCOMPRESSIBLE FLOW:** Vortex system of wing. Lifting line and lifting surface theory. Induced velocity distribution: Biot and Savarts law. Elliptic load distribution. Effects of changes in planform, aspect ratio and twist.
2. **ONE DIMENSIONAL COMPRESSIBLE FLOW:** Basic laws and equations of thermodynamics flow equations. Velocity of sound. Isentropic subsonic and supersonic flows through converging and diverging passages. Supersonic flow through constant area ducts. Normal shock relations.

- 3            **TWO DIMENSIONAL SUPERSONIC FLOW** past wedges and concave corners. Oblique shock relations. Hodograph shock- polar. Strong; weak and detached shocks. Prandtl-Meyer expansion flow past two dimensional concave corners. Expansion hodograph. Reflection of shocks and expansion waves. Method of characteristics.
- 4            **VISCOUS FLOW THEORY:** Boundary layer theory, estimation of boundary layer thickness, laminar and turbulent boundary layers, skin friction; transition, separation, examples of cricket and golf balls , Laminar flow airfoils.

**BAS 016    PROPULSION – II**

1.        **NOZZLE & DIFFUSERS-NOZZLE- FLOW/** Operating characteristics for isentropic flow/ flow and shock waves, Converging /diverging nozzles, effect of back pressures, area ratio and mass flow, Diffuser /Nozzles in subsonic & supersonic flow, Engine Inlet design, siezing and performance for various flow regimes
2.        **COMBUSTION SYSTEMS:** Basics of combustion chambers, Ignition system, Flame stability and afterburner
3.        **INTRODUCTION TO    RAMJET,** Turbojet with and without after burner, Turbo fan Engine, optimum by pass ratio, Turbo-Prop Engine Cycle analysis of real engines
4.        **CENTRIFUGAL AND AXIAL FLOW COMPRESSOR:** Euler's Turbo-machinery equations. Axial Flow Compressor analysis, cascade action, flow field, velocity diagrams, flow annulus area stage parameters. degree of reaction, cascade airfoil nomenclature and loss coefficient, diffusion factor, stage loading and flow coefficient, stage pressure ratio, Blade Mach No, Radial variation, Design Process, Performance.
5.        **AXIAL FLOW TURBINE:** Introduction to turbine analysis, mean-radius stage calculations, Stage parameters, stage loading and flow coefficients, degree of reaction, stage temperature ratio and pressure ratio, blade spacing, radial variation, velocity ratio. axial flow turbine stage flow path dimension, stage analysis. Turbine Performance. Blade Cooling.
6.        **JET ENGINE SYSTEMS :**Introduction to Fuel system, Lubrication system, Cooling system, ignition system

**BAS 017    FLIGHT MECHANICS**

1.        **INTRODUCTION STATIC AND DYNAMIC STABILITY:** Concepts of static and dynamic stability and control.
2.        **STATIC LONGITUDINAL STABILITY:** Stick fixed static longitudinal stability, neutral point, power effects, and stick free static longitudinal stability. Hinge moments, aerodynamic balancing static margin, in flight measurement of stick fixed and stick free neutral points
3.        **LATERAL AND DIRECTIONAL STABILITY AND CONTROL:** Asymmetric flight, weather cock stability, rudder fixed and rudder free static directional stability- rudder lock, dihedral effect. Control in roll, aileron control power. Cross coupling of lateral and directional effects.
4.        **MANEUVERING FLIGHT AND STABILITY:** Elevator angle per g and stick force per g maneuver margin stick fixed static maneuvering longitudinal stability, neutral point, power effects, stick free static maneuvering longitudinal stability. Hinge moments, static margin, in flight measurement of stick fixed and stick free neutral points
5.        **AERODYNAMIC BALANCING :** Methods of aerodynamic balancing , control of flutter and wing torsional diversion

**BASL 015    Lab-14 (PROPULSION – II)**

1.        Study of cut section of gas turbine engine
2.        Study of centrifugal and axial flow compressors

3. Study of jet engine fuel system and combustion chamber
4. Study of starting system
5. To measure velocity across converging divergent nozzle operated by compressed air

**BASL 016 Lab-15 (AERODYNAMICS- II)**

- 1 Flow visualization over a delta wing
- 2 Pressure distribution over a aerofoil

**BASL 017 Lab-16 (AIRCRAFT STRUCTURES)**

- 1 Study & use of strain gauges, loads cell
- 2 Study of landing gear structure
- 3 Experiment on determination of shear centre.
- 4 Buckling of channel and z- sections.
- 5 To plot load versus deflection on fin/wing

**SIXTH SEMESTER**

**ET-524 . PRINCIPLES OF ENGINEERING MANAGEMENT & ECONOMICS**

1. **BASIC CONCEPT** : Management, **Though** and function , micro-economics for engineers , economic environment and policies, human behavior at work, staff training and development.
2. **ORGANIZATIONS** : Organizations structure and compatibility , power, authority and delegation , organization dynamics – a response to growth and decay.
3. **MANAGERIAL CONTROL** :Management quality, time value of money, decision making: models techniques and processes.
4. **INTRODUCTION TO PROJECT MANAGEMENT** : Projects : concept and phases , project management, value engineering, eco friendliness of project.

**BAS 018 AIRCRAFT SAFETY AND MAINTENANCE ENGINEERING**

1. Classification and brief philosophy of aircraft maintenance practices as per Civil Aviation Requirements.
2. Aircraft health monitoring using statistical techniques for periodic dates of presentation on failures and maintenance.
3. Aircraft & component useful life & extension.
4. Basic safety concepts in engineering.
5. Air Safety Circulars.

**BAS 019 AIRCRAFT INSTRUMENTS**

1. Introduction to Aircraft instrument- Multimeter / meggar and measurement of basic electrical characteristics.
2. RPM measuring instruments. Temperature indicator, Fuel Indicator.
3. Airspeed indicator, artificial horizon, yaw / pitch indicator.
4. Magnetic Heading Reference System.
5. Gyro concept, need for a true surface, optical gyro.
6. Flight Director System.
7. Strap-down Technology.

**BAS 020 BASIC CONTROL THEORY**

1. **INTRODUCTION TO FEEDBACK SYSTEM** : Laplace transform, Fourier transforms, characteristics of basic feedback loop, introduction to dynamics of stable and unstable system.

2. **MODELS OF COMPONENTS AND SYSTEMS:** It's variable and equations, modeling of passive electrical components and systems. Static and dynamic variables, modeling of DC motors and servo systems, transducer, sensors and actuators , transport delay.
3. **FREQUENCY RESPONSE ANALYSIS** : Open loop and closed loop poles and zeros, Nyquist diagram , nyquist stability criterion , stability margin, illustrations of phase margin and gain margins
4. **THE BODE MAGNITUDE PLOT** : Studies on BODE phase plot, stability margins on the BODE plot, time delay effects.
5. **THE ROOT LOCUS METHOD** : The locus equation, properties and sketching rules, loci for systems.
6. **TIME RESPONSE** : Steady state error, transient response to a input, performance measurement.
7. **SYSTEM DESIGN** : Signal conversion and processing :Servo components, synchors, sensors, actuators, computers electronic design aspects: rating, time delays, reasonable values, etc. proportional controller, proportional integral controller, proportional integral differential controller.

#### **BASL 018 Lab – 17 (BASIC CONTROL THEORY)**

1. To study open loop system.
2. To study closed loop system with feedback.
3. To study the bode plot .
4. To study the root locus method.
5. To study the PI, PD, PIV controllers.

#### **BASL 019 Lab – 18 (CAD-CAM)**

1. Study of CRT monitors.
2. Draw simple line on computer screen translate, rotate reflect 2-D object about any axis.
3. Draw 2-Dimensional object.
4. Draw 3- D object and show scaling ,rotation & translation of that object about any particular axis
5. Test the painter's algorithm by showing general filled polygons with different interior styles.
6. For given part to be machined, prepare a CNC part program to machine the holes on vertical axis CNC machining center using the ISO standard G-codes.. You may choose Program Zero (Axes) to be used for the component. Show the axes chosen and write the program.
7. For a given component to be machined, prepare a CNC part program to machine the part contour on any vertical axis. Shown machining center using the ISO standard G-codes. Show the axis chosen and write the program using the initial tool position.
8. Prepare a CNC part program for a component to be machined on any turning center using the ISO standard G-codes.. Write the program using the initial tool position.
9. Develop a CNC milling part program in a post processor version to machine the given Component.

#### **BASL 020 PROFESSIONAL TRAINING**

Three weeks training at Aircraft Manufacturing or Aircraft Spares Manufacturing or Aircraft Maintenance Organizations or Laboratories engaged in Aeronautical Research or DGCA Labs / Research centers .

## SEVENTH SEMESTER

### BAS 021 ENVIRONMENTAL SCIENCE

- 1 Multidisciplinary nature of environmental studies
- 2 Natural resources
- 3 Ecosystems
- 4 Biodiversity
- 5 Pollution
- 6 Social issues and the environment
- 7 Human pollution and the environment
- 8 Field work

### BAS 022 COMPOSITE MATERIALS

1. **INTRODUCTION TO COMPOSITES:** Materials: Classification of composite, particulate composite, fibrous composites. Use of fiber reinforced composites.
2. **MANUFACTURING COMPOSITES** :Fibers, matrices and manufacture of composites :properties of various types of fibers like glass, Kevlar, Carbon and Graphite, methods of manufacture, surface treatment of fibers, various forms of fibers, matrix materials, polymers: Thermosetting and thermoplastic polymers, properties of polymers like epoxies, phenolics, polyester peek etc
3. **UNIDIRECTIONAL COMPOSITES:** Orthotropic Lamina and short fiber composites: Anisotropic elasticity, unidirectional and antistropic lamina, thermo mechanical properties , micromechanical analysis, classical composite lamination theory cross and angle ply laminates, symmetric, anti symmetric and general asymmetric laminates, mechanical coupling. Analysis of simple laminated structural elements, lamina failures theories, first ply failure, vibration and buckling analysis, sandwich structures, and secondary failure modes.
4. **NDT TECHNIQUES** : Ultrasonic, acoustic and X-ray techniques

### BME-006 MECHATRONICS

1. **SENSORS AND TRANSDUCERS** :Introduction to transducers and sensors, general characteristics of transducers and sensors, transducers' applications and selection.
2. **ACTUATIONS SYSTEMS (MECHANICAL)** :Mechanical, hydraulic power pack, pumps and compressors, control valves and actuators, Ancillary device and design of circuits.
3. **ACTUATIONS SYSTEMS(ELECTRICAL)** :Electrical drives, control systems, input and output devices.
4. **PROGRAMMABLE LOGIC CONTROLLER** :PLC structures and languages, programming of PLC, interfacing PLC with actuators, open loop and closed loop control using PLC.
5. **LINEAR SYSTEM ANALYSIS:** Laplace transforms, Basics of linear system, control system analysis.

### BME-007 QUALITY ENGINEERING

1. **QUALITY SYSTEMS** : Introduction to quality control, Conceptions of total quality management, Tools of quality , Role of ISO and OSHA in quality.
2. **QUALITY TOOLS- STATISTICAL** : Capability indices, control Charts, Design of Experiments
3. **QUALITY MANAGEMENT** : Implementation of quality systems in industry, cost quality, case studies

### BMEL-701 Lab-19 (MECHATRONICS)

1. Design and Analysis of Full Wave Rectifier.

2. To Study the Working Principle of Proximity Sensor.
3. To Carry out Addition and Multiplication of Two 8-bit Numbers on a Microprocessor.
4. To Write up a Microprocessor Program and Set up a Control Circuitry using Proximity Switch to Operate a DC Motor.
5. To Write a Stepper Motor Control Program.
6. To Write a PLC Program to Control the Operation of Two DC Motor Simultaneously.
7. To Write a PLC Program to Control the Operation of DC Motor by Pushing either of the Push Buttons.
8. To Study the Operation of a Regenerative Circuit.
9. To Study the Operation of a Sequencing Circuit.

### **BASP 001 PROJECT**

Theoretical or experimental project work taken up by individual student-to continue over two semesters.

## **EIGHTH SEMESTER**

### **BAS 023 AIRCRAFT DESIGNS**

1. **PRELIMINARIES:** Aircraft Design Requirements, specifications, role of users. Aerodynamic and Structural Consideration, Importance of weight. Airworthiness requirements and standards. Classifications of airplanes. Special features of modern airplane.
2. **AIRPLANE WEIGHT ESTIMATION :** Selection of type and number of power plant units , Weight estimation based on type of airplane, trends in wing loading, weight-estimation based on mission requirements, iterative approach.
3. **BASICS OF WING DESIGN:** Selection of airfoil, influencing factors. Span wise load distribution and planform shapes of airplane wing. Stalling, take off and landing considerations. Wing drag estimation, high lift devices.

### **BAS 024. INTRODUCTION TO ROCKETS & MISSILES**

1. **INTRODUCTION** to rockets and missiles & their differences , important current missiles & Indian guided missiles development programme.
2. **ROCKETS :** Classification of rockets , different propellants, block diagram of solid, liquid & hybrid rockets, igniters for solid propellant rockets , basic rocket equation for exhaust velocity, area ratio, equilibrium pressure added velocity, velocity gain by staging.
3. **PRELIMINARY DESIGN** of solid propellant rocket given working pressure, required velocity gain & payload.
4. **MISSILES :** Various types of missiles, classification, guidance, different types of guidance, homing, command, beam rider etc.
5. **BLOCK DIAGRAM** of different missiles systems, working of passive homing missiles.
6. **MISSILES AERODYNAMICS :** Slender body theory. Lift, drag, minimum drag, stability of rocket & missiles calculations, static stability margin, materials for rockets & missiles , future trends.

### **BAS 025. SPACE DYNAMICS**

1. **SOLAR SYSTEM:** Reference frames and coordinate systems, Celestial sphere, ecliptic, Earth's atmosphere.
2. **GENERAL BODY PROBLEM:** Many body problem - Lagrange - Jacobi identity - The circular restricted three body problem – Libration points - Relative Motion in the N-body problem - The two - body problem - Satellite orbits - Relations between position and time - Orbital elements, center force motion.

3. **SATELLITE Injection and Satellite Orbit Perturbations** General aspects of satellite injections - Satellite orbit transfer - Various cases - Orbit deviations due to injection errors.
4. **SPECIAL AND GENERAL PERTURBATIONS** - Cowell's Method - Encke's method - Method of variations of orbital elements - General perturbations approach Two dimensional interplanetary trajectories - Fast interplanetary trajectories - Three dimensional interplanetary trajectories - Launch of interplanetary spacecraft - Trajectory about the target plant.
5. **BALLISTIC MISSILE TRAJECTORIES** The boost phase - The ballistic phase - Trajectory geometry - Optimal flights - Time of flight - Re-entry phase - The position of the impact point - Influence coefficients.
6. **MATERIALS FOR SPACECRAFT** : Space environment - Peculiarities -Effect of space environment on the selection of materials of spacecraft.

**ELECTIVES. PLEASE REFER TABLE BELOW.**

**BASP 002 AIRCRAFT DESIGN PROJECT**

Aircraft design project will be taken up as group activity (4-5 students) based on the theory covered.

**ELECTIVE 1**

**BASE 001 HELICOPTER ENGINEERING**

1.	<b>INTRODUCTION:</b> Differences with fixed wing aircraft, Basic features & layout, Helicopter components and performance requirements.
2.	<b>HOVERING :</b> Introduction to hovering theory and vertical flight performance analysis. Autorotation in vertical descent, physical concepts of blade motion and rotor control aerodynamics of forward flight & performance, tail rotor,
3.	<b>HELICOPTER PERFORMANCE:</b> Force, momentum and power equilibrium.
4.	<b>CONTROL OF HELICOPTERS:</b> Introduction to helicopter vibration problems.
5.	<b>ROTOR BLADE:</b> Aerofoil selection, material, construction, blade area, number of blades.

**BASE 002 ROCKET PROPULSION**

1.	<b>INTRODUCTION:</b> Classification & basic features, propellants & igniterS
2.	<b>GASDYNAMICS OF ROCKET MOTORS-</b> Nozzle theory, departure from ideal theory.
3.	<b>COMBUSTION.</b> Aero-thermo chemistry, Burning of solid propellants & its internal ballistics.
4.	<b>DESIGN.</b> Basic design features of solid propellant rocket.
5.	<b>LPR</b> Introduction to Liquid & Hybrid Propellant rocket propulsion.

### **BASE 003 HIGH SPEED AERODYNAMICS**

1.	<b>COMPRESSIBLE SUBSONIC AND TRANSONIC FLOWS:</b> Linearized theory for subsonic compressible flow about a thin wing at small angle of attack.
2.	<b>TRANSONIC REGIME.</b> Flow past upswept airfoils, swept wings at transonic speeds. Area rule, forward swept wing, extension to transonic aircraft.
3.	<b>SUPERSONIC FLOW:</b> Differential equations of motion for steady compressible flows. Small perturbation potential theory. Solutions for supersonic flows. Mach waves, and Mach angles. Prandtl- Glauertaffine transformation relations for subsonic, flows, Linearised and exact two dimensional supersonic flow theory. Lift, -drag, pitching moment and centre of pressure of supersonic profiles.
4.	<b>BASIC CONCEPTS</b> of Hypersonic Flow.

### **BASE 004 FLIGHT TESTING**

1.	Ground / flight calibration of aircraft speed indicator/avionic instruments, CG determination of aircraft before & after refueling, engine parameter during ground running, determination of glider drag polar..
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### **BASE 005 INTRODUCTION TO COMPUTATIONAL FLUID DYNAMICS**

1.	<b>INTRODUCTION TO CFD:</b> CFD as a design tool, explicit and implicit methods.
2.	<b>GRID GENERATION:</b> Equation of fluid Dynamics, boundary conditions and, O,C,H types of grids, various space discretisation methods such as FDM, FVM, FEM : concept of state update formula..

### **BASE 006 FINITE ELEMENT METHOD**

1.	<b>FEM</b> Discretization and the Direct Stiffness Method , Basic concepts of structural modeling , Review of the stiffness method of structural analysis , Modeling stiffness, loads and displacement boundary conditions. Advanced modeling: general constraints, sub structuring.
2.	<b>FORMULATION OF FINITE ELEMENTS</b> , Mathematical interpretation of finite elements, variational formulation. Development of continuum elements, shape functions, consistent loads. Isoparametric elements for plane stress. Numerical integration, Convergence requirements.
3.	<b>COMPUTER IMPLEMENTATION</b> of the Finite Element Method Pre processing: model definition. Element level calculations. Equation assembly. Equation solver. Post processing: strain and stress recovery.

### **BASE 007 MICROPROCESSOR**

1.	<b>INTRODUCTION</b> to 8085 microprocessor 859-
2.	<b>SIGNALS</b> and pin configuration 8085 microprocessor
3.	<b>EXECUTION</b> Of programmes of 8085
4.	<b>TYPE OF INSTRUCTIONS</b> and addressing for 8085
5.	<b>AN OVERVIEW OF 8086 ARCHITECTURE</b> , special functions of registers , addressing , instructions set , assembly directive of simple programmes, procedures, macros.
6.	<b>ASSEMBLY LANGUAGE</b> involving logical , branch and calls instructions, sorting , evaluation , string manipulation
7.	<b>PIN DIAGRAM</b> , Min and Max mode of operation, timing diagram, memory interface to 8086
8.	<b>INTERRUPT STRUCTURE</b> of 8086 , vector interrupt, serial data transfers schemes , asynchronous and synchronous data schemes , 8251, TTL to RS232C and RS232C to TTL conversion .

## **BASE 008 APPLIED INDUSTRIAL AERODYNAMICS**

1.	<b>WINDS ENERGY:</b> Types of winds, Causes of variation of winds, Atmospheric boundary layer, Effect of terrain on gradient height.
2.	<b>WIND ENERGY HARNESSING:</b> Horizontal axis and vertical axis machines, Power coefficient, Betz coefficient by momentum theory, fans, blowers, wind mills.
3.	<b>AERODYNAMICS OF VEHICLES.</b> Power requirement and drag coefficients of automobiles, Effects of cut back angle, Aerodynamics of trains and Hovercraft.
4.	<b>BUILDING AERODYNAMICS:</b> Pressure distribution on low-rise buildings, hoardings, Wind forces on buildings, Special problems of tall buildings, building ventilation and architectural aerodynamics.
5.	<b>FLOW INDUCED VIBRATIONS:</b> Effect of Reynolds number on wake formation of bluff shapes, Vortex induced vibrations.

## **ELECTIVES-II**

### **PRODUCTION MANAGEMENT**

1.	<b>STRATEGIC PLANNING IN PRODUCTION MANAGEMENT:</b> Overview of Production Management, Plant Location and Facility Layout, Cost Profit Volume or Break Even Analysis, Project Management, Forecasting.
2.	<b>PLANNING FUNCTION IN PRODUCTION MANAGEMENT :</b> Aggregate Production Planning, MRP, ERP, Capacity Planning, Work Study and Measurement ,
3.	<b>OPERATIONAL ASPECTS OF PRODUCTION MANAGEMENT :</b> In Bound and Out Bound Logistics, Theory of Constraints, Supply Chain Management,
4.	<b>CONTROL AND MEASUREMENT OF PRODUCTION MANAGEMENT:</b> Control Function in Production Management, Scheduling and Sequencing, Just-in-Time, Measurement in Production System,

### **INDUSTRIAL ENGINEERING & OPERATIONAL RESEARCH**

1.	<b>INDUSTRIAL ENGINEERING :</b> Introduction to Industrial Engineering, System Approach for Industrial Engineering, Changing phase of Industrial Engineering, Productivity, Innovation and Technology Management.
2.	<b>WORK SYSTEM DESIGN :</b> Method Engineering and Motion Study, Time Study, Work Sampling, Standard data and PMT Systems.
3.	<b>PRODUCT DESIGN AND DEVELOPMENT :</b> Phases of Product and Process Design , Tools and Techniques of Product Design, Business Process Re-Design, Environmental Consideration in product design.
4.	<b>ERGONOMICS:</b> Man-Machine Systems, Ergonomics and Product Design, Environment and Human Productivity.
5.	<b>OPERATIONS RESEARCH APPLICATIONS :</b> Introduction to Operations Research, LP Models and Application Transportation Models, Stochastic Models.
6.	<b>DECISION MAKING TOOLS :</b> Simulation in Industrial Engineering, Game Theory, Multi-Objective and Priority Making Decision Tools.

## **INDUSTRIAL PSYCHOLOGY**

1.	<b>FUNDAMENTALS</b> : Psychological terms.
2.	<b>APPLICATIONS</b> : Industrial environment, in the areas of work study, human relation , conflict management , motivational theories etc.

## **SYSTEMS METHODS** -

1.	<b>SYSTEM CONCEPTS</b> : definitions, modeling, feedback , representation of engineering systems.
2.	<b>OPTIMIZATION TECHNIQUES -1</b> : Linear programming – graphical method, linear programming – simplex method, transportation problem , assignment problem
3.	<b>OPTIMIZATION TECHNIQUES 2</b> : Inventory method, queuing problem, critical path method / PERT.

## **10. GUIDELINES FOR PROJECT COURSES**

### **(1) Objective**

The objective of the project is to help the student develop ability to apply the engineering and technological concepts, tools and techniques to study and attempt to solve any engineering or system problem.

### **(2) Prerequisite**

Student can take up Project Course only after completing a minimum of two years after admission into B.Tech. Programme.

### **(3) Types of Project**

The project may be from any of the following types:

- (i) Comprehensive case study (covering any engineering system).
- (ii) Field oriented analysis and/or design problems (such as design of mechanical engineering elements/equipment, industrial/engineering processes and systems).
- (iii) Engineering management (such as evaluation, estimation, optimization, planning and management etc.)
- (iv) Repair and maintenance of mechanical equipment.

### **(4) SUBMISSION OF PROJECT REPORTS**

Project reports shall be submitted to training center. The report after duly scrutinized, will be forwarded to the Coordinator (IGNOU-AERO), School of Engineering and Technology, IGNOU, Maidan Garhi, New Delhi – 110 068 and the results/grade will be obtained from the Director (SR&E), IGNOU, Maidan Garhi, New Delhi – 110 068.



**INDIRA GANDHI NATIONAL OPEN UNIVERSITY**  
 MAIDAN GARHI, NEW DELHI – 110 068  
**APPLICATION FORM FOR ADMISSION – JULY- 2010**

**Completed form with attested copies of certificates and prescribed registration fee in the form of demand draft of Rs. 10,000/- drawn in favor of IIAEIT, payable at Pune and submit to Indian Institute for Aeronautical Engineering and Information Technology, Pune by 30<sup>th</sup> June, 2011.**

**DO NOT  
STAPLE**

Affix your  
passport size  
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(3.5 cm x 4.5 cm)  
duly attested

1. Programme Code    2. Enrollment No. (To be allotted by IGNOU)    3. Preference for training at

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4. Details of Fees

							/			/	<b>2</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>
Demand Draft No.					Date			Month			Year				Amount (in Rupees.)				

Bank Name

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

5. Region Code

--	--	--	--	--	--	--	--	--	--	--	--

(Code to be allotted by IGNOU)

6. Training Institute

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(For Institutes available see next page)

7. Name (as appearing in your Secondary (10<sup>th</sup> Class) Examination Certificate)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

8. Father's / Husband's Name / Mother's Name (Strike out whichever is not applicable)

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9. Address for Correspondence (Do not give Box No. address; Leave a blank box between each unit of address like House No., Street Name, P.O., etc.)

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City

District

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State

Pin Code

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10. Telephone No. (if any) with STD Code

STD Code

Telephone No.

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11. Mobile No. (if any)

<b>0</b>														
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12. E-Mail Address (if any)

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**13. Date of Birth**  
(As given in 10<sup>th</sup> exam certificate)

<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
Date	Month	Year			

**14. Age (as on 1<sup>st</sup> July, 2011)**

<input type="text"/>	<input type="text"/>	<input type="text"/>
Years	Months	Days

**15. Sex:** Cross (✓) in the box Applicable to you

Male  Female

**16. Nationality:** Cross (✓) in the box applicable to you

Indian  Others   
If other please specify: .....

**17. Territory Code:** Cross (✓) in the box applicable to you

Urban  Rural

**18. Category:** Cross (✓) in the box applicable to you

Gen.  SC  ST  OBC

**19. Relevant Educational Qualifications** (Which make you eligible for the programme)

Qualification Code *	Main Subjects	Year of Passing	% of marks in PCM	Name of the Board
<input type="text"/>		<input type="text"/>	<input type="text"/> • <input type="text"/>	(Board / University must be approved / recognized by the Government of India).
Highest percentage of marks obtained in English in 10 <sup>th</sup> <input type="checkbox"/> or 12 <sup>th</sup> <input type="checkbox"/> or B.Sc./ Examination <input type="checkbox"/> [Cross (✓) in the box applicable to you.]				

**DECLARATION BY APPLICANT**

I hereby declare that I have read and understood the conditions of eligibility for the programme for which I am seeking admission. I fulfill the minimum eligibility criteria for this programme as prescribed in the prospectus. I have provided necessary and relevant information. In the event of any information being found incorrect or misleading, my candidature shall be liable to cancellation by the University at any time and I shall not be entitled to refund of any fee paid by me to the University/Training Institute. Further, I have carefully studied the rules of the University as printed in the Prospectus and I accept them and shall not raise any dispute in future over the same rules & the rules formulated from time to time.

Date  /  /

Sign of Parent / Guardian

Signature of candidate

**\*Educational Qualification Codes :**

10 +2 or Equivalent	- 002	Diploma in Engineering	- 003
Graduation in Engineering	-004	Graduations or Equivalent	- 005

**CHECKLIST**

Before submitting the application form please make sure that you have affixed your photograph and signed over it and attached the following (Tick the relevant boxes):

- i. Demand Draft for Registration fee Rs 10,000/- as applicable.
- ii. Attested Certificates in support of your eligibility qualification (s). (attach attested copies of marks-sheet, 12 pass certificates)
- iii. Attested Category Certificate for SC/ST/OBC candidates wherever required and caste validation certificate.
- iv. Attested Date of Birth Certificate (attach attested copy of secondary (10<sup>th</sup>) examination certificate issued by a recognized Board).
- v. Leaving certificate

**Certificate by the Head of the Training Institution**

Certified that the admission form and the attached documents have been duly verified by the institution and the candidate fulfills all the eligibility criteria prescribed for admission to the programme.

**Date:**

**(Signature & seal of Head of the Institution)**



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