

1. Introduction:

The *National Knowledge Commission*, in its recommendations, has emphasised the importance of an *all inclusive, quality higher education system*, for developing skills of human resource in keeping with the demands of the global market. In this context, the importance of *improving the quality of Engineering and Technical education* has been highlighted. To keep pace with the global standards of Engineering Education, India has become a provisional signatory to the Washington Accord in 2007.

The *Washington Accord* is an apex global organisation of 10 member-nations for standardisation of Engineering Education. All Indian Undergraduate Engineering Degrees that conform to the *standards set by Washington Accord*, will be accorded '*an equal status in all member countries*' and will be '*recognized as engineering degrees of high international standards*'. Presently the degrees awarded from the IITs and the Birla Institute of technology & Sciences (BITS) Pilani, are considered worthy of high honour. Once the other Engineering Universities and Colleges of the next rung *upgrade their curricula in accordance with this Global standard*, they will be recognised as equivalent to the Engineering degrees of the Nations who are signatories of the Washington Accord. It is expected that as India becomes a permanent signatory to the Washington Accord in 2013, it will facilitate the *mobility of engineering graduates and professionals at international levels*'. The Engineering graduates from NBA-accredited programmes will be accepted for higher education and employment in other member countries.

2. Expectations:

With this in view, the *All India Council for Technical Education (AICTE)* has worked out a *guideline for curriculum* that has updated the '*modes of assessments and quality of faculty and courses*' in the engineering institutes from the subcontinent to bring them up to the international standards'. This aims to bring the *academic programmes, curricula and syllabi*, as well as the *assessment, examination and evaluation systems at par with the international standard*. The accreditation system has to be revised and made completely '*outcome based, with credit system for flexibility and continuous evaluation for improved learning*'.

It is felt that all modern, globally acceptable Engineering degrees should be able to impart to the students appropriate *skills that are suitable for a rapidly changing industrial scenario*. The modern day Engineers have to undertake *time bound assignments* that need to be *implemented on a fixed budget with limited resources*. They are expected to complete their jobs quickly and efficiently for which they must have both *well honed technical and social skills*. This is possible if they have access to more information on *holistic* basis. The database of technological information is expanding rapidly. This makes it difficult for the student to have a *complete grasp of all the information* they are expected to know. Instead of trying to teach every aspect of the subject, which is impossible to do within the span of the four years of the Engineering courses, it is important to *improve the skills for accessing information and developing flexible learning abilities*. It will also help in making the Indian industries competitive if *R&D institutions enter into partnership with the Institutes* in sharing their knowledge and skills and become stake holders in framing the curricula.

The curriculum and course structure suggested by AICTE to meet the demands are expected to incorporate the following:

1. There should *greater emphasis on design oriented teaching* including design methodologies that adopt problem-solving approach.
2. There should be *greater exposure to industrial and manufacturing processes*.
3. Outmoded technologies must give place to *newer appropriate and emerging technologies*.
4. Greater emphasis to be put on *management education and professional communication skills*.

There will be *periodic review of the curriculum and subject content* of the technical programmes. This should ensure that the syllabi are up to date and not outmoded or obsolete. This will effectively fulfil the technological requirements of the country.

3. AICTE Guidelines for the Model Curriculum:

The *AICTE* has incorporated all these points in the *suggested blue print of the revised curriculum* which has been sub-divided into different categories.

General 5-10%: This includes Humanities and Social Sciences.

Management Education and Professional Communication Skills are needed for the following reasons:

- a. Management of persons, machines and materials are involved in assignments.
- b. Engineers must have some training in behavioral Sciences, Industrial Psychology etc as they are expected to work with people from different backgrounds.
- c. In team work, communication skills are as important as management and engineering skills.
- d. The courses therefore must have scope for developing communication skills along with some understanding of economics, finance and marketing.
- e. Group discussions, seminars, symposia should also be a part of the curriculum.

This part of the curriculum should consist of the following skills.

- i. Language/Communication skills
- ii. Humanities and Social Sciences
- iii. Economics and Principles of Management

iv. NSS, NCC, NSO, Rural Development

Basic Science 15-25%

- i. Computer Literacy with Numerical Analysis
- ii. Mathematics
- iii. Physics
- iv. Chemistry

Engineering Sciences and Technical Arts 15-25%

- i. Engineering graphics
- ii. Workshop Practice
- iii. Engineering Mechanics
- iv. Electrical Science I (Basic Electrical Engineering)
- v. Thermodynamics and Heat Transfer
- vi. Material Science and Engineering
- vii. Electrical Science II (Electronics and Instrumentation)

Professional subjects 55-65%

- i. Each engineering discipline will have its own minimum number of core courses which will be classed as the **Professional Core**.
- ii. Rest of the courses will cover professional subjects as per list suggested by experts, in line with the academic regulations of the institution.
- iii. About 10% Electives should be made available to the students. These will be the **Professional Electives**.
- iv. Open interdisciplinary electives allow a student to diversify his/her spectrum of knowledge. These come under the category of **Free Electives**.
- v. In order to create a variety of individual skill and profile, it will be desirable to have a provision for some audit (non-credit) courses during the last two years of the degree program.
- vi. In the case of laboratory practical a bank of experiments be prepared, and every year new experiments/modifications be introduced. A majority of experiments should preferably be open-ended. The students are expected to work by themselves without the aid of technicians.
- vii. Continuous evaluation in tutorials, practical work, laboratory and project assignments.

Suggested break-up of the different categories of papers as per AICTE guideline are as follows:

- Professional Core: 45-55 credits or 22.5% - 27.5%
- Professional Elective: 25-30 credits or 12.5% - 15%
- Free Elective: 15-20 credits or 7.5% - 10%
- Project: 10 - 15 credits or 5% - 10%
- Seminar & Industrial Training : 5 - 10 credits or 2.5% - 5%

4. Uniform Structure for the Curriculum Proposed for the Under Graduate Courses of WBUT: [Annexure - I]

WBUT has proposed a uniform structure for all the under-graduate courses which conforms to the model curriculum laid down by AICTE as per the requirements of the Washington Accord. The structure contains, in relative proportions, all the elements suggested by AICTE. The proportionate representations of these topics are as under:

A: General:

[Communicative English; Language laboratory; NSS; Values & Ethics in Profession; Communication Skills & Report Writing; Principle & Practices in Management; Production & Operations Management / Introduction to Organisational Behaviour/ Financial Management; Group Discussion]

In the unified UG syllabus structure adopted by WBUT 18 credits out of 212-218 (8.3% - 8.5%) have been reserved for this category of subjects as against 5-10% prescribed by AICTE. Average of 8.4%.

B: Basic Science:

[Physics; Chemistry; Mathematics; Basic Computation & Computer Programming]

The WBUT unified UG syllabus structure there are 39 credits out of a total of 212-218 credit points (17.9% - 18.4%) that have been reserved for this category of subjects as against AICTE's prescription of 15-25%. Average percentage is 18.1%.

Here all subjects have been classified into two groups: *Physics based* subjects and *Chemistry based* disciplines. Physics based disciplines are again divided into two categories; those that are non-Electrical and all the Electrical & Electronics based disciplines. Physics based disciplines are to take two (2) Physics and three (3) Mathematics papers while Chemistry based streams will replace two Physics by two (2) Chemistry papers. Physics - I, Chemistry - I and Mathematics - I & II are common for all. Physics - II is meant for Physics based streams while Chemistry - II will be taken by the other Chemistry based group. Chemistry based disciplines with more emphasis on Biology will replace Mathematics - III by Biology.

The Groups are as follows:

Group-A: Chemistry based - [Bio-Technology, Food Technology, Leather Technology, Textile Technology, Ceramic Technology, Chemical Technology, any other which emphasis on Chemistry]

+ Physics Based Non-Electrical - [Apparel Production Engineering, Automobile Engineering, Computer Science & Engineering, Civil Engineering, Information Technology, Marine Engineering, Mechanical Engineering, Production Engineering]

Group-B: Physics Based with Electrical bias - [Applied Electronics & Instrumentation Engineering, Bio-Medical Engineering,



Electrical Engineering, Electrical & Electronics Engineering, Electronics & Communication Engineering, Instrumentation & Control Engineering, Power Engineering]

The common compulsory papers in the first and second years for the different Groups have been equitably distributed for balancing the teaching load.

C: Engineering Sciences and Technical Arts:

[The common Engineering Science papers are Basic Electrical & Electronics Engg I & II, Engineering Mechanics, Thermodynamics & Fluid Mechanics, Basic Environmental Engineering & Elementary Biology, Numerical Methods. Each discipline will have a choice of two more discipline specific Engineering Science papers.]

The unified UG course structure of WBUT reserves 40 credits out of 212-218 (18.3% - 18.7%) have been reserved for this category of subjects as against 15-25% as prescribed by AICTE. Average is 18.6%.

D: Professional subjects:

In the unified UG syllabus structure adopted by WBUT 115 - 121 credits out of 212-218 (54.2% - 55.5%) have been reserved for this category of subjects as compared to AICTE's prescription of 55-65%. The average percentage of course is 54.1%.

The break up is as follows:

Professional Cores: 56 - 66 credits out of 212-218 (25.7% - 31.1%) [AICTE: 45-55 credits or 22.5% - 27.5%]

Each discipline can choose 10 theory + 10 Practical papers to cover all basic topics related to the discipline. This will help the student to have an overall perspective of the fundamental concepts related to the discipline.

Professional Electives: 26 credits out of 212-218 (11.7%) [AICTE: 25-30 credits or 12.5% - 15%]

There are 6 Theoretical and 3 Practical papers on advanced study of certain speciality of the discipline. The College / Institute as well as the students can exercise their individual choice. The College will have the scope to develop a few niche areas as per its strength of infrastructure. The student will be allowed to study subjects of her/his choice from these niche areas. If the niche areas can be developed well then the affiliated Institutes may, in later years, allow students of other Institutes to take specialised Elective papers on mutual agreement of student exchange/sharing. This will help in developing different core areas of engineering in the future. This also leaves scope for introducing new subjects from the emerging areas listed by AICTE, or other fields that emerge in the future. The recent list of such niche/emerging areas is as follows.

- i. Electronics,
- ii. Bio-Medical Engineering,
- iii. Computers,
- iv. Environmental Engineering,
- v. Robotics, Industrial Engineering,
- vi. Power Systems,
- vii. Power Electronics,
- viii. Biotechnology,
- ix. Instrumentation etc.

While detailing the syllabi, it has been found that it is difficult to strictly adhere to the structure. Although, the credit points for different categories of Professional Core and Electives are fixed in the structure, there may be some flexibility in the number of cores and electives provided the total credit points of these two categories do not change. Hence if there is need for extra core papers in some discipline, then these papers are to be accommodated in place of Professional electives.

Free Electives: 18 - 22 credits out of 212-218 (8.3% - 10.4%) [AICTE: 15-20 credits or 7.5% - 10%], on an average 9.3% of the course are reserved for free electives.

4 Theoretical papers, two with practical, belonging to a different discipline can be offered. These may be Professional Core or Professional Elective papers of an allied discipline to begin with. Free / Open Elective papers of another Engineering discipline, from the Emerging areas or even from the Management fields may be customised if needed. Free Electives may also be customised to satisfy Industrial needs. Such papers may be designed in consultation with Industrial partners.

Project+ Design + Industrial Training + Seminar + Grand Viva:

The structure suggested has allotted 19 credits out of 212 - 218 (8.7% - 8.9%) for the above topics as compared to the model AICTE curriculum. [AICTE: Project:- 10 - 15 credits or 5% - 10% + Industrial Training + Seminar :- 5 - 10 credits or 2.5% - 5%]. [AICTE guideline : 7.5% - 15%. WBUT: 8.8% on an average.]

It is suggested by AICTE that the curriculum will put *greater emphasis on design oriented teaching* including design methodologies that adopt problem-solving approach. In order to train a student in the design aspects of Engineering, a **Design laboratory** has been introduced along with the Project work. This will enable a student to have greater practice on designing. This will be in addition to the Project work undertaken. Under this category students may develop circuits, systems or models, handle workshop equipment, work in specialised laboratories that will help them to be familiar with sophisticated instruments. Each discipline can choose its mode of instructions according to the requirement of that field.

This will help in catering to the diverse needs of the students and develop their potentials in different areas as per their aptitude. Some of the deserving students may be allowed to work as Interns in reputed concerns or research laboratories etc. The main idea is



to help the student put his/her knowledge into practice. This may encourage the students to go into a career in research and development. This will alternatively, offer scope to the Institutes to teach the students how to handle industry standard packages. There will also be enough flexibility to accommodate emerging practices and develop the basic skill of handling engineering problems.

An affiliating University like West Bengal University of Technology has large number of Colleges under its umbrella, with heterogeneous infrastructure and varied quality and aspirations of students. The uniform syllabus is meant to impart to the students appropriate *skills that are suitable for a rapidly changing industrial scenario*. The syllabus not only caters to the average student, it must also have the scope to nurture the exceptionally meritorious ones. The scope for taking the elective papers provides all categories of students to opt for subjects of their interest and ability. Although the credit courses are compulsory for all students, a meritorious one may be allowed to take on audit courses in the final semester, which will be in addition to the prescribed papers. Meritorious students can also be encouraged to work as interns in prestigious projects if they qualify to do so. Many of the industries have already started discussions on such prospects.

5. Modalities of Framing Syllabus and Improving the Learning Process & Evaluation:

The curriculum gets revised every few years. Joint *workshops* are conducted before finalising the syllabus. Constant feedbacks are taken to upgrade the syllabus and make it more relevant.

Since the new accreditation system has been made completely '*outcome based, with credit system for flexibility and continuous evaluation for improved learning*', the WBUT curriculum has both internal assessment and end-term assessment for evaluation. The curriculum is credit based and internal assessment guarantees continuous evaluation. The hands-on practical classes have both continuous assessment and end-term evaluation.

Detailing of Syllabus:

To make the *evaluation out-come based*, each individual paper has to be detailed out following the procedure of specifying the minimum requisites for the paper, the course content in details and finally spelling out the learning out-come that defines the level of understanding of the topic, skill-sets and capabilities acquired [Annexure - II]. This will help in proper evaluation in terms of the expectations.

Learning Material:

In order to make the learning process uniform, each paper may have a model course structure framed much like the NPTEL courses and tailored to fit the needs of the particular content of the paper [Annexure - III]. Standard course structures like the NPTEL courses or those offered by MIT (USA) etc may be used. Standard laboratory manuals may be designed for the practical courses. Apart from the standard experiments, each college may be encouraged to develop some innovative experiments to encourage the students.

Setting of Question Papers:

Each paper will be divided into about 5 modules. The questions are to be set from each module. A question bank may be developed to draw from. All faculty members may be encouraged to send questions with appropriate answers to the question bank. There may be a Board of Editors to evaluate the standard of the questions and categorise them according to the degree of difficulty involved in answering them. The questions may further be categorised as Basic, Problem oriented, Conceptual, etc. Such questions may be framed from each and every module. Long, descriptive answers are to be discouraged. The aim will be to ask for precise, to-the-point answers and to look for problem solving abilities. [Annexure - IV]


6. Industry - Institute Partnership:

Members of industries have been included in the different Boards-of-Studies for reflecting the perspective of the industries in to the syllabus.

Some corporate houses have already engaged themselves in partnerships. Joint training programmes are being organised. These models can be extended and developed further in all areas of learning.

IT firms are already offering to mentor the students jointly with their teachers in executing real life projects. [Infosys organises Campus Connect Programmes, IBM has Faculty Development Programmes etc]. Such exercise could be extended to other areas.

Industrial training could be made more meaningful.

Signature
08/02/2019




First Year - First Semester

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU	English	2	0	0	2	2
2	Basic Sc.	Chemistry-1 / Physics-1	3	1	0	4	4
3		Mathematics-1	3	1	0	4	4
4	Engg. Science	Basic Electrical & Electronic Engineering - I(Gr-A+Gr-B)	2	0	0	4	4
5		Engg. Mechanics	2	1	0	4	4
Total of Theory						18	18
B. PRACTICAL							
6	HU	Language Laboratory	0	0	2	2	1
7		NSS	0	0	2	2	1
8	Basic Sc	Chemistry-1/Physics-1	0	0	3	3	2
9	Engg. Science	Basic Electrical & Electronic Engineering - I	0	0	3	3	2
10		Engg Drawing & Computer Graphics / Workshop Practice	1	0	3	4	3
Total of Practical						14	9
Total of Semester						33	27

Physics based branches divided in to Gr-A & Gr-B, Gr-A= Phys in sem-I , Gr-B = Phys in sem-II:
Chemistry based branches Physics in sem-1.

First Year - Second Semester

A. THEORY							
Sl. No.	Field	Theory	Contact Hours/Week				Credit Points
			L	T	P	Total	
1	Basic Science	Basic Computation & Principles of Computer Programming	3	1	0	4	4
2		Physics-1 / Chemistry-1	3	1	0	4	4
3		Mathematics-2	3	1	0	4	4
4	Engg. Science	Basic Electrical & Electronic Engineering-II (Gr-A+Gr-B)	2	0	0	4	4
5		Engineering Thermodynamics & Fluid Mechanics	3	1	0	4	4
Total of Theory						19	20
B. PRACTICAL							
7	Basic Science	Basic Computation & Principles of Computer Programming	0	0	3	3	2
8		Physics-1/Chemistry-1	0	0	3	3	2
9	Engg. Science	Basic Electrical & Electronic Engineering- II	0	0	3	3	2
10		Workshop Practice / Basic Engg Drawing & Computer Graphics	1	0	3	4	3
Total of Practical						13	9
Total of Semester						32	28

Second Year - Third Semester



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A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU	Ethics, Philosophy & Values	2	0	0	2	2
2	Basic Sc.	Chemistry-2/ Physics-2 (Gr-A) /Mathematics-3 (Gr-B)	3	1	0	4	4
3	Engg. Sc.	Env Sc for Gr-A; /Engineering Science -1 (discipline specific) Gr-B	3	0	0	3	3
4		Engineering Science -2 (discipline specific)	3	0	0	3	3
6	Prof Core	Two papers	3	1	0	4	4
			3	1	0	4	4
Total of Theory						18	20
B. PRACTICAL							
8	Basic Sc	Chemistry-1/ Physics-1 Gr-A; No lab for Gr-B	0	0	3	3	2
9	Engg. Sc.	Discipline specific ES; 1ES Lab for Gr-A & 2 ES Labs for Gr-B	0	0	3	3	2
10	Prof. Core	Two Practicals	0	0	3	3	2
			0	0	3	3	2
Total of Practical						12	8
Total of Semester						30	28

* Gr-B has no Basic Science Lab; Two Engg. Science Labs to be included for gr-B.

Second Year - Fourth Semester

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU	Economics for Engineers	2	0	0	2	2
2	Basic Sc.	Mathematics-3(Gr-A) / Biology/Physics-II (Gr-B)	3	1	0	4	4
3	Engg. Sc.	Engg Sc (discipline specific) Gr-A /Basic Environmental Engineering & Elementary Biology (Gr-B)	2 1	0	0	3	3
4&5	Professional Cores	Two papers	3	1	0	4	4
			3	1	0	4	4
Total of Theory						17	17
B. PRACTICAL							
7	HU	Communication skill & Report writing	0	0	3	3	2
8	Engg. Sc.	ES Lab for Gr-A; / Phys Lab for Gr-B	0	0	3	3	2
10	P.C.	Two Labs	0	0	3	3	3
			0	0	3	3	3
Total of Practical						14	10
Total of Semester						32	28

* Chemistry & Bio-Tech based subjects may take one Biology paper instead of the extra Mathematic III.



Third Year - Fifth Semester



A. THEORY							
Sl.No	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU	Principles & Practices of Management	2	0	0	2	2
2&3	P.C.	Two papers	3	1	0	4	4
			3	1	0	4	4
4	P. E.	One paper	3	0	0	3	3
5	F. E.	One paper	3	0	0	3	3
Total of Theory						16	16
B. PRACTICAL							
8	P.C.	Two Labs	0	0	3	3	2
			0	0	3	3	2
9	P.E./F.E.	Two Labs	0	0	3	3	2
			0	0	3	3	2
Total of Practical						12	8
Total of Semester						28	24

Third Year - Sixth Semester

A. THEORY							
Sl.No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HU	Production & Operations Management / Indian Society Literature & Culture / Introduction to Organisational Behaviour	2	0	0	2	2
2&3	P.C.	Two papers	3	0	0	3	3
			3	0	0	3	3
4&5	P. E.	Two paper	3	0	0	3	3
			3	0	0	3	3
	F. E.	One paper	3	0	0	3	3
6							3
Total of Theory						17	17
B. PRACTICAL							
8	P.C.	Two Labs	0	0	3	3	2
			0	0	3	3	2
9	P.E.	One Lab	0	0	3	3	2
10	F.E.	One Lab	0	0	3	3	2
Total of Practical						14	10
Total of Semester						32	27



Fourth Year - Seventh Semester

A. THEORY							
Sl. No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	



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1 & 2	P.C.	Two papers	3	0	0	3	3
3 & 4	P. E.	Two paper	3	0	0	3	3
5	F. E.	One paper	3	0	0	3	3
Total of Theory						15	15
B. PRACTICAL							
6	HU	Group Discussion	0	0	0	3	2
7	P.C.	One Lab	0	0	3	3	2
8	P.E.	One Lab	0	0	3	3	2
9	F.E.	One Lab	0	0	3	3	2
10	Industrial training *						2
Total of Practical						14	10
Total of Semester						29+ID	25

- *Training to be completed after completion of sixth semester.

Fourth Year - Eighth Semester

A. THEORY							
Sl. No.	Field	Theory	Contact Hours/Week				Cr. Points
			L	T	P	Total	
1	HSS.	Seminar	2	0	0	2	2
2	P. E.	One paper	3	0	0	3	3
3	F. E.	One paper	3	0	0	3	3
Total of Theory						8	8
B. PRACTICAL							
	Design	Design Design Lab / Industrial problem					
4		(Industrial training)	0	0	0	6	4
5	Project.	Project-2	0	0	12	12	6
10	Grand Viva						2
Total of Practical						18	10
Total of Semester						18	18

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