



# Bachelor of Technology (Honours)

# BIORESOURCE

## ACADEMIC HANDBOOK



School of Industrial Technology  
Universiti Sains Malaysia  
[www.indtech.usm.my](http://www.indtech.usm.my)

**Academic Handbook**  
**Bachelor of Technology (Honours) (Bioresource)**  
**Academic Calendar 2022/2023**

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## Vision and Mission

### Universiti Sains Malaysia

#### Vision

Transforming Higher Education for a Sustainable Tomorrow

#### Mission

USM is a pioneering, transdisciplinary research intensive university that empowers future talents and enables the bottom billions to transform their socio-economic well-being

## Vision and Mission

### School of Industrial Technology

#### Vision

World class centre in technological innovation for a sustainable tomorrow

#### Mission

1. To be the prime education provider of technologists who are competent, capable of independent thinking, possess communication and analytical skills, and able to fulfil the needs in various industries and socio-economic development.
2. To pursue cutting-edge research in the fields of Food Technology, Bioresource Technology, Environmental Technology, and Bioprocess Engineering Technology.
3. To contribute to the well-being of the community through sustainability-led dynamic transdisciplinary academic programmes, research innovation, teamwork, and continuous improvement.

## Niche Research Area

### School of Industrial Technology

Sustainable Materials, Processing, and Energy Technologies

# History

## School of Industrial Technology

1973

The School of Industrial Technology commenced with the establishment of the School of Applied Sciences. The School offered the Bachelor of Applied Science programmes in Electronic Science and Technology, Food Science and Technology, and Polymer Science and Technology.

1984

The name of the School was changed to the School of Engineering Sciences and Industrial Technology. Hence, the curricula were amended to Bachelor of Engineering (B. Eng) and Bachelor of Technology (B. Tech) to meet the requirement of engineering and industrial technology courses.

1986

The School was split into :

- School of Electrical and Electronic Engineering
- School of Materials and Mineral Resources Engineering
- School of Industrial Technology

School of Industrial Technology offered Bachelor of Technology programmes in Food Technology, Polymer Science and Technology, Quality Control & Instrumentation, and Wood, Paper and Coatings Technology.

2001

Polymer Technology and Quality Control & Instrumentation programmes were upgraded into:

- Polymer Engineering programme
- Mechatronic Engineering programme

1999

Environmental Technology programme was introduced by School of Industrial Technology.

2002

Wood, Paper and Coatings Technology programme was renamed Bioresource, Paper and Coatings Technology programme.

2008

Bioprocess Technology programme was introduced by School of Industrial Technology.

2018

Master of Science (Environmental Science) programme was introduced by School of Industrial Technology.

2020

Bioresource, Paper and Coatings Technology programme was renamed Bioresource Technology programme.

2022

Bioprocess Technology programme was changed to Bioprocess Engineering Technology programme.

# Management

## School of Industrial Technology



- |    |  |  |
|----|--|--|
| 1  | Dean   | Prof. Datuk Ts. Dr. Abdul Khalil Shawkataly,<br>D.S.P.N., D.P.S.M. |
| 2  | Deputy Dean (Academic, Career & International)                         | Assoc. Prof. Dr. Mardiana Idayu Ahmad                              |
| 3  | Deputy Dean (Research, Innovation & Industrial - Community Engagement) | Assoc. Prof. Dr. Husnul Azan Tajarudin                             |
| 4  | Deputy Dean (Resource Development & Branding)                          | Assoc. Prof. Dr. Leh Cheu Peng                                     |
| 5  | Programme Chairman (Food Technology)                                   | Assoc. Prof. Dr. Uthumporn Ultra @ Sapina Abdullah                 |
| 6  | Programme Chairman (Environmental Technology)                          | Assoc. Prof. Dr. Yusri Yusup                                       |
| 7  | Programme Chairman (Bioresource Technology)                            | Dr. Nurul Fazita Mohammad Rawi                                     |
| 8  | Programme Chairman (Bioprocess Engineering Technology)                 | Dr. Mohamad Hafizi Abu Bakar                                       |
| 9  | Senior Assistant Registrar (Academic & Administration)                 | Mdm. Rasslene Rass Rasalingam                                      |
| 10 | Assistant Registrar (Postgraduate & Human Resource)                    | Ms. Nur 'Aqila Badrul Hisham                                       |

## Academic Programme

The School of Industrial Technology offers the following bachelor degrees:

- Bachelor of Technology (Honours) (Food)
- Bachelor of Technology (Honours) (Bioresource)
- Bachelor of Technology (Honours) (Environment)
- Bachelor of Bioprocess Engineering Technology with Honours

Acceptance to any of the above programmes is subjected to selection and entry qualification. Most of the first year courses consist of basic science courses in Chemistry, Mathematics, Physics, and Computer. From level 200, all students are required to enrol for courses relevant to their respective programmes up to level 300 (Bioresource and Environmental Technologies) or 400 (Food and Bioprocess Engineering Technologies), whereby they are required to conduct one final year research project.

Students are also required to undergo industrial training in various industries relevant to their study programme for 12 (Food, Bioresource, and Environment Technologies) or 24 (Bioprocess Engineering Technology) weeks. This training is aimed at exposing the students to actual working practice and atmosphere of the industry.

## Details of Programme

### Type of Programme

### Structure of Programme

Bachelor of Technology with Elective

Students choose several elective courses to widen their specialisation area and their knowledge in industrial technology.

Bachelor of Technology with Minor

Students choose and complete one minor area offered by other schools.

- Starting in the second semester of Year I.

## Bioresource Technology

This programme offers a comprehensive curriculum, which covers the basic and applied aspects of bioresource (wood and non-wood biomass) in the production of various bio-based products. Coatings technology for bioresource-based products is also highly emphasized. Students will learn about macro to nano scales fibre science and technology, bioplastic, pulp and paper production and testing, paper recycling, fundamentals of resins and biocomposites, paint, and product design while gain practical skills through hands-on classes and internship programme. The program is also designed to equip graduates with soft skills such as effective communication, interpersonal relation skills and critical thinking to help them actualize their intellectual capacity, which would in turn enhance their employability in a variety of related industries.

The curriculum of Bioresource Technology covers three stages of study, which emphasize on relevant course sequence, besides ensuring that teaching learning is distributed evenly throughout the whole period of study.

## Mentor-Mentee System & Counselling Service

The mentors are appointed among the academic staff of the school who provide assistance and guidance to students, mainly in academic matters. However, the school has established an open mentor system, whereby probation students are free to see any of the mentors. Nevertheless, probation students are recommended to discuss academic-related problems with mentors from their own programme.

The mentors appointed are as listed below:

No.	Name	Room No.	Phone Extension	E-mail Address
1.	Dr. Mazlan Ibrahim	341	2204	maz@usm.my
2.	Ts. Dr. Azniwati Abd Aziz	342	6364	azniwati@usm.my

## Programme Educational Goal & Objectives

The goal of the Bachelor of Technology (Honours) (Bioresource) degree programme is to produce graduates who have specialised expertise, solid knowledge, critical thinking, creative, research skills in the field of Bioresource Technology to meet the employable needs of the country in various related industries or agencies and graduates and able to lead the community for sustainable national development.

Therefore, the Bachelor of Technology (Honours) (Bioresource) degree programme is designed to produce graduates:

- who are competent, creative, innovative and capable of solving problems in Bioresource Technology on the global and society level for sustainable development.
- who can communicate and work in interdisciplinary teams effectively in the Bioresource Technology field.
- who have leadership skills, a positive attitude, and professional ethics in the Bioresource Technology field.
- who can contribute to society's well-being and the sustainability of the environment.
- who have an interest in entrepreneurship and constantly strive to acquire new knowledge through research, continuing education and/or professional development activities.

## Programme Learning Outcomes

At the end of the programme, students will be able to:

1. Acquire the advanced and comprehensive theoretical and technical knowledge and skills in the area of Bioresource Technology specialised (Knowledge).
2. Apply extensive technical skills in the area of Bioresource Technology specialisation (Practical Skills).
3. Identify and resolve issues and problems in a critical, creative, and innovative manner in the area of Bioresource Technology specialisation (Cognitive Skills).
4. Acquire the skill to communicate effectively in a well-structured manner to a diversity of audiences (Communication Skills).
5. Display a sense of responsibility and master social skills in diverse learning and working communities locally and internationally (Interpersonal Skills).
6. Understand and manage to make decision in a professional and ethical manner within the varied social and professional environment and practice (Ethics and Professionalism).
7. Manage current information and recognise the importance of lifelong learning (Personal Skills).
8. Acquire entrepreneurial knowledge base for career development (Entrepreneurship Skills).
9. Function effectively as an individual and in a team with the ability to lead within broad organisational scales. (Leadership, Autonomy and Responsibility).
10. Demonstrate basic digital skills and technological application for living, learning and working in a society (Digital Skills).
11. Demonstrate numeracy skills in all aspects of life (Numeracy Skills) .

## Programme Requirements

Course Code Classification	Normal Programme	Minor Programme	Min. Total Unit Requirements
T	72	72	
E	30	10	120
M	0	20	
U	18	18	

### Notes:

T (core courses) – compulsory courses for a particular area of specialisation that must be taken and passed.

E (elective courses) – courses must be taken by students with elective programme to strengthen their technology specialisation courses.

M (minor courses) – minor specialisation offered by other schools.

U (university requirements) – courses to fulfil the university requirements.

## Graduation Requirements

- ☑ Fulfil the minimum required (7 semesters) of the residential requirement for the programme of study and has not exceeded the maximum period of study (12 semesters).
- ☑ Fulfil all credit requirements of the courses for the programme of study required units such as the requirements for each component (core, elective/minor, and university courses or option).
- ☑ Obtained a CGPA of 2.00 and above for core courses.
- ☑ Obtained a CGPA of 2.00 and above for the programme.
- ☑ Achieved a minimum of 'C' or a grade point of 2.00 for Bahasa Malaysia, English (4 units), Appreciation of Ethics and Civilisations, Philosophy and Current Issues, and Core Entrepreneurship courses.



# University Requirements for Graduation

LOCAL STUDENTS		INTERNATIONAL STUDENTS	
Compulsory Courses	Units	Compulsory Courses	Units
❖ LKM400/2 Bahasa Malaysia IV	2	❖ LKM100/2 Bahasa Malaysia I	2
English Language ( <b>MUET Band 6</b> )		❖ English Language courses	4
(i) (LHP410/411/412/458/459)			
<b>and/or</b>			
(ii) Foreign language courses			
English Language ( <b>MUET Band 5</b> )			
• LSP301/2 General English 2 <b>and</b>			
(iii) 410/411/412/458/459			
English Language ( <b>MUET Band 4</b> )	4		
• LSP201/2 General English 1			
English Language ( <b>MUET Band 2 – 3</b> )			
(iii) LSP101/2 Progressive English* <b>or</b>			
(iv) Re-sit MUET			
* Prerequisite for LSP201/2 General English 1			
❖ HFE224/2 Appreciation of Ethics and Civilisations	2	❖ HFF225/2 Philosophy and Current Issues	2
❖ HFF225/2 Philosophy and Current Issues	2	❖ SEA205E/4 Malaysian Studies	4
❖ WUS101/2 Core Entrepreneurship	2	❖ Option/English Language	2
❖ WAR122 (Integrity and Anti-Corruption Course)	2	❖ Co-curricular	2
Optional Courses	Units	Optional Courses	Units
❖ Co-curricular/Skills Courses/Foreign Language Courses/Options		❖ Co-curricular/Skills Courses/Foreign Language Courses/Options	
❖ WSU101/2 Sustainability: Issues, Challenges & Prospect	4	❖ WSU101/2 Sustainability: Issues, Challenges & Prospect	4
❖ HTV201/2 Thinking Techniques			
Minimum Requirements	18	Minimum Requirements	18

**Note: Student must pass all University courses with the minimum grade of C.**



# Curriculum Structure

COURSE TYPE	LEVEL 100 (2023/2024)		LEVEL 200 (2024/2025)		LEVEL 300 (2025/2026)		LEVEL 400 (2026/2027)		TOTAL UNIT
	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	SEMESTER 1	SEMESTER 2	
CORE (T)	IEK 101/3	IWK 101/4	IUK 108/4	IWK 205/3	IWK 301/3	IWK 308/3	IWA 404/6*		72
	IUK 191/4	IWK 103/4	IWK 201/4	IWA 283/2	IWA 382/2	IWA 381/2			
	IWK 100/2	IWK 105/4	IWK 203/4		IWA 383/2	IWA 313/8**			
	IWK 102/4		IWA 281/2		IWA 313/8**				
ELECTIVE (E)	13	12	16	5	11	9	6		30
	IUK 107/4	IEK 115/3	IBK 212/2	IEK 108/3	IEK 212/3	IWK 305/2			
		IUK 291/4		IUK 208/3	IWK 304/3	IWK 306/2			
				IUK 303/3	IWK 307/2				
UNIVERSITY (U)	4	7	2	16	8	4			18
	WUS 101/2	WSU 101/2	HFF 225/2	HFE 224/2	LSP 201/2 or LSP 301/2	LSP 301/2			
	LKM 400/2 or Ko-K/1-2	LKM 400/2 Ko-K/Skill Courses/ Foreign Languages Courses/Option/2	HTV 201/2	LSP 101/2 or LSP 201/2					
	3-4	WAR 122/2	5	2	2	2			
<b>TOTAL MINIMUM CREDIT FOR GRADUATION</b>									<b>120</b>

\* Students must register for this course online during their internship.

\*\* Course is offered in TWO (2) semesters (unit counted per semester is 4).

# List and Synopsis of Courses

## 1. IEK 101/3 Chemical Process Calculations

This course is about general calculations involved in chemical processes. The students will be exposed to mass and energy balance and the steps needed to solve related problems. These topics will help the students solve problems effectively through the correct problem-solving methodology, relevant data collection and data analysis. This course also introduces the student to the properties and phase behaviour of steam, gases as well as basics of chemistry and physics.

## 2. IEK 108/3 Process Fluid Mechanics

**Course Prerequisites:** s IEK 101/3

This course introduces students to the concept of fluid statics, incompressible and compressible fluid flow, as well as flow across submerged bodies. Students will also be exposed to the topics of metering, separation, mixing, and pumping. Other topics include Fanning friction factor, pumping power and cost, as well as flow rate calculations.

## 3. IEK 115/3 Environment, Safety and Health Legislation

This course exposes the student to the concept of environmental, occupational safety and health management based on two main acts, Environmental Quality Act 1974 and the Occupational Safety and Health Act 1994. This course uses a case study learning approach.

## 4. IUK 107/4 Chemistry for Technologist

This syllabus is aimed to be comprehensive in scope and mainly intended to strength the applied chemistry background of the students. Students will learn the basics of inorganic chemistry, nuclear and radiochemistry, organic chemistry, and instrumental analysis. Spectroscopy methods such as FT-IR, NMR, ICP, and AAS will be used for the characterisation of functional groups, hydrogen atoms characterisation, and analysis of inorganic elements.

## 5. IUK 108/4 Statistic with Computer Applications

This course discusses on probability models for quality control of discrete random variation: random variation, cumulative distribution function, mean, variance and standard deviation. The course also discusses Discrete distribution: hypergeometric distribution, Binomial distribution, Poisson distribution, Continuous distribution, Normal distribution, exponential distribution and uses in reliability modelling.

## 6. IUK 191/4 Mathematics I

This course introduces the concepts of functions and limits of single variable. Linear, polynomial, logarithmic, exponential and trigonometry functions will be discussed. The focus will be on the understanding of concept and solving of differentiation and integration with applications. Students are then introduced to differential equations focusing on separable differential equation and first-order linear equations. Matrices and determinants are taught in solving systems of linear equations by using Gauss and Cramer methods.

## 7. IWK 100/2 Bioresource as Industrial Raw Materials

This course introduces students to the various types of lignocellulose materials. Main resources of raw materials from the forest and agricultural wastes will be discussed. Benefits to economy, national and international trade will also be discussed. The potential of lignocellulose as a source of energy will be introduced. Emphasise is also given on the resources from the non-wood, such as oil palm, bamboo, rattan, and other types of the lignocellulose fibres, as raw materials for pulp and paper, biocomposites (thermoplastic, thermoset and elastomer), and others applications. Various types of products and the importance of raw materials for products application derived from the bioresources will be highlighted.

### 8. IWK 101/4 Basic Coatings Technology

This course comprises of the introduction to the basics of polymer science, chemistry of addition polymerisation by free radical initiators, ionic and etc. It also discusses on the chemistry for condensation polymerisation and copolymerisation. Industrial polymerisation techniques include bulk, solution, emulsion, suspension and etc. Polymer solution and dispersion rheology encompasses basic concept, rheology parameter measurement, basic concept on polymer structure; crystalline, semi-crystalline and amorphous polymer behaviour. Characterisation of polymer consists of molecular weight definition, molecular weight measurement and various polymer characterisation techniques.

### 9. IWK 102/4 Basic Bioresource Science and Technology

This course is a basic introduction to structure of bioresource and organisation of wood anatomy – fibre, vessel, parenchyma. Wood cell ultrastructure – cell wall organisation, microfibril. Physical property of wood; moisture content, shrinkage and wood swelling, density. Mechanical property of wood; wood-flexural strength, compression, tension, shear, impact, MOR, MOE. Natural resistance of wood. Degradation and wood destructive agents – termites, fungi, insects, borer, parasite and control. Electrical and acoustic properties of wood. Preservation - chemicals (CCA, boric-borate, etc), preservation schedule. Wood drying - kiln and air-drying process, relationship of water vapour movement in wood drying, degradation resulting from drying and ways to reduce degradation. Production and machining of sawn timber.

### 10. IWK 103/4 Pulp Production and Paper Recycling

This course emphasises on the principles of pulping, chemical recovery, pulp bleaching and paper recycling. The main topics include various types of raw material for pulping, effects of biomass components on pulping, principles and types of pulping and pulp bleaching, advantages and disadvantages of conventional and chlorine-free bleaching, paper types, resource and various types of secondary fibres, utilisation rate and waste paper procurements. The advantages and disadvantages of paper recycling in terms of economical and technical aspects are also included.

### 11. IWK 105/4 Bioresource Based Products

**Course Prerequisites:** s IWK 102/4

This course teaches the students on wood composites and wood chemical technologies. Wood composites technology deals with comparing the efficiency between wood composites and bulk wood. Students will be exposed to the technologies of producing ply woods, particle boards, fibre boards, laminated veneer woods, parallel strand woods, and other wood composites – properties, processing and utilisation. Wood chemical technology will include chemicals obtained from trees and lignocellulose; thermal modification; charcoal and activated carbon; wood gas, and chemical modification.

### 12. KAT 145/4 Analytical Chemistry I

**Course Prerequisites:** s KOT 122/4 or s IUK 107/4

Stoichiometry calculations, statistical data treatment, concepts of equilibrium, gravimetric analysis, acid-base equilibria, acid-base titrations, complexometric titrations, precipitation reactions and titrations, electrochemical cells, and redox titrations.

### 13. IBK 212/2 Renewable Biomass

This theoretical course will expose students to various type of renewable biomass materials that can be used as substrate in the production of different bioprocess products. Focus is emphasised on the importance of this renewable biomass in human life for decades to come. On the other hand, to various methods and technologies that involves in biomass conversion to value-added product, such as chemical, biochemical, and thermochemical method, will be introduced to the students.

### 14. IEK 212/3 Process Heat Transfer

**Course Prerequisites:** s IEK 101/3

This course introduces the student to the fundamental principles of heat transmission by conduction, convection, radiation, and evaporation. This course will also discuss on the applications of these principles to the solution of industrial heat transfer problems and the design calculations for industrial heat exchanger equipment.

### 15. IUK 208/3 Experimental Design with Computer Applications

This course discusses on the Replication, Randomisation, Blocking, and Definitions in Experimental Design (Experiment, Treatment, Factor, Level, Experimental unit, Experimental design, Random, Replicate).

### 16. IUK 291/4 Mathematics II

**Course Prerequisites:** s IUK 191/4

This course expands the concepts of functions and limits to two variables. Linear, polynomial, logarithmic, exponential and trigonometry functions will be discussed. The focus will be on the understanding and solving partial derivatives of differentiation and solving double and triple integration with simple applications. Students are then introduced to differential equations focusing on separable differential equation and second-order linear equations. Infinite series, Taylor-MacLaurin series and Fourier series are taught with a view to examine the theory and properties of certain functions that can be represented as sums of series.

### 17. IWA 281/2 Coatings Technology Laboratory I

**Course Prerequisites:** s IWK 101/4

This course is a practical course which teaches students how to prepare polymeric resins for coating applications. The resins prepared are unsaturated polyester resin, epoxy resin, polyvinyl acetate and polymethyl methacrylate. Methods of preparation are systematically outlined. Basic resin properties are also studied. Students are familiarised with the application of each resin in the coating industry.

### 18. IWA 282/2 Bioresource Technology Laboratory I

**Course Prerequisites:** s IWK 102/4

This is a laboratory course that analyse bioresource structure and anatomical organisation of bioresource. Students will learn how to measure physical properties of bioresource such as moisture content, shrinkage and swelling and density. Student will be doing and measure the strength of the bioresource - bending, compression, tensile, shear, impact, MOR, and MOE. The students will determine the chemical composition of bioresource. This include the extractive, cellulose, hemicellulose, and lignin.

### 19. IWA 283/2 Paper Technology Laboratory I

**Course Prerequisites:** s IWK 103/4

This practical course will expose the students to various kinds of pulping methods such as craft, soda and chemi-mechanical. Students are also required to run the pulp beating and lab papermaking process; also pulp and paper testing.

### 20. IWK 201/4 Raw Materials and Coatings Chemistry

**Course Prerequisites:** s IWK 101/4

This course teaches the students on various material components that are required to prepare coating products such as paints, adhesives and printing inks. Specific raw materials used for each component are identified. The preparation, properties and functions of the raw materials are systematically discussed. The chemistry of coatings is also covered in this course in order to enhance the scientific knowledge in coatings.

### 21. IWK 203/4 Stock Preparation and Papermaking

**Course Prerequisites:** s IWK 103/4

This course covers general stock preparation and papermaking processes which are being practiced in the paper industry. Stock preparation part involves the pulp disintegration, pulp beating, wet-end additives addition, pulp blending, metering, and approach flow system. Including the stock preparation on secondary fibre (waste paper) processes, such as re-pulping, washing, cleaning, and de-inking. For papermaking part, its covers formation of paper, pressing, drying, calendaring and reeling processes.

### 22. IWK 204/3 Bioresource, Paper and Coatings Product Development

In this course steps involved in developing a product are discussed. Product design is the main focus of this course. Students will be exposed to various types of materials, material properties and processing techniques used to make products. The technique to choose the most suitable material and processing technique to produce a selected product will also be taught.

### 23. IWK 205/3 Chemical Additives and Paper Properties

**Course Prerequisites:** s IWK 203/4

This course emphasises on the importance of fibre properties in papermaking; analyses and measurement techniques of paper properties, including physical properties, mechanical strength, and optical properties. Besides, this course also discusses various additives that are used in paper industry including sizing agents, dry and wet strength additives, fillers, retention aids, surface sizing, dyes and pigments and brightening agents.

### 24. IEK217/3 Environmental Management

This course exposes the students to the concept of planning, implementation and management of the environment through systematic methods. The methods mainly discussed in this course are the Environmental Management System in line with the international standard ISO 14001 and Environmental Impact Assessment (EIA) along with Environmental Management Plan (EMP). Furthermore, students will learn other methods such as environmental performance evaluation, environmental labelling and Life Cycle Assessment (LCA).

### 25. IWA 313/8 Research Project of Bioresource, Paper and Coatings Technology

**\*\*Course is offered in TWO (2) semesters**

**Course Prerequisites:**

- (i) Students must take all core courses of levels 100 and 200.
- (ii) Students must also collect at least 40 credit units of core courses.

This course will introduce the student problems relating to Bioresource, Paper and Coatings Technology fields. Through research, the student will be tasked to solve the problem. Lecturers will supervise the students in carrying out the literature search, laboratory work, and dissertation writing. The student will also attend a series of lectures on research philosophy, experimental design, scientific thinking, laboratory safety, thesis writing, viva voce presentation.

### 26. IWA 381/2 Coatings Technology Laboratory II

**Course Prerequisites:** s IWA 281/2

This course is related to the synthesis of alkyd resin and pigment for paint formulation, dyeing, and preparation of rubber-based adhesive. Students are taught to apply their theoretical knowledge to practical application. This course also trains students to analyse and discuss critically on the various experiments which they have performed.

### 27. IWA 382/2 Bioresource Technology Laboratory II

**Course Prerequisites:** s IWA 282/2

This practical course enables students to analyse and understand the mechanical, physical, thermal, and fundamental identification characterisation of fibres raw materials, include thermosets and thermoplastics matrices. Chemical modification of lignocellulosic (solid wood and plant fibres) will be prepared and analysed. Production of conventional biocomposites, thermoplastics, and thermosets (filled/reinforced) composites will be produced and characterised.

### 28. IWA 383/2 Paper Technology Laboratory II

**Course Prerequisites:** s IWA 283/2

This course exposes the students to the process of pulp bleaching including the calculation of chemical used and analyses of the resultant pulp and paper properties, determination of paper properties, and starch content of commercial paper products, and also the process of paper recycling. Experiments involved are determination of various commercial paper properties, bleaching of pulp, determination of starch content of commercial papers quantitatively, and effect of pH and beating toward re-pulping.

**29. IWK 301/3 Coatings Process and Equipment****Course Prerequisites:** s IWK 201/4

This course deals with coating, which covers paint technology in details. Individual component used in paints and formulation will be explained. Corrosion control and barrier coatings will be discussed in detail. Also, standard testing methods will be elaborated to evaluate the performance of the paints. Furthermore, colour systems will be classified by different methods.

**30. IWK 304/3 Furniture Manufacturing****Course Prerequisites:** s IWK 102/4

This course is a combination of theory and practical on basic knowledge related to the production of furniture. The focus will be on planning, designing, processing steps, different types of machines used in furniture production, various types of joints used in furniture making, finishing processes, and introducing some aspects of ergonomic pertaining to furniture manufacturing.

**31. IWK 305/2 Advanced Technology of Coatings****Course Prerequisites:** s IWK 201/4

This course covers the advanced technology related to coating in industry. The students are exposed to various aspects of coating technology. Particular emphasis is given to release coating, coating methods for pressure-sensitive adhesives, specialty rubber adhesives, and ultraviolet (UV) and electron beam (EB) radiation curing. The students are familiarised with the materials selection and applications for each coating technology.

**32. IWK 306/2 Fibre and Lignocellulosic Composite**

This course is about the fundamental study of natural fibre, especially non-wood type from agriculture waste, such as rice husk and oil palm biomass, and the importance of in producing a composite. Natural adhesive source from lignocellulosic like tannin, lignin, furfural alcohol, and starch will be also included in this course. Students will learn about the preparation of lignocellulosic based composites, include polymer matrix composite by various types of process and moulding, such as extrusion, compression moulding, injection moulding, and resin transfer moulding. In addition, the interfacial properties of a composite, interaction between filler/fibre and polymer matrix, and surface treatment of natural fibre will be discussed.

**33. IWK 307/2 Advanced Paper Technology – Instrumental Analysis for Pulp and Paper**

This course exposes students to the various instrumental techniques for analysis of biomass, pulp, paper and materials related to the papermaking industry. Emphasis is placed on the criteria, application and capacity of an instrumental technique to provide students the necessary problem-solving skill involving the application of solo and serial analysis using advanced and classic instrumental techniques. The course supports students' higher-order thinking skills through exposure to case studies as a way of simulating problem-solving situation.

**34. IWK 308/3 Mechanics of Structural Materials****Course Prerequisites:** s IUK 191/4

This course focuses on topics of material strength, mechanical testing, and fracture mechanics of a material. Particular emphasis is given to bending properties of various types of beam, such as straight beam and curved beam. These include the deflection of a beam, shearing force, and bending moment of a beam.

**35. IWA 404/6 Bioresource, Paper and Coatings Technology Industrial Training****Course Prerequisites:** Students have completed FOUR (4) semesters of study, regardless of the accumulated units.

This course involves placement of students to undertake internship at industries. During the internship, students are able to gain an insight into industrial practices and appreciate how principles of science, technology and management are applied in the actual workplace.

## Minor Programmes

All students that choose to take a Minor programme must choose one minor programme and commence the programme in the second semester of the first year of their studies. These students must complete 20 units of the courses in the minor package.

Among the minor programmes offered are:

School	Minor Package	Code
School of Biological Sciences	Biology	oB01
School of Physics	Physics	oZ01
School of Chemical Sciences	Chemistry	oK01
School of Mathematical Sciences	Mathematics	oM01
School of Humanities	English Language	oH01
	Malay Linguistics	oH02
	Geography	oH03
	Literature	oH04
	Islamic Studies	oH05
	History	oH06
	Japanese Studies	oH11
	Philosophy and Civilisations	oH15
	Translation and Interpretation	oH14
	Japanese Language Studies	oL01
School of Language, Literacies, & Translation	Chinese Language Studies	oL02
	Communicational Arabic	oL06
School of Art	Fine Arts	oH07
	Performing Arts	oH08
	Musics	oH09
	Drama and Theatre	oH10
	Communicational Graphics	oH12
	Acting and Directing	oH13
	Music Technology	oV01
	Communication Studies	oY05
School of Communication	Science and Environment Journalism	oY06
	Management	oA03
School of Management	Archeology	oU01
Centre for Global Archeological Research	Anthropology and Sociology	oS01
School of Social Science	Economics	oS02
	Social Development and Administration	oS04
	Political Science Development	oS05
	Planning and Management	oS07
	Industrial Relation Public	oS08
	Policy and Administration	oS09
	International Relation	oS10
	South-East Asian Studies	oS11
	Psychology	oS12



The following minor programmes are popular among students of the School of Industrial Technology:

**(a) Communication Studies (oY05)**

No.	Code/Units/Course Title
<b>A. Compulsory (9 credits)</b>	
<b>i) Choose any 1 course (3 credits)</b>	
1.	YKT101/3 Introduction to Human Communication
2.	YKT102/3 Introduction to Mass Communication
3.	YKT104/3 Introduction to Communication Studies
<b>ii) Choose any 2 courses (6 credits)</b>	
4.	YKT218/3 Communication Theory 1
5.	YKT220/3 Communication Theory 2
6.	YBP201/3 Communication for Sustainable Development
<b>B. Choose (11 credits)</b>	
7.	YFP324/3 Cinema Studies
8.	YFP321/3 Television Studies
9.	YBP224/3 Public Relations
10.	YBP326/3 Corporate Communication
11.	YBP300/3 Integrated Marketing Communication
12.	YWP223/3 Feature Writing
13.	YKT221/3 Media Laws and Ethics
14.	YWP315/3 Media and Gender

**(b) Psychology (oS12)**

No.	Code/Units/Course Title
1.	STU231/4 Foundation in Psychology (Compulsory)
<b>Choose any 3 courses (12 credits)</b>	
2.	STU241/4 Health Psychology
3.	STU242/4 Social Psychology
4.	STU243/4 Development Psychology
5.	STU244/4 Abnormal Psychology
6.	STU337/4 Counselling

**(c) Management (oA03)**

No.	Code/Units/Course Title	Title Semester
1.	AKW103/4 Introduction to Management	I & II
2.	AKW104/4 Accounting and Finance	I & II
3.	AKP201/4 Marketing	I & II
4.	AKP202/4 Organisational Behaviour	I & II
5.	AKP302/4 Operation Management	I & II

Course 1 and 2 are compulsory and pre-requisites to other courses.

### (d) Economics (oSo4)

No.	Code/Units/Course Title
1.	SKE109/3 Principles to Economics Issues (Compulsory) - Sem. II
2.	SEW101/3 Microeconomics (Compulsory) - Sem. II
3.	SEW103/3 Macroeconomics (Compulsory) - Sem. II
<b>Choose any 3 courses (11 credits)</b>	
4.	SEU226/4 Labour Economics
5.	SEU228/4 Malaysian Economy
6.	SEU333/3 Industrial Organisation
7.	SEU334/3 Money, Banking and Financial Markets
8.	SEU336/3 Environmental and Natural Resources Economics
9.	SEU339/3 Economic Planning and Project Analysis

### (e) Islamic Studies (oHo5)

No.	Code/Units/Course Title
<b>Package A (12 credits)</b>	
1.	HIA101/4 Introduction to Islamic Studies (Compulsory Grade C)
2.	HIU123/4 The Islamic Creed: Concept and Realisation
3.	HIS213/4 Sources and Principles of Islamic Laws
<b>Package B (8 credits)</b>	
4.	HIS224/4 The Islamic Family Institution
5.	HIU226/4 Akhlaq and Islamic Spiritual
6.	HIS311/4 Zakat and Wakaf
7.	HIS315/4 Mu'amalat: Concept and Application
8.	HIU321/4 Al-Quran, Tawhid, and Science

For students wishing to register for the minor programme, please make sure that time-tabling and course scheduling allow you to graduate in the stipulated period. See the Minor Programmes Handbook for further information on Minor Specialisations.

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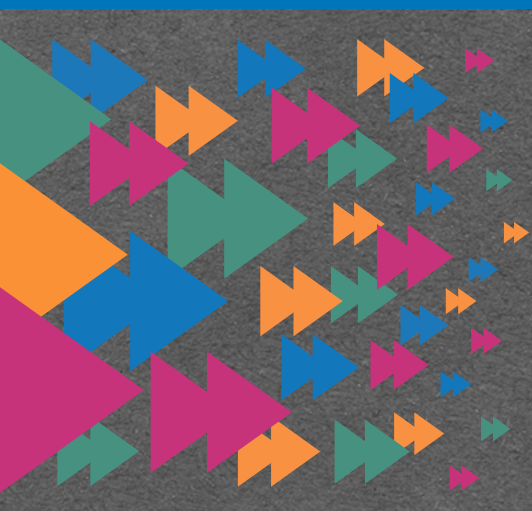
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**THE PREFERRED UNIVERSITY**  
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