

**KRITERIA DAN STANDARD BAGI PROGRAM PENDIDIKAN DALAM  
 BIDANG SAINS**  
***CRITERIA AND STANDARDS FOR EDUCATIONAL PROGRAMMES IN THE  
 FIELD OF SCIENCE***

<p><b>MATLAMAT AM PENDIDIKAN</b></p> <p>Mengeluarkan graduan Sains yang berpengetahuan luas melalui:</p> <p>(a) Penyampaian ilmu pengetahuan dan kemahiran berlandaskan prinsip-prinsip saintifik</p> <p>(b) Penanaman sikap, etika dan profesionalisma serta ciri kepimpinan warganegara yang bertanggungjawab untuk pembangunan masyarakat dalam kerangka wawasan negara</p> <p>(c) Pemupukan kemahiran menganalisis dan menyelesaikan masalah serta kebolehan menilai dan membuat keputusan secara kritis dan kreatif berlandaskan bukti dan pengalaman.</p> <p>(d) Pemupukan minat mencari ilmu dan kemahiran pembelajaran seumur hidup demi mempertingkatkan pengetahuan yang selari dengan perubahan pantas gedung ilmu global.</p> <p>(e) Pendedahan isu-isu umum dan khusus yang mempunyai kerelevanan institusi, kebangsaan, serantau dan global (contohnya etika sains, bioterrorisme, degradasi alam sekitar, salahguna teknologi).</p> <p><b>HASIL PEMBELAJARAN</b></p> <p>Setelah selesai mengikuti sesuatu program Sains, siswazah patut berkeupayaan dalam perkara berikut:</p> <p>(1) Sentiasa mempertingkatkan diri untuk mencari, berkongsi dan mengguna pengetahuan dan ketrampilan dalam bidang sains secara saintifik, profesional dan etikal dalam pembangunan sejagat.</p> <p>(2) Menggunakan imaginasi intelek dari</p>	<p><b>GENERAL EDUCATIONAL GOAL</b></p> <p>To produce broadly educated science graduates through the:</p> <p>(a) Provision of knowledge and skills based on scientific principles.</p> <p>(b) Nurturing attitudes, ethics, sense of professionalism and leadership skills as responsible citizenry for societal advancement within the framework of the national vision.</p> <p>(c) Fostering of skills for appraising and solving problems and the ability to critically evaluate and make creative decisions based on evidence and experience.</p> <p>(d) Development of the quest for knowledge and life long learning skills for continuous upgrading of knowledge that parallels the rapid growth in global knowledge.</p> <p>(e) Exposure to general and specific issues that are of institutional, national, regional and global relevance (for example ethics of science, bioterrorism, environmental degradation and abuse of technology)</p> <p><b>LEARNING OUTCOMES</b></p> <p>At the end of a programme in Science, graduates should be competent in the following:</p> <p>(1) Continuously upgrading themselves in seeking, sharing and using knowledge and skills in the field of science in a scientific, professional and ethical manner for global development.</p> <p>(2) Use their intellectual imagination to</p>
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<p>segi menganalisis isu dan masalah sains, membuat cadangan alternatif dan memberi keputusan secara kreatif.</p> <p>(3) Menggunakan dan mengadaptasi pengetahuan bidang sains untuk tuntutan pekerjaan, industri dan masyarakat.</p> <p>(4) Berkomunikasi secara efektif dan menunjukkan sikap dan akhlak sebagai warga negara yang bertanggungjawab.</p>	<p>analyse issues and problems in science and to propose alternative solutions and decisions creatively.</p> <p>(3) Utilise and adapt scientific knowledge for the demands of employment, industry and society.</p> <p>(4) Communicate effectively and demonstrate attitudes and moral behaviour of a responsible citizen.</p>
<p><b>KELAYAKAN</b></p>	<p><b>QUALIFICATIONS</b></p>
<p><b>Sarjana Muda Sains</b>  <i>Sarjana Muda Sains (bidang)</i>  <u>Contoh:</u> <i>Sarjana Muda Sains Fizik</i>  <i>Sarjana Muda Sains (bidang)</i>  <u>Contoh:</u> : <i>Sarjana Muda Sains (Fizik)</i></p>	<p><b>Bachelor of Science</b>  <i>Bachelor of Science ( field)</i>  <u>Example:</u> <i>Bachelor of Physical Sciences</i>  <i>Bachelor of Science ( field)</i>  <u>Example:</u> <i>Bachelor of Science ( Physics)</i></p>
<p><b>Sarjana Muda Sains Gunaan</b>  <i>Sarjana Muda Sains Gunaan (bidang)</i>  <u>Contoh:</u> <i>Sarjana Muda Sains Gunaan ( Kimia Industri)</i>  <i>Sarjana Muda Sains (bidang)</i>  <u>Contoh:</u> <i>Sarjana Muda Sains Bioperubatan</i></p>	<p><b>Bachelor of Applied Science</b>  <i>Bachelor of Applied Science (field)</i>  <u>Example:</u> <i>Bachelor of Applied Science (Industrial Chemistry)</i>  <i>Bachelor of (field) Science</i>  <u>Example:</u> <i>Bachelor of Medical Sciences</i></p>
<p>Setiap jurusan utama ini mempunyai komponen major atau minor dengan penamaan ijazah bagi setiap jurusan utama seperti berikut:</p>	<p>Each stream has major or minor components with nomenclature of qualifications as follows:</p>
<p><b>Program dwi major</b>  Bagi program yang mempunyai dua major, jumlah kredit keseluruhan program melebihi program sains biasa bagi memenuhi keperluan kedua-dua disiplin. Untuk layak sebagai major, disiplin kedua hendaklah berjumlah lebih kurang 40 - 50% daripada jumlah kredit keseluruhan program.</p>	<p><b>Double major programmes</b>  A double major programme has more credits than a normal programme in order to satisfy the requirements of both disciplines. To qualify as a major, the second discipline should be 40 – 50% of the total credits in the program.</p>
<p>Nama Ijazah mengandungi kedua-dua disiplin yang disambung dengan "dan"  <u>Contoh:</u> <i>Sarjana Muda Sains Matematik dan Ekonomi</i> atau  <i>Sarjana Muda Sains (Matematik dan Ekonomi)</i></p>	<p>The degree contains the names of both disciplines linked by the word "and"  <u>Example:</u> <i>Bachelor of Mathematical Science and Economics</i> or  <i>Bachelor of Science (Mathematics and Economics)</i></p>

**Program Major-minor**

Program Sarjana Muda Sains major-minor mempunyai jumlah kredit yang melebihi program biasa bagi memenuhi keperluan kedua-dua disiplin. Untuk layak sebagai minor, disiplin kedua hendaklah berjumlah 25 - 30% daripada jumlah kredit keseluruhan program.

Nama Ijazah mengandungi kedua-dua disiplin yang disambung dengan "dengan"

*Contoh: Sarjana Muda Sains Matematik dengan Ekonomi* atau *Sarjana Muda Sains (Matematik dengan Ekonomi)*

**Elektif**

Kursus elektif dalam sesuatu disiplin yang tidak mencapai 25-30% jumlah kredit atau tidak menggambarkan pengkhususan, tidak dibenar diletakkan sebagai 'pengkhususan' dalam nama ijazah, tetapi kursus-kursus boleh ditulis dalam transkrip.

**REKABENTUK PROGRAM**

Program bidang Sains dibahagikan kepada dua jurusan utama:

- (a) Sains
- (b) Sains Gunaan

Siswazah program Sarjanamuda Sains mempunyai kefahaman yang mendalam mengenai asas sains dan teori, dapat menghalusi prinsip dan berpotensi mendapat penemuan dan menjana aplikasi baru dalam sains melalui kaedah penyelidikan.

Siswazah program Sarjana Muda Sains Gunaan mempunyai kefahaman terhadap teori sains dengan penekanan dan tumpuan

**Major-minor programmes**

A major-minor Bachelor of Science programme has more credits than a normal programme in order to satisfy the requirements of both disciplines. To qualify as minor, the second discipline should be 25 – 30% of the total credits in the programme.

The degree contains the names of both disciplines linked by the word "with"

Example: *Bachelor of Mathematical Science with Economics* or *Bachelor of Science (Mathematics with Economics)*

**Electives**

Elective courses that do not accumulate to 25-30% of the total programme credits or which do not reflect any specialization, are not allowed to appear in the name of the degree, but they can be reflected in the transcript.

**PROGRAMME DESIGN**

Programmes in the field of Science are divided into two main streams:

- (a) Sciences
- (b) Applied Sciences

A graduate of a Bachelors degree in Science has strong understanding of the scientific fundamentals and theory, is able to refine principles and has potential to discover new fundamentals and to develop applications in science through the use of research methodology

A graduate of a Bachelors degree in the Applied Sciences understands scientific theory and has more emphasis and focus on the

yang lebih kepada aspek gunaan dalam berbagai bidang, contoh: kimia industri, kimia petroleum, sains bahan, instrumentasi, matematik kewangan, matematik komputasi, sains bioperubatan, dll.

Perbezaan di antara kedua-dua jurusan ialah:

- (i) Kedalaman dan kelebaran kandungan kursus asas.
- (ii) Kandungan teras program (major).
- (iii) Latihan industri dimestikan bagi program Sarjanamuda Sains Gunaan dan merupakan satu opsyen bagi Sarjanamuda Sains.
- (iv) Program Sarjanamuda Sains memerlukan lebih banyak latihan makmal dan asas integratif lanjutan.

#### **Cadangan unit dan jangkamasa program**

- (a) Trend seluruh dunia adalah untuk menganugerah Sarjana Muda Am bagi program yang memakan masa tiga tahun. Sistem 3 tahun Inggeris (yang sedang diubah) ialah sistem yang berasaskan pengkhususan yang sempit dan terfokus. Dalam sistem ini Sarjana bersamaan Kepujian.
- (b) Untuk mengeluarkan siswazah Sains (dengan kepujian) yang berkebolehan, jangkamasa kursus perlu dipanjangkan dan jumlah unit juga dipertingkatkan.
- (c) Program tiga hingga empat tahun yang dicadangkan menganugerah kepujian yang berasaskan disiplin asas yang dikuatkan oleh subjek teras dan elektif untuk menambahkan fleksibiliti.
- (d) Dalam merekabentuk struktur program Sains, unit untuk kursus wajib universiti tidak diambilkira dalam perhitungan unit tetapi kursus yang dianggap integral kepada pencapaian hasil pembelajaran Sains (contohnya, etika, komunikasi, kemahiran interpersonal) dihitungkan dalam komponen "Etika dan Kemanusiaan".

applied aspects in various fields, for example: industrial chemistry, petroleum chemistry, material science, instrumentation, financial mathematics, computational mathematics, biomedical science, etc.

The differences between the two streams are:

- (i) The depth and breadth of the content in the fundamental areas.
- (ii) The program core content (major).
- (iii) Industrial training is a must for Applied Science programmes but is an option only for Science.
- (iv) Science programme requires more laboratory work and advanced integrative fundamentals.

#### **Proposed units and program duration**

- (a) The worldwide trend is to award a general degree for a three-year programme. The English three-year programme (that is undergoing change) is a narrow and focussed system based on increasing specialization. In this system, Masters is equivalent to Honours.
- (b) To produce competent science graduates (with honours), the duration of the course is lengthened and the total number of units increased.
- (c) The three to four-years programme that is suggested awards an Honours degree based on a fundamental discipline that is strengthened by core and elective subjects that add flexibility.
- (d) In designing the structure of the science programme, the compulsory university courses are not taken into account in the calculation of the total units but courses that are integral to the achievement of the learning outcomes (for example ethics, communication, interpersonal skills) are counted in the "Ethics and Humanities" component.

<p>(e) Jumlah unit bagi program empat tahun adalah diantara 90-110 dan merangkumi:*</p> <ul style="list-style-type: none"> <li>(i) kursus asas sains (5 - 30%),</li> <li>(i) teras program (55 -70%)</li> <li>(ii) kaedah saintifik (15 - 30%) yang disepadukan dengan kursus asas dan teras,</li> <li>(iii) elektif (5-30%) dan</li> <li>(iv) kursus Kemanusiaan yang diintegrasikan diseluruh program Sains (5-10%).</li> </ul> <p>(f) Struktur kursus dilampirkan dalam Jadual 1.</p> <p>(g) Kursus lain dihitung diluar julat 90-110 dan jumlah besar tidak melebihi 120 unit.</p> <p>(h) Jumlah beban akademik ialah 8 jam/hari untuk 5 hari/minggu. Beban purata ialah 15 unit/semester.</p>	<p>(e) The total units for the four-year system is between 90 – 110 comprising:*</p> <ul style="list-style-type: none"> <li>(i) fundamentals of science (5 – 30%),</li> <li>(ii) programme core (55 – 70%)</li> <li>(iii) scientific method (15 – 30%) and is integrated with fundamental and core courses</li> <li>(iv) electives (5–30%) and</li> <li>(v) Humanities courses that are integrated throughout the science programme (5 -10%).</li> </ul> <p>(f) The structure of the programme is given in Table 1</p> <p>(g) Units for other courses are added to the 90 – 110 range and the total units should not exceed 120 units.</p> <p>(h) Total academic load is 8 hours/day for 5 days/week. The average load is 15 units/semester.</p>
<p><b>Kaedah pengajaran-pembelajaran</b></p> <p>Untuk maklumat terperinci sila rujuk kepada dokumen “Kod Amalan Jaminan Kualiti IPTA” edisi Mei 2002.</p> <p>Program Sains mesti menumpu kepada pembentangan, perbincangan dan amali supaya pelajar dapat menunjukkan kefahaman teori, kemahiran analisis, kebolehan bercakap, menulis, merancang dan mengurus, serta kerja berpasukan dan kepimpinan. Latihan industri mesti diadakan bagi program Sains Gunaan.</p>	<p><b>Teaching-learning Methods</b></p> <p>For more details please refer to the document “Quality Assurance of Public Universities in Malaysia : Code of Practice”, May 2002 edition.</p> <p>Science programmes must focus on presentations, discussions and practical work that enable students to demonstrate understanding of theory, skills in analysis, ability to speak, write, plan and manage as well as teamwork and leadership. Industrial training is a must for Applied Science programmes.</p>
<p><b>PENILAIAN PELAJAR</b></p> <p>Untuk maklumat terperinci sila rujuk kepada dokumen “Kod Amalan Jaminan Kualiti IPTA” edisi Mei 2002.</p>	<p><b>STUDENT ASSESSMENT</b></p> <p>For more details please refer to the document “Quality Assurance of Public Universities in Malaysia : Code of Practice”, May 2002 edition.</p>
<p><b>KRITERIA KEMASUKAN DAN LALUAN PENDIDIKAN</b></p>	<p><b>ENTRY CRITERIA AND EDUCATIONAL PATHWAYS</b></p>

Calun lulus peperiksaan matrikulasi atau STPM dengan 3 prinsipal termasuk Kertas Am, atau mana-mana sijil/diploma yang setaraf dengannya.

Kelayakan minimum pelajar luar negara hendaklah sama dengan kelayakan memasuki universiti yang diiktiraf di negara mereka

### **Penukaran program**

Penukaran program boleh berlaku pada mana-mana sesi. Syarat pemindahan kredit hendaklah jelas

### **STAF AKADEMIK**

'Staf akademik' ditakrifkan sebagai mereka yang memegang jawatan pensyarah, profesor madya dan profesor. Guru dan tutor tidak dimasukkan dalam kumpulan staf akademik.

Peranan, tugas, sumbangan dan komitmen staf akademik sangat penting bagi kesohoran mana-mana IPT. Mutu program dan siswazah yang terhasil serta pelaksanaan program sangat bergantung kepada mutu dan komitmen staf akademik. Sumbangan kepakaran staf akademik menghasilkan: (a) siswazah yang bakal menjadi pemimpin, pendidik, profesional, teknokrat dll; (b) penemuan ilmu baru atau penambahbaikan program yang sedia ada melalui usaha mencari kebenaran; (c) penyebaran ilmu melalui penulisan dan pengajaran; (d) perkhidmatan kepada masyarakat, negara dan dunia; (e) dan penghasilan produk rekaan dan barangan.

### **Dasar rekrutmen dan perkhidmatan staf akademik**

- Kelayakan minimum adalah Ijazah Sarjana dalam bidang yang berkaitan dan Ijazah Sarjanamuda kelas 2 atas atau

Candidates should pass the matriculation examination or STPM with 3 principals including General Paper, or any equivalent certificate/diploma.

For foreign students, the minimum qualification must be similar to the entry qualification of recognized universities in the country of origin.

### **Transfer student**

Transfer of programme can occur in any academic session. The criteria for credit transfer must be clear.

### **ACADEMIC STAFF**

“Academic staff” are those holding the posts of lecturer, associate professor and professor. Teachers and tutors are not included as academic staff.

The role, tasks, contribution and commitment of academic staff are vital for any IPT to excel. The quality of the programme and the graduates, as well as the implementation of the programme are dependent on the quality and commitment of academic staff. The expertise of academic staff results in (a) graduates who are future leaders, educators, professionals, technocrat, etc; (b) discovery of new knowledge or improvements of existing programmes in the quest for truth; (c) disseminating of knowledge through writing, and teaching; (d) service to society, the nation and world; and (e) creation of products and goods.

### **Academic staff recruitment and service policy**

- Minimum qualification is a Masters degree in the relevant field and a Bachelors degree with second class upper or CGPA >

<p>PNGK &gt; 3.0,</p> <ul style="list-style-type: none"> <li>□ Bagi bidang bukan kritikal yang tidak sukar mendapat tenaga akademik, sekurang-kurangnya 75% staf mempunyai Ph.D.</li> <li>□ Bagi bidang yang kritikal dan bagi menjamin kesinambungan nisbah staf akademik kepada pelajar yang disarankan, IPTA mesti mempunyai program rekrutmen dan latihan yang teratur dan berterusan. Contoh, skim tutor, ASTS, SLAB, dll.</li> <li>□ Menggalakkan pertukaran, tindakan, pinjaman dari luar terutamanya daripada industri/profesional, tetapi ini hendaklah tidak melebihi 20% tenaga pengajar.</li> <li>□ Nisbah profesor : profesor madya : pensyarah yang semakin mengecil, dengan nisbah yang menjurus kearah 5 : 3 : 2</li> </ul>	<p>3.0</p> <ul style="list-style-type: none"> <li>□ In non-critical fields where there is no shortage of academic staff, at least 75% of the staff must have PhD.</li> <li>□ In critical fields and to maintain the recommended academic staff to student ratio, IPTA must have a structured and continuous recruitment and training programme. e.g. tutor scheme, ASTS, SLAB.</li> <li>□ Encourage staff exchange, secondment and loan especially from the industry/profession, but the proportion should not exceed 20% of total academic staff.</li> <li>□ The ratio of professor: associate professor :lecturer should be decreasing towards a ratio of 5 : 3 : 2.</li> </ul>
<p><b>SUMBER PENDIDIKAN</b></p> <p><b>Kemudahan fizikal</b> Kemudahan fizikal termasuk (a) ruang untuk pentadbiran, (b) ruang pengajaran ( pengajaran kumpulan besar seperti bilik kuliah dan auditorium; pengajaran kumpulan kecil seperti bilik tutorial; kelas praktikal seperti makmal sains, makmal komputer), dan makmal pengajaran mikro (c) alat-alat tertentu (seperti pandang dengar, CCTV, LCD), (d) stesen kerja lapangan, (e) bengkel mekanikal dan elektronik, baikpulih, bengkel peniup kaca (f) ruang khusus seperti bilik sejuk, muzium, herbarium, rumah kaca, rumah haiwan, stor kimia, bilik peralatan, (g) makmal seperti makmal penyelidikan projek tahun akhir, makmal penganalisan data</p> <p>Spesifikasi ruang fizikal dilampirkan dalam Jadual 2.</p> <p><b>Kemudahan untuk orang kurang upaya</b> Lif untuk semua bangunan</p>	<p><b>EDUCATIONAL RESOURCES</b></p> <p><b>Physical facilities</b> Physical facilities include (a) areas for administration, (b) teaching (e.g. class room and auditorium facilities for large group teaching; tutorial rooms for small group discussion; science and computer laboratories for practical classes, microteaching laboratory (c) specific equipment (e.g. audio visual, CCTV, LCD), (d) field work station, (e) mechanical and electronic workshop, maintenance, glass blowing workshop (f) special rooms such as the cold room, museum, herbarium, glass house, animal house, chemical store, equipment room, (g) laboratories for final year research project, data analysis laboratory,</p> <p>The specifications for physical space are given in Table 2.</p> <p><b>Facilities for people with special need</b> Elevator for every building</p>

<p>Laluan khas untuk orang kurang upaya Bilik air khas di setiap bangunan</p>	<p>Special lane for the handicapped Special washroom in every building</p>
<p><b>Perpustakaan</b> Buku Teks                    1 buku/10 orang Buku Rujukan                1 buku/50 orang Jurnal                            10 judul/bidang</p>	<p><b>Library</b> Text book                      1 book/10 students Reference                        1 book/50 students Journal                            10 titles/field</p>
<p><b>Teknologi Maklumat dan Komunikasi</b></p>	<p><b>Information                    and                    Communication Technology</b></p>
<p>Komputer : Pelajar                    1 : 4 Komputer : Pensyarah                1 : 1 Komputer : Makmal                    1 : 1 Komputer : Pegawai Tadbir        1 : 1</p>	<p>Computer : Student                    1 : 4 Computer : Lecturer                    1 : 1 Computer : Laboratory                1 : 1 Computer : Admin Officer            1 : 1</p>
<p>Bilik Tutorial/Dewan Kuliah 1 node komputer  1 LCD 1 PC 1 layar putih 1 papan putih 1 sistem PA (dewan kuliah) 1 video imager 2 server (e-mail dan pencapaian maklumat)/jabatan</p>	<p>Tutorial room/lecture hall 1 node computer  1 LCD 1 PC 1 white screen 1 white board 1 PA system (lecture hall) 1 video imager 2 servers (e-mail and database)/department</p>
<p>Perlu ada jaringan maklumat yang menghubungkan antara jabatan dengan fakulti dan universiti. Semua maklumat kursus (tugasan, markah, skema, ujian, tutorial, dsb) boleh dicapai melalui internet. Pengurusan kursus (pendaftaran, gred, dsb) secara online. Laman web di setiap jabatan Latihan ICT untuk setiap staf sekurang-kurangnya sekali setahun. Sekurang-kurangnya dua kursus /program yang menggunakan komputer sebagai alat bantu belajar. Pencarian bibliografi berkomputer.</p>	<p>There must be an information network among departments, faculties and university.  All information related to a course (assignment, marks, marking scheme, test, tutorial, etc) is accessible via internet. Online course management (registration, grade, etc). Website for every department ICT training for each staff at least once a year.  At least two computer-aided courses per programme.  Computer based bibliographical search.</p>
<p><b>Amali : Alat Pengajaran</b> 1 set eksperimen/2 orang pelajar 1 peralatan umum amali/5 orang pelajar</p>	<p><b>Practical : Teaching equipment</b> 1 experimental set/2 students 1 practical equipment/5 students</p>



<p><b>Penyelidikan dan Pembangunan</b> Peralatan penyelidikan Kemudahan gunasama peralatan khusus/bidang penyelidikan utama.</p> <p><b>Kepakaran Pendidikan</b> Pelantikan penilai/pemeriksa luar perlu dibuat bagi setiap program pengajian sekurang-kurangnya 3 tahun sekali.</p> <p><b>Kemudahan untuk pertukaran pelajar dan staf</b> IPTA perlu mengadakan MOU/MOA dengan institusi pengajian/penyelidikan yang lain untuk kemudahan pertukaran pelajar dan pegawai.</p> <p><b>Belanjawan dan pengagihan sumber</b>  Kewangan: RM10 000/pelajar Pengajaran &amp; Penyelidikan : Sekurang-kurangnya RM20000 / Penyelidikan Pensyarah/Tahun.</p>	<p><b>Research and Development</b> Research equipment Facilities for sharing special equipment/main research field</p> <p><b>Educational expertise</b> Appointment of external assessor/examiner once in every 3 years for each programme.</p> <p><b>Student and Staff Exchange</b>  Universities should have MOU/MOA with other educational/research institutions to facilitate student and staff exchange</p> <p><b>Budget and resource allocation</b>  Finance: RM10 000/student Teaching &amp; Research :At least RM20 000 / Lecturer Research/Year</p>
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**Jadual 1: Struktur dan kandungan program Sains**  
**Table 1: Programme structure and content of Science**

<b>Kandungan Content</b>	<b>Sarjana Muda Sains Bachelor of Science</b>	<b>Sarjana Muda Sains Gunaan Bachelor of Applied Science</b>
<p align="center"><b>Sains Asas Fundamental Sciences (5 - 30%)</b></p>	<ul style="list-style-type: none"> <li>• Fizik / <i>Physics</i></li> <li>• Kimia / <i>Chemistry</i></li> <li>• Biologi / <i>Biology</i></li> <li>• Matematik / <i>Mathematics</i></li> <li>• Geologi/Sains Bumi / <i>Geology/Earth Science</i></li> </ul> <p>Pilih 2-3 subjek. Kedalaman dan keluasan bergantung kepada keperluan program  <i>Select 2-3 subjects. The depth and breadth depends on program requirements</i></p>	
<p align="center"><b>Teras program Programme core (55 -70%)</b></p>	<p><u>Contoh (Examples)</u></p> <ul style="list-style-type: none"> <li>• Fizik / <i>Physics</i></li> <li>• Kimia / <i>Chemistry</i></li> <li>• Biologi / <i>Biology</i></li> <li>• Matematik / <i>Mathematics</i></li> <li>• Geologi / <i>Geology</i></li> <li>• Zoologi / <i>Zoology</i></li> <li>• Genetik / <i>Genetics</i></li> <li>• Mikrobiologi / <i>Microbiology</i></li> <li>• Botani / <i>Botany</i></li> </ul> <p><i>etc</i></p>	<p><u>Contoh (Examples)</u></p> <ul style="list-style-type: none"> <li>• Kimia Industri <i>Industrial Chemistry</i></li> <li>• Kimia Petroleum <i>Petroleum Chemistry</i></li> <li>• Sains Bahan <i>Material Science</i></li> <li>• Instrumentasi <i>Instrumentation</i></li> <li>• Matematik Kewangan <i>Financial Mathematics</i></li> <li>• Matematik Komputasi <i>Computational Mathematics</i></li> <li>• <i>Computer Aided Geometric Design</i></li> <li>• Sains Alam Sekitar <i>Environmental Science</i></li> <li>• Kimia Analisis <i>Analytical Chemistry</i></li> <li>• Bioteknologi <i>Biotechnology</i></li> <li>• Geofizik <i>Geophysics</i></li> <li>• Sains Angkasa <i>Space Science</i></li> <li>• Sains Biomedik <i>Biomedical Science</i></li> </ul>

		<ul style="list-style-type: none"> <li>• Sains Akuatik <i>Aquatic Science</i></li> <li>• Perhutanan <i>Forestry</i></li> <li>• Sains Haiwan <i>Animal Science</i></li> <li>• Sumber Asli <i>Natural Resources</i></li> <li>• Sains Tumbuhan <i>Plant Science</i></li> <li>• Penyelidikan Operasi <i>Operational Research</i></li> </ul>
<b>Elektif</b> <i>Electives</i> <b>(5-30%)</b>	Imbangan antara kursus elektif dan teras program. Kelihatan dalam transkrip	
<b>Kaedah saintifik</b> <b><i>Scientific method</i></b> <b>(15%-30%)</b> Amali, projek penyelidikan, penyelesaian masalah, kajian literatur, kerja lapangan  <i>Practicals, research project,</i> <i>problem solving, literature</i> <i>search, field work</i>	Latihan industri hanyalah satu opsyen.  <i>Industrial training is optional.</i>	Latihan industri adalah wajib dengan tempoh 8-10 minggu  Industrial training is compulsory for 8-10 weeks.

<p><b>Kemanusiaan dan Etika</b> <b><i>Humanities and Ethics</i></b> <b>(5-10%)</b></p> <p>Disepadukan dengan kursus Sains, tambah beberapa kursus khusus <b><i>(integrated in the Science courses, add several specific courses)</i></b></p>	<p>Kandungan kursus melibatkan aspek-aspek Etika dan Kemanusiaan yang membolehkan pelajar berkomunikasi, membuat keputusan dan beramal dengan beretika. Sebaik-baiknya aspek-aspek ini disepadukan dengan kursus Sains yang lain serta ditambahkan dengan beberapa kursus khas. Aspek dalam kursus wajib universiti yang relevan bagi Sains seeloknya dipindah dan dilaksanakan di bawah kawalan fakulti/program.</p> <p><i>The courses cover the aspects of Ethics and Humanities that will develop better skills in communication and ethical decision-making and practice. These courses should be integrated with the other Science courses with the addition of some specific courses. As far as possible aspects in the compulsory university courses which are relevant to Science should be transferred to and implemented under the control of the faculty/programme.</i></p> <p>Contoh kursus termasuklah/ <i>Examples of courses include:</i> Sejarah Sains (<i>History of Science</i>) Falsafah Sains (<i>Philosophy of Science</i>) Sains dan Masyarakat (<i>Science and Society</i>) Kelestarian (<i>Sustainability</i>) Etika Komunikasi</p>
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**Jadual 2: Spesifikasi Ruang Fizikal**  
**Table 2: Physical Space Specifications**

<p><u>Staf</u> Ruang pejabat bagi:</p> <p><b><i>Pegawai Akademik</i></b></p> <p>Profesor 16.50m<sup>2</sup>/orang Prof. Madya 16.50m<sup>2</sup>/orang Pensyarah 14.00m<sup>2</sup>/orang Tutor 18.50m<sup>2</sup>/2 orang</p> <p><b><i>Pegawai Sokongan (Pejabat)</i></b></p> <p>Dekan 23.00m<sup>2</sup>/orang TD 20.00m<sup>2</sup>/orang KJ 18.00m<sup>2</sup>/orang Pegawai Tadbir 14.00m<sup>2</sup>/orang</p> <p>Pegawai Sistem Maklumat 14.00m<sup>2</sup>/seorang</p>	<p><u>Staff</u> Office space for:</p> <p><b><i>Academic Officer</i></b></p> <p>Professor 16.50m<sup>2</sup>/person Associate Professor 16.50m<sup>2</sup>/person Lecturer 14.00m<sup>2</sup>/person Tutor 18.50m<sup>2</sup>/2 person</p> <p><b><i>Support Officer (Office)</i></b></p> <p>Dean 23.00m<sup>2</sup>/person Deputy Dean 20.00m<sup>2</sup>/person Head 18.00m<sup>2</sup>/person Administrative Officer 14.00m<sup>2</sup>/person</p> <p>Information System Officer 14.00m<sup>2</sup>/person</p>
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Pen. Pegawai Sistem Maklumat 8.00m <sup>2</sup> /seorang	Assistant Information System Officer 8.00m <sup>2</sup> /person
Pembantu Tadbir (jurutrengkas) 5.00m <sup>2</sup> /seorang	Assistant Administration (secretarial) 5.00m <sup>2</sup> /person
Pembantu Tadbir (perkeranian) 5.00m <sup>2</sup> /seorang	Assistant Administration (clerk & operation, finance) 5.00m <sup>2</sup> /person
Pelukis 7.50m <sup>2</sup> /seorang	Artist 7.50m <sup>2</sup> /person
PAR 3.00m <sup>2</sup> /orang	General worker 3.00m <sup>2</sup> /person
<i>Pegawai Sokongan (Akademik)</i>	<i>Support Officer (Academic)</i>
Pegawai Sains 14.00m <sup>2</sup> /orang	Science Officer 14.00m <sup>2</sup> /person
Juru Teknologi Makmal Universiti 5.00m <sup>2</sup> /orang	University Laboratory Technologist 5.00m <sup>2</sup> /person
Peniup Kaca 7.50m <sup>2</sup> /orang	Glass Blower 7.50m <sup>2</sup> /person
Pekerja Am 3.00m <sup>2</sup> /orang	General worker 3.00m <sup>2</sup> /person
<b>Makmal</b>	<b>Laboratories</b>
Pengajaran 7.90m <sup>2</sup> /orang	Teaching 7.90m <sup>2</sup> /person
Penyelidikan 11.00m <sup>2</sup> /orang	Research 11.00m <sup>2</sup> /person
Bilik persediaan pengajaran 24.00m <sup>2</sup> / 2 makmal pengajaran	Teaching preparation room 24.00m <sup>2</sup> / 2 teaching laboratories
Stor(kimia/mikroskop/alat rosak/buangan/alat kaca) 4 x 24m <sup>2</sup> /jabatan (500 orang pelajar)	Store(Chemical/microscope/default items/wastage/glass) 4 x 24m <sup>2</sup> /department (500 students)
Bilik peralatan 8 x 24m <sup>2</sup> /jabatan (500 orang pelajar)	Equipment room 8 x 24m <sup>2</sup> /department (500 students)
Bengkel (Elektronik) 2 x 24m <sup>2</sup> /jabatan (500 orang pelajar)	Workshop (Electronic) 2 x 24m <sup>2</sup> /department (500 students)
Bilik Timbang 14m <sup>2</sup> /2 makmal	Weighing room 14m <sup>2</sup> /2 teaching laboratories
Pengajaran (kecuali matematik)	(excluding mathematics)
Bilik Haiwan 50m <sup>2</sup> (Biologi, Biokimia dan Mikrobiologi)	Animal room 50m <sup>2</sup> (Biology, Biochemistry and Microbiology)
Herbarium 50m <sup>2</sup> (Biologi), 15m <sup>2</sup> (Biologi, Mikrobiologi)	Herbarium 50m <sup>2</sup> (Biology), 15m <sup>2</sup> (Biology, Biochemistry and Microbiology)
Bilik Cetak 20m <sup>2</sup> /jabatan	Printing room 20m <sup>2</sup> /department
Bilik Mesyuarat 50m <sup>2</sup> /jabatan	Meeting room 50m <sup>2</sup> /department
Bilik Sembahyang 50m <sup>2</sup> /jabatan	Prayer room 50m <sup>2</sup> /department
Bilik Rehat Umum 25m <sup>2</sup> /jabatan	Restroom 25m <sup>2</sup> /department
Tandas 1 w.c. /30 orang	Washroom 1 w.c. /30 person
Bilik Sumber 25m <sup>2</sup> /jabatan	Resource room 25m <sup>2</sup> /department
Bilik Persatuan Pelajar 25m <sup>2</sup> /jabatan	Student society room 25m <sup>2</sup> /department
Bilik Menunggu/Tetamu 20m <sup>2</sup> /jabatan	Waiting room 20m <sup>2</sup> /department
Bilik Kebal 15m <sup>2</sup> /jabatan	Strong room 15m <sup>2</sup> /jabatan
Bilik Seminar/Tutorial 40m <sup>2</sup> /20orang x 5setiap jabatan	Seminar/tutorial room 40m <sup>2</sup> /20 person x 5 per department
Dewan Kuliah 100m <sup>2</sup> /100 orang x 5 setiap jabatan	Lecture hall 100m <sup>2</sup> /100 person x 5 per department

Makmal Komputer (perkhidmatan) 20m <sup>2</sup> /jabatan	Computer laboratory (service) 20m <sup>2</sup> /department
Bilik Fail 20m <sup>2</sup> /jabatan	File room 20m <sup>2</sup> /department
Stor Alat Tulis 20m <sup>2</sup> /jabatan	Stationery store 20m <sup>2</sup> /department

**PANEL PENGUBALAN STANDARD BAGI PROGRAM PENDIDIKAN DALAM  
BIDANG SAINS**  
**PANEL FOR ESTABLISHING STANDARDS FOR EDUCATIONAL PROGRAMMES IN  
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